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CONTENTS

FOREWORD

Ladies and gentleman, dear JUDOKAS, all participants and readers of the 7th SCIENTIFIC AND PROFESSIONAL CONFERENCE ***„APPLICABLE RESEARCH IN JUDO“*** proceedings book.

The seventh edition of the proceedings book is in front of you.

The European Judo Union, The Croatian Judo Federation and the Faculty of Kinesiology of the University of Zagreb *(Croatia)* are organizing this joint research conference for the SEVENTH time.

To remind you, we started in 2015. in Zagreb and moved to Poreč in 2016. and we were there until 2019., and we remain here also in 2023. and 2024.year.

Our invited lecturers and participants were Olympic winners and European and World champions and medallists, best judo sport scientists and researchers, most influential coaches from all over the World, judo professors and lecturers as well as judokas and their coaches who wanted to listen about new knowledge in judo sport.

This year we will continue with the same tradition, and we tried to maintain the quality of the conference as before and we strive to increase the number of scientific and professional papers every year.

We succeeded in doing that this year, and we have a record number of works, so far, the largest number of authors from three continents, Asia *(from Japan)*, South America *(Brazil)* and Europe.

We believe that, as in previous years, we will maintain your attention and interest in scientific achievements and the professional opinions of experts and scientists who will present the papers. It will be especially interesting on the second day during the practical part of the presentations, which will be extremely interesting for coaches for all ages.

This year's conference is bigger than ever before in Poreč and will host many researchers who will present many interesting topics.

We would like to remind you, once again, that this conference is called applicable research in judo for several reasons.

First we want to present papers and result of research which is applicable for judo training and can improve judo sport in many ways.

Second, judokas from Europe, ex competitor, coaches, trainers researchers and professors give their opinions from results of their research and experiences through their scientific and professionals papers.

Third, from the first conference till today our Conference offered materials and papers that are useful for trainers and coaches for beginners to high class judokas.

We are all very happy to be a part of this seven edition of this conference and we hope that all of you will enjoy in oral and practical presentation of results of this year presenters.

This year some of our invited lecturers will present their work, both theoretical and practical.

We hope that some of these proven achievements and information will already be applied "tomorrow" in the training processes of judokas for all ages.

And for the end of foreword we wont to give thanks to everyone who, with their papers, suggestions, reviews and other activities necessary for the organization of a scientific conference, contributed that the conference each year is better and better, and we expect that this one, surpass the all which one held so far.

ORGANIZING COMMITTEE

THE CONTRIBUTION TO JUDO RESEARCH OF THE I-DŌJŌ AT THE UNIVERSITY OF HERTFORDSHIRE

Mike Callan[1]

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ABSTRACT

The i-dōjō, the International Judo Research Unit, based at the University of Hertfordshire's Institute of Sport, was established in 2018 to advance global judo research with a mission to develop evidence-based insights to enhance judo management, coaching, and practice. The unit engages in research, consultancy, knowledge transfer, and training, with significant contributions to postgraduate studies, including PhD projects on moral development, , performance, social impacts, and leadership in judo. From 2018 to 2024, the unit produced 62 research outputs and contributed to the European Judo conferences and the Arts and Sciences of Judo journal. The i-dōjō also leads on the International Consensus Conference on Safe Falling for the Elderly. Training programs, such as the Judo Research Induction Course and Finding Your Feet initiative, foster judo education and active ageing. Important partnerships with key organisations support the unit's research and training goals. Future plans are to promote judo's educational and social benefits.

Key words: Judo, research, doctoral study, education

INTRODUCTION

The i-dōjō is the International Judo Research Unit, which sits within the Centre for Research in Psychology and Sport, it is based in the Institute of Sport at the University of Hertfordshire. This paper considers the history of the unit and its impact on judo research globally.

The establishment of the research unit was approved by the Associate Dean *(Research)*: School of Life and Medical Sciences in April 2018 and the unit was soft launched during the 5th European Judo Science and Research Symposium in Poreč, Croatia in June 2018 *(Callan, 2018)*.

BACKGROUND

The concept of an entity to encourage and develop research and detailed study into aspects of judo was conceived by Professor Mike Callan from around 2010. The idea was to inform evidence-based decision making and further the collective understanding of the judo family.

The University of Hertfordshire i-dōjō emerged from two earlier iterations; firstly at Anglia Ruskin University *(ARU)*, the undergraduate degree BSc *(Hons)* Sports Coaching *(European Judo Union)*, was delivered in partnership with the European Judo Union *(EJU)* and ran from 2010 to 2016 building on the successful courses at the University of Bath which ran from 2005 – 2009 *(Callan, 2008)*. A judo research entity was created at ARU on 23 October 2012, World Judo Day, The Anglia Ruskin Judo Research Group *(ARJRG)*. The EJU ceased the partnership with ARU in 2014 with remaining students graduating in 2016. and in 2016 the focus of judo research within the UK moved to the University of Chichester *(UoC)*.

Within the Department of Sport Development and Management at UoC, in April 2017, the i-dōjō International Judo Research Centre was established. The research centre organised two important conferences; The International Perspectives on Safeguarding the Child in Sport welcomed Japanese keynote speakers from the universities of Kanoya and Nagoya, as well as the Director the Child Protection in Sport Unit. The International Research Seminar, which held a special session on judo with speakers from four different nations.

In February 2018 an opportunity to deliver strategic developments in sport arose at the University of Hertfordshire and in April 2018 the focus moved to the newly created i-dōjō the International Judo Research Unit hosted there.

THE MISSION OF THE UNIVERSITY OF HERTFORDSHIRE I-DŌJŌ

To benefit society through the development of high-quality evidence-based understanding to impact on the management, coaching and practice of the way of judo.

ACTIVITIES

Initially the intent was that the unit would engage in research, consultancy, knowledge transfer and training. The related objectives set were:

Research – The Unit will engage in research activities relevant to its' mission and aims and in line with the University Research Strategy. Consultancy – The Unit will offer consultancy services to clubs, regional and national federations, governmental and non-governmental bodies, and international organisations in the form of services to improve the performance and participation levels of judo. Knowledge transfer – The Unit will seek to engage in Knowledge Transfer activities through the impactful dissemination of knowledge. Training – The Unit will offer training in the practice and study of judo to academics and practitioners.

LOGO

A dōjō is 'a place to study the way. In this case the 'way' is the way of yielding, or judo. The 'i' is an abbreviation for international, thus the i-dōjō, is the international place to study the way of judo. A logo was developed utilising the IJF regulation pantone colour 285M – 286M *(IJF, 2019)*.

Figure *1. The logo of the i-dōjō*

RESEARCH

Postgraduate study. The intent of the i-dōjō was to offer postgraduate research study into aspects of judo. Initially, three students commenced PhD study, having completed their pre-PhD programme at UoC. Slaviša Bradić from Croatia investigating 'Judo as a Method of Moral and Psychological Development' *(Bradić, 2023)*, Georgios Bountakis from Greece investigating 'Japanese expert teachers' understanding of the application of rhythm in judo; a new pedagogy' *(Bountakis & Callan, 2022)*, and Geert Claes from Belgium investigating 'Winning a bronze medal in judo and the possible influence of the ranking position in the International Judo Federation *(IJF)* Senior World Ranking List and the related seeding' *(Claes, 2017)*.

They were joined by three colleagues; Temba Hlasho from South Africa investigating 'the Impact of Socioeconomic Conditions of the Performance of Black Judo Players', Daniel Lascau from Romania investigating the 'Impact of Kodokan Judo Techniques in Winning Medals at yearly peak events', and Darren Warner from Great Britain investigating 'A case study of leadership, athlete-centred coaching and skill training periodisation in Olympic judo'.

In 2022 they were joined by Envic Galea from Malta investigating 'An autoethnographic research into how the IJF Academy developed, evolved, and functions', and MSc by Research student Nicolas Fletcher from Great Britain investigating whether 'IJF Safe Sport *(Safeguarding)* policies, procedures and operational practices are able to meet

the responsibilities of an International Federation?' and Roberto Orlando from Italy investigating 'Judo as a means of economic integration for Refugees, Asylum Seekers, and migrants'.

In 2024 Orkhan Orujzade from Azerbaijan enrolled, investigating 'a Comparative Study of the Psychological Effects of Judo on Women and Girls in Azerbaijan, Turkey and Croatia', and later in 2024 two further students will enrol; Franciscus Tandean from Australia investigating 'The role of Online Videos in Advancing Judoka Performance', and Duncan Jack from South Africa investigating 'The cause and effect of judging decisions in Judo: a case study of elite competition'.

A total of 11 PhD and one MSc by Research students commencing study into judo topics over a six-year period from 2018 – 2024.

Outputs. The research unit has generated 62 research outputs from 2018 – 2024. Particularly members have made eight contributions to the European Science of Judo Research Symposia in Poreč between 2018 – 2023. The unit has also heavily supported the IJF academic interdisciplinary journal, The Arts and Sciences of Judo, with eight papers published between 2021 – 2023.

CONSULTANCY

Professor Callan has been the strategic advisor to the Azerbaijan Judo Federation since 2021, supporting the development of strategic plans, and advising on aspects related to both performance and social projects.

Additionally, the i-dōjō in collaboration with Anglia Ruskin University provided advice to the British Judo Association on the development of the 'Finding your Feet' coach education initiative, helping coaches understand how best to teach ukemi to older populations.

KNOWLEDGE TRANSFER

To contribute to the sharing of knowledge, members have served on a range of scholarly boards and committees.

Envic Galea, Florin Daniel Lascau, and Mike Callan are members of the IJF Scientific Committee. Mike Callan is a member of the EJU Scientific Commission, and from 2018 – 2024 he was the Education Director of the Commonwealth Judo Association. Envic Galea, Florin Daniel Lascau are members of the IJF Academy Commission and along with Slaviša Bradić are leaders of the IJF Academy teaching around the world. Envic Galea and Slaviša Bradić are members of the IJF Kata Commission, and Slaviša Bradić is a Director of the IJF Military and Police Commission and EJU Head Kata Commissioner. Florin Daniel Lascau is an IJF Head Referee Director. Envic Galea is Head of the EJU Medical Commission, EJU General Treasurer and Vice President of the Commonwealth Judo Association.

In 2023 i-dōjō collaborated with academic partners Tokai University and the IJF Academy, along with JUDOs and Judospace to organise the Inaugural International Consensus Conference on Safe Falling for the Elderly through Judo. With over 40 delegates from 14 nations the event saw a sharing of expertise in the teaching of ukemi which led to the creation of the International Consensus Statement 'How can judo contribute to reducing the problem of injurious falls in older adults?' to be published by the IJF in the Arts and Sciences of Judo.

TRAINING

Together with the IJF Academy the unit provides doctoral research training for judo coaches in the form of a short course, the Judo Research Induction Course *(J-RES)*. Commencing in 2022, there have been two cohorts, who have developed research proposals to enable application for further study.

The Finding your Feet initiative has trained over 100 coaches to work with older adults and a number of clubs are starting sessions on falling in their local communities. These are often funded by health or active ageing related budgets thus generating additional funds to support the judo clubs.

In 2024 i-dōjō graduates, Dr Georgios Bountakis and Dr Slaviša Bradić collaborated with the Icelandic Judo Federation and the EJU to organise the first Children Kata festival & Kata seminar, which was attended by Dr Laszlo Toth, EJU President.

PARTNERSHIPS

In 2022 the University of Hertfordshire signed a Memorandum of Understanding with the IJF Academy, to allow interested judo coaches, teachers and managers to pursue judo studies to postgraduate level. There are extensive links with Japanese judo including particularly the Kodokan, the All-Japan Judo Federation, Tokai University, JUDOs NPO, Park24 Co Ltd., Kanoya University, International Budo University and Vories School, Shiga Prefecture.

The unit also collaborates extensively with the Live Longer Better in Hertfordshire movement, seeking to encourage active ageing through judo practice. Additionally, there is a strong relationship with the British Judo Association and the members of the i-dōjō have key roles in a number of national federations including Croatia, Iceland, Belgium, Malta and Azerbaijan enabling regular knowledge sharing.

FUTURE DEVELOPMENTS

There are plans to organise the second International Conference on Safer Falling for older adults through judo, hosted again at Tokai University, to include lectures and practical sessions. The research work on safer falling and applying the principles of ukemi to a population not normally associated with judo.

The are close ties with the Azerbaijan Sports Academy and the i-dōjō team is looking forward to supporting the development of academic judo initiatives in partnership with them. Finally the i-dōjō is keen to build on the strong relationship with the EJU Education Department to further contribute to the education of judo within Europe in any way possible.

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JUDO IS SAFE: FROM FIGHTING MARTIAL ART TO A MODERN OLYMPIC SPORT

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ABSTRACT

This aim of the paper is a comprehensive retrospective analysis of the evolution of judo rules from its inception in 1882 to the present day, focusing on safety regulations. Judo, originating from jujutsu, underwent significant transformations in the late 19th century, transitioning from a combat practice to a structured athletic discipline under the guidance of Jigoro Kano. The study highlights the development of rules aimed at ensuring competitor safety, from the early prohibition of dangerous techniques to modern-day refinements targeting injury prevention. Through an examination of historical documents and contemporary research, the paper demonstrates judo's ongoing commitment to balancing its martial heritage with modern safety standards, reaffirming its position as a global sport promoting discipline, respect, and personal development.

INTRODUCTION

Jujutsu, an ancient fighting style practiced by samurai as a complement to their swordsmanship, underwent significant transformations in the latter half of the 19th century, evolving more into a structured athletic discipline. Recognizing its potential as a method of physical training, numerous Jujutsu schools emerged in Tokyo during this period *(Nakajima & Thompson, 2012)*. Following the Meiji Restoration and Japan's transition towards modernization, there arose a necessity to develop an art that aligned with the country's ongoing societal reforms. Jigoro Kano, a prominent figure in Japan's educated elite, emerged as a pivotal advocate for change. Drawing upon his expertise in multiple jujutsu schools, Kano founded Judo in 1882. He eliminatied the most dangerous techniques from jujutsu and introduced an innovative method of character-building through physical education *(Sánchez-García, 2016)*.

Kano developed judo by studying existing jujutsu styles, retaining useful elements, rejecting unnecessary ones, and adapting it to modern society. He defined jujutsu as techniques for self-defense, which the public often perceived as dangerous, since jujutsu clashes were violent, often resulting with injuries. To counter this, Kano emphasized the benefits of judo as physical education, combat training, and intellectual and moral education *(Nakajima & Thompson, 2012)*. To make it safe for the practicioners Kano developed a set of rules around 1885 for the Red the and White competiton that is held in his school named Kodokan *(Brousse, 2015)*. Two main points were put in front by the founder himself, safety of the competitors and the dominance of the nage waza *(throwing techniques)* complemented by katame waza *(grappling techniques)*. Atemi waza *(stricking techniques)* was excluded from randori *(free practice)* to be practiced mainly through kata *(All Japan Judo Federation, 2009)*.

The initial judo rules closely resembled real combat. As judo evolved, so did its rules. Nevertheless, the core concept of sudden death, where one crucial mistake or action can determine the outcome, has been preserved. All the rules that were introduced served as a help to motivate the competitors to strive to win with an ippon, so judo remained a martial art where a 100% duel must be the rule. An ippon, achieved through perfect technique, ends the contest decisively. This concept parallels the "out of contest" status from the days of medieval warriors *(IJF, 2020)*. While it encourage a warrior mentality, the safety of practitioners must come first. Today's competitions are extremely well-regulated and fully align with the humanistic, educational, and social principles of the Olympic Charter *(IJF, 2020)*. Judo is a modern combat sport practiced globally, with the International Judo Federation boasting over 200 member countries, a fact that garners significant research interest *(Peset Mancebo et al., 2013)*. Over the years, judo has undergone numerous rule changes aimed at enhancing its appeal, safety, and alignment with the standards of a modern Olympic sport *(Barreto et al., 2022; Samuel et al., 2020)*. Extensive research has been conducted to investigate the impact of these modifications on various aspects of judo matches, including scoring, penalties, attacks, defense, and other relevant factors. However, to the best

of my knowledge, there exists no comprehensive review that systematically examines all the rules transformations that have transformed this martial art, originally devised for samurai combat, into a secure and recognized Olympic discipline.

The study aimed to obtain a thorough overview of judo rules spanning from their inception to the present day, with a particular focus on regulations aimed at ensuring contestant safety.

METHOD

In this retrospective study, a comprehensive search and analysis of scientific papers and official documents governing judo competition rules was conducted. The search encompassed repositories including the International Judo Federation and the Serbian Judo Federation websites, alongside search conducted through Scopus and Google Scholar platform. Table was utilized to summarize key information, enhancing the visualization of the evolution of judo rules throughout the specified timeframe.

RESULTS

Early development (1882-1951)

In The Complete Kano Jiu-Jitsu *(Judo)* that was first published in 1905. it is pointed out that rules state that a contestant is considered defeated if they become unconscious for any reason. Serious techniques are prohibited such as kicking and breaking arms, legs, or necks *(Hancock & Higashi, 2016)*. There is also a part of the rules that can be considered as a form of "waiver of liability." It outlines that competent witnesses from each side must ensure the agreement is properly drawn, signed, and witnessed, thereby preventing any contestant or participant from taking legal action due to injuries or death occurring during the contest.

As judo as sport and martial art evolved, observed dangerous techniques were banned. In 1916., Do-jime *(body scissors; trunk strangle)*, technique in which your scissors the trunk of your opponent's body between your legs, and Ashi-garami *(leg entanglement)*, wraping the leg around your opponent's from the outside to apply pressure to his knee joint, were prohibited to use in randori and shiai. Kodokan still have this techniques in the syllabus, ensuring that old judo techniques have been perserved. Use of joint lock attacks was exclusievly restricted to the elbow joint in 1925 *(Callan, 2008)*.

The importance of judo competitors well being was clearly one of the corner stones of judo development led by Kodokan Institute. Acording to Callan *(2021)* and Bennett *(2009)* the inaugural meeting of the Kodokan Judo Medical Research Group was held in 1932. Some of the primary research areas assigned to the newly formed group of nine doctors included the influence of judo on physiological development, the stress on bones and joints from each technique, the medical effects of unconsciousness, medical considerations of women's judo, and, notably, judo injuries.

The establishment of this medical research group in 1932 is particularly significant when compared to other major sports organizations; for instance, the FIBA Medical Commission was founded in 1977 *(FIBA, 2024)*, and the FIFA Medical Assessment and Research Centre was established in 1994 *(Dvorak & Junge, 2015)*. This early initiative by Kodokan underscores its pioneering role in integrating medical research with sports practice, highlighting its long-standing commitment to athlete health and safety.

The advancement of judo on a global scale was impeded by the onset of the Second World War. Originally planned to debut as a demonstration sport at the cancelled 1940 Tokyo Olympics, its progress was hindered by Japan's involvement in the conflict *(Benesch, 2020)*. Following the war, a prolonged period was required to stabilize the sport and lay the groundwork for its subsequent resurgence.

Expansion of Judo sport (1951-2010)

The regulations delineated in "The Contest Rules of Kodokan Judo", originally published by the Kodokan and formally endorsed by the All-Japan Judo Federation, were adopted by the International Judo Federation *(IJF)* upon its establishment in 1951. These rules underwent revision in 1955 as judo prepared for its first World Championships in 1956. To ensure the safety of competitors during judo matches, a variety of prohibited techniques and actions were added or clarified. In addition to Ashi-garami and Do-jime, the Kawazu-gake technique was also excluded. Counters to Harai-goshi *(Hip sweep)*

or similar techniques that involve sweeping from inside the leg supporting the opponent's weight are now forbidden. Additionally, among other restrictions, the following actions were specifically banned: applying any hold or lock that could injure the opponent's vertebrae; lifting an opponent who is lying on their back on the mat and then dropping them onto the mat *(Daki-age)*; when an opponent clings to a contestant from behind, the contestant intentionally holding the opponent and throwing themselves backward *(The Contest Rules of Kodokan Judo, 1955)*.

Significant addition to judo regulations added in 1978 was the imposition of a Hansoku-make penalty *(signifying a very grave infringement)* for competitors who "dive" headfirst onto the mat, bending forward and downward while executing or attempting throws such as Uchimata or Harai-goshi *(Lampe, Kajmovic, Simenko, & Bečić, 2022)*. There is no clear evidence that Kani-basami technique *(Scissors Throw or Flying Scissors)* was prohibited by the official judo rules in the 1980s. The association of this technique with an incident resulting in the injury of Yasuhiro Yamashita, a highly regarded judoka, during the 1980 All Japan Judo Championship has cast a negative light on its reputation. In "Kodokan Judo: Throwing Techniques" by Toshirō Daigo, the ban is attributed to a "high-profile incident" at the 1980 Men's All Japan Selected Championships, citing a high injury rate associated with the technique *(Daigo, 2005)*. It took 43 years before it was incorporated into the official IJF rules in 2023.

In contrast to the bann of Kani-basami that can not be tracked in the official rules until 2022, the 1983 IJF Rules clearly stipulated the Kei-koku penalty *(indicating a grave infringement)* for any instance of falling directly to the mat while executing or attempting techniques like Waki-gatame *(IJF, 1983)*. Few safety changes were implemented until the Rio Olympics in 2016, with one notable adjustment occurring in 2003, which prohibited falling directly backward while executing or attempting techniques like Kata-guruma, whether in a standing or kneeling position *(IJF, 2003)*.

Modern Judo (2010-2024)

Over the past fifteen years, significant efforts have been undertaken within the realm of judo to mitigate the incidence of injuries. Notably, during the period spanning 2017-2018, particular emphasis was placed on refining regulations regarding Ukes' landing techniques. Specifically, if Uke endeavors to prevent landing on their back through maneuvers deemed hazardous to the head, neck, or spine, they are subject to penalty under the Hansoku-make rule *(IJF, 2017)*. This adjustment primarily targeted the conventional bridge defense tactic, which posed inherent dangers. To enhance clarity and reinforce safety protocols, in 2018, the International Judo Federation *(IJF)* extended penalties to encompass any deliberate use of the head in defense to evade or mitigate the impact of a scoring technique *(IJF, 2018)*. Also, to set a positive example for young judoka, false breakfalls will not be recognized as valid maneuvers. If an individual falls on both elbows, the action will be counted, whereas falling on just one elbow will not be considered a valid action *(IJF, 2016)*.

In Ne-waza scenarios, the act of overextending the leg during Shime-waza or Kansetsu-waza is strictly prohibited. In such instances, the referee will promptly announce "Mate" and penalize the offending contestant with a Shido. Additionally, the utilization of Kata-sankaku to block the opponent in Ne-waza or its application in Tachi-waza is explicitly prohibited *(IJF, 2018)*. Moreover, in 2020 throwing the opponnent with Kata-sankaku grip will lead to a disqualification *(Barreto et al., 2022)*.

After thorough deliberation, two additional techniques have been prohibited: the standing application of Ude-gaeshi *(reverse arm) (Lampe et al., 2022)*, and the execution of reverse Seoi-nage, which are now subject to penalty with Shido *(Messner, 2022)*. To specife "In the variation of Seoi-nage techniques when Tori turns away from Uke, twisting their Tsurite and Hikite using the sake lapel of uke’s judogi, without controlling uke, standing or dropping down in an unknown direction, without giving the possibility to the opponent to perform Ukemi and sometimes with uke falling with the neck on the mat, is forbidden."

Although not employed in randori or competition for decades, two techniques were officially integrated into the IJF Rules in 2023. These are: 1. The application of Ashi-garami, which incurs a penalty of shido. 2. The application of Kani-basami, which results in a Hansoku-make penalty *(IJF, 2023)*.

Table 1. Timetable of the most significant rule changes concerning the well-being of judo competitors

Prohibited actions and/or techniques	Timeframe
techniques that include kicking and breaking arms, legs, or necks	end of the 19th century
Do-jime and Ashi-garami	1916.
Kansetzu-waza allowed only on elbow joint	by 1925.
Kawazu-gake sweeping from inside the supporting leg of the opponent's applying any hold or lock that could injure the opponent's vertebrae lifting an opponent who is lying on their back on the mat and then dropping them onto the mat (Daki-age) when an opponent clings to a contestant from behind, the contestant intentionally holding the opponent and throwing themselves backward	1955
hansoku-make for head-dive while performing a throw	1978.
Waki-gatame in Tachi-waza	1983.
falling directly backward while executing or attempting techniques like Kata-guruma	2003.
falls on both elbows	2016.
all bridge landing and head defense while performing Ukemi will be penalized with Hansoku-make	
overextending the leg during Shime-waza or Kansetsu-waza	
Kata-sankaku to block the opponent in Ne-waza or its application in Tachi-waza is explicitly prohibited	2017-2018.
Ude-gaeshi and reverse Seoi-nage	2022.
Kani-basami and Ashi-garami (official IJF Rules)	2023.

DISCUSSION

To ensure the safety of practitioners, Jigoro Kano, the founder of judo, initially developed a one-page set of rules around 1885 for the Red and White competition held at his school, Kodokan. By 1955, the Kodokan Judo Contest Rules had been formally accepted by the newly established International Judo Federation *(IJF)* and the All Japan Judo Federation *(AJJF)*. This initial codification consisted of 16 pages, outlining essential guidelines for judo practice and competition *(The Contest Rules of Kodokan Judo, 1955)*. As judo grew and evolved, the need for more detailed regulations became apparent. The 2023 Sport and Organization Rules, now 220 pages, reflect this evolution *(IJF, 2023)*. These expanded rules cover all aspects of the sport, from technical guidelines and safety protocols to organizational structures and ethical standards. The increased detail demonstrates the sport's commitment to practitioners' well-being and the integrity of its competitions.

During judo's early development from 1882 to 1951, rules were established to prioritize safety and fairness, including the prohibition of serious techniques like kicking and breaking limbs *(Hancock & Higashi, 2016)*. The Kodokan Judo Medical Research Group, formed in 1932, demonstrated a pioneering commitment to athlete health and safety, predating similar initiatives in other major sports organizations. However, the global advancement of judo was stopped by the Second World War, delaying its planned debut as a demonstration sport at the 1940 Tokyo Olympics. In the subsequent expansion of judo sport from 1951 to 2010, regulations were continually revised to enhance competitor safety, with significant additions such as the imposition of penalties for dangerous actions and the banning of specific techniques associated with high injury rates.

In the realm of modern judo from 2010 to 2024, considerable efforts have been dedicated to minimizing injuries through regulatory refinements. Notably, between 2017 and 2018, significant attention was directed towards amending regulations concerning Ukes' landing techniques, particularly targeting maneuvers hazardous to the head, neck, or spine, under the Hansoku-make rule *(IJF, 2017; IJF, 2018)*. Additionally, false breakfalls were deemed invalid maneuvers to set a positive example for young judoka, since the Ukemi is the most important prevention method used in judo *(Lockhart et al., 2022)*. This firm course demonstrated the International Judo Federation's *(IJF)* unwavering commitment to safety, particularly evident in the prohibition of numerous techniques encompassing both Tachi-waza and Ne-waza, which

were not without objections from the judo community. Interestingly, two techniques, Ashi-garami and Kani-basami, previously not used in competition for decades, were officially integrated into the IJF Rules in 2023, albeit with penalties reflecting the federation's stringent safety measures, highlighting their commitment to safeguarding competitors from potential harm.

CONCLUSION

In conclusion, the evolution of judo rules reflects a continuous effort to balance the sport's martial origins with modern safety standards. From its inception under Jigoro Kano's guidance to its global expansion and refinement by the International Judo Federation, judo has maintained a steadfast commitment to prioritizing the well-being of its practitioners. While adapting to contemporary demands and challenges, the sport has remained true to its core values of discipline, respect, and mutual benefit, ensuring that judo continues to thrive as both a competitive sport and a vehicle for personal development.

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NEW TRENDS IN JUDO STRENGTH TRAINING: PRACTICAL APLICATONS TOWARDS MAXIMUM WORK SPECIFICITY

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ABSTRACT

The purpose of this invited lecture is to introduce the Functional ElectroMechanical Dynamometer *(FEMD)*, a cutting-edge device designed to replicate a wide range of sports movements, with a particular focus on judo techniques. This innovative technology captures comprehensive data on various aspects of strength, enabling precise measurement and enhancement of the specific force required in judo and jujitsu. By providing detailed insights into explosive power, endurance, and isometric strength, the dynamometer facilitates targeted training programs that significantly improve performance in judo competitions. Moreover, recent publications have begun to explore and validate the use of this device in both judo and jujitsu, highlighting its potential impact on these disciplines *(Escobar-Molina et al. (2023)*. Analysis of grip specificity on force production in grapplers and its effect on bilateral deficit grip specificity and bilateral deficit in force production among grapplers. https://www.ncbi.nlm.nih.gov/pmc/articles/ PMC10563762/).

Keywords: *Functional ElectroMechanical Dynamometry; Performance; Specific Tests.*

TRAINING SPECIFICITY: THE JUDO CASE

Strength training is a key element in the training process for athletes in general *(1)* and specifically in combat sports *(2)*. When prescribing strength training, several factors need to be considered to optimize the intended results, and one of the most important aspects for athletes is the specificity principle *(3)*. In grappling combat sports such as judo, maximal strength *(2)*, muscle power *(4)*, and strength endurance *(5)* are necessary depending on the action to be executed. Studies analyzing the time-motion analysis of these sports *(6)* provide evidence regarding the specific actions throughout the match and contribute to better training organization.

A common element among grappling combat sports is the need for grip control to execute throwing and groundwork techniques, which differ depending on the execution of the grip on a uniform *(e.g., judogi)* or on the opponent's body *(e.g., wrestling)*. Therefore, the amplitude of the grip and the surface of contact are determined by the characteristics of these sports. In the case of judo, it demands dynamic strength-endurance due to the predominance of actions in standing combat *(7)*. However, these strength-endurance actions are followed by powerful actions, which are frequently necessary for the successful execution of scoring techniques *(4)*.

During most scoring actions in judo, both hands are in contact with the opponent's uniform, but each segment executes a different action. For instance, the wrist, elbow, and shoulder angles and force application are distinct, and these aspects are related to side dominance *(7,8)*.

The difference in strength development between sides and the application of force in specific positions may result in a bilateral strength deficit, which occurs when the forces applied simultaneously by two segments are lower than the sum of forces that each segment is able to generate *(9,10)*. A plausible mechanism to explain the bilateral strength deficit is that the central nervous system sends higher action potentials at different speeds, activating muscle groups in distinct time sequences. During a bilateral task, the central nervous system unifies the energy to release it to a single functional unit *(9)*.

Considering the high prevalence of grip disputes during grappling combat sports matches, and the lapel and sleeve grip positioning necessary to execute most of the throwing techniques *(11)*, as well as ground techniques, a very specific combination of force application is needed, resulting in specific muscle activation for the pulling and lifting actions performed by each side *(12)*.

Although the specific technical actions involved during grip disputes have been extensively analyzed in judo literature *(8)*, and some studies have investigated the strength characteristics of the handgrip of judo athletes *(6,13,15)*, few studies have considered the force application by different sides *(12)*, and to the best of our knowledge, no study has investigated the bilateral strength deficit during actions involving a grip by judo athletes.

The analysis of the bilateral strength deficit in these types of tasks involving a general and a sport-specific grip may contribute to a better understanding of this phenomenon *(16)*. Regarding the analysis of the bilateral strength deficit, tests have mainly used actions requiring muscle power or maximal isometric strength. Additionally, when using maximal isometric strength tasks, most researchers used a single specific angle and not a sport-specific gesture.

Specifically, when considering judo, authors have used several tests, including the countermovement jump test *(14,17,18)*, the standing long-jump test *(17)*, the Special Judo Fitness Test *(19)*, and the maximal isometric handgrip test *(18,20,21)*. These studies indicated a significant bilateral strength deficit in the lower body and better performance when techniques were executed by the dominant side. However, the only article reporting muscle activation during a judo-specific pulling action *(12)* did not present the force application on each side, which is quite relevant for this sport.

Currently, the use of electromechanical functional dynamometry allows the analysis of force application in specific positions *(22,23)*. The main advantage of using this technology is the high transferability and specificity to sports actions such as judo.

ABOUT MYOQUALITY M1: THE FEMD

Functional ElectroMechanical Dynamometry *(FEMD)* is a new technology that allows the development of accurate strength tests in athletes. MYOQUALITY M1 *(Model Research, Granada, Spain)* with a precision of 3 mm for displacement, 100 g for a sensed load, a sampling frequency of 1.000 Hz and a range of velocities between 0.05 m·s-1 to 2.80 m·s-1. Its control core precisely regulates both force and angular velocity through a 2000 W electric motor. The user applies forces on a rope that winds on a roller, thus controlling and measuring both force and linear velocity. A load cell detects the rope's tension, and the resulting signal goes to an analog-to-digital converter with a 12-bit resolution. Displacement and speed data are collected with a 2500 ppr encoder attached to the roller. Data from the different sensors are obtained at a frequency of 1 kHz.

Technological advancements have enabled the use of the FEMDs, which constitute a major breakthrough in the quality of sport-specific strength training. This innovation bridges the gap between the control of specific strength training and its application to real sports movements, allowing for evaluation and training under functional conditions *(24,25,26,27)*. Working with FEMDs allows for precise control of various variables during sport-specific gestures, including load, range of motion, speed of movement, magnitude of resistance, and type of muscle contraction *(isometric, concentric, and eccentric)*. Moreover, FEMDs can simultaneously measure force, acceleration, and power, effectively simulating specific movement patterns and linking training to functional conditions and their assessment.

MYOQUALITY M1 has created a community called MyoCommunity, made up of Athletes, Clubs, Universities and High Performance Centers that use our technology such as:

- Carolina Marín (Olympic champion in Rio de Janeiro 2016, 3-time world champion in 2014, 2015 and 2018, champion at the European Games in Krakow 2023, and 7-time European champion in 2014, 2016, 2017, 2018, 2021, 2022 and 2024 in badminton).
- Real Madrid FC, FC Barcelona, Handball players of the first Spanish.
- Universities in Spain: Granada, Sevilla, Córdoba, Cádiz, Almería, León, Vigo, Alicante, Alcalá Henares, Zaragoza.
- Other Universities: Coimbra (Portugal), Andrés Bello (Chile), Santisima Concepción (Chile), De las Américas (Chile), Del Atlántico (Colombia), Del Cauca (Colombia), De la República (Uruguay), De Morelos (México).
- Hihg Performance Centers: Sierra Nevada (Granada), Madrid, León, INSEP (Paris), CERENEO (Neurorehabilitation-Suiza) and Andalusian Centre for Sports Medicine.

In addition, thanks to this device, it has been possible to publish research work in the field of health and sports performance. As an example, the following are listed in table 1 and some pictures in images 1.

Table 1. Papers in the last five years published using the FEMD.

YEAR PUBLISHED	TOPIC
2019	Soriano-Maldonado et al. (2019). Effects of a 12-week resistance and aerobic exercise program on muscular strength and quality of life in breast cancer survivors: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6946307/
2019	Machado-Payer et al. (2019). Muscle Quality Index as a Predictor of Hip Osteoarthritis: https://journals.lww.com/topicsingeriatricrehabilitation/Abstract/2020/01000/Muscle_Quality_Index_as_a_Predictor_of_Hip.6.aspx
2020	Bermudez et al. (2020). Coordination and power during Squat Jumps with loads controlled by an electromechanical dynamometer: http://revistasabi.fi.mdp.edu.ar/index.php/revista/article/view/326/351
2021	Huerta-Ojeda et al. (2021). Influence of Maximal Isometric Strength on 20-Meter Sprint Time: https://www.scielo.br/j/rbme/a/TPg67H34R6TqvdJ9bhPfMFP/abstract/? lang=en
2021	Sanchez et al. (2021). Test-retest reliability of a functional electromechanical dynamometer on swing eccentric hamstring exercise measures in soccer players: https://pubmed.ncbi.nlm.nih.gov/34316399/
2022	Chirosa-Rios et al. (2022). Defensive Two-Step Test In Handball Players: Reliability Of A New Test For Assessing Displacement Velocity: http://ojs.e-balonmano.com/ index.php/revista/article/view/613
2023	Contreras-Diaz et al. (2023). Dynamometric Strength Profile of Hip Muscles in Youth Soccer Players: https://www.mdpi.com/1660-4601/20/2/1291
2023	Escobar-Molina et al. (2023). Analysis of grip specificity on force production in grapplers and its effect on bilateral deficit grip specificity and bilateral deficit in force production among grapplers. https://www.ncbi.nlm.nih.gov/pmc/articles/ PMC10563762/
2023	Chirosa-Rios LJ et al. (2023). The Role of the Specific Strength Test in Handball Performance: Exploring Differences across Competitive Levels and Age Groups. https://www.mdpi.com/1424-8220/23/11/5178
2024	Torres-Banduc M (2024). Impact of Starting Knee Flexion Angle on Muscle Activity and Performance during Plyometrics without Jumping. Sensors. https://doi.org/ 10.3390/s24010044

Image *1. MYOQUALITY M1: An example of specific judo actions.*

Once the validity and reliability of the device had been demonstrated, we set out to verify the bilateral strength deficit in general and in grappling combat sport specific action in the control group and grapplers. A sample of 73 subjects, divided into 2 groups, was used: the Student Group *(15 females and 16 males)* and the Grappler Group *(29 males and 13 females)*. The male and female participants attended four laboratory sessions over a 48-hour interval, the first two

to familiarize themselves with the FEMD, and the last two to collect maximal isometric strength data, using a standard grip and a judo/jiujitsu specific grip. Significant differences in mean and peak forces *(p < 0.001)* were found, with high performance combat sport athletes having greater maximal isometric strength compared to students both bilaterally and unilaterally *(p < 0.001)*. All comparisons also indicated higher values for males compared to females *(p < 0.001)*. The results suggest that specific training in combat sports as well as sex differences play a significant role in maximal isometric strength performance. The type of grip used affects the application of force in the upper limb isometric strength tests, finding a main effect of grip type *(p < 0.001)*, with the standard grip obtaining higher levels. However, the dominance between hands remains constant. More research is needed on specific judogi/jiu-jitsu-gi grips and their impact on maximal isometric strength with the FEMD and this device opens up a wide range of possibilities for the study of Judo.

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LINKS BETWEEN TATAMIS - RESEARCH AND RESEARCH – TATAMIS THE CONTRIBUTION OF RESEARCH TO TATAMIS AND THE CONTRIBUTION OF TATAMIS TO RESEARCH

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ABSTRACT

Examples from the tatami and from research illustrate the advantages and limitations of the links between tatami and research. The aim in this 7th Conference, is to show, within 5 examples, that there are convergences that can benefit both fields.

The analysis of two articles *(sports magazine vs. scientific magazine)* on judoka attack systems shows the convergence of profiles proposed and the interest of the scientific approach.

The results of the analysis of judoka's efficiency in the standing-to-ground-work transition *(scientific book chapter)* offer a useful reading grid in competition and/or training.

The use of scientifically established physiological data underlines the contribution made by research, explaining, for example : *(1)* the dangers of training to resist strangulation; *(2)* how to organize uchi-komi and nage-komi differently.

Analysis of the use of video enables us to differentiate between video assistance and video analysis and presents tools for training or decision support. These examples illustrate the need for scientific reflection *(method, approach, repeatability, refutability)* to ensure that the results obtained are scientifically valid, and the possibilities of linking this research with the tatami and vice versa.

Keysword: *links research-trainers, behaviors analysis, decision support system, judo.*

INTRODUCTION

My communication in 2014 was entitled : "Beyond the white reflecting image that is the judogi: research, works and thoughts on balance, education, and creativity in judo".

My works always concern these themes.

The aim in this 7th Conference, is to show, within five examples, that there are convergences that can benefit both fields. These five examples concern the attack system, the tachi-waza => ne-waza transition, resistance to shime-waza, uchi-komi and nage-komi and video analysis.

With the exception of shime-waza resistance, all these examples are based on tatami use and/or scientific publications. There are *(many)* other examples that demonstrate these convergences. I'm thinking in particular of the work of Emerson Franchini and Stanislaw Sterkowicz concerning judo tests and physiological knowledges. You'll be familiar with Emidio Centracchio's work on video analysis, and we'll have a lot of work to do with the data he puts online on his site.

Example *1 : the judoka attack system*

The concept of tokui-waza has long been questioned in terms of the attack system. In 1975, Baudot, Pelletier and Urvoy wrote :

"Many judokas base their judo on their tokui-waza. In combat, they attempt it in distinct phases that change continuously, whereas they should combine several techniques *(renzaku-waza)* in relation to a main one, according to the opportunities. When the judoka can execute an attack with several complementary techniques, move from right to left, from front to

back or vice versa, from hip techniques to leg techniques [author adds: with the same kumi-kata], continue the combat in ne-waza, it is a sign that he has assimilated the principles of judo".

The reading of judo magazines leads us to maintain an important link with research work. Our comments will be based on two articles, one published in a specialist judo journal and the other in a peer-reviewed journal.

Table *1. Comparison of the two papers (research question, sources, methodology, conclusions)*

Analysis plan		Roux (2019) (standing and ground attack system)	Calmet-Pierantozzi (2021) (standing attack system)
Research question		The system of attacks is an individual construction that allows the judoka to acquire a complete panoply of techniques enabling him to take the initiative against his opponent, whatever his attitude.	An attack system is composed of a kumi-kata, which allows the opponent to be thrown in different directions using different judo throw techniques.
Sources		Unspecified, based on personal expertise	Internet sites, published papers (cf. references)
Methodology	Samples, subjects	Unspecified, based on personal expertise	28 high-level judokas, various categories, 9 countries, from 2011 to 2017
	Combats analyzed	Unspecified	At least 4 combats from the same competition for each judoka.
	Verification	Unspecified	Data verification
	Analyses	Unspecified	Statistical analysis of data
	Criteria used	Data based on personal expertise: Kumi-kata, throw technique(s), special, preparation and pre-action diagram(s), combination(s) of techniques	Data collected from 122 combats, 973 attacks Kumi-kata, time, throw technique(s), direction of attack, score obtained, number of supports
Conclusions / Results : Virtual judoka presented		Has an effective special and several complementary techniques enabling him to cover all attack directions. Has several kumi-kata and can adapt to most kumi-kata situations. Depending on his favorite techniques, masters the different principles of preparing direct and indirect attacks (action-reaction; feints; chaining; redoubling attacks). Vary the pace of attacks and adapt to the situation.	6 different kumi-kata with the possibility to throw with a kumi-kata: - corresponding to the direction of attack (60%) - opposed to the direction of attack (30%) - mixed kumi-kata (lapels or sleeves) (10%) these kumi-kata allows to combat against any opponent using any kumi-kata. Throws: 6 different directions of attack - 80% are direct attacks - 20% are linked attacks Supports: Throws used in the system of attacks require 1 or 2 supports (50% vs 50%) Physiology: This judoka can combat for 20 min (i.e., around 4 or 5 combats, with rest between combats), and can do 3 attacks per minute.

Advantage of the coach's publication: you get his expertise immediately *(even if you have to wait for him to develop it)*, but it is a lone source, so you have to consult other coaches to see if there are any common points *(but it is already a form of research)*.

Advantages of scientific publication: you can justify your methodology and have your work reviewed by other experts, confirm, or refute by other experts. Disadvantages: collecting data and analyzing it to confirm a hypothesis can be time-consuming.

What is characteristic about these two publications is the convergence of their content.

Scientific analysis can provide more:

- The attack system is independent of rule changes and independent of the judoka's gender: women and men organize themselves in the same way during combats.
- Modelling the results allows us to understand them in another way.

This graph *(Fig. 1)* models the activity of beginners, experienced judoka, and experts in placing and using their kumi-kata.

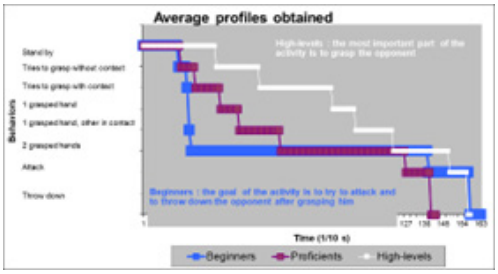

Fig. *1 : placing and using the kumi-kata according to level (Calmet, Miarka, Franchini, 2010).*

This graph *(Fig. 2)* models the activity of a judoka during a combat at the World Championships. The stairs are made up of steps representing a sector of rotation. There are 8 sectors for analyzing rotations *(like the eight directions of the kuzuchi rose)*.

A white ascending staircase models rotations without kumi-kata, a black ascending staircase models rotations with kumi-kata.

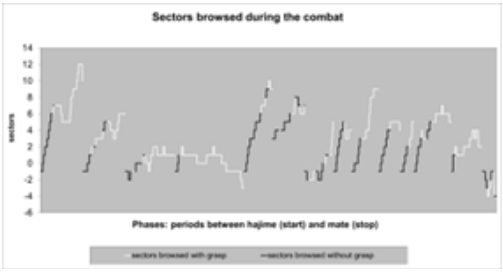

Fig. *2 : modelling rotations without or with kumi-kata (Calmet, 2010)*

This graph *(Fig. 3)* models a judoka's attack system during a World Championship, showing his efficiency *(the directions in which he scores points)*, his technical skills *(the directions in which he attacks)* and his physical condition *(number of attacks per 20s)*.

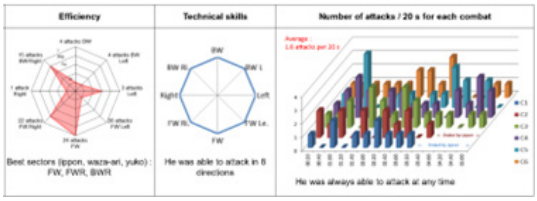

Fig. *3 : modelling efficiency, technical skills, and physical condition (Calmet, Pierantozzi, 2013).*

The system of attack is an important aspect of individualized training, introduced from the blue belt onwards in the French judo progression.

These two types of production show the importance of the evolution of scientific ideas *(Kuhn, 1962)*, changes take a long time. And the scientific analysis can bring new information that can always be repeated, verified and refuted *(Popper, 1959)*.

Example *2: Contribution to the analysis of the transition from tachi-waza to ne-waza*

Concerning this second example, our comments will be based on Roux's diploma obtained in 1990 from the "Institut National du Sport, de l'Expertise et de la Performance", revised and published in a book chapter in 2010. The observation grid *(Tab. 3)* has been validated after a pre-study of 150 standing connections during the 1985 World Championships. The author then analyzed the behavior of 29 judokas from 8 different countries during high-level competitions *(1982 Kano Cup, 1984 Olympic Games, 1985 World Championships, 1987 Japanese Championships, 1987 European Championships, 1987 World Championships, 1988 Olympic Games)*. The database *(Tab. 2)* includes 211 sequences of transition from tachi-waza to ne-waza *(standing attacks resulting in ippon were not included)*.

Data collections :

Table 2. Number of transitions tachi-waza => ne-waza and power balance for Tori on landing

211 transitions tachi-waza => ne-waza		
Throws	38	18,0%
Dodges	60	28,4%
Blocking	107	50,7%
Counters	6	2,8%

Power balance (FAVorable - DeFAvorable - Balanced) EXPloited - NonEXploited for Tori on landing						
	Nb.	Rate.	EXP		NEX	
FAV	150	71,1%	86	57,3%	64	42,7%
DFA	48	22,7%	0	0,0%	48	100%
Bal.	13	6,2%	0	0,0%	13	100%

One can read this table : on 211 transitions, 60 were after dodges *(28,4%)*; on 211 transitions,150 were FAVorable for Tori, 64 transitions were NonEXploited by Tori.

Observation grid :

Table 3. Typology of arrival on the ground

Family	Uke's position	Tori's position	
UKE "Face the sky"	Flat back (supine)	Kneeling on the side	Close to a kneeling situation
		Riding on Uke	
		Kneeling close to the head	
		One leg grasped	
UKE "Face down"	On all fours	Kneeling on the side	
	2 knees on the ground	Riding on Uke	
	Lying face downward	Kneeling close to the head	
TORI "Standing	On all fours	Standing on the side or in front	
	2 knees on the ground		
	Lying face downward		
"Balanced"	Seated	Standing between the legs	
	Flat back (supine)	Kneeling between the legs	

This observation grid allows specific kakari-geiko to train transition : Tori attacks without score = ippon, Uke facilitate the throw and the arrival on the ground:

a. Tori attacks o-uchi-gari, Uke falls on the ass then arrives "Flat back", Tori has one leg grasped, then ne-waza
b. Tori attacks tai-otoshi, Uke dodges and arrives "on all fours", Tori rides on Uke

This example shows the contribution *(the transition :)* of scientific research to tatamis. Criteria and methodology are clear, and the collect of data can be repeated, checked and refuted.

The observation grid is immediately useful for trainers or athletes.

The following examples will show the complement: the contribution of tatamis to research.

Example *3: shime-waza resistance*

Let's go back and look at some recommendations or instructions given a few years ago:

Resisting strangulation means showing willpower and determination. We used to train to improve our determination, let ourselves be strangled, and then resist and give up only at the last moment, just before fainting.

Some judokas began to experience dizziness, fainting and blackouts when wearing a tie that was a little too tight. Doctors diagnosed a weakening of the carotid sinus trigger threshold *(Lu, Lu & Pasquier, 2018)*. This led to a drop-in heart rate.

Nowadays, children have played the "scarf game" to feel dizzy, and this has unfortunately led to tragic accidents *(Courteau, 2010)* and one can found on internet examples concerning punishment and strangulation *(Langé, 2020; Merle & Giquel, 2023)* or personal training "Judo pushes me to my limits, to my limits. You learn to have a strong mind, to resist strangulation" *(Damien, 2022)*.

Scientific papers give as conclusions, that :

"Concussion, with the resulting impairment of cognitive functioning, requires immediate cessation of sporting activity, as there is a high risk of injury and further concussion, with a risk of prolonging the duration of post-concussion syndrome. Recovery time varies. In our view, a management approach similar to that used in rugby is appropriate, with consultation of a specialist neurologist who will assess the severity of the concussion after 48 hours, then see the judoka again after resuming exercise in stages under the supervision of the sports physician"*(Frey, Chermann, 2016)*.

"In the event of a suspected concussion, during training or competition, the coach, referee, doctor or competition referent must, from January 2024, report it to the federation on a dedicated IT space. This notification will lead to a computer tagging of the judoka's license, preventing him or her from training or competing without prior medical advice. We need to focus on a particular situation specific to our sport: loss of consciousness due to strangulation *(loss of consciousness due to Shime-Waza)*. At present, any loss of consciousness due to strangulation requires immediate cessation of competition, regardless of age, and systematic reassessment after 48 hours" *(Menard, Winkler, Frey 2024)*.

The recommendation from the field *(without scientific references, based solely on what the trainers said)* was therefore counterproductive.

Example *4 : improving speed in uchi-komi*

Judo requires speed, precision, strength...

Fournier *(1997)* explains that "... weight training is not an essential part of training, which must take place on the mat". These principles are beginning to be challenged. For example, for the past year and a half, a trainer appointed to INSEP has been in charge of weight training and physical preparation in general". The same was true for speed and explosiveness qualities.

Teacher says, we are going to improve speed, so you have to repeat the uchi-komi 10 times very quickly. The uchi-komi disposition is with two lines: white judoka and blue judoka.

White starts the exercise, 10 times for approximatively 10s. While Blue starts the exercise, 10 times for approximatively 10s, White is not really in rest. Then White changes place and repeat the same sequence. In fact, the effort is composed by intensive effort during 10s, no passive rest during 10s. After 2 times, it is sure that anaerobic-alactic pathway has been exceeded.

Knowledge in physiology enables uchi-komi and nage-komi *(speed and plyometric)* to be organized differently. The rule is quite simple : intensive short effort *(< 7s to 10s)* => long active or passive rest *(>=1min to 5 min)*.

Judo teachers manage could this nage-komi in another organization.

In groups of 7: 5 Uke in line, 1 Tori, 1 at rest. Tori does nage-komi with the 5 uke *(approx. 5s)*, then he takes the place to rest. The first Uke becomes Tori, the one in rest becomes the 5th Uke. Tori has about 5s of passive rest, then 25s of active rest as Uke. When all 7 have fulfilled their role as Tori, the 6 judokas perform uchi-komi in a soft way, moving manner, 7th does alone *(tendoku-renshu)*, while 30s. In this example, we have intensive effort *(approx. 5s)* then rest *(approx. 60s)*… and all judoka are active… an important visual indicator for judo teacher.

Another example with images, thanks to Emerson for providing me with these kinds of ideas.

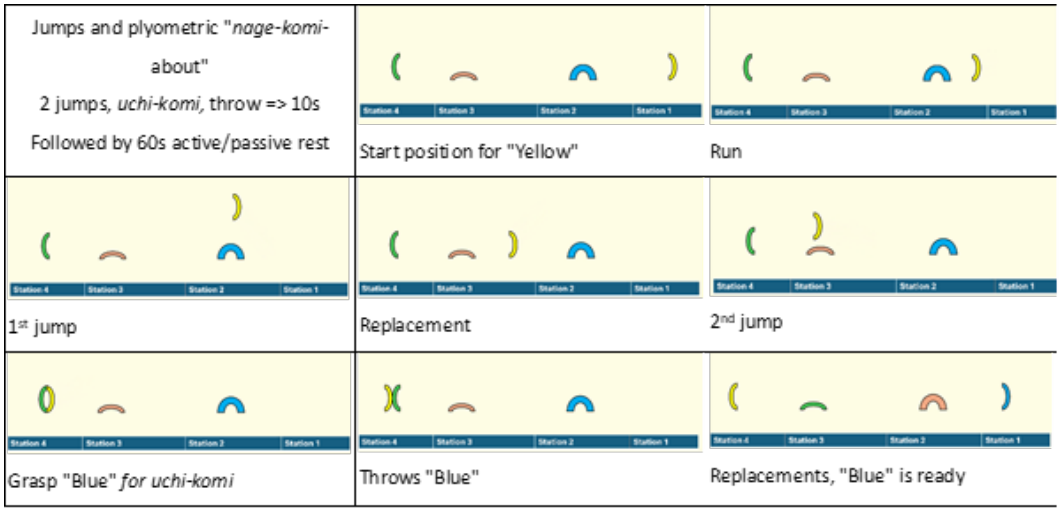

Fig. 4 : Jumps and plyometric "nage-komi-about", the first part, the "Yellow" one.

Yellow *(1st Tori)* does intensive effort: 2 jumps, 3 uchi-komi, 1 throw => 10s; followed by a rest of 3 x 10s *(the 3 other Tori)* and when all 4 have fulfilled their role as Tori, the 4 judokas perform uchi-komi in a soft way, moving manner, while 30s. In this example, we have intensive effort *(approx. 10s)* then rest *(approx. 60s)* … and all judoka are active… an important visual indicator for judo teacher.

The recommendation from the field with scientific references and imagination can give us interesting solutions. Especially for clubs.

Example *5: video assistance and video analysis*

A recent combat has led the International Judo Federation *(IJF)* to change the result. At the world championships in Doha on 05/13/2023, the final opposed Riner *(France)* and Tasoev *(a Russian fighting under a neutral banner)*. From a winner at the end of the combat, the IJF decided to award the title to both combatants several days later.

Video assistance is a system available in real time during the combat to enable the central referee to confirm or modify the decision to be taken on a specific point on the tatami. Video analysis is carried out cold, after the bouts, and consists

of replaying one or more combats *(in their completeness)*, sequence by sequence, to rigorously record one or more criteria. The examples of the attack system and the tachi-waza => ne-waza transition are perfect examples.

In this final, the action "discussed" was a Tasoev's counter . The referee and video assistance applied the rules as they had already been applied on this date 13/05/2023: no score for this type of action.

The IJF ended up invalidating this result, thus confining itself to a late "video assistance" and not a real video analysis, as IJF did not go back over the complete course of the combat.

Table 4. Time, score and penalties (Assigned / virtual) during this combat

Combat	Advantage / Penalty	Penalty chronology		Assigned / virtual
		Riner	Tasoev	
RT : 02:41	***Shido Tasoev (excessive passivity : 46s without attack)***	***0***	***1***	***Virtual***
RT : 02:27	Shido Riner (excessive passivity : 38s without attack)	1	1	Virtual
RT : 01:53	***Shido Tasoev (excessive passivity : 47s without attack)***	***1***	***2***	***Virtual***
RT : 01:05	Shido Tasoev (grasp belt without attack : 09s)	1	3	Virtuelle
RT : 00:57	Shido Riner (excessive passivity : 38s without attack)	2	3	Virtuelle
RT : 00:32	Shido Tasoev (excessive passivity : 39s without attack)	2	4	Virtuelle
GS : 00:08	Shido Riner (excessive passivity : 41s without attack)	3	4	Virtuelle
GS : 00:16	Shido Tasoev (Bear hug)	3	5	Assigned
GS : 00:30	Shido Tasoev (excessive passivity : 62s without attack)	3	6	Assigned
GS : 00:54	***Shido Riner (excessive passivity : 46s without attack)***	***4***	***6***	***Virtual***
GS : 02:20	***Shido Tasoev (defensive kneeling posture)***	***4***	***7***	***Virtual***
GS : 02:35	***Shido Tasoev (excessive passivity : 46s without attack)***	***4***	***8***	***Virtual***
GS : 03:07	Gaeshi-waza Tasoev (counter-attack)	Sore made		Virtual
GS : 03:28	Shido Riner (excessive passivity : 22s without attack)	5	9	Assigned
GS : 03:38	***Waza-ari Riner (ma-sutemi-waza)***	***Sore made***		***Assigned***

In bold, the sequences that can be penalized according to a strict reading of the rules.

This video analysis of the entire combat shows that Tasoev should probably have received a third penalty even before the "discussed" action.

In any case, video analysis allows us to take the time to rigorously review the actions. Video analysis can also be used to train referees, judoka and coaches, enabling them to look back on their work after the competition, by highlighting specific events.

For example, about periods without attack, if we consider only attacks and mate - hajime, we have :

A combat duration of 33s followed by an attack: 04:00 to 03:27

A combat duration of 24s followed by mate: 03:27 to 03:03

A pause of 18s

20s combat time then two attacks: 03:01 to 02:41

27s of combat then mate: 02:40 to 02:13

A pause of 30s

17s duration of combat, then one attack: 02:12 to 01:53

06s duration of combat then mate: 01:53 to 01:47

All these sequences seem correct, but the mate - hajime periods can mask combat durations of over 45s without attack *(Fig. 5, green rectangles)*.

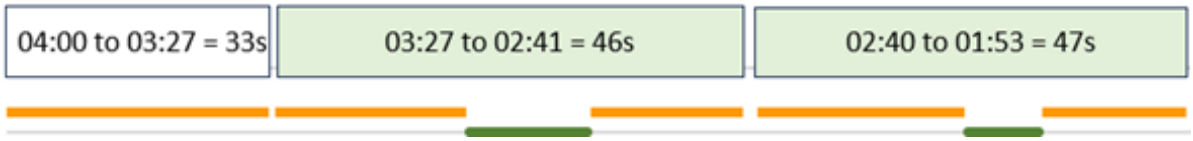

Fig. *5: non-attack periods longer than 45s, interspersed with pauses (mate - hajime)*

Video analysis can be used to highlight particular moments in the combat *(attack system, tachi-waza => ne-waza transition, rotational shifts in combat)*, as well as to model combat strategies. The data collected is then analyzed statistically if required.

CONCLUSIONS

These examples, which are by no means exhaustive, show that it is possible to construct teaching or training situations and model them in order to better understand them or better train judoka *(coaches, athletes, leaders)*.

We have highlighted a few points in particular:

The activity of beginners, experienced judoka, and experts in placing and using their kumi-kata

That women and men fought with attack systems that did not differ significantly.

That Olympics and Paralympics also had comparable attack systems.

Our scientific work can cover both practical and innovative issues. Our work also aims to study throws and their classification, and learning situations.

The focus of this congress is very much in line with the objectives of the IJF and UEJ scientific commissions: to conduct research in various fields related to judo, to collaborate with other researchers and experts, and to disseminate research results through publications, presentations and other appropriate means.

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TEACHING JUDO TACTICS ?

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The teaching of judo bears the mark of a cultural and philosophical heritage which gives technical knowledge a central place in the content to be transmitted.

The most commonly used teaching tool is the demonstration, a situation in which a static and complacent partner serves as a dummy and offers a semblance of oppositional reaction, usually virtual. In many countries, the complexity of the throws is carefully examined by all the authors of the teaching manuals published by the national judo organisations, but little attention is paid to the way in which beginners can access the degrees of difficulty that will arise when they are put into a real combat situation.

On the basis of these reference texts, judo teaching clearly favours the mastery of the analysis of the throw over the difficulty of adaptation left to the student's initiative. Aware of this paradox, many teachers have developed their own teaching methods over the years, offering their students an approach that does not dissociate technical knowledge from the tactical context in which it is used.

But however rich they may be, these personal solutions have mostly remained individual or too confidential.

The aim of this presentation is to examine the knowledge that needs to be passed on, and therefore learned, in judo. By definition, the main aim of the discipline founded by Kano is to throw down, immobilize or force to abandon someone who, having an identical project, has no intention of collaborating. So, while technical knowledge remains an essential component in the pursuit of this objective, its achievement cannot be envisaged in isolation from any tactical considerations inherent in the context of opposition. While didactic reflection on this theme is widespread and abundant in all combat and team sports, judo is surprisingly discreet on the subject.

Three lines of thought emerge. The first concerns the cultural heritage and the clash of conceptions that coexist within a constantly evolving activity. The second looks at attempts at pedagogical innovation that have sought to reform teaching content. Finally, we will look at the conditions that need to be met in order to provide teachers with concrete and useful answers to the question of prioritising content with a view to ‘building a judoka's tactical knowledge’.

DEMOGRAPHIC CHARACTERISTICS OF JUDO ATHLETES PARTICIPATING IN WORLD CHAMPIONSHIPS VETERANS: A DESCRIPTIVE STUDY

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ABSTRACT

The International Judo Federation organizes the World Championships Veterans. Despite being a world event, the literature characterizing the athletes who participate in this event is limited. The objective of this study was to characterize the careers of athletes participating in the World Championships for Veterans. A total of 3453 of those competitors (2981 males and 472 females were analyzed according to the number of competitions in the Judo World Tour, World Championships for Veterans, Veteran Continental Championships, and age of athletes at their first competition. Our findings indicated that the majority had their first world-level competition experience in the veterans' category.

Keywords: *Older athlete; Combat sport; Judo World Tour*

INTRODUCTION

As individuals age, there is a natural decline in physiological, functional, and cognitive capacities. Physical activity interventions play a crucial role during this process by reducing the associated health risks *(WHO, 2022)*. One strategy to enhance adherence to physical activity among older individuals is involvement in sport-based programs. Moreover, participation in competitions can serve as means of socialization for older athletes *(Ciaccioni et al., 2019)* and provide an opportunity for maintaining high levels of fitness among older practitioners *(Pero et al., 2009)*. In judo, the organization of World Championships Veterans *(WCV)* by the World Veterans Association continued until 2008. Subsequently, those championships were integrated into the International Judo Federation *(IJF, 2023)*, leading to the organization of several international competitions. Additionally, educational programs have been developed to guide coaches in providing safe practices for older practitioners *(Palumbo et al., 2023)*. The veterans class in judo begins at 30 years old, with weight categories mirroring those of senior competitions. However, unlike senior World Championships where participation is limited, the WCV lacks a ranking list. Consequently, athletes may participate for reasons such as socialization and health benefits *(recreational athletes)*, often including new athletes who begin practicing in older age or with a focus on competition and performance *(athletes with experience in Senior World Championships) (Pero et al., 2009)*. The age at which an athlete first competes may influence their motivations and type of practice. For instance, a study of veteran athletes found that four out of five participants had competition experience before the age of 35 *(Kontro et al., 2022)*, with those who started competing at a younger age showing greater motivation for competition and performance.

Athletes who initiate their first world-level competition experience at different ages may exhibit differences in technical proficiency. Those who begin competing at a younger age often possess a more developed technical background *(Pero et al. 2009)*. Consequently, international events such as the Veterans Championships in judo may attract participants with varying levels of experience. Understanding the characteristics of athletes participating in competitions provides valuable insights into their technical backgrounds and skill levels. This knowledge, coupled with information on safe practices *(Palumbo et al., 2023)*, can inform practical applications and initiatives aiming to promote veteran competitions. Therefore, the objective of the present study is to characterize the athletes participating in the WCV in relation to their careers.

METHODS

Participants

This study is of a descriptive design. A total of 3453 athletes *(2981 males and 472 females; mean age 49.3 ± 10.9 years)* competed in the WCV from 2016 to 2023. Specifically, data from this period was considered, excluding the year 2020 due to the COVID-19 pandemic. The number of athletes in each year was 966, 1,105, 789, 1,253, 369, 837, and 973 for 2016, 2017, 2018, 2019, 2021, 2022, and 2023, respectively.

Data Collection

All data were collected and compiled from the official International Judo Federation website *(https://veterans.ijf.org/)*. Those archived data are open-access, and no ethical issues were involved in the analysis and interpretation, as they were obtained as secondary form and not generated through experimentation. Athletes personal details were not presented in the analysis. The study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

The data are presented in terms of absolute and relative frequencies. All analyses, data processing, and graph generation were performed using R package version 4.3.3.

RESULTS

*Fig*ure 1 presents the number of participants by geographic location. Europe emerged as the most represented continent, accounting for 60.46% of the total athletes.

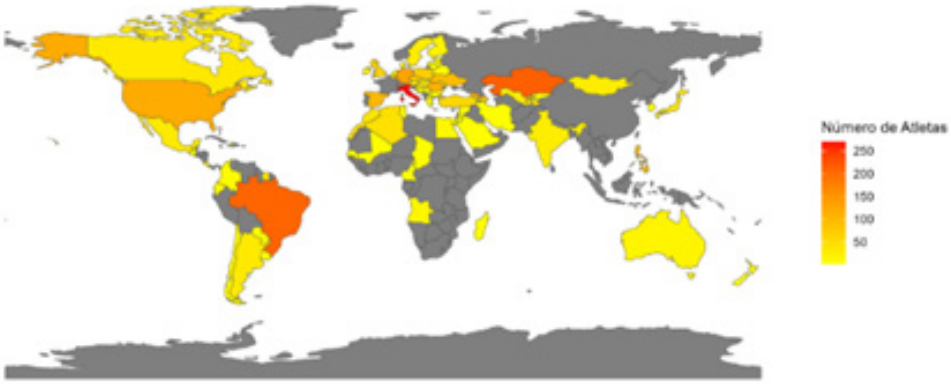

Figure *1. Number of athletes who participated in World Championships Veterans by geographic location.*

The data illustrates fluctuations in sex representation across different editions of the WCV *(Figure 2a)*. While most participants were typically males *(above 80%)*, there were variations in the proportion of females from one year to another *(ranging from 4% to 17%)*. These proportions highlight the distribution of athletes through various levels of competitions within the Judo World Tour *(Figure 2b)*. Notably, there was a higher participation rate in World Championships *(11%)*, followed by Continental competitions *(9%)*, but there was a lower rate of Olympic level athletes *(1%)*.

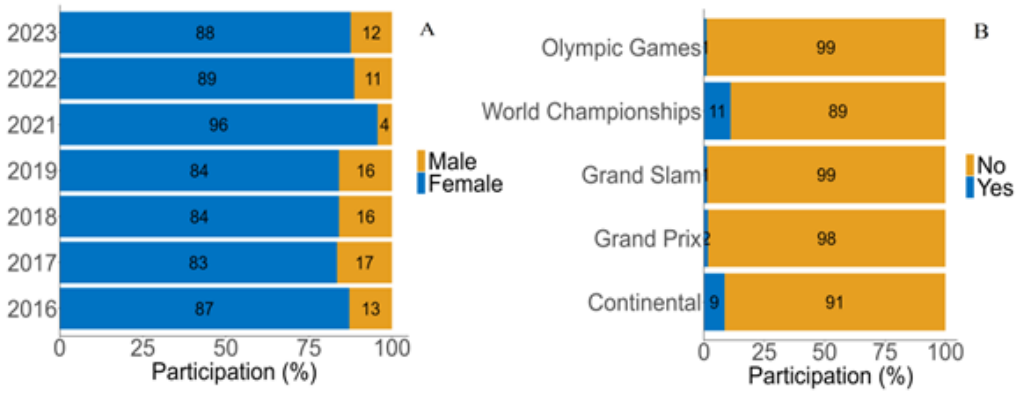

Figure *2. Proportion of athletes who competed at World Championships Veterans by sex (A) and Proportion of athletes who took part in the Judo World Tour during their careers (B).*

*Fig*ure 3 presents the number of participations for WCV *(A)* and Veteran Continental Championships *(B)*. In general, athletes participated once in the WCV *(2301 athletes)*, while the majority athletes did not participate in the continental competition *(1874 athletes)*.

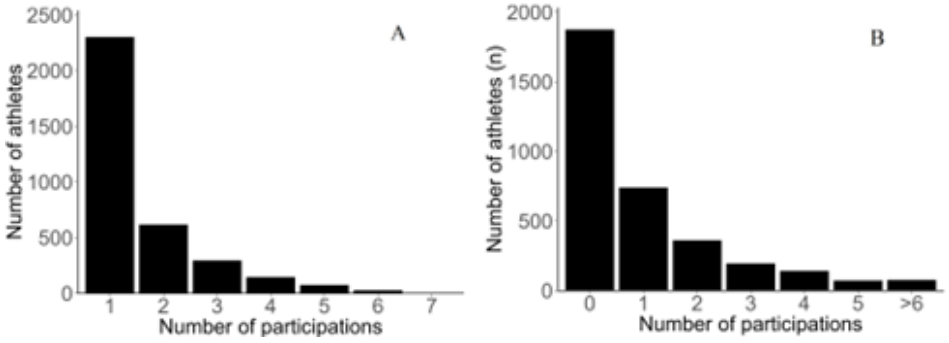

Figure *3. Number of participations in World Championships Veterans (A) and Veteran Continental Championships (B).*

The age distribution of athletes at their first competition is presented in *Fig*ure 5. The largest cohorts of athletes initiating their competitive journey were aged 30 to 35, with over 100 athletes competing for the first time in each age group. Additionally, there was a peak in participation at around the age of 44.

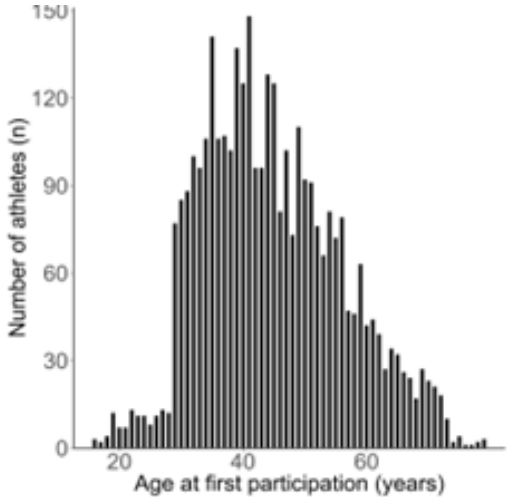

Figure *4. Age distribution of athletes at first competition*

DISCUSSION

The primary finding of this study indicates that a higher percentage of athletes participating in the WCV did not participate in the Judo World Tour during their careers. Another discovery suggests that veteran athletes typically initiate their participation in competitions at an older age. Additionally, disparities were observed based on athletes region and sex.

In terms of the Judo World Tour, the highest participation rates were observed in World Championships and Continental competitions. Conversely, participation rates were lower in competitions as Grand Prix, Grand Slam, or Olympic Games. These trends may be attributed to the age at which athletes first enter competition and the lack of a ranking list for this competition. Most athletes in our sample began competing at or after the age of 35. Previous research has shown that athletes who began competing before the age of 35 demonstrated higher motivation and performance compared to those who started later, with a focus on fitness and health *(Kontro et al., 2022)*. Consequently, those athletes may choose to participate exclusively in competitions within their age group and a limited number of competition. However, athletes who began competing at a younger age had a longer career span, enabling them to participate in more events on the Judo World Tour *(Ruiz-Juan et al., 2012)*, potentially enhancing their technical proficiency *(Pero et al., 2009)*.

Our findings reveal disparities in the number of athletes from different continents participating in the WCV. Furthermore, athletes typically participated only once in this competition, with minimal participation in Veteran Continental Championships. These trends may be influenced by competition location. While home-advantage in judo has been associated with winning medals *(Julio et al., 2013)*, financial considerations also play a role. Veteran athletes often miss the same level of financial support as younger athletes, leading them to choose competitions based on proximity or participate only once. For example, most Veterans Championships investigated in this study were held in Europe *(3)* and America *(2)*, with European-based championships being more frequent in the Veteran Continental Championships.

We found limited participation of female athletes in veterans competitions, reflecting trends observed in younger female athletes *(Julio et al., 2013)*. It is possible that older female judo athletes face barriers to participate in competitions. Additionally, female veteran athletes may prioritize social factors over competition, perceiving competition as less important *(Gil et al., 1996)*. Given the potential of sport-based judo programs to improve the health of older practitioners *(Palumbo et al., 2023)*, it is imperative to take action to promote greater participation of females in veterans competitions.

A limitation of this present study is the lack of information about the kyu and dan levels of athletes in their first international event. This information would provide greater insight into the athletes' levels.

CONCLUSION

These findings highlight that most athletes had their first world-level competition experience in the veterans category. Otherwise, athletes who participate in the WCV exhibited limited participation in major international events, including the Grand Prix, Grand Slam, World Championships, or Olympic Games. This pattern underscores the importance of promoting the WCV as a viable transition opportunity for senior athletes post-career, particularly for older female athletes.

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ACUTE WEIGHT GAIN AND HYDRATION STATUS OF JUNIOR MEN JUDO ATHLETES DURING A REAL COMPETITION

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ABSTRACT

This study aimed to determine the acute weight gain and hydration status of men judo athletes competing in the senior category during an official competition. Thirty-three male judo athletes voluntarily participated in the study. Body weight *(BW)* and urine specific gravity *(USG)* were measured at the official weigh-in time and just before the competition. A significant increase was observed in the body weight of the athletes between the official weigh-in time *(BW=67.5±7.0)* and just before the competitions *(BW=69.6±7.4) (t(32)*=-8.236, p=0.000). The body weight of the athletes increased by 2.1±1.4 *(3.1±2.3%)* from the official weigh-in to the pre-competition time. Although a significant decrease was observed in the hydration status of the athletes *(t(32)*= 2.234), p=0.033), 91% of the athletes were dehydrated during the official weigh-in *(USG=1.027±0.005)* and 85% before the competition *(USG=1.025±0.006)*. The findings of this study revealed that there was a 3% rapid weight gain in male judo athletes before the competition, but the athletes were dehydrated both during the weigh-in and before the competition. Although the International Judo Federation's rule allowing a maximum weight gain of 5% stops athletes from excessive weight gain, it does not prevent them from dehydrating before competition.

KeyWords: *Combat sports, dehydration, men athletes, health*

INTRODUCTION

Judo is an Olympic combat sport in which technical-tactical characteristics, together with well-developed anaerobic capacity, aerobic power, muscular power, maximum strength, agility, and strength-endurance, are critical for success *(Franchini et al., 2011)*. All judo athletes participate in competitions according to age and weight divisions. Weight divisions match athletes of the same size to make events fair and reduce the danger of injury to competitors. Previous research has clearly showed how athletes who want to compete in a smaller weight category resort to acute bodily water loss and dehydration just before official weigh-ins *(Ceylan & Balci, 2023; Ceylan, Barley, & Balci, 2023; Jetton et al., 2013)* by wearing sauna suits, engaging in heavy exercise and extreme environments. Athletes strive to acquire a competitive advantage against weaker and lighter opponents by resorting to rapid weight loss *(RWL) (Daniele et al., 2016; Matthews & Nicholas, 2017; Matthews et al., 2019)*. Following RWL, athletes may resort to rapid weight gain *(RWG)* in the following days, which may improve performance by giving them a size and strength advantage over a lighter and weaker opponent *(Matthews et al., 2019)*. Reale et al. *(2016)* proposed a relationship between RWG and success in actual judo contests. The differences in recovery time between the official weigh-in and the commencement of competition may have an impact on RWG in combat sport athletes *(Ceylan et al., 2021)*. RWG varies across combat sports *(Ceylan & Balci, 2023; Matthews & Nicholas, 2017; Reale et al., 2016)*.

RWL may result in extreme dehydration. Evidence-based research found that dehydration of 3-4% of body mass impairs muscular strength, power, and endurance in high-intensity exercises lasting 30 seconds to 2 minutes *(Judelson et al., 2007)*. Given that judokas begin weight reduction at a young age *(Berkovich et al., 2016; Kons et al., 2017)* and lose almost 5-7% of their body mass before tournaments *(Kons et al., 2017)*, it is unavoidable that they will have poor health and performance. In 2013, the International Judo Federation *(IJF)* suggested a new regulation regarding weigh-in time, requiring weigh-in one day before the tournament. This regulation gives athletes over 15 hours of recovery time, which was earlier only 2 hours. In addition, randomly selected athletes from each weight category are weighted prior to the competition, and they are expected not to gain more than 5% of their official weight category, otherwise they will be disqualified *(IJF, 2020)*. However, it is unclear if such rules stopped competitors from being dehydrated. Thus, this study aimed to investigate RWG and hydration status via urine specific gravity *(USG)* of men judo athletes during a

competition. The study hypnotized that athletes would present dehydration before official weigh-in and hydration in the morning of the competition following 15h of recovery and would not exceed 5% body mass gain due to the current rule related to the weight gain.

METHODS

Study Design

This descriptive study aimed to assess the extent of sudden alterations in body mass and urinary measures of hydration status in male judo athletes at the official weigh-in and before competition in a real competitive setting.

Participants

Thirty-three junior men judo athletes volunteered for the study during national championships. Athletes in the heavyweight category were not eligible to participate in the study. The athletes were not informed about the nature of the study and were instructed to continue with their usual routines. The data was collected during the 2022 National Championships. Prior to the measurements, a written consent form was obtained from each athlete, and the study was conducted in accordance with the Helsinki Declaration. All procedures were approved by the local ethical commission.

Measurements

Body composition assessment: Body composition was assessed with a bioelectrical impedance *(BIA)* device *(TANITA BC-545, Japan)*. Before measurement, information about sex, height, age was entered to BIA device and athlete mood was selected. BIA is an appropriate device to determine body composition of people from different conditional level *(Swartz et al., 2002)* and young adult participants *(Vasold et al., 2019)*. Body fat percentage was recorded for each athlete.

Hydration Assessment: Before any body mass measurements were taken, each participant provided a midstream urine sample. The samples were placed in plastic cups, and USG was calculated using a digital refractometer *(ATAGO PAL-10S, Japan)*. Urine samples were promptly examined for USG and then discarded. USG was classified as hypohydrated *(USG ≥1.020)* as suggested by ACSM position stance *(Sawka et al., 2007)*.

Acute Weight Gain: The official weigh-in took place between 19:00 and 19:30, about 15 hours before the commencement of the tournament. During the official weigh-in, the competitors' actual body mass was determined using a calibrated digital scale. The athletes were weighed an hour before the matches started. All weight measurements were performed using the same scale. The acute weight gain *(AWG)* and AWG % were computed as follows:

AWG= *(body mass 24h post competition)* – *(Body mass at official weigh-in)*

$$\%\text{Weight gain}=\left(\frac{\text{Acute weight gain}}{\text{Official weight}}\right)\times 100$$

Statistical Analysis

The analysis was carried out with IBM SPSS *(IBM Corporation Inc. Armonk, NY, the USA)*. The mean, standard deviation and 95% confidence interval *(CI)* of the variables were given. The data normality was checked with Shapiro-Wilk test and descriptive methods using skewness and kurtosis coefficients *(Ghasemi & Zahediasl, 2012)*. The difference between USG and body weight of the athletes was carried out using Paired Sample T test. Statistical significance was set at $p<0.05$.

RESULTS

Variable (n=33)	Mean ± SD	95% CI
Age (year)	20.0 ± 2.5	19.2-21
Body height (cm)	1.71 ± 0.1	1.70-1.75
Body fat percentage (%)	7.1 ± 2.0	6.4-7.8

Judo experience (year)	10.2 ± 3.7	8.9-11.5
SD: standard deviation; CI: confidence interval		

Table 1. The demographic information of the athletes

Athletes' body weight significantly increased from official weigh-in to before the competitions *(p=0.000)*. Athletes body weight was 67.5± 7.1 at the official weigh-in and 69.6± 7.4 one hour before the competition. Athletes' body weight are illustrated in *Fig*ure 1. Athletes' mean AWG was 2.1±1.5 kg *(95% CI= 1.6-2.6)* and AWG% was 3.1±2.3 *(95% CI= 2.6-3.9)*.

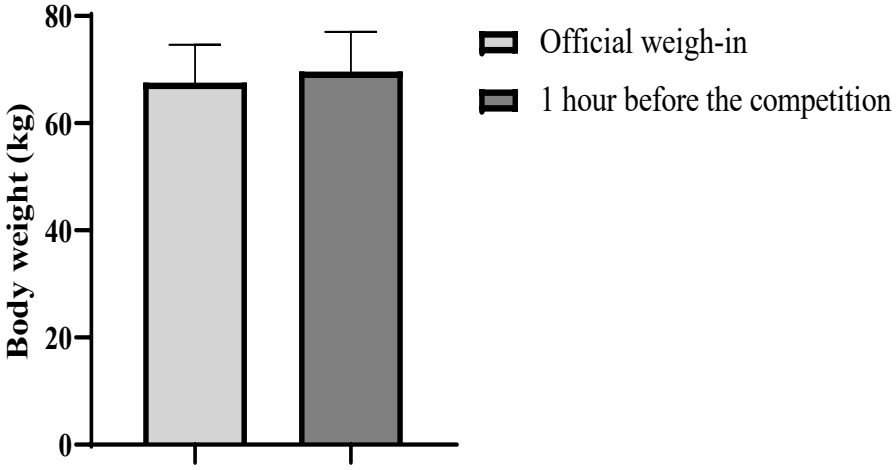

Figure *1. Athletes body weights at the official weigh-in and 1h before the competition*

Athletes' USG significantly decreased from 1.027±0.005 *(95% CI= 1.025-1.029)* to 1.025±0.006 *(95% CI= 1.023-1.027)* from the official weigh-in to 1h before the competition started *(p=0.03)*. 90.9% of the athletes were classified as hypohydrated while 9.1% was classified as hydrated at the official weigh-in. As for the hydration classification at 1h before the competition, 84.8% of the athletes were hypohydrated while only 15.2% was hydrated.

DISCUSSION

This study evaluated hydration status and AWG of junior judo athletes during a real competitive environment. The main findings of the current study as follows: a) athletes' body weight significantly increased from the official weigh-in to 1h before the competition, b) athletes' hydration status decreased from the official weigh-in to 1h before the competition while athletes presented high level of hypohydration at two measurement times.

Certain regulations have been developed within judo to prevent the health and performance-related negative impacts of AWL and dehydration. Two of such requirements are: 1) an official weigh-in is held almost 15 hours before the competition, and 2) a random weigh-in check immediately before the first bouts in the morning of the tournament to verify that athlete weight gain is less than 5%. *(IJF, 2013, 2020)*. However, although these regulations aim athletes compete with optimal hydration status, they do not entirely prevent athletes from dehydration-induced weight loss as proven in the current study.

Many studies investigated elite judo athletes' weight and hydration change during official competitions and trainings and they stated high prevalence of hypohydration in athletes from different age and competitive levels *(Ceylan et al., 2022; Ceylan, Barley, & Balci, 2023; Ceylan et al., 2021; Ceylan & Santos, 2020; Ceylan, Taşcan, et al., 2023; Pettersson & Berg, 2014; Stefanovsky et al., 2019)*. Some of these studies highlight that judo athletes present non-optimal hydration habits before, during and after the official competitions. However, the most devastating results presented by Ceylan,

Taşcan, et al. *(2023)*. The authors monitored hydration status, body weight and fluid intake of elite judo athletes during an international training camp with ad libitum fluid intake. Even when athletes were at a weight-stable period, most of the athletes were classified as hypohydrated and the fluid intake level of the athletes was not enough to eliminate hypohydration among measurements.

The study results show that hypohydration is present in junior judo athletes despite the measurements taken by IJF. As it is plainly difficult to avoid rapid weight loss among judo competitors, it may be a more realistic strategy to focus on minimizing the negative consequences of AWL and hypohydration by informing/educating coaches and athletes about AWL. Future studies are warranted to determine the motives affecting athletes' fluid intake and the effect of educational programs on hydration habits of judo athletes.

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AISE AND THE PROPOSAL OF JUDO AS A PARADIGM FOR EDUCATION

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ABSTRACT

Judo, Kano's educational proposal, can be seen as both revolutionary and visionary when related to the time in which it was conceived and utopian as referred to its rapid spread across space and time, being still so effective nowadays all over the world.

To paraphrase Mark Twain, - not knowing it was impossible, he achieved it -. Those who come after him will have the great responsibility of carrying forward this great and complex work.

AISE, Italian Sports-Education Association, was born from the idea of a man, Cesare Barioli, who made the ideals of Kano's judo his starting point and his life path, of extending the proposal of individual improvement promoted by Kano to all sports and to all women and men who share these ideals.

Keywords: *Education, AISE, seyrioku-zen'yo, jita-kyoei, longlife learning.*

INTRODUCTION

"Judo is the most effective Way *(Do)* to use physical and mental strength. Training in the discipline of Judo means achieving perfect knowledge of the spirit through attack-defense training and assiduous effort to obtain physical-spiritual improvement. The perfection of the individual thus obtained must be directed towards social service, which constitutes the ultimate objective of Judo" *(J. Kano: 'Judo', 1915 - 1916)*.

Judo was conceived as a complex educational system for the development of the human being, for his realization and unification *(seiryoku-zen'yo)*, with the ultimate aim of being useful to society *(jita-kyoei)*.

J. Kano's program is based on the "principle of the three cultures", intellectual, moral and physical, which identify three interconnected paths that must be equally cultivated to develop individual potential in a balanced way *(Cunningham, 1998)*.

Philosophers and pedagogists such as E. Pestalozzi, J. Dewey, E. Morin, have argued that the purpose of education is to teach how to live in an integral way, fully expressing one's personality, and that "this flourishing of the self can only occur in relation to us, to the community and to the society in which we live" *(Morin, 2023)*.

In the conference at the University of Southern California *(USC)* in Los Angeles in 1932, Jigoro Kano explains that, as compared to jiu-jutsu *(art or practice of adapting to achieve victory)*, judo *(principle of adaptability)* applies not only to combat or physical education, but also to other fields of human activity by improving the intellectual and moral faculties, thus completing the education of young people.

Judo is therefore a large and complex educational project developed by Jigoro Kano with a rigorous scientific method.

Cesare Barioli, one of the pioneers of Italian judo, was a profound researcher and expert of the discipline, author of numerous articles, books, and editor of important translations of texts on judo and beyond. He began his training in the period in which Judo was yet to be discovered in Italy and his point of reference soon became the French school, where judo had developed long before, driven by a group of intellectuals who deepened this discipline in its broader interpretation. Struck and fascinated by this vision and driven by the need to fill this gap in Italian judo, he began his lifelong battle until he conceived and founded the AISE *(Italian Sports-Education Association)* in 2002. An association, therefore, with ambitious goals which also makes use of Kano Jigoro's writings to study and promote judo, which, as its founder [Kano J.] said, is broad and deep.

THE HISTORICAL ASSUMPTIONS: KODOKAN YUDANSHAKAI AND BUNKAKAI

Forty years after the Kodokan was founded, Kano, as a member of the IOC, after helping judo to spread widely throughout Japan and in several countries around the world, was indeed aware that the rapid spread of judo might cause a loss in its contents.

In 1922 Jigoro Kano founded the cultural association Kodokan Bunka-kai, and the dan bearers' association Kodokan Yudansha-kai, with the purpose of preserving and spreading judo's cultural, moral and philosophical aspects, promoting the full development of the individual according to the key principles of the best use of the energy of mind and body *(seryoku-zen'yo)* and mutual prosperity and well-being *(jita-kyoei)*.

In Judo Kyohon *(Yoko-no-katsudo,1922)*, Kano states:

"...I said that on every occasion training acquires its splendor only if it is supported by moral and mental discipline; but it will always remain incomplete if it does not lead to a real application in practical life" and that the Kodokan Bunka-kai was born from the urgent need of "spreading the culture and the technique to perfect the personality and organize social life by eliminating the superfluous, which are the prerequisites for a healthier and more stable society."

The Bunka-kai regulations contained the actions to be undertaken to achieve the goals: publication of magazines, organization of conferences and training courses, diffusion by sending teachers to different regions through the establishment of regional Yudanshakai. The research focused on various aspects: how to dress, eat, live, work for the well-being of the people, morality, physical education and hygiene. *(S. Shobo, 1983)*.

On June 5, 1934, at the Parnassus Society in Athens, Jigoro Kano communicated that he conceived judo as an educational paradigm of the human being, based on two principles:

"1° Whatever the objective, the best way to achieve it will be the maximum or most efficient use of mental and physical energy directed towards that goal.

2° The harmony and progress of an organization, consisting of several individuals, regardless of whether the number of such individuals is low or high, can be best preserved and achieved through mutual aid and concession."

Kano's urgency, at his highest development step of judo, was therefore to communicate to the world that the aim of judo was to realize the maximum human potential in the service of society and to spread a culture of solidarity and peace.

"Put education at the basis of everything. The education of one human being can influence ten thousand learners, and the knowledge of one generation reaches a hundred generations"

(J. Kano, 1934).

FROM JUDO-EDUCATION TO SPORT-EDUCATION

AISE was founded by a group of judoists who wanted to propose and disseminate the principles of judo as a paradigm for global individual training and growth.

In a conference in L'Aquila, in 1999, Cesare Barioli explained as follows:

- In practice, how does judo work? One of his mottos is: "Give to grow and grow to give more". The structure of judo is described as a foundation which is to teach how to fight; the walls of the building are "being healthy to be useful", and the roof is made up of the moral principle of the "Best Use of Energy".

It all begins with a greeting, which is a ritual to fix attention. Then, behind the superficial facade of studying falls and perfecting punch and kick techniques, throws and body-to-body fighting, the young man faces a period in which the goal is to give all of himself to judo. After this experience he will be able to give all of himself to any goal: family, work, a business, the solution to a crisis. The next step leads him to give all of himself with judo. This implies meeting the other and being able to work and build together with him, using the education received.

The third step is to give all of oneself to others, that is, the understanding of the social principle: we are together to build a better world -

The two judo maxims Seiryoku-Zen'Yo and Jita-Kyoei summarize this paradigm. Through physical practice these two principles are acquired in a profound and tangible way.

The effort directed towards effective action in combat, seeing oneself in the mental state of fighting for life and death *(shiai)*, seeking the ippon, leads to the search for the best use of physical and mental energies *(seiryoku-zen'yo)*, and this attitude can be applied in everyday life. This couldn't be possible without the presence of an opponent, who actually makes the action happen. The main pursuit of our purpose is the consideration towards the opponent and, more widely, towards our whole community *(jita-kyoei)*.

At the end of the 90s the judo-education project involved associations in several regions of Italy sharing this same vision of judo as an instrument to pursue the global and integral development of an individual's personality, the same need to thoroughly research the values and principles of judo and the same belief that the benefits of judo should be extended to women and men of all ages for a lifelong learning.

Particular attention was paid to the most disadvantaged categories; disabled, youth at risk, convicts, again with the aim of promoting autonomy and integration into society as far as possible.

In 2002, AISE made the move from judo-education to sport-education aiming to expand this vision to all specialties involved in education, culture and sport.

AISE: FROM VISION TO MISSION

The vision of AISE is:

"Our origins are in that judo whose beauty lies in fighting, in which the union of body, mind and heart leads to working together for a better future".

Article 4 of the Association's founding statute states:

Aims and objectives: AISE is an apolitical, non-partisan, non-denominational, non-profit association which applies equal opportunities between the sexes. AISE promotes and organizes physical activities in an educational sense as a moment of psycho-physical and ethical growth of the individual, for a better social integration and moral training; it works for the well-being of individuals through education, culture, health protection, civil protection, ecological sensitivity and social solidarity.

To this aim, AISE organizes and supports, through the commitment of voluntary members, or in collaboration with other public or private bodies:

a. the development of physical activities with educational intent and psycho-physical well-being;
b. training opportunities for young people; training sessions, tournaments, internships, seminars;
c. activities that include people with disabilities, with socio-economic disadvantages, the elderly, and young people at risk;
d. teacher training and refresher courses;
e. cultural, educational or ecological events and trips;
f. dissemination and publishing; publication of articles, books, organization of conferences and dissemination via social media;
g. collaborations with universities;
h. volunteering, civil service and any other activity compliant with social purposes.

AISE organizes in-depth weekends for young people on both technical and cultural aspects, summer and winter judo internships and related activities *(climbing, sailing, swimming, trekking, cooking, crafts, environmental protection)*. Thanks to the twinship with the University of Tsukuba, Japan, young Japanese athletes were hosted at the internships.

Since 2005, student judo tournaments have been organized, with referee rules that emphasize the pursuit of ippon, also open to the participation of athletes with intellectual-relational disabilities belonging to the first ability category.

Over the years, mixed team competitions of girls and boys and White and Red *(Kohaku-shiai)* have been organized co-operating with other associations, to show judo and its values to a wider audience through events of significant spectacularity and beauty.

Many activities were aimed at offering opportunities for participation in courses and internships to young people with social and socio-economic hardship, orphans and refugees through dedicated projects such as "Social Emergency", "Friendship Between Peoples" and "Social Action" with the involvement of the institutions.

Through the "Women and Sport" movement, AISE's aim is to focus on the role of women in sport, their participation in decision-making bodies, the relationship between men and women and the overcoming of cultural and ethnic barriers.

In the field of judo adapted to intellectual-relational disabilities, AISE relies on an experience dating back to the 1980s, in the relationships with European experts, especially from France, which were translated over the years into activities that characterized AISE. The aim is to encourage the participation of people with disabilities in internships, meetings and tournaments organized in various cities in Italy, Northern to Southern, with the involvement of local and national associations. Training and refresher courses for Special Needs Judo teachers were organized in collaboration with the Belgian and Dutch G-judo and with the EJU and in-depth courses on learning difficulties with rehabilitation experts and the University of Verona. Every year an international congress is organized on the topic of disability in which experts interact and plan future activities.

AISE organizes in-depth and training internships for teachers and young people who want to embark on the path of teaching. For this purpose, thematic seminars are also organized by inviting national and international teachers, trainers and university professors.

To progress in the study of judo and related disciplines, AISE organizes international conferences every year in different cities, hosting speakers from the world of judo and from the University.

Today, twelve years after the death of Master Barioli, AISE is mainly concerned with promoting the culture of judo-education through a network of people and facilities co-operating in the planning of activities by pursuing the original ideal, opening up to the collaboration of all entities that wish to share their experiences and skills.

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BIOMECHANICAL ANALYSIS OF TECHNICAL ACTIONS USED IN THE 2021 EUROPEAN JUDO CHAMPIONSHIP – BEHAVIORAL PATTERNS AND EFFECTIVENESS

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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. The objective was to biomechanically analyse the technical actions used in the 2021 European Judo Championships based on combat time and gold score and verify the effectiveness of these same technical actions both genders. 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 $p \leq 0.05$. We complemented the association analysis between variables by calculating the adjusted standardized residuals. In both genders and phases of combat, the use of binary 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 trunk-leg binary techniques. Throughout the fights, women registered differences in the use of groups of techniques. The trunk-leg binary and minimum arm lever techniques revealed significant effectiveness in both phases of combat in both the male and female categories.

Keywords: *Judo, Biomechanics, Lever techniques, Binary techniques, Competitive performance analysis.*

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 must 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 behavioral 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)*.

Batista et al. *(2022)* observed in international competitions, the combat phase the most used techniques by the female gender are the maximum arm lever class, unlike the male gender that are the variable arm lever and minimum arm lever techniques. There were significant differences between genders in this phase in the mentioned classes. It should be noted a high use of techniques of maximum arm lever by the male categories, but without evidence of statistical significance, as well as a reduced use of medium arm techniques by both genders. The same authors observed an application predominance in the male categories of variable arm lever techniques and arm/leg binary. The female categories showed a predominance of the use of maximum arm lever and variable arm lever techniques, as well as leg-arm binary. There is a significant association of minimum arm lever techniques scored with Wazari in the male categories, as well as a significantly higher use of medium arm techniques scored with Ippon.

The objective of this study was to biomechanically analyze the technical actions used in the 2021 European Judo Championships based on combat time and gold score and verify the effectiveness of these same technical actions both genders.

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 & Sterkowicz-Przybycien, 2013)*. Data analysis was carried out to identify each technique according to seven categorization classes for Tachi-Waza, also used by other authors *(Batista et al., 2022; Sterkowicz, Sacripanti & 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 26.0 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 $p \leq 0.05$. 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 $p \leq 0.05$.

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
Male	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**
Female	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%

Table 2. Predominance of lever techniques during combat

	Phase	Midlle Arm	Max Arm	Variab Arm	Min Arm	Total
Male	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**
Female	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%

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

When we observed the effectiveness in the male categories, there were significant associations in both combat phases, in the trunk-leg binary techniques with the Ippon advantage and with Wazari advantage only in the combat phase. Significant associations were recorded equally in both phases, with the advantage of Ippon and Wazari in the application of minimum arm lever techniques. Significant associations with non-scoring techniques were recorded in the combat phase, in the application of arm-leg binary techniques, medium arm lever techniques and variable arm lever techniques. In the golden score phase, this same association was only recorded with arm-leg binary techniques.

Table 3. Male binary techniques and advantages

	Adv Combat	Arm Leg	Trunk Leg	Arms	Total
Male	Ippon	26 a	16* b	0	42
	%	61.9%	38.1%	0.00%	100.0%
	Wazari	26 a	18* b	0	44
	%	59.1%	40.9%	0.00%	100.0%
	Non Score	1269* a	407 b	3	1679
	%	75.6%	24.2%	0.2%	100.0%
	Total	1321	441	3	1765
	%	74.8%	25.0%	0.2%	100.0%
	Adv GS	**Arm Leg**	**Trunk Leg**	**Arms**	**Total**
Male	Ippon	1a	3* b	0	4
	%	25.0%	75.0%	0.00%	100.0%
	Wazari	2a	3a	0	5
	%	40.0%	60.0%	0.00%	100.0%
	Non Score	122* a	45 b	0	167
	%	73.1%	26.9%	0.00%	100.0%
	Total	125	51	0	176
	%	71.0%	29.0%	0,00%	100.0%

Table 4. Male lever techniques and advantages

	Adv Combat	Midlle Arm	Max Arm	Variab Arm	Min Arm	Total
Male	Ippon	0a	21a	19a	20* b	60
	%	0.0%	35.0%	31.7%	33.3%	100.0%
	Wazari	0a	26a,b	27 a	17* b	70
	%	0.0%	37.1%	38.6%	24.3%	100.0%
	Non Score	59* a	460b	572* b	176 c	1267
	%	4.7%	36.3%	45.1%	13.9%	100.0%
	Total	59	507	618	213	1397
	%	4.2%	36.3%	44.2%	15.2%	100.0%
	Adv GS	**Midlle Arm**	**Max Arm**	**Variab Arm**	**Min Arm**	**Total**
Male	Ippon	0a, b	1 b	2a, b	3* a	6
	%	0.0%	16.7%	33.3%	50.0%	100.0%
	Wazari	0 a, b	1 b	1 b	4* a	6
	%	0.0%	16.7%	16.7%	66.7%	100.0%
	Non Score	6 a, b	82 b	84 b	21 a	193
	%	3.1%	42.5%	43.5%	10.9%	100.0%
	Total	6	84	87	28	205
	%	2.9%	41.0%	42.4%	13.7%	100.0%

When we observed the effectiveness in the female categories, there were significant associations in the use of trunk-leg binary techniques with the advantage of Wazari in the combat phase and Ippon in golden score. There were also significant associations in the combat phase, with the advantage of Ippon and Wazari in the application of minimum arm lever techniques. Significant associations with non-scoring techniques were recorded in the combat phase, in the application of arm-leg binary techniques and variable arm lever techniques.

Table 5. Female binary techniques and advantages

	Adv Combat	Arm Leg	Trunk Leg	Arms	Total
Female	Ippon	21a	12a	0	33
	%	63.6%	36.4%	0.00%	100.0%
	Wazari	14a	18* b	0	32
	%	43.8%	56.3%	0.00%	100.0%
	Non Score	1290* a	430 b	5	1725
	%	74.8%	24.9%	0.3%	100.0%
	Total	1325	460	5	1790
	%	74.0%	25.7%	0.3%	100.0%
	Adv GS	**Arm Leg**	**Trunk Leg**	**Arms**	**Total**
Female	Ippon	0a	3*b	0	3
	%	0.0%	100.0%	0.00%	100.0%
	Wazari	2a	2a	0	4
	%	50.0%	50.0%	0.00%	100.0%
	Non Score	137* a	67 b	1	205
	%	66.8%	32.7%	0.5%	100.0%
	Total	139	72	1	212
	%	65.5%	34.0%	0.5%	100.0%

Table 6. Female lever techniques and advantages

	Adv Combat	Midlle Arm	Max Arm	Variab Arm	Min Arm	Total
Female	Ippon	1a, b	6 b	5 b	9* a	21
	%	4.8%	28.6%	23.8%	42.9%	100.0%
	Wazari	0a, b	14 b	15 b	14* a	43
	%	0.0%	32.6%	34.9%	32.6%	100.0%
	Non Score	30a, b	288 b	373* b	127 a	818
	%	3.7%	35.2%	45.6%	15.5%	100.0%
	Total	31	308	393	150	882
	%	3.5%	34.9%	44.6%	17.0%	100.0%
	Adv GS	**Midlle Arm**	**Max Arm**	**Variab Arm**	**Min Arm**	**Total**
Female	Ippon	0a	2a	1a	0a	3
	%	0.0%	66.7%	33.3%	0.0%	100.0%
	Wazari	0a, b	5 b	3a	2a, b	10
	%	0.0%	50.0%	30.0%	20.0%	100.0%
	Non Score	2a, b	26b	70* a	17 a, b	115
	%	1.7%	22.6%	60.9%	14.8%	100.0%
	Total	2	33	74	19	128
	%	1.6%	25.8%	57.8%	14.8%	100.0%

DISCUSSION

Overall, we observed a predominance of use by judokas of binary techniques *(60%)* compared to the use of lever techniques *(40%)*. This evidence contradicts the results observed by Sterkowicz, Sacripanti and Sterkowicz-Przybycien *(2013) (lever 60.5% and binary 39.5%)* and Batista et al. *(2022) (lever 62% and binary 38%.)* which recorded an opposite reality. When analyzed by groups of techniques, the hierarchy of technical actions used in the combats analyzed in Tachi-Waza respect the same trend found by Batista et al. *(2022)*, in binary techniques *(arm-leg binary and trunk-leg binary)* and in lever techniques *(variable-arm, maximum-arm, minimum-arm and medium-arm lever techniques)*. However, if we analyze by genders 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.

The trunk-leg binary and minimum arm lever techniques revealed significant effectiveness in both phases of combat in both genders categories, contrary to what reported Batista et al. *(2022)*, where they recorded significant effectiveness with minimum arm lever techniques, judged with the Wazari score in the male categories.

Throughout the combat phase in both genders, there were significant associations with the unscored execution of arm-leg binary techniques and variable arm lever techniques. Apparently, the training standardization worldwide tends to shape the technical options and their application frequency in modern judo *(Batista et al., 2022)*, with innovative technical actions even appearing in chaotic forms that escape the technical classicism observed in the recent past *(Sterkowicz, Sacripanti, & Sterkowicz-Przybycien, 2013)*.

This work, despite presenting a method of classifying the technique different from the conventionality of technical analysis works in judo, presents an interpretative limitation based on the absence of other technical-tactical indicators before the technical execution by the competitors.

Due to the somatotypical variability and decision-making of athletes, it will be interesting in future studies to evaluate trends in technical options and technical-tactical patterns in different weight categories and phases of the competition.

CONCLUSION

In both genders and phases of combat, the use of binary 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 trunk-leg binary techniques. Throughout the fights, women registered differences in the use of groups of techniques. The trunk-leg binary and minimum arm lever techniques revealed significant effectiveness in both phases of combat in both the male and female categories.

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LONG-TERM DEVELOPMENT IN JUDO: A NEW APPROACH OF TEACHING JUDO FOR YOUNG JUDOKAS

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ABSTRACT

This paper proposes a novel approach to judo instruction in Flanders , drawing upon existing Long-Term Development in sport *(LTD)* knowledge and informed by experience and research conducted within the region. LTDP is a holistic plan in which physical and technical development are linked and reinforce *(judo)*skill development. It also integrates judo values as a foundation for personal growth and self-development of young judokas. In line with the LTDP guidelines established within this framework, a new competition format, the Judo Kids Cup, is introduced for young judokas. This competition prioritizes skill acquisition, positive experiences, and fostering of a long-term development perspective.

INTRODUCTION

Judo Vlaanderen's Long-Term Development Plan *(LTDP)*: A Framework for Lifelong Judo.

Building upon the established principles of Long-Term Development in sport *(LTD)* as outlined by Balyi and Hamilton *(2019)* , Judo Vlaanderen has implemented a comprehensive Long-Term Development Plan *(LTDP)* for judokas in Flanders. This plan serves two primary objectives:

Enhancing the Pathway to Lifelong Judo: The LTDP aims an enjoyable judo experience for judokas across all skill levels and age groups. By providing a structured approach to training and guidance, the plan seeks to encourage continued participation in judo throughout an individual's life.

Supporting the Development of High-Performance Judo Athletes: By focusing on building a strong foundation of skills and athletic development, we aim to enhance the pathway to high-performance judo.

This plan started from critical evaluation of current practices. For an extended period, the kyu-grading program, coaching course, and competition formats had remained unchanged. However, the crucial question arose: Were these practices effectively achieving the Federation's core objectives?

Did they truly spread and promote judo's universal values across Flanders in a way that was accessible and inclusive for all ages and skill levels? Additionally, were they adequately supporting the development of talented judokas into high-performance athletes?

The answer, unfortunately, was concerning. Statistics from Flemish judo clubs revealed a troubling trend:

- 70% of our judokas are aged 14 and younger.
- A judoka aged 11 and younger remains member of a judo club for an average of 2.18 years.
- 41.27% of our judokas aged 11 and younger have only been members for 1 year.
- 29.91% of our judokas aged 11 and younger have only been members for 2 years.
- Every year, 30% - 35% of our judokas between the ages of 10 and 19 drop out.

These statistics highlight the concerning trend of judokas leaving the sport at a young age. This is a problem that many judo clubs are facing, and it was important to take steps to address it.

The Long-Term Development Plan *(LTDP)* would become a guidance for each club and coach to improve the development of judokas. The plan differentiates 9 stages based on the physical, mental, and socio - emotional characteristics of judokas. In each developmental stage guidelines were formulated to improve the training and guidance of the Flemish judokas in their development towards lifelong judo. With the intention of integrating this LTD into each club, Judo Vlaanderen worked out three learning pathways.

Physical Development: Judo as a means to promote physical development and mastery of movement skills. Kano also emphasized this use of judo as a means to promote physical education .

Technique Development: Judo is a martial arts sport aimed at developing the necessary skills to apply technique efficiently and successfully in the game of attack and defense. Technique as a means to efficiency.

Socio - emotional Development: Judo emphasizes personal growth, self-development, and striving to bring out the best in oneself in order to contribute positively to society. It means learning to behave according to the two pillars of seiryoku-zenyo *(maximum efficiency)* and jita-kyoei *(mutual welfare and benefit)*.

Competition Structures across all Judoka Levels

Building on this holistic perspective, with the objective of creating a supportive learning environment, Judo Vlaanderen also evaluated competition structures across all judoka levels. Some key findings regarding competition drop-out:

Early Competition Start and Transition Challenges: Many judokas between 6 and 12 years old compete frequently in tournaments for age groups U9, U11 and U13. However, the transition to U15 competitions proves difficult, leading to a significant drop-out from competition at this stage.

Declining Participation in Higher Age Groups: Participation in regular competitions further declines for judoka in the U18, U21, and senior categories.

Taking these conclusions into account, Judo Vlaanderen also developed Long-Term Development Plan *(LTDP)* guidelines to enhance competition experiences for young judokas. In 2023, Judo Vlaanderen implemented a new competition format called the 'Judo Kids Cups' for judokas aged U9, U11, and U13. This event format prioritizes fun and development over competitive aspects.

PRACTICAL IMPLEMENTATION IN TRAINING AND COACHING

Long-Term Coach Development

Building upon this LTDP a long-term coach development plan for coaches was formulated. This LTCDP describes the skills, competences and characteristics of a coach needed in different contexts *(participation or performance)* throughout the development stages of judokas.

It describes the different roles that the coach in each developmental stage of judokas should take to optimally guide these judokas throughout their judo career. Important is the role of the coach for the first stages in which coaching in participation or performance contexts is no different. For judokas U9, U11, U13 focus on development, enjoyment, and well-being is always more important than performance *(or winning)*.

A Holistic View on the Development of Judokas: The Learning Pathways and Kyu Grade Program.

Physical Development: This educational program consists of a staged approach to progressively enhance the fundamental movement skills *(locomotion: walking, running; object control: catching, throwing; manipulative skills: climbing, hitting, sweeping, kicking; postural control: rotating; movement exploration: dribbling, gliding; object manipulation: lifting, carrying; jumping and landing; propulsive and receptive forces: pulling, pushing)* of young judokas. Subsequently, the program introduces judo-specific skills *(shisei [posture], shintai [body movement], kumikata [gripping], tsukuri [creating*

advantageous position], kuzushi [breaking balance]). A cornerstone of this program is the integration of exercises that concurrently target skill acquisition and the development of physical qualities: coordination, strength, flexibility, speed, and endurance. This holistic approach aims to elevate the overall judo skill and physical fitness of young athletes. After working on fundamental movement skills and judo-specific skills the first techniques can be introduced.

Technique Development: Both fundamental movement skills and judo-specific skills are the first steps to more complex judo techniques and the kyu-grade program. For each technique we had different stages of learning. According to Fits and Posner *(1964)*, there are three stages that athletes go through when learning new movements: Verbal-cognitive stage, motor-associative stage, and autonomous stage. The learning line technique aims to provide optimal opportunities for each judoka to successfully pass through the above-mentioned phases for different techniques. In this way, each judoka can manage to apply one or more techniques in randori.

Each technique, both in katame-waza and in nage-waza, is learned in several stages and steps. The kyu-grade program thus forms more than just a sequence of techniques. It is a guideline that supports the learning process, with the final goal of mastering and applying the technique in randori and competition. The learning process always starts with the basic conditions for a technique. Basic conditions are the movement skills and judo-specific skills that judokas must master before learning technique. Once these basic conditions are mastered, the step can be taken to learn the technique. We differentiate three learning stages with different goals:

- Basic stage (from 5th kyu): Learning the technique.
- Deepening stage (from 4th kyu): Applying the technique.
- Personalization stage (from 3rd kyu): Making the technique your own.

Deliberate Practice, Play and Randori are Essential Elements for this Judo Technique Development. A crucial aspect of this process lies in the coach's ability to create a dynamic learning environment. This involves fostering an atmosphere where judokas are encouraged to learn, grow, and continuously develop their skills. The coach should provide guidance, feedback, and challenges to stimulate the judokas' progress and ensure they are maximizing their learning opportunities.

The Kyu Grade Program: This new program for young judokas is designed to be appropriate for children's abilities, in line with their motoric development. The following principles were used:

- A broad base of stability: from two-legged stability to one-legged stability;
- Limit movement in different planes;
- Movements forward and backward as a basis;
- From flexion-extension movement to more complex movement;
- Symmetrical gripping of the judogi: Place both hands first and grip before working with one hand;
- From a symmetrical movement of the legs to asymmetrical work, thus limiting the mutual combination of movement in the upper and lower limbs;
- Learning by reference. Building further on what has already been learned or mastered.

Clustering Techniques for Enhanced Learning: Methodology for mastering this kyu grade program utilizes a technique clustering approach for both nage-waza and katame-waza. This approach groups techniques based on preparation, direction, and similarities in execution *(movement patterns across different techniques)*.

Prior to learning the full execution of a technique *(up to 1st kyu)*, the program emphasizes a thorough understanding of preparatory movements and foundational skills. This approach leverages the concept of transfer of learning, where knowledge and skills acquired from one technique can be applied to the learning of another. The clustering methodology aligns with current scientific understanding of motor learning.

Every movement relies on a network of neurological and neuromuscular connections, termed coordinative structures. Techniques with similar movement patterns share overlapping coordinative structures. This explains why the coordinative structures established for by example seoi-nage *(shoulder throw)* can be readily adapted to ippon-seoi-nage *(single shoulder throw)*, as both techniques share similar body posture and positioning.

The kyu grade program categorizes nage-waza based on preparation, throwing direction, and shared execution elements. Similarly, katame-waza are grouped according to preparatory movements, starting positions, and shared execution

patterns. This approach leverages established scientific principles to create a developmentally appropriate and efficient learning experience for young judokas.

Socio-Emotional Development: A list of seventeen behaviors was identified to put five fundamental values *(respect & discipline, engagement & social cohesion, safety, lifelong learning, courage)* into practice to help judokas in their personal growth and development up to 1st kyu, to bring out the best in themselves in order to contribute positively to society *(seiryoku-zenyo and jita kyoei)* .

Practical Implementation in Competition – Judo Kids Cup

Informed by the Long-Term Development Plan *(LTDP)* guidelines, Judo Vlaanderen introduced the ***Judo Kids Cup***, a competition format designed specifically for U9, U11, and U13 judokas. This new competition format embodies the LTDP philosophy, creating a platform that prioritizes:

Skill Development: The format encourages young judokas to experiment and refine their techniques in a competitive yet supportive environment. Learning time in this concept is maximized.

Positive Experiences: The focus is on participation, sportsmanship, and having fun, ensuring a positive introduction to judo competition.

Long-Term Growth: The Judo Kids Cup aligns with the LTDP's vision of nurturing a love for judo and setting the foundation for future success.

The Judo Kids Cup goes beyond simply awarding winners. It provides a platform for young judokas to test their skills and enjoy judo in a supportive environment.

Competition guidelines ensure a beneficial experience for all participants.

- The fights are guided by a Kids Cup Coach, (KC-coach) instead of a referee.
- No points are given. The KC-coach continuously gives instruction and guidance.
- Every fight is followed by a short review between the KC-coach and the judokas.
- Minimum of 4 rounds for each judoka. Each round will run for its full duration. There will be no early stoppage due to score.
- The KC coach promotes technical development according to the skill level of the judokas and intervenes when safety is at risk. This proactive approach helps maintain a safe and controlled environment for all judokas.
- Competition day for judokas is limited (U9 = max. 2h, U11 = max. 2h15, U13 = max. 3h).

Experience *a Judo Kids Cup.*

CONCLUSION AND FUTURE PROJECTS

The learning pathways and kyu-grade program will be further implemented by on-the-job training, workshops, and tools to support clubs. The LTDP is fully integrated in our LTDCP and all coach educational programs since 2023.

The Judo Kids Cup competition format has proven successful in engaging young judokas. While initial skepticism existed among some coaches regarding the de-emphasis on winning, the format's focus on skill development and positive experiences has been well-received. This aligns with the core principles of the Long-Term Development Plan *(LTDP)* and prioritizes fostering a love for judo and long-term participation over short-term victories.

Encouraged by the Judo Kids Cup's effectiveness, the focus now shifts towards developing and reforming judo competitions for U15 and older age groups. This initiative aims to bridge the gap between youth and junior competition structures, ensuring a smooth transition and fostering continued engagement. By prioritizing skill development, sportsmanship, and a positive competitive environment, the objective is to reduce dropout rates and keep judokas actively participating in the sport throughout their development.

This Long-Term Development Plan *(LTDP)* receives support from Sport Vlaanderen, the Flemish government's sports authority. Over the next four years, a key objective will be the implementation of these new programs and competition formats.

Parent *Quote after a Judo Kids Cup*

“Our daughter had already participated in a few competitions without much success. We saw the motivation dropping, but yesterday she completely revived. She found it very enjoyable. She also learned a lot from the feedback afterwards."

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Appendix.

[1] As a result of Belgium's federal structure with three communities and three regions (Flanders, Wallonia, German region), this division is also present in sports federations. Judo Belgium is divided into Judo Vlaanderen and Judo Wallonie Bruxelles. Flanders counts about 17 000 judokas.

[2] Sport for Life Society (2019), Long-term development in sport and physical activity 3.0

[3] Kennisplatform Sport Vlaanderen, 2022, consulted on 10/03/2024

[4] The context in which the athlete practices judo without aspiring to high performance judo, but with a focus on development, enjoyment, and well-being. Sport practice in this context is often classified as recreational sport. (i.e., non-high-performance sport).

JITA KYOEI MEANS MUCH MORE THAN A MORAL CODE

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ABSTRACT

In the Erasmus+ project Jita Kyoei 2, we enhanced the French moral code by adding four new values to the existing eight: Trust, Proactivity, Responsibility, and Self-realisation. This effort aimed to align the code more closely with the core judo ethical principle of Jita Kyoei. Throughout the project, we elaborated on each value and described the behaviours that support or represent these values. The Go kyu system inspired our approach to this detailed analysis of the Jita Kyoei principle.

Additionally, the project introduced the titles of Mediator of Jita Kyoei Values, Trainer of the Mediators, and Trainer of Trainers of Mediators. For these roles, we developed a comprehensive educational curriculum and syllabus. Recognising the importance of role modelling in teaching values and education in general, we placed significant emphasis on the training of coaches. Values and Judo must be lived experiences; thus, we must transfer them from posters on dojo walls to the tatami among the people.

For this reason, judo clubs must become spaces for social interaction *(without phones)* and communication, where young people can find meaning in their lives.

Keywords: *Jita Kyoei, Moral Code, Mediator of Jita Kyoei Values, Trust, Proactivity, Responsibility, Self-realisation, Erasmus+*

INTRODUCTION

The slogan Jita Kyoei *(mutual benefit)*, whose meaning could be simplified to "achieving mutual progress through cooperation," represents the ethical principle of Judo. The slogan took many years to develop before Jigoro Kano presented it to the public. Its content and meaning have been deeply embedded in the essence of Judo since its inception *(Gatling 2021)*. On the other hand, there is the Moral Code, composed by the French judo master Bernard Midan and officially introduced in October 1985 *(Brousse, 2021)*. The code emerged in response to the excessive "sportification" of Judo, which neglected its educational aspect. It was based on the Samurai Moral Code described by Inazo Nitobe in his book "Bushido, the Soul of Japan."

The Moral Code includes eight values. The number eight has symbolic significance for the Japanese. *Fig*ure eight is a vertical symbol of infinity and represents the perfect balance between man and the universe. This indicates that Midan did not attempt to deconstruct the principle of Jita Kyoei or perform a deeper analysis of Judo philosophy; instead, he adopted a few values from the list of Samurai values.

At first glance, the slogans differ significantly. One speaks of ethics, the other of morality. Let us examine the etymology of these two terms.

Ethics: The word derives from the Greek word "ethos," which means character, habit, or moral habit. It is a philosophical discipline that deals with the criteria of human will and conduct concerning good and evil *(Dictionary of Standard Slovene Language 1 2024)*.

Morality: The term comes from the Latin word "moralis," or from "mos," coined by Cicero, means customs or manners. It evaluates and directs interpersonal relationships based on the conception of good and evil *(Dictionary of Standard Slovene Language 2 2024)*. Morality is a set of rules, norms, and ideals, and feelings of guilt and similar responses internally sanction their violation.

In its original meaning, ethics and morality focus on studying, understanding, and guiding human behaviour in accordance with certain norms, customs, and societal values. Ethics refers to the systematic philosophical investigation of moral principles and values. In contrast, morality more directly pertains to the rules, specific norms, values, and customs

that govern an individual's behaviour within a particular society. It distinguishes between good and bad behaviour and actions. Therefore, morality can be understood as the applied aspect of ethics. We can say that ethics is the theoretical, general part, while morality is the practical, individual part of addressing values *(Jelenko, 2018)*.

Similarly, there is a difference between ethical and moral principles. If the Judo Moral Code is a set of values that are specific and guide behaviour in certain situations, Jita Kyoei operates more on a conceptual level and offers a broad principle that encompasses and transcends these eight values, emphasising mutual benefit and common good. Jita Kyoei not only shows how to behave in a particular situation but also encourages judokas to think about how their actions can benefit both themselves and society as a whole. The difference between the Moral Code and Jita Kyoei lies in their scope and application. Jita Kyoei directs the interpretation and implementation of other values in the dojo and everyday life outside the dojo. In a word, Jita Kyoei is a much broader concept than the Moral Code.

METHOD

While we drew theoretical insights from professional literature, the practical aspect was developed as part of the Erasmus+ project Jita Kyoei 2. In this project, we are preparing the curriculum and syllabus for the titles of Mediator of Jita Kyoei Values, Trainer of the Mediators, and Trainer of Trainers of Mediators.

The project is theoretically based on the ethical principles of Judo, Jita Kyoei *(Japan)*, and the theory of the Moral Code *(France)*. Through this project, we discovered that the Moral Code is too superficial and, in its breadth, does not capture the essence of Jita Kyoei. Therefore, it cannot replace the slogan or its meaning. Consequently, we incorporated four additional values into the original Moral Code. These values are Trust, Proactivity, Responsibility, and Self-realisation. With these new values, we aimed to enhance the Moral Code to better align with the ethical principle of Jita Kyoei.

The next step in the project involved creating educational content to train young judokas to earn the title of Mediator of Jita Kyoei Values and their senior colleagues and coaches to earn the titles of Trainer of the Mediators *(local level)* and Trainer of Trainers of Mediators *(national level)*.

RESULTS

The project within the European education platform Erasmus+ named Jita Kyoei 2 is a continuation of the successful Jita Kyoei project. The project involves partners such as the European Judo Union, France Judo Federation, judo clubs from Romania, Portugal, and Croatia, and the leading partner GIB from Slovenia. It is categorised as a big project and spans three years, from 2023 to 2025. The project aims to create an educational programme that will help judo coaches understand and teach values and the corresponding behaviours derived from the ethical principle of Jita Kyoei.

When comparing the Moral Code and Jita Kyoei, we found that none of the eight values within the Moral Code speaks about cooperation, mutual growth, or the need for individuals to educate themselves and succeed in some way that would facilitate the growth of society. Understanding the time and cultural contexts in which Jita Kyoei *(1922)*, the Moral Code *(1985)*, and the Jita kyoei 2 project *(2024)* were developed was also important.

Upon analysing the ethical principle of Jita Kyoei and the Moral Code, we discovered that the former speaks of a way of life based on the judoka *(individual)* using their knowledge and experience to help others and society achieve mutual progress. The emphasis is on reciprocity, meaning the joint advancement of both or all participants in the process. The Moral Code, however, is primarily a list of guidelines for behaviour in certain situations. It must be acknowledged that various national judo federations have created attractive posters featuring the eight values of the Moral Code. However, as Yves Cadot stated during his 2023 lecture in Ljubljana, these values must be transferred from the walls into the dojo and onto the tatami. Values must be lived.

Young people enter Judo and engage in it during their susceptible developmental periods. According to psychologist Erik Erikson, certain stages of development include:

- Developmental psychology stage: Diligence vs. Inferiority (ages 6–11 years): This stage involves the development of industriousness, feelings of competence, cooperation, and adherence to rules. Encouragement, affirmation,

and the development of strengths or repeated failures in work and relationships can lead to dissatisfaction and passivity.

- Developmental psychology stage: Identity vs. Disorientation (ages 12–18 years): This stage involves the development of identity and independence, but also the possibility of an identity crisis, a negative outlook on life, cynicism, and the potential for individuals to go astray.

These are two critical periods in an individual's development. Judo clubs serve as spaces for "systemic coaching," where knowledgeable and well-rounded coaches can do a great deal of good for young people. Conversely, a misguided coach overly focused on competitive sports can do significant harm. Since values are primarily transmitted through example, coaches are crucial in the education of young people. Judo "per se" and individual values are neither good nor bad; they are given their significance by the person who embodies and lives them. A self-assessment questionnaire can help coaches gain insight into their behaviour and how they live out these values.

HOW WE ENHANCED THE MORAL CODE

In the Erasmus+ project Jita Kyoei 2, we attempted to enhance the Moral Code by adding new values *(Trust, Proactivity, Responsibility, Self-realisation)* to align more closely with the meaning and essence of Jita Kyoei. We developed a teaching programme for these new values and in general. We also established an educational system that progresses vertically from the local to the national level.

We decided to enhance the Moral Code because it is a well-known and positively received system among "Western" judokas, making the change easier to accept. We approached this task inspired by the Go Kyu system: we broke down the philosophical essence of Jita Kyoei into smaller and simpler parts, which we explain and bring closer to students through the educational process. Although the newly expanded Moral Code cannot replace Jita Kyoei, it can help us better understand it and begin to act in its spirit. We also developed a programme for teaching values. We prepared a curriculum and syllabus for the titles of Mediator of Jita Kyoei Values, Trainer of Mediators, and Trainer of Trainers of Mediators. We prepared vertical education and laid the groundwork to immediately begin teaching values in the training programmes for Judo Trainer titles.

MEDIATOR OF JITA KYOEI VALUES

The Mediator of Jita Kyoei Values title can be obtained by young judokas aged 14 with at least a 2nd kyu. A Mediator cannot lead a group independently; instead, they are intended to assist the coach and focus more on education within each training session than on the correct execution of techniques. The course for Mediators lasts twenty hours and consists of a theoretical part, a practical part during the course and six hours of practical work with a group in the club.

The Trainer of Mediators is one level higher. This title is available to judo masters *(over twenty years old)*. Trainers of Mediators operate at the local level. They organise training for new Mediators in their town or region and serve as Mediators in their home clubs.

The Trainer of Trainers of Mediators is currently the highest level. Their activities are at the national level, or in larger countries, at the regional or interregional level. They are responsible for organising the entire training structure and ensuring that new training sessions are conducted according to the programme and schedule.

CONCLUSION

Our society is undergoing significant changes. Modern technology, especially smartphones, has taken over the world. Values and socialisation are no longer transmitted as they once were, through conversation and interaction, but mainly through social media. Neoliberalism, an economic and political doctrine that advocates for the free movement of people and capital, has a noticeable impact on the understanding and evaluating values in modern society and sport. Young people are becoming lost in such a world, left without meaning *(nihilism)* and wasting their lives. To all these "mishaps," we can add older generations' distrust towards the youth, which manifests in not giving them opportunities to be active, work within clubs, or be creative in other ways *(Galimberti, 2021)*.

Just as judo "per se" is neither good nor bad, the same applies to values.

Values are a way of thinking, not just a way of behaving. We can effectively transmit them to others only if they are placed at the centre of attention for everyone involved in the educational process, not just as a peripheral topic. Teaching values must involve two-way communication and must engage emotions. For this reason, judo clubs must become spaces for interaction *(without phones)* and communication, where young people can find or recognise the meaning in their lives. Amidst all the negativity highlighted by sociologists, psychologists, and philosophers, the Erasmus+ project titled Jita Kyoei 2 is an attempt to revitalise Judo as an educational method for developing the body, mind, and spirit.

The training for the titles of Mediator of Jita Kyoei Values, Trainer of Mediators, and Trainer of Trainers of Mediators imparts essential knowledge to coaches who, by their example, educate young judokas who will one day take over the teaching of Judo and the management of clubs from us. Therefore, educating our young people well is even more critical. With the ethical principle of Jita Kyoei *(achieving mutual progress through cooperation)* and the ultimate goal of Judo *(if you do not use your knowledge and abilities to help the progress of society, your life has been meaningless)*, Jigoro Kano gave us judokas an excellent opportunity to become good people through the practice of Judo. Along with this opportunity comes the greater responsibility to contribute through our actions to the development of other people and society as a whole.

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PHYSICAL FITNESS AND PERFORMANCE DURING A SINGLE JUDO MATCH

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ABSTRACT

The main objective of the present study was to compare the physiological profiles of judo athletes winning and losing a direct standardized contest. The main hypothesis of the present study was that judo athletes who would win their matches would present better developed strength-endurance, aerobic and anaerobic power and capacity, compared to defeated athletes. A total of 32 male adult judo athletes were recruited to take part in the present study. The athletes underwent anthropometric measurements, lower- and upper-body grade maximal cycle ergometer tests to determine aerobic power and capacity-related variables, lower- and upper-body Wingate tests to determine anaerobic power and capacity-related variables, a judo-specific strength-endurance test, and a 5-min judo match, during which its time-motion structure and efficiency determined, blood lactate *([La])* was measured and rating of perceived exertion recorded. Independent Student t-tests and discriminant analysis were used to compare winner and defeated judo athletes. The main findings of the present study were that winner and defeated athletes did not differ regarding aerobic power and capacity, anaerobic power and capacity, or strength-endurance. However, winners were able to attack more frequently, achieve a greater efficiency in these attacks, and present a lower glycolytic activation during the match *(inferred via the peak [La])*. These variables *(total number of attacks, efficiency, and peak [La])* discriminated winner and defeated judo athletes.

Keywords: *performance; combat sports; discriminant analysis.*

INTRODUCTION

Physical fitness has been considered relevant for judo performance. As the match is intermittent in nature and may last from a few seconds, when an ippon is scored at the beginning of the contest, up to more than 4 min when the match is prolonged to the extra-time, several physical abilities support judo performance. Among the most frequently variables tested in judo athletes are the aerobic and anaerobic power and capacity, strength-endurance, and metabolic and rating of perceived exertion during the match *(Franchini et al., 2011a)*. Although each of the variables may be related to specific judo actions during the match *(Franchini et al., 2023)*, judo athletes with different physiological profiles differ regarding the physiological responses to effort *(Gariod et al., 1995)*, and some of the physical test performances differ between elite and non-elite judo athletes *(Borkowsky et al., 2001; Franchini et al., 2005)*.

Few studies compared the physiological, metabolic, and performance parameters in judo athletes taking part in direct opposition *(Suay et al., 1999)*. Thus, the main objective of the present study was to compare the physiological profiles of judo athletes winning and losing a direct standardized contest. The main hypothesis of the present study was that judo athletes who would win their matches would present better-developed strength-endurance, aerobic and anaerobic power and capacity compared to defeated athletes.

METHODS

Participants

A total of 32 male adult judo athletes were recruited to participate in the present study. Participants ranged from state to national level and were in their competitive phase, but none were using any rapid weight loss procedure during the study. Judo athletes were grouped according to their technical ability, weight category, and age. No differences regarding these characteristics were observed between winning and defeated judo athletes *(Table 1)*.

Table 1. Age and anthropometric characteristics of defeated and winning judo athletes in direct confrontation.

	Defeated (n = 16)	Winners (n = 16)	95%CIdif
Age (years)	22.7 ± 5.3	22.6 ± 5.8	-4.0; 4.1
Body mass (kg)	78.4 ± 12.6	77.3 ± 10.8	-7.4; 9.6
Height (cm)	174.2 ± 6.1	175.2 ± 6.2	-5.4; 3.4
Body fat (%)	14.9 ± 4.7	13.0 ± 3.9	-1.3; 4.9

values *are mean and standard deviation, and 95% confidence interval of the difference (95%CIdif)*

Study design

The present study involved anthropometric measurements *(body mass and height)*, body fat percentage estimation *(Drinkwater and Ross, 1980)*, and a test battery composed of: *(a)* maximal graded exercise cycle ergometer tests, one for lower-body and one for upper-body, where onset of blood lactate *([La])* accumulation, heart rate, peak oxygen consumption, and the associated mechanical parameters to these variables were determined; *(b)* lower- and upper-body Wingate tests, where peak and mean power were determined; *(c)* a dynamic strength-endurance test gripping the judogi, where the maximal number of repetitions were determined; *(d)* athletes contested a one 5-minute judo match, which was filmed, and had its time-motion structure and efficiency determined.

Efficiency was considered the number of scores divided by number of attacks. Before, and 1, 3, and 5 minutes after the match, [La] was measured, whereas rating of perceived exertion was measured after the match. The tests protocols, intervals, sequence, and measurements were conducted as described previously *(Franchini et al., 2023)*.

Statistical analysis

Data are presented as mean and standard deviation, along with the 95% confidence interval of the difference *(95%CIdif)*. A Student t-test for independent samples was used to compare winner and defeated athletes. When a significant difference was found, Cohen's d was calculated as a measure of the effect size, and classified according to the proposal of Rhea et al. *(2004)* for highly trained athletes. Additionally, a linear discriminant analysis for the binomial variable *(win or not)* was conducted, using the stepwise method. The significant level was set at 5%.

RESULTS

Table 2 presents the main results of the maximal graded exercise tests.

Table 2. Physiological parameters derived from lower- and upper-body maximal graded cycle ergometer tests in winner and defeated judo athletes.

	Defeated (n = 16)	Winners (n =16)	95%CIdif
Lower-body test			
VO2peak (mL/kg/min)	45.5 ± 8.9	51.7 ± 8.6	-12.5; 0.1
Maximal aerobic power (W)	243 ± 46	253 ± 41	-42; 21
Maximal heart rate (bpm)	184 ± 10	185 ± 8	-8; 5
Rating of perceived exertion (a.u.)	18.7 ± 1.9	19.3 ± 1.1	-1.7; 0.5
Power at OBLA (W)	152 ± 40	163 ± 26	-36; 13
Heart rate at OBLA (bpm)	152 ± 12	150 ± 11	-7; 10
VO2 at OBLA (mL/kg/min)	29.0 ± 5.9	31.8 ± 6.8	-7.4; 1.8
Upper-body Wingate test			
VO2peak (mL/kg/min)	38.8 ± 6.7	39.1 ± 5.8	-4.9; 4.2

Maximal aerobic power (W)	142 ± 29	146 ± 24	-23; 16
Maximal heart rate (bpm)	181 ± 9	179 ± 11	-5; 9
Rating of perceived exertion (a.u.)	18.4 ± 1.8	18.5 ± 2.1	-1.5; 1.3
Power at OBLA (W)	75 ± 23	82 ± 22	-22; 11
Heart rate at OBLA (bpm)	146 ± 11	143 ± 12	-6; 11
VO2 at OBLA (mL/kg/min)	22.9 ± 3.3	24.9 ± 4.6	-4.9; 1,2

VO2peak = *peak oxygen consumption; OBLA = onset blood lactate accumulation; values are mean and standard deviation, and 95% confidence interval of the difference (95%CIdif).*

No significant differences *(p > 0.05)* were found between winner and defeated athletes regarding the aerobic power and capacity or physiological responses to lower- and upper-body graded cycle ergometer tests.

Table 3 presents the main results of lower- and upper-body Wingate tests, and the strength-endurance test gripping the judogi.

Table 3. Peak and mean power during lower- and upper-body Wingate tests and number of repetitions in the chin-up gripping the judogi test.

	Defeated (n =16)	Winners (n =16)	95%CIdif
Lower-body Wingate test			
Peak power (W)	834 ± 183	822 ± 136	-105; 128
Mean power (W)	619 ± 117	639 ± 92	-95; 56
Upper-body Wingate test			
Peak power (W)	701 ± 131	703 ± 139	-105; 91
Mean power (W)	479 ± 81	484 ± 70	-60; 50
Chin-up gripping the judogi (rep)	12 ± 5	14 ± 4	-6; 1

values *are mean and standard deviation, and 95% confidence interval of the difference (95%CIdif)*

No significant differences *(p > 0.05)* were found between winner and defeated athletes regarding the lower- and upper-body Wingate test performances or strength-endurance.

Table 4 presents the main actions executed by athletes during the match, their efficiency, [La], and rating of perceived exertion responses to the match.

Winner judo athletes attacked more *(t30 = 2.72; p = 0.011; d = -0.80, moderate)* and were more efficient than defeated ones *(t30 = -3.95; p < 0.001; d = -0.14, trivial)*. Additionally, peak [La] was lower for winners compared with defeated athlete *(t30 = 2.17; p = 0.038; d = 0.71, moderate)*.

Table 4. Number of attacks, efficiency, blood lactate, and rating of perceived exertion in response to a judo match in winner and defeated athletes.

	Defeated (n =16)	Winners (n =16)	95%CIdif
Total number of attacks (rep)	8 ± 3	12 ± 5	-7; -1*
Efficiency (%)	3.8 ± 6.2	24.9 ± 20.4	-32.0; -10.2*
Peak blood lactate (mmol/L)	9.2 ± 2.8	7.5 ± 1.6	0.1; 3.4*
Rating of perceived exertion (a.u.)	15.6 ± 2.0	14.8 ± 1.8	-0.6; 2.2

***significant** *difference between winner and defeated athletes (p < 0.05); values are mean and standard deviation, and 95% confidence interval of the difference (95%CIdif).*

Regarding the discriminant analysis, the Lambda Wilks test indicated the adequacy of variables inserted into the model *($p < 0.001$)*. The model, including efficiency, total number of attacks, and peak [La] after the match, resulted in a predictive accuracy of 87.5% of cases being properly classified. The canonical correlation for this model was 0.80, and the variability explained by the model, determined via the squared canonical correlation, was 0.64, indicating that these variables may predict 64% of the final outcome *(i.e., win or defeat)*. The standardized canonical discriminant function coefficients indicate the importance of each predictive variable. Efficiency was the strongest predictor *(0.94)*, followed by total number of attacks *(0.91)*, whereas peak [La] presented an inverse relationship with the outcome *(-0.52)*.

DISCUSSION

The main findings of the present study were that winner and defeated athletes did not differ regarding aerobic power and capacity, anaerobic power and capacity, or strength-endurance. However, winners were able to attack more frequently, achieve greater efficiency in these attacks, and present a lower glycolytic activation during the match *(inferred via the peak [La])*. These variables *(total number of attacks, efficiency, and peak [La])* discriminated between winner and defeated judo athletes.

Although previous studies have indicated the relationship between judo-specific actions during the match and physiological and performance variables *(Franchini et al., 2023)*, few studies compared winner and defeated judo athletes in direct opposition regarding their physical fitness *(Suay et al., 1999)*. Studies have indicated that elite judo athletes present higher anaerobic power and capacity compared with non-elite judo athletes *(Franchini et al., 2005)*, and international level judo athletes execute a higher number of repetitions in the chin-up gripping the judogi test compared with regional level judo athletes *(Franchini et al., 2011b)*, but no such evidence was found concerning aerobic power and capacity *(Borkowsky et al. 2001)*. In the present study, no variable related with aerobic power and capacity, anaerobic power and capacity, or strength-endurance discriminated judo athletes in direct opposition. The only differences between groups were the total number of attacks, efficiency, and peak [La] in response to the match; these variables also composed the discriminant model. A higher frequency of attacks indicate dominance and contributes to a lower number of penalties received by the athlete, which is an important aspect in the current rules *(Ceylan et al, 2022)*. Efficiency is a key element in many sports, and judo athletes also strive to be highly efficient in their actions, especially because one of the key foundations of judo is seryoku-zenyo *(best use of physical and mental energy) (Murata, 2013)*. No surprisingly, winner judo athletes were able to attack more frequently and end the match with a lower peak [La]. A lower physiological strain was observed in Olympic level judo athletes compared with national level judo athletes when executing judo actions *(Arruza et al., 1996)*, and a lower [La] was previously observed in elite judo athletes compared with non-elite judo athletes in simulated matches *(Franchini et al., 2004)*. Therefore, focusing on technical and tactical development - specifically in becoming more efficient - is still the best approach for winning a judo match.

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PERIPHERAL NEUROPATHY AND BENEFIT OF JUDO: A PILOT STUDY

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ABSTRACT

Peripheral neuropathies *(PN)* are a group of disorders, genetic or acquired. Physical activity remains the most effective lifestyle modification for counteracting weakness, the distal muscle atrophy and lack of balance in subjects with PN. This pilot study would demonstrate if training exercise benefit could be achieved by practicing Judo. 3 female subjects with PN were recruited for 9 months Judo intervention *(60min/week)*. Specific test battery at the beginning, at the end and after 2 months without Judo training was assessed to measure the adaptation. The main changes observed after the Judo intervention were the improvement of the physical fitness and functional abilities in the 2 subjects who attended more consistently. It can be stated that neuropathic subjects can practice Judo having physical and functional benefit, even if we cannot strongly assert it, because of the little sample. **Keywords:** *Peripheral neuropathies, physical activity, Judo, benefit,*

INTRODUCTION

Peripheral neuropathies *(PN)* are a group of disorders caused by damage to peripheral nerves. The cause may be genetic, such as hereditary neuropathies, or acquired, such as dysimmune neuropathies and chronic inflammatory demyelinating neuropathy. The most common worldwide widespread genetic neuromuscular disease is a group of hereditary motor and sensory neuropathies *(HMSN)*, known as Charcot-Marie-Tooth disease *(Nagappa et al., 2023; Saporta, 2014)*. CMT disease is heterogeneous group of neurological disorders, characterized by chronic, length-dependent, slowly progressive sensorimotor polyneuropathy *(Bird, 2023)* with a prevalence of 1 in 2500 individuals *(Pisciotta & Shy, 2018)*. Another form of PN is chronic inflammatory demyelinating polyneuropathy *(CIDP)*, a rare neurological disease characterized by muscle weakness and altered sensations *(Querol et al., 2021)*.

The prevalence, which varies according to studies, is between 0.67 and 10.3 per 100,000 habitants *(Broers et al., 2019)*. CIDP is a disease in which the immune system causes demyelinating damage, followed by axonal loss of peripheral nerves. CIDP is a long-term condition characterized by a variable course, which can be relapsing remitting or gradually progressive *(Mathey et al., 2015)*. The PN most representative symptoms could be: i) impaired tactile and proprioceptive sensitivity that progresses from distal to proximal *(Hafsteinsdottir & Olafsson, 2016; Li et al., 2019)*, that further compromises the balance *(Reilly et al., 2011)*; ii) muscle weakness which mainly affects the distal limbs, especially the lower ones, which mainly causes difficulty in walking with a consequent greater risk of falls in daily life compared to healthy subjects *(Hafsteinsdottir & Olafsson, 2016; Li et al., 2019)*; iii) extremity deformity such as pes cavus or monkey hands *(Casasnovas et al., 2008)*. A very common phenomenon in CMT subjects is the presence of overwork weakness in these patients *(Prada et al., 2018)*. The daily activities of people with PN are made furthermore difficult by possible chronic pain, muscle cramps, numbness, and paraesthesia *(Szigeti & Lupski, 2009)*.

Taking these different aspects into consideration, several works in the literature have reported that neuropathies are often linked to depression *(Bellofatto et al., 2023)*. At present, PN cannot be stopped or reversed and there is no definitive treatment, while immunotherapies exist for acquired neuropathies, but often cannot completely reverse the nerve injury. Rehabilitation is effective in slowing progression and maintaining improvements achieved but is often expensive. In many countries the rehabilitation activity is not supported by a national healthcare system. An effective strategy to improve everyone's sense of well-being and quality of life through physical activity is to practice sport, as well as reducing social barriers of discrimination for disabled people *(DePauw K, 2009)*. Physical activity remains the

most effective lifestyle modification for counteracting weakness, muscle atrophy *(distal in the legs and arms)*, and lack of balance, that make daily activities in subjects with PN increasingly difficult *(Szigeti & Lupski, 2009)*. A recent study demonstrated that CMT subjects who participated in sporting activity, had a better physical quality of life and less neuropathic pain compared to those who did not participate in any sporting activity *(Pazzaglia et al., 2022)*.

It appears that sensorimotor training has great potential to target most neuropathies and combined with resistance training is therefore currently the best treatment option *(Streckmann et al., 2022)*. Sport-specific training exercises could be achieved by practicing Judo, one of the most practiced Olympic sports worldwide *(International Judo Federation, 2023)*.

Judo has numerous evidence in the literature that the practice of this sport can improve in adult and older people: physical performance, balance, self confidence in the ability to perform various daily activities without falling *(Arkkukangas et al., 2021; Chan et al., 2023; Palumbo et al., 2023)*, muscle strength *(Chan et al., 2023; Palumbo et al., 2023)*, walking speed and health *(e.g., bone density, anthropometry) (Palumbo et al., 2023)*. It has also been shown that the regular practice of specific Judo training significantly improves the proprioceptive system of blind people *(Almansba et al., 2012)*. Since there is no evidence whether Judo can be adapted to neuropathic people, the aim of this study is to understand whether its practice can produce benefits in these subjects.

METHODS

Participants

3 female subjects were recruited for this pilot study, all diagnosed with PN, mean age of 58,7+4,5 years, mean height of cm 162+0,04 cm, and a mean weight of 64+17,6 kg *(tab.1)*. The participants signed an informed consent document explaining the design of the study and objectives.

Subjects	Sex (F/M)	Periferal Neuropathy	Age (n.years)	High (cm)	Body Weight (kg)	BMI
M	F	CMT	59	1,6	79	30,9
B	F	CIDP	54	1,6	44,6	17,4
C	F	MAGinMUGS	63	1,67	68,4	24,5
Average (sd)			58,7 (4,5)	1,6 (0,0)	64,0 (17,6)	24,3 (6,7)

Judo Training Intervention

The subjects joined an adapted Judo program, 9 lessons in 9 weeks, *(60 min/week)*, administered on a 75m2 Judo mat *(IJF proved)*, in a well-ventilated space. One Judo teacher, 6th Dan black belt, expert in adapted Judo for old and disable people, led the lessons, with one volunteer MD thesis student, both with academic background in Sport Science.

The general and specific objectives of the Judo intervention, defined with an expert on PN physiotherapist, were improvement of: coordination skills *(proprioception, posture, movement control, static and dynamic balance)*; strength *(postural muscles, core, upper and lower limbs, particularly in the actions of grasping, pushing, pulling and lifting)*; muscle flexibility and joint mobility *(especially of the lower limbs and hip)*; psycho-physical condition *(reduce the sense of neuromuscular fatigue, improve decision-making and determination times)*; cognitive abilities *(attention and concentration)* and mood state *(especially through exercise in group and game activities)*.

The content of the judo sessions included typical exercise for middle age and older people *(Chan et al., 2023; Palumbo et al., 2023)*: different types of general movements *(gaits with different standing postures and on the ground, alone or in pairs with or without holds, in all directions with or without body rotation)*; falling techniques *(Ushiro Ukemi, Yoko Ukemi, Mae Ukemi)*; specific grappling techniques *(Kumi Kata)*, sometimes mediated by an object *(necessary to overcome the lack of judogi and simplify the management of the movement linked to the partner)*; standing throw techniques *(adapted O Soto Gari and Uki Goshi)* and ground immobilization *(Kesa Gatame)*; opposition games *(for example: competing for an object, competing for space, competing to touch a part of the body)*.

The teaching method used the principle of gradual progression. The specific precautions for these PN practitioners were a greater alternation of standing and floor work, to diversify muscular effort and avoid overload and the manifestation of fatigue symptoms.

Assessment and Instrumentation

The 3 subjects completed PN specific test battery at the beginning of the program *(T0)*, at the end *(T1)* and after 2 months without Judo training *(T2)*. The measurements were: weight and height; Charcot-Marie-Tooth Functional Outcome Measure *(CMT-FOM) (Eichinger et al., 2018)*; the Short Physical Performance Battery *(SPPB) (Welch et al., 2021)*; the Walk scale questionnaire *(Walk-12) (Holland et al., 2006)* and the Hospital Anxiety and Depression Scale, *(HADS) (Zigmond & Snaith, 1983)* . In CMT-FOM higher score indicates lower physical fitness, on the contrary the higher score in SPPB indicates better shape. For the WALK-12 and HADS questionnaires, the higher is the score, the greater is the problems detected. The whole PN test battery was made in 30min/subject, respecting the same/weekday and hour of day.

RESULTS

Table 2. PN Test Battery Subjects Results

	Freq n/9	Body Weight (kg)			BMI			CMT-FOM			SPPB			WALK-12			HADS anxiety			HADS depression			HADS tot		
Subjects	n/9	T0	T1	T2	T0	T1	T2	T0	T1	T2	T0	T1	T2	T0	T1	T2	T0	T1	T2	T0	T1	T2	T0	T1	T2
M	8/9	79	74	74	31	29	29	17	15	19	12	9	11	30	30	37	7	11	8	6	7	6	13	18	14
B	6/9	45	45	45	17	18	18	13	11	10	11	10	9	29	23	26	8	5	8	3	3	2	11	8	10
C	2/9	68	68	67	25	24	24	8	8	5	10	12	12	31	16	21	18	17	16	14	11	11	32	28	27

The main changes observed after the Judo intervention were the improvement of the physical fitness and functional abilities of participant M. and B., who they attended more consistently *(CMT-FOM - 2 score respectively)*, while no change for subject C., who participated in only 2 lessons. This improvement in M., the CMT subject, was not maintained two months after the end of the Judo activity *(CMT-FOM +4)*. M. improved also in body weight after the Judo activity, losing 4 kg, a loss maintained after the end of the intervention.

DUSCUSSION

This study aimed to understand whether the sport of Judo could be suitable for neuropathic subjects, as there is no evidence in the literature. The study participants tolerated the adapted Judo training well and no adverse events were reported during the intervention. Fatigue was monitored during the various training sessions through direct interviews with the participants. High intensity and repetitive exercise could, in fact, have a negative impact on the muscular strength of the weakened or denervated muscle *(Prada et al., 2018)*.

To date, growing support for adapted motor programs for neurological and neuromuscular subjects is evident in the literature *(Bottoni et al., 2024)*. This pilot study showed how a protocol inherent to Judo positively influenced functional abilities assessed through the CMT-FOM. The subjects participated with variable frequency, M. and B. participated assiduously, unlike C., who rarely participated in the training sessions, this is also demonstrated in the results.

The program was carried out with workloads that allowed the subjects to achieve the objectives set at the beginning of the program without the risk of incurring injuries. After 9 weeks of training session the main changes observed were the improvement of the participants' physical abilities.

The results obtained in the HADS scale are not reliable because they are excessively dependent on the subject's mood. It was not possible to understand the change in mood, because it depends excessively on the subject's characteristic.

CONCLUSION

After this is a pilot study on adapted Judo to subjects with PN, it can be stated that neuropathic subjects can practice this martial art, without problems and have physical and functional benefit, even if we cannot strongly assert it, because of the little sample. It is our intention to better understand the possible benefits of practicing this discipline on these subjects, expanding the study sample and the intervention period.

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THE ROLE OF THE GAME-BASED METHOD IN THE DEVELOPMENT OF COGNITIVE ABILITIES OF JUDO ATHLETES AT THE INITIAL STAGE OF TRAINING

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ABSTRACT

For the identification of relevance of the game-based method as means of psychological and physical correction and the development of cognitive abilities in the process of training of judo athletes at the initial stage, the author made an analysis of the health situation of children, the cause of which is the lack of motor activity and decrease of the fitness level. The study involved 15 judo athletes with the age of 9-10 years. The examined the basic characteristics of temperament manifestation and psychological adaptation of initial stage judo athletes with the age of 9- 10 years, by means of pedagogical observation and psychological testing.

Keywords: *judo, training, research, methodology, games, correction*

INTRODUCTION

Numerous studies over the last few decades stir question related to the issue of sport training of athletes with a view to achieving high sport results *(Branco, BHM, et.al., 2017)*.

While studying the traditional play method it can be noted that in scientific research this method is mostly used with the aim of all-around physical development, touching upon one of pleasure and emotionality factors, which contributes to the formation of motivation and interest for judo, which in its turn contributes to the positive transfer of skills that are necessary for social integration *(Detanico, Daniele, et. Al., 2019)*.

Also, significant attention is given to the use of different games for the purpose of formation of different technical and tactical plot situations *(&)*.

After some time there were created specialized games, oriented towards the study of technical action fragments, with a simultaneous development of special motor skills in combat system. For an illustrative example can be used the classification of games presented at a more detailed level in the scientific and methodological *(Tihonova, I.V., et. al., 2020)*.

However, given the current negative factor that influence the motor activity of the young generation, it can be noted a lack of motor activity and decrease of the fitness level in children and young people, and this factor has a negative impact on the selection of children for different sport groups, judo included *(Detanico, Daniele, 2019; Nader, PR, et.al., 2008)*. The problem lies in the passivity of children and teenagers which is formed under the influence of internal and external factors. One of this factors is the excessive use of digital technologies. Numerous studies show the negative influence of gadgets overuse on cognitive functions, changes of the perceptual characteristics, attention, decrease of the working memory productivity and intellect *(Skowronek, J, 2023; Ito M, 2017)*.

That is why one of the leading characteristics of our research is the study of the play method and means of physical correction and development of cognitive abilities in children at the initial stage of judo.

METHODS.

The study involved 15 judo athletes with the age of 9- 10 years. The research was conducted at the “ANGELUS” sport club, Republic of Moldova within two years. The research has been carried out by means of: analysis and synthesis of

scientific and methodological literature on the studied problem in the pedagogical and psychological field. The analysis of the literature resources was made throughout all research stages.

The features of the age range 9-10 are determined in the scientific and methodological literature as "junior school children" which is perceived as the age of "peaceful" development of the highest nervous activity. At the same time the insignificant deterioration of the highest nervous system activity in school children , in particular, force, motility and balance of the nervous processes coincides with the beginning of the puberty, as well as the process of disadaptation to the study process in school *(Vodeaha, I.E., 2018)* .

In this regard, we studied the basic characteristics of the temperament manifestation and psychological adaptation in judo athletes at the age of 9-10 years, by means of pedagogical observation and psychological testing, based on the analysis of the nervous system features and paying particular attention to the reactions and behavior of athletes in the process of playing, training or competition activity. The obtained experimental data were subjected to statistical processing.

The measurement of the muscle strength was conducted with the use of the hand dynamometry method with a medical handgrip dynamometer by using the formula: Power index= Hand dynamometry *(kg x 100)* Body weight *(kg)*. During data collecting periods the subjects were totally relaxed, standing, the straight hand with the dynamometer was moved aside, perpendicular to the torso, the subject is clenching the hand with maximal strength. The free hand was relaxed and lowered down. The test was applied to both hands alternately. The readings were made three times with short breaks. The average result for each hand was registered.

RESULTS AND DISCUSSION

The features of the age range 9-10 are determined in the scientific and methodological literature as "junior school children" which is perceived as the age of "peaceful" development of the highest nervous activity. At the same time the insignificant deterioration of the highest nervous system activity in school children, in particular, force, motility and balance of the nervous processes coincides with the beginning of the puberty, as well as the process of disadaptation to the study process in school *(Vodeaha, I.E., 2018)*.

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For the identification of the child leading channel of perception we used the observation method and the diagnostics of the leading sensory system.

The major objective was to present the current state of the issue set in front of us, identify and analyze the indices of mental personality traits and their differences in judo athletes at the initial stage in order to identify the role of the play method.

To identify the usage peculiarities of the play method in other fields as well, thus providing an interdisciplinary approach to the play method as one of the therapeutic effects. This collaboration leads to the creation of new strategies which support the personality development with the help of adapted games and activities for the correction of particular motor abilities, for the increase of physical, intellectual and cognitive abilities, including the support of the sensory regulation and development process *(Elbeltagi, R., et. al. 2023)*.

The correlation data analysis shows that, generally speaking, the anthropometric indicators of athletes do not influence their psychological characteristics *(Table 1)*.

However, there is an inverse relationship between the physical development of athletes *(weight and height)* and the neuroticism level *(r= -0.52)*. The athletes that are physically larger have a lower level of emotional instability irrespective of age. In addition, the average level of neuroticism in the group is 14.9 points, which is a high figure and in combination

with the extraversion indicator of 16.1 points, shows the prevalence of the choleric type in the 9-10 years old children practicing judo. It can be assumed that this is related to the peculiarities of competitive activity.

Table 1. The rezalts of correlation data analysis the anthropometric indicators and psychological characteristics of athletes

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Visual	1,00												
2	Audiual	-0,67	1,00											
3	Kinesthetic	-0,82	0,13	1,00										
4	Neuroticism	-0,37	0,60	0,03	1,00									
5	Extraversion (unit)	0,45	0,04	-0,64	0,10	1,00								
6	Right 1	0,55	-0,58	-0,29	-0,39	0,18	1,00							
7	Left 1	0,38	-0,51	-0,12	-0,49	0,05	0,88	1,00						
8	Right 2	0,66	-0,56	-0,45	-0,51	0,33	0,91	0,79	1,00					
9	Left 2	0,55	-0,62	-0,25	-0,53	0,22	0,83	0,90	0,87	1,00				
10	mass 1	0,16	-0,28	0,00	-0,52	0,03	0,11	0,24	0,35	0,42	1,00			
11	mass 2	0,27	-0,37	-0,08	-0,52	0,14	0,26	0,39	0,49	0,56	0,95	1,00		
12	height 1	0,20	-0,28	-0,05	-0,43	0,11	0,09	0,10	0,34	0,31	0,85	0,82	1,00	
13	height 2	0,21	-0,26	-0,09	-0,45	0,16	0,11	0,13	0,42	0,39	0,75	0,74	0,94	1,00

The study of data related to the leading sensory system is indicative of the fact that the leading sensory system for judo athletes with the age of 9- 10 year is kinesthetic *(6.1 points)*, *(Figure 1)*.

It is important to note that the visual system is slightly behind the kinesthetic one and it has 5.6 points, which is indicative of a complex influence of these sensory systems. This interaction is explained by the age peculiarities of the subjects. The auditory system is less developed in athletes *(3.3 points)* and has little influence on their sport results.

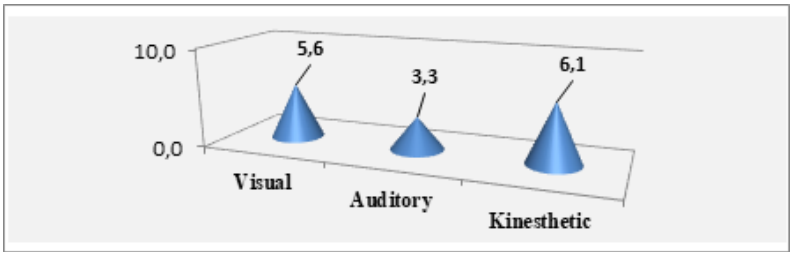

Figure *1. Leading sensory system of 9- 10 years old judo athletes*

The visual system is better developed in extraverts *(r=0.45)*, which can be regarded as one of the model characteristics of the given age group, taking into consideration their motor activity. The auditory system has a correlation to the neuroticism level *(r= 0.60)*, which is indicative of a possible effective regulation of the emotional state of young athletes by means of auditory exposure.

It seems to be interesting the inverse relationship between the kinesthetic form of perception and the extraversion level *(r= 0.64)*. This influence may be due to the fact that namely in a state of rest it easier for the athletes to develop kinesthetic sensitivity and other characteristics related to intuitive reaction and anticipation.

It is worth mentioning that the dynamometry indices for the right and left hands have significant difference. Thus, at 9 years old the athletes have an indicator of 13.0 points for the right hand, and the left hand -11.5 points, and at the age of 10 the data are 15.1 and 12.5 points accordingly. Moreover, there is a direct correlation between the dynamometry indices and visual sensory system and a reversed correlation with the auditory system and also with the

level of neuroticism. This is explained by the fact that the kinesthetic sensory system is related to the sensitivity of the nervous system, and the force characteristics *(of the nervous system as well as the physical characteristics)* does not contribute to its development.

CONCLUSION

Given that the achievement of a high level of sportsmanship depends largely on the development level of specialized psychological processes and qualities, which allow the athlete to realize their physical, technical and tactical abilities, the data collected in the study of the play method importance allow for demonstrating its high significance. Since numerous studies have shown that the development of the emotional, intellectual and volition spheres of junior school children is heterochronic and interdependent. In this regard, any perturbation on the development of one of these spheres has an impact on the development of the other two, in doing so the randomness is regarded as modulating development in general. Considering that up to the age of ten years children have an increased need for movement and the major difficulties are caused by the situations when they need to control their motor activity. It is possible to notice that when this necessity is blocked by the norms of school behavior, the child can display muscle tension, there is a decrease of attention and productivity level and fatigue occurs quickly. The implementation of play in the judo training process as one aspect of therapeutic approach will contribute to the formation of a positive emotional climate, development of physical, emotional, social and cognitive skills, it will also shape their personality and improve relationships, provide them a complete development and successful psychological and social adaptation in society.

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RAPID WEIGHT LOSS IN FEMALE JUDO: ANALYSIS OF METHODS AND TRENDS FROM 1980 TO 2023.

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ABSTRACT

The study aimed to understand athletes' perceptions of weight loss effects on performance and long-term health. The study analyzed rapid weight loss methods in female judo athletes from 1980 to the present. A questionnaire based on the Rapid Weight Loss Questionnaire was used to collect data from 86 Spanish judo team members. The athletes' average age was 35.6 years, with 64 kg weight, and 8 years of high competition experience. The prevalence of weight loss methods used over four decades was assessed, highlighting the potential health risks and ethical concerns associated with drastic weight cutting in sports. Authors suggest classifying extreme weight loss practices as doping due to their health risks, unfair competitive advantage, and violation of sportsmanship principles.

Keywords: *Trends weight loss; Female judo athletes; Health risks; Doping; Competitive advantage; Athlete perceptions.*

INTRODUCTION

There are many combat sports, such as wrestling, taekwondo, boxing, judo, etc., conditioned by their categorization based on the athlete's weight. The main objective of the category proposal is to establish equality of conditions between competitors, also facilitating access to the competition for those athletes who, due to having a smaller physical constitution, could not compete within a generic category where they would encounter opponents of much more weight than them.

Unlike other combat sports, judo has a smaller number of weight classes. Consequently, there is a greater variety of kilograms between categories, leading to more severe weight loss behaviors among competitors *(Artioli, Gualano, et al., 2010)*. Judo in particular has established 7 women's weight categories: <48, <52, <57, <63, <70, <78 and +78 kg and 7 men's <60, <66, <73, <81, <90 , <100 and +100kg. *(IJF, 2015)*. Although, as has already been said, the intention of categorization by weight is to favor equality of conditions between competitors by equalizing their body size, strength and agility and reduce the risk of injuries *(Artioli, Scagliusi, et al., 2010)*, very often this classification can also become an advantage for those competitors who reduce their body mass to compete in a lower category than they would encounter with lighter and weaker adversaries *(Franchini et al., 2012)*.

This is possible as currently weigh-in is not immediately prior to competition, but is usually done 6 to 24 hours before competition, often allowing athletes to use aggressive rapid weight loss practices *(RWL) (Khodaee et al., 2015)*, which can be recovered during the hours before the competition allowing judokas to participate in lower weight categories with a weight higher than the heavy one. Prior to 2015 *(IJF, 2015)*, weighing was carried out on the same day 1-2 h before the competition, it is likely that these changes have prompted athletes and coaches to develop new strategies to adjust weight. Thus, to take advantage of this advantage, athletes often resort to RWL strategies, such as severe restriction of food intake or different dehydration induction techniques *(Ceylan et al., 2022)*, which go against of many sporting aspects, including a very important one, their own health *(Franchini et al., 2012)*.

Fortunately, this situation has been changing for some time. There are even authors who are beginning to consider that these drastic weight loss practices should be classified as doping for three essential reasons: they are likely to cause a health risk, they can be a way to gain an advantage over the opponent and they go against the sports spirit *(Artioli et al., 2016)*.

Related literature states that approximately 89% of judokas, excluding heavyweights, have lost weight to compete *(Artioli, Scagliusi, et al., 2010)*. Furthermore, Artioli et al. *(2016)* state that judokas usually lose between 2 and 10% of their weight in the 2-3 days prior to the competition and *(Franchini et al., 2012)* found similar values in the range of 5-10% during the week prior to the competition.

These RWL methods not only have negative impacts and risks on the athlete's health but also some studies have reported effects on different physical condition indicators, although in this sense the results are controversial, and everything depends on the evaluated abilities and the time. of recovery regarding weighing *(Artioli et al., 2016; Franchini et al., 2012)*. This work aims to analyze the evolution of the need to lose weight and the methods used to lose it from 1980 by the athletes of the Spanish judo team. Secondly, it is asked what the prevalence of the methods has been used to lose weight. To finally know what the athletes' perception these weight reductions has been about how have influenced their performance and their long-term health.

METHODS

Participants.

Eighty-six women participated in this study at the time of the evaluation of the questionnaires. All members of the Spanish judo team at some point from 1980 to the present day. With a current average age of 35.6 *(±12.6)* years, a weight of 64 *(±6.1)* kg and a dedication to high competition of 8 *(±3.5)* years.

Participants were asked to participate by emailing a Google-Drive Form, which included an introductory letter explaining the nature of the study and the voluntariness of participation, as well as the guarantee of anonymity.

The inclusion criteria were to have won a medal in the Spanish Absolute Championship *(+18 years)* and to have represented the Spanish judo team in an official international competition.

The questionnaire administered was an adaptation of the Portuguese version of the Rapid Weight Loss Questionnaire *(RWLQ)*. This instrument was validated and validated by Artioli et al. *(2010)* and includes some questions about personal information, weight category and data on habits to lose weight and the diet developed during competitive life. The weight categories have always been seven, but at the beginning of 2001 they were modified, going from *(<48, <52, <56, <61, <66, <72 and +72 kg)* to *(<48 , <52, <57, <63, <70, <78 and +78 kg)*. The competitive periods were established in four categories *(1: 1980-1990; 2: 1990-2000; 3: 2000-2010; 4: 2010-present)*.

Statistical analysis

All the variables are nominal and ordinal, so they have been analyzed qualitatively. Contingency tables have been calculated to observe the frequency distributions of all the variables.

In order to verify the formulated hypotheses, the Chi-square test *(χ2)* has been applied to establish if there are statistically significant associations *(p<0.05)* between the different variables, using Cramer's V statistic to indicate the magnitude of association.

All calculations were carried out with the software Statistical Package for Social Science version 22.0 *(SPSS, Inc., Chicago, IL, USA)*. The statistical association and the description of the frequencies has been analyzed between the following variables: Competitive period *(4 categories)* VS. % of weight lost *(4 categories)*. Competitive period *(4 categories)* VS. Who has influenced weight loss strategies *(4 categories)*. Frequency of use *(5 categories)*. Opinion of all participants.

RESULTS

In order to contrast the hypotheses of association between the different variables, the Chi-square test *(χ2)* with the following results: The statistical analysis carried out taking into account the variable of the competitive period of the judokas shows that there is no statistically significant association with the % of weight dropped for the competitions $\chi 2_{(9)}$=16,412, p=0.059 *(Figure 1)*. On the other hand, the relationship between the competitive period and who has

influenced the weight loss strategies does show a significant association $\chi 2(9)=22,382$, p=0.008 and a moderate magnitude according to Cramer's V statistic=0.454 *(Figure 2)*.

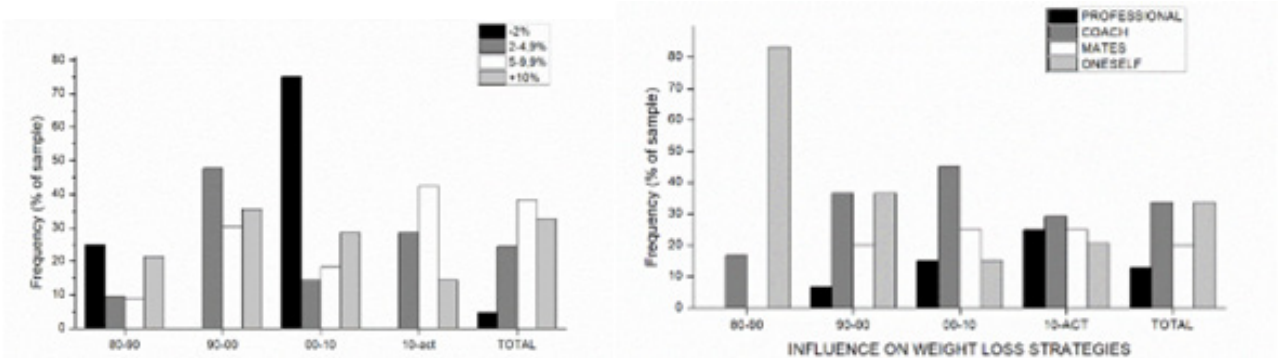

Figure *1. Comparison of the participants according to the competitive period and the % of weight lost during the competitions.*

Figure *2. Comparison of the participants according to the competitive period and who set the strategy to lose weight.*

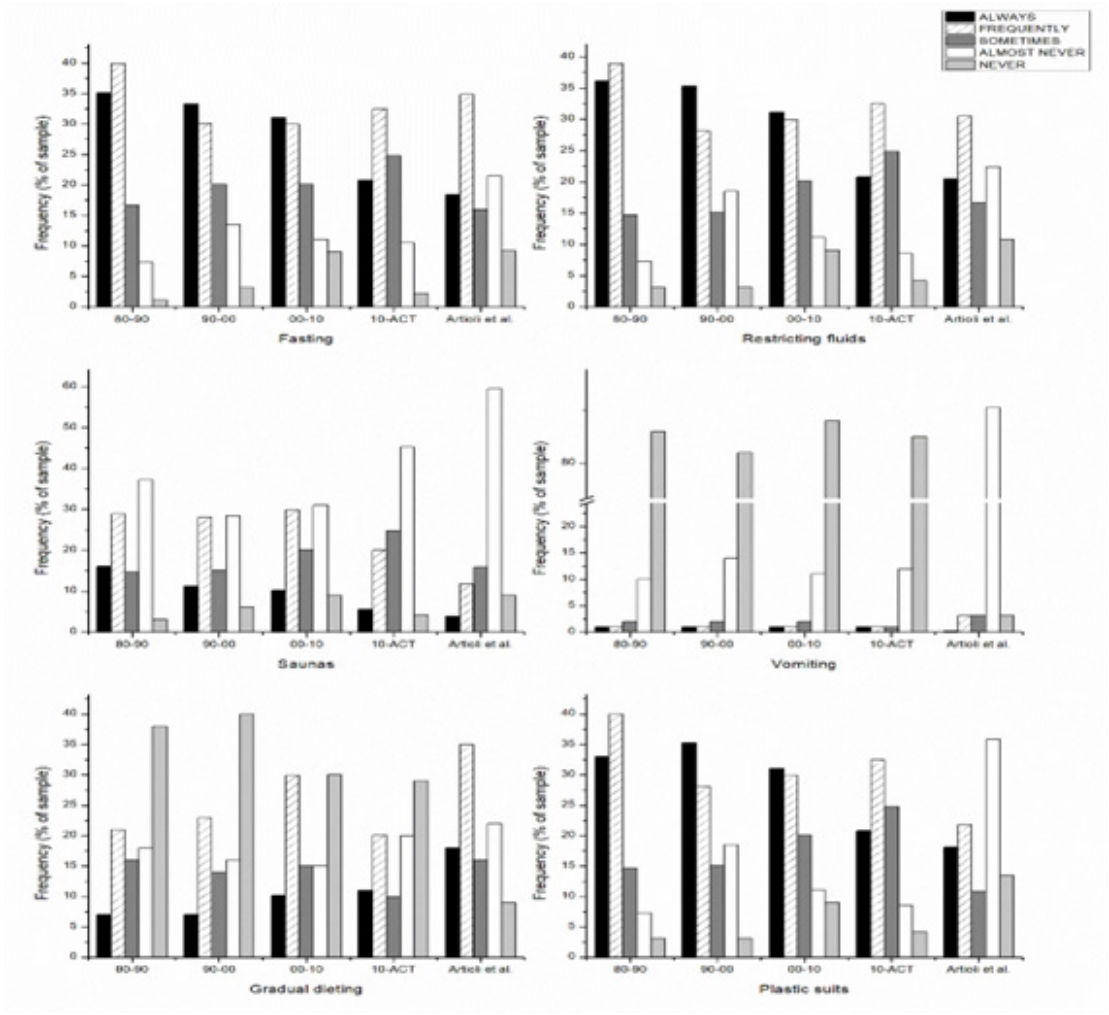

Figure *3. Comparison of the participants according to the competitive period and the different methods to lose weight.*

The application of the Chi-square test *(χ2)* to detect the associations between the different weight adjustment methods and the competitive period shows that there are no significant differences *(p>0.05)* between the prevalence of any method in any of the analyzed periods. Even so, figure 3 shows at a descriptive level the different distributions according to the different periods analyzed, in which different distributions can be observed even if they are not statistically significant. *Fig*ure 3 shows the frequency distribution of the four periods analyzed in this study and also incorporates the frequency distribution provided in the study by Artioli et al. *(2010)* in which female and male participants are included.

*Fig*ure 4 shows the scores obtained *(1-4)* in the questionnaire administered to all participants.

*Fig*ure 5 shows the results in response frequencies of all participants regarding the convenience or otherwise of the methods used by themselves to lose weight and their impact on performance and health.

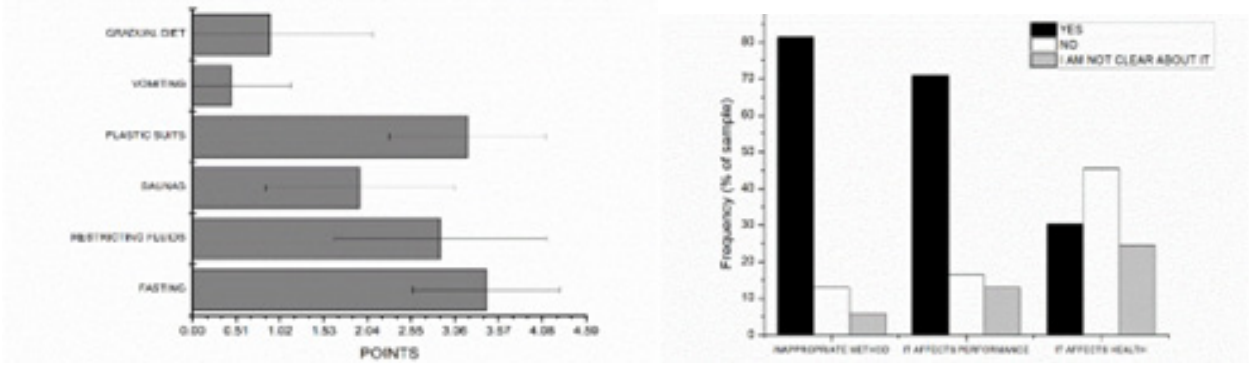

Figure *4. Scores obtained (between 1 and 4 points) in the questionnaire administered to all participants.*

Figure *5. Frequency distribution on the convenience and impact of the methods used to adjust the weight.*

The application of the Chi-square test *(χ2)* to detect the associations between the desirability of the weight adjustment method and the effect on performance shows a significant association $\chi 2_{(4)}$=47,476, p=0.001 and a moderate-high magnitude according to Cramer's V statistic=0.532. On the other hand, the calculation carried out taking into account the convenience variable of the weight adjustment method and the health effect shows that there is no statistically significant association with % weight lost for competitions $\chi 2_{(4)}$=16.412, p=0,076.

DISCUSSION AND CONCLUSION

The intergenerational difference centers on the fact that judokas from periods further removed from today tend to lose greater percentages of weight. This situation may be due to the change in regulations *(IJF, 2015)* that allowed weighing the previous day and entails a change in strategy in the distribution of weight loss or also in the influence of the people who influence this strategy, since it is observed that currently the presence of professionals from the field of nutrition is being incorporated into the process. Nutritionists play a crucial role in monitoring athletes' health during rapid weight loss practices. They can assess the impact of weight cutting methods on the athletes' overall well-being and provide guidance on maintaining essential nutrient levels *(Ranisavljev et al., 2022)*.

The most common methods are fasting and dehydration from the use of plastic suits, agreeing with Berkovich et al. *(2019)* who also advocates that the coach actively participate in the fight against unhealthy practices, as demonstrated in the evolution of the participation, coaches are gaining prominence in the weight loss processes in judo.

According to the results obtained, the dominant perception is that the methods used are inappropriate and that they affect performance but there is no awareness that they negatively affect health, showing that athletes have low to moderate knowledge about the effects of RWL *(Malliaropoulos et al., 2017)*, on aspects that have already been scientifically demonstrated where RWL induces hypohydration in judo athletes, putting the health of its practitioners at risk from a deterioration in thermoregulation and cardiovascular stress *(Ceylan et al., 2022)*.

Finally, it can be concluded that the negative aspects of the RWL have not improved significantly for 4 decades, professionals have been incorporated who have helped athletes in the processes that they mostly did on their own and it has been evident that much more information is needed and firm measures that help in the subsequent process when the weight is regained.

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COMPARISON OF RATE OF PERCEIVED EXERTION BETWEEN TWO SPECIFIC JUDO TESTS

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ABSTRACT

Judo is a complex sport in which to succeed athletes need high level of many motor and functional abilities. To assess the state of these abilities there is a need for specific tests in sport diagnostics. Throw-2-push-up test is one of specific tests used to assess specific endurance of athletes. Aim of this paper was to compare rate of perceived exertion between Throw-2-push-up test and Special judo fitness test which is one of the most used tests in diagnostics of judo athletes. Results of these research suggests that Throw-2-push-up test induces equal psychological and physiological load on athletes as Special judo fitness test. The Throw-2-push-up tests is simple and easy to perform and can be useful to coaches in diagnostics of athletes.

Keywords: *judo, diagnostics, endurance*

INTRODUCTION

Judo is a martial art that belongs to acyclic polystructural sport activities *(Sertić, H. & Segedi, I., 2013)*. Due to its complex structure, many motor and functional abilities as well as technical and tactical knowledge are essential for success. Because of this complexity, there is a need for specific tests to assess the athletes. In diagnostics of judo athletes, general tests are most often used to assess the state of individual motor and functional abilities which are important for the sport. In practice, specific tests are most often used as an addition to general tests, which is why there is a need for further development and use of specific tests. With the aim of creating specific judo tests, researchers have constructed large number of tests over the last 30 years. Some of the mentioned tests are: Special Judo Fitness Test *(Sterkowicz, 1995)*; JMG test *(Garcia, 1999)*; Judogi Grip Endurance Strength Test *(Franchini, Miarka, et al., 2011)* Uchi-komi Fitness Test *(Almansba et al., 2012)*; COP test *(García García, 2012)*; Bac2Skl *(Sertić et al., 2015; Segedi et al., 2014)* and many others. Few of these tests aim to assess specific coordination or speed, but most tests are designed to assess specific endurance under competitive combat-like conditions by attempting to simulate real-world conditions. Special judo fitness test *(SFJT)* is used in many papers and has been tested on a large sample of judo athletes through various age groups, making it the most used specific test in judo *(Sterkowicz-Przybycień, K. L., & Fukuda, D. H., 2014; Sterkowicz-Przybycień, K., et al., 2019)*. The Throw-2-push-up test *(Bac2skl)* also aims to assess specific endurance and was constructed at the Faculty of Kinesiology, University of Zagreb. The SJFT is performed intermittently for 95 seconds while the Bac2skl Test is performed continuously for 90 seconds. So far, it has been established that the Bac2skl Test produces almost the same physiological response in the form of heart rate and blood lactate concentration at the end of the test as the SFJT *(Sertić, H., Segedi, I., Sterkowicz, S., 2007)*. The aim of this paper is to compare the rating of perceived exertion of two specific tests that produce a similar physiological response.

METHODS

The sample of respondents consisted of male judokas n=11. The sample of variables consisted of heart rate at the end of the Special Judo Fitness Test and the Bac2Skl test; rating of perceived exertion upon completion of both specific judo tests *(Borg G. A., 1982)*.

The special judo fitness test is performed with the 2 partners who are standing at distance of 6 meters. The subject runs from partner to partner and throws the ippon-seoi-nage technique. The subject performs this for 15 seconds, followed by a 10-second break, followed by 30-second work, a 10-second break, and a final 30-second work interval.

The Bac2skl test is performed continuously for 90 seconds. The subject throws the partner the o-goshi technique and performs 2 push-ups, repeating the cycle as many times as possible for 90 seconds. The data were processed with the Statistica program. Basic descriptive parameters were calculated: arithmetic mean, standard deviation *(SD)*, minimum *(MIN)* and maximum *(MAX)* scores. The Pearson chi-square test was used to determine the differences in rating of perceived exertion of two specific judo tests.

RESULTS

Table 1. Basic descriptive statistics

	N	Mean	Min	Max	Std. Dev
Age	11	17,73	15,00	20,00	1,49
Height	11	178,64	167,00	195,00	7,41
Weight	11	76,64	62,00	95,00	10,98

Table 2. T-test for dependant samples for changes in heart rate

	Mean	Std. Dev	N	p
Hr_Bac2Skl	180,36	24,78		
Hr_SFJT	178,91	9,61	11	0,82

Table 3. x2 test for rate of perceived exertion in specific judo tests

	x2	p
RPE_Bac2Skl x RPE_ SFJT	13,50	p=,56

DISCUSSION

The results of this research indicate that two specific tests produce a similar physiological response in the form of heart rate at the end of the test. The above agrees with the already conducted research in which lactate concentration and heart rate were at the same levels at the end of both tests *(Sertić, H., Segedi, I., Sterkowicz, S., 2007)*. There is no difference between two specific tests in rating of perceived exertion even though there is a difference in way the tests are performed. Special judo fitness evaluates the combination of phosphagen and glycolytic anaerobic systems due to the maximum duration of the 30-second interval and the rest interval.

The Bac2skl test is performed continuously for 90 seconds without rest, thus assessing the glycolytic anaerobic system to a greater extent. Some research suggests that intermittent activities are perceived as more enjoyable and less difficult than continuous exercises *(Bartlett, J. D. et al., 2011)*. But this may apply when activities last more than 5 minutes. But both specific tests last for less than two minutes which can be a reason for similar levels of rate of perceived exertion. Even though Special judo fitness test is intermittent and simulates judo bout to greater extent Throw-2-push-up test can effectively assess athletes anaerobic endurance. Both tests can be used in the diagnosis of an athlete's state of fitness during training process.

The advantage of both tests is that they are simple to perform and can be used frequently. Given that the rate of perceived exertion does not differ between these two tests they will produce equal psychological load on athletes when performed. Also, since there is equal psychological and physiological load on athletes the Throw-2-push-up test can be equally useful in testing of athletes. Also, it is useful for coaches to have diverse tools in testing of athletes.

CONCLUSION

With development of sport there is a growing need for specific tests that assess important fitness parameters of athletes. Even though many tests can be constructed for assessment of the same motor and functional abilities their effect on athletes can differ. The Throw-2-push-up test causes an equal psychological and physiological response as Special judo fitness test.

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ANALYSIS OF MEDAL MATCHES IN HIGH LEVEL JUDO TOURNAMENTS

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ABSTRACT

It is known that the qualifying and final/medal matches in judo tournaments have different dynamics. The main goal of the athletes and coaches participating in the competitions is to win medals in the tournaments. For this reason, this study aimed to analyse the differences of scores, penalties and match duration in medal matches according to gender and weight category. We analysed 734 medal matches *(316 bronze, 157 gold)* in the Senior World Judo Championships, Abu-Dhabi, Düsseldorf, Osaka, Paris Grand Slam, Budapest, Hohhot, Montreal, Zagreb Grand Prix and Qingdao Masters tournaments held in 2019 and published on the official website of the International Judo Federation *(IJF)*.

The effects of gender and weight category on match duration, scores and penalties obtained in each match were analysed by two-factor analysis of variance, and the differences in the way matches were concluded according to gender *(2x2)* and weight category *(2x3)* were analysed by Chi-square test. The number of scores and penalties and total match duration did not differ according to gender and weight categories *(p>0.05)*. Thirty percent of the medal matches were completed with golden score. The proportion of matches completed with a score or penalty was similar in gender and weight categories *(p>0.05)*. The fact that the total match duration, the number of scores and the number of penalties were similar between men and women in all weight categories can be explained by the similar level of competition in the medal matches.

Keywords: *Judo, finals, total match duration, scores, shido*

INTRODUCTION

Many important changes have been made in judo match rules especially in the last decade, *(Barreto et al. 2022a)*, and numerous analyses have been published on the effects of these changes on match dynamics *(number of attacks, efficiency, etc.)*, scores, penalties and duration of the judo matches *(Segedi et al. 2014, Ceylan and Balci 2017, Ceylan et al. 2021, Calmet et al. 2017a, Katicips et al. 2018)*, scores, penalties and durations of judo matches *(Segedi et al. 2014, Ceylan and Balci 2017, Ceylan et al. 2021, Calmet et al. 2017a, Katicips et al. 2018, Doppelhammer and Stöckl 2020, Barreto et al. 2021, Barreto et al. 2022b, Barreto et al. 2023)*.

In addition, the effects of gender, weight category on match duration, scores and penalties were examined in senior judo matches *(Segedi et al. 2014, Sterkowicz-Przybycień et al. 2017, Kons et al. 2018, Balci and Ceylan 2020, Sulecka et al. 2020, Ceylan and Balcı 2021, Kons et al. 2022, Dopico-Calvo et al. 2023)*. It has been reported that match duration in high-level judo matches vary according to weight category, and female athletes have more scores and penalties than men *(Ceylan et al. 2022, Ceylan and Balcı 2021)*. However, it is known that the match dynamics are different in qualification, final and medal matches in judo tournaments.

More number of penalties, longer match duration and lower efficiency index score for winning athletes were observed in final matches compared to qualifying matches *(Ceylan et al. 2020)*. In addition, it was shown that in the final and final stages, matches were completed with a higher percentage of the golden score compared to the qualifications, and in parallel, the total match duration was longer *(Ceylan et al. 2020, Dopico-Calvo et al. 2023)*.

In many of the studies cited above, the evaluation of match duration, penalties and scores by gender and weight category was made by including matches at all stages of tournaments. Since the qualifying and final matches in tournaments are

different in terms of match duration and other match dynamics, in this study, it was aimed to analyse only the medal *(final and third place)* matches of high-level judo tournaments. In the current study, it was foreseen to observe similar match dynamics in terms of weight category and gender due to the presence of athletes with similar performance levels in medal matches.

METHODS

The data were obtained from judo matches published on the official website of the International Judo Federation *(IJF)*. Since the data were publicly available and the information of the athletes was not used, there was no need to obtain ethics committee permission for the research *(Balcı and Ceylan 2020)*. In the study, scoreboard data *(duration, score, penalties)* from a total of 734 medal matches *(316 bronze, 157 gold)* in the Senior World Judo Championship, Abu-Dhabi, Düsseldorf, Osaka, Paris Grand Slam, Budapest, Hohhot, Montreal, Zagreb Grand Prix and Qingdao Master held in 2019 were used in the analyses. Matches completed with fusen-gachi, kiken-gachi and direct hansoku make were not included in the analysis. For the proportional comparisons according to weight categories, the weights were divided into three groups; extra lightweight *(-48kg, -60 kg)*, half lightweight *(-52kg, -66 kg)* and lightweight *(-57kg, -73 kg)* were included in the first group *(lightweight)*, half medium heavyweight *(-63kg, -81 kg)* and medium weight *(-70kg, -90 kg)* were included in the second group *(mediumweight)*, half heavyweight *(-78 kg, -100 kg)* and heavyweight *(+78kg, +100 kg)* were included in the third group *(heavyweight)*.

Analyses were performed with Statistical Package for the Social Sciences *(SPSS)* 22.0 and JASP 0.16.3 programmes. The significance level was set at $p<0.05$. After the normal distribution was checked, the differences of the match durations according to the medal *(gold-bronze)* and the way the matches were concluded *(scores-penalties)* were analysed by t-test in independent groups. In pairwise comparisons, the effect size was assessed by Cohen's d and classified as 0.20 small, 0.50 medium and 0.8 large effect. The effects of gender and weight category on match duration, scores and penalties obtained for each athlete in each match were tested by two-factor *(2×7)* analysis of variance. In the analyses of variance, the eta-square *(η2)* was calculated for the effect size, and its classification was accepted as 0.01 small, 0.06 medium and 0.14 large effect *(Cohen et al. 1988)*.

The difference in the way the matches were finalised *(scores-penalties)* according to gender *(2×2)*, weight category *(2×3)*, and the difference between winning and defeated athletes in terms of shido intake *(2×4)* were evaluated by Chi-square test, and the effect size was evaluated by Phi or Cramer's-V.

RESULTS

The mean, standard deviation and 95% confidence intervals of match duration by gender and weight categories were presented in Table 1. There was no effect of gender *($F1,459=0.00$; $p=0.96$; $\eta2 < 0.001$ [trivial])*, weight category *($F6,459=1.64$; $p=0.13$; $\eta2 = 0.021$ [small effect])* and the interaction of these two factors *($F6,459=0.65$; $p=0.69$; $\eta2 = 0.008$ [trivial])* on match time. In other words, the match times in all weight categories were similar for men and women *(Table 1)*. There was a significant difference in match times when medal matches ended in a penalty *(294.6±102.8)* or a score *(212.5±116.0)* *($t(471)$=5.75; $p<0.001$; $d=0.72$ [moderate effect])*. However, the total duration of the bronze *(224.1±115.9)* and gold *(229.0±122.1)* medal matches were similar *($t(471)$=-0.42, $p=0.68$; $d=-0.041$ [trivial])*.

Table 1. Match durations (second) for gender and weight category.

		Women				Men		
Weigth category	n	Mean	±	SD	n	Mean	±	SD
Extra-lightweight	36	209,1	±	132,6	37	202,9	±	108,3
Half-lightweight	37	236,4	±	134,1	39	239,9	±	120,6
Lightweight	34	240,5	±	114,7	33	204,9	±	140,4
Half-middleweight	35	255,5	±	126,9	32	252,6	±	102,5
Middleweight	34	224,9	±	131,9	31	239,8	±	94,3

Half-heavyweight	29	233,5	±	131,0	31	217,1	±	77,2
Heavyweight	32	181,7	±	88,7	33	220,5	±	118,0
Total	237	226,3	±	124,5	236	225,2	±	111,0

SD: *standard deviation.*

30.7% of the medal matches were completed within the golden score. The proportion of matches completed in the golden score was similar in men and women *(χ2(1, n=473)*= 0.11, p=0.74; Phi=-0.015 [trivial]). However, a higher proportion of matches in middleweight athletes *(Std res=2.8)* than in light and heavyweight athletes were completed with a golden score *(χ2(2, n=473)*=7.86, p=0.02; Cramer's V=0.13 [trivial]). The proportion of matches completed with hansoku-make in the golden score was higher than those in actual match time *(χ2(1, n=473)*=31.61, p<0.001; Phi=-0.26 [small effect]).

Table 2. Number of score (ippon and/or waza-ari) per match for gender and weight category

		Women				Men		
Weigth category	n	Mean	±	SD	n	Mean	±	SD
Extra-lightweight	36	1,28	±	0,74	37	1,16	±	0,73
Half-lightweight	37	1,00	±	0,67	39	1,05	±	0,60
Lightweight	34	1,18	±	0,58	33	1,12	±	0,48
Half-middleweight	35	1,09	±	0,66	32	1,00	±	0,62
Middleweight	34	1,15	±	0,66	31	1,10	±	0,70
Half-heavyweight	29	0,79	±	0,49	31	1,13	±	0,72
Heavyweight	32	1,06	±	0,80	33	1,06	±	0,66
Total	237	1,08	±	0,67	236	1,09	±	0,64

SD: *standard deviation.*

There was no effect of gender *(F1,459=0.03; p=0.85; η2 < 0.001 [trivial])* and weight category *(F6,459=1.17; p=0.32; η2 = 0.015 [small effect])* and no common effect of factors *(F6,459=0.85; p=0.53; η2 = 0.011 [small effect])* on the total number of scores *(ippon/waza-ari)* in medal matches *(Table 2)*.

Gender *(F1,459=0.84; p=0.36; η2= 0.002 [trivial])*, weight category *(F6,459=1.92; p=0.08; η2 = 0.024 [small effect])* and the common effect of factors *(F6,459=1.08; p=0.37; η2 = 0.014 [small effect])* did not affect the total number of shido in matches *(Table 3)*.

Table 3. Number of shido per match for gender and weight category

		Women				Men		
Weigth category	n	Mean	±	SD	n	Mean	±	SD
Extra-lightweight	36	1,36	±	1,53	37	1,92	±	1,53
Half-lightweight	37	2,22	±	1,69	39	2,41	±	1,63
Lightweight	34	2,03	±	1,36	33	1,79	±	1,62
Half-middleweight	35	1,89	±	1,59	32	2,13	±	1,58
Middleweight	34	1,65	±	1,74	31	2,35	±	1,47
Half-heavyweight	29	2,52	±	1,84	31	2,16	±	1,44
Heavyweight	32	2,41	±	1,58	33	2,24	±	1,50
Total	237	1,99	±	1,64	236	2,14	±	1,54

SD: *standard deviation.*

There was no significant difference in the proportion of matches ending with a score or penalty between men and women *(χ2 (1, n=473)*=0.05, p=0.82; Phi=-0.011 [Small effect]). Also, the rates of matches ending with a score were similar between weight categories *(χ2(2, n=473)*=2.20, p=0.33); Cramer's V=0.068 [trivial].

DISCUSSION

This study, which analysed medal matches in top-level judo tournaments, had several important findings; firstly, the total number of scores and penalties in matches and the total match duration were similar in all weight categories for both men and women. Secondly, approximately 1/3 of the matches were decided by golden score, which was similar for men and women, whereas the number of matches decided by the golden score was higher in middleweights than in lightweights and heavyweights. Finally, the proportion of matches that ended with a score or a penalty did not differ according to gender and weight category. It was observed that matches completed in golden score resulted in hansoku-make at a higher rate than matches completed in actual match duration.

Changes in competition rules can affect the change in the number of scores and penalties in judo matches *(Calmet et al. 2017a)*. However, the frequency of attacks, number and duration of standing or ground attempts in judo matches differ in terms of weight category and gender *(Sterkowicz-Przybycień et al. 2017)*. Depending on these differences, gender and weight category have an effect on the number of scores and penalties *(Sulecka et al. 2020)*.

Doppelhammer and Stöckl *(2020)* emphasised that women had fewer penalties than men in the study examining the effect of rule changes in 2017. In more recent analyses of high-level judo matches, Ceylan and Balcı *(2021)* reported that women had a higher number of waza-ari and shido than men, while heavyweight athletes had a higher number of ippon scores than other weight categories. In this study, in which only medal matches were analysed, it was found that there was no difference between gender and weight categories in terms of the number of scores and penalties. This may be explained by the similar level of competition in the medal matches as opposed to the previous qualification rounds.

Total match duration is related to the scores and penalties *(Balci and Ceylan 2020)*. In recent years, along with many refereeing rule changes, many changes have been made in the match duration, while the time limit in the golden score process was abolished in 2013, the actual match duration was limited to 4 minutes in the senior category for women in 2015 and for men in 2017 *(Barreto et al. 2022a)*. According to the current rules, in case of a tie in the actual match duration, the matches continue to the golden score period and the matches are completed when one of the athletes gets a score *(ippon or waza-ari)* or receives three shido *(hansoku-make) (IJF 2024)*. It has been reported that the total match duration is different in qualifying, repechage, and medal matches, and the total match duration is longer in medal matches than in other rounds *(Ceylan et al. 2020)*.

Therefore, it is expected that the match durations for medal matches are longer than the studies reported by including all qualifying stages *(Ceylan and Balcı 2021, Ceylan et al. 2022)*. In addition, it is reported that match duration may differ according to both gender and weight categories *(Sterkowicz-Przybycień et al. 2017)*. However, in this study, it was determined that the effect of gender and weight categories on the duration of medal matches was not significant, and the total match duration were similar in all weight categories in men and women.

In this study, it was observed that 30.7% of the medal matches were completed with a golden score. It is known that the percentage of matches ending in golden score increased especially after the rule changes in 2017 *(Calmet et al. 2017b, Monteiro et al. 2019)*. This increase in the percentage of matches completed in golden score was reported to be even higher in the final matches *(Monteiro et al. 2019)*.

Although it varies according to gender and weight category, approximately 18-20% of high-level judo matches are completed with a golden score *(Ceylan and Balcı 2021; Ceylan et al. 2022)*. It was reported that this rate and duration increased in the tournaments before the Tokyo Olympics *(Barreto et al. 2021, Barreto et al. 2022a)*. In the Olympics *(Tokyo 2020)*, 50% of the gold medal matches and 35.7% of the bronze medal matches were completed with a golden score *(Kons et al. 2022)*. The high level of competition in medal matches, especially in high-level tournaments, leads to an increase in the proportion of matches completed with a golden score.

The results of the current study show that the score, penalty and match duration were similar between genders and among weight categories in the medal matches where athletes with similar performances faced each other, unlike the elimination matches in high-level judo competitions. Analysing the dynamics of medal matches in which competition is

high rather than the elimination matches may reveal new information for athletes and coaches. For this purpose, more detailed analyses of medal matches in World Championships and Olympic Games are recommended.

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IN SEARCH OF MOTOR EFFICIENCY IN GRAPPLING SPORTS: A COMPARATIVE ANALYSIS OF JUDO AND BRAZILIAN JIU-JITSU (BJJ) ATHLETES

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ABSTRACT

Among theorists and practitioners, there is a consensus on the significant role of identifying leading priorities in motor efficiency within combat sports disciplines. This is due to the complex structure of tasks in these activities, which require a specialized and focused multi-dimensional motor efficiency function. The aim of this study was to assess the level of differentiation in motor efficiency among athletes who train competitively in different grappling sports, namely Judo and Brazilian Jiu-Jitsu *(BJJ)*.

A study was conducted on a purposively selected group of 30 men, consisting of elite grappling athletes, including 15 elite Judokas and 15 elite Brazilian Jiu-Jitsu *(BJJ)* practitioners. The participants were deliberately relocated and comparatively grouped based on their respective disciplines into two groups: the Judo Group *(N=15)* and the BJJ Group *(N=15)*. Measurements of selected manifestations of motor potential were taken, including static balance, simple reaction time, trunk flexibility, grip strength, explosive strength, agility, endurance to abdominal and back muscle fatigue, and functional strength in a hanging position. These measurements were conducted using tests from the Eurofit battery, a computer-based coordination ability test, and a specific trial *(hanging on a kimono, with a block)*. Relative strength indices *(SW)* were also calculated for isometric potential in hanging and hand dynamometry, as well as maximal anaerobic work *(MAW)* indices for explosive strength. The results were subjected to comparative analysis using statistical procedures *(Student's t-test for independent variables, Cohen's d effect size)*. The level of statistical significance was set at $p<0.05$.

The analysis demonstrated that the tests used to assess the levels of selected aspects of motor fitness significantly differentiated *(strong effect)* the athletes in terms of the results: static balance *(p=0.0049; d=1.12)*, simple reaction time *(p<0.001; d=1.50)*, grip strength *(p=0.039; d=0.80)*, explosive strength *(p<0.001; d=1.66)*, and agility *(p<0.001; d=1.36)*, with higher levels observed in the Judo group. In the BJJ group, trends were noted in terms of trunk flexibility *(p=0.024; d=0.87)*, abdominal muscle endurance *(p=0.007; d=1.09)*, functional strength in a bent-arm hang on the kimono *(p=0.006; d=1.08)*, and relative isometric dimensions in the hang *(p=0.047; d=0.74)*. For back muscle endurance, MWA and SW1 grip indices, the testing procedure showed comparable results for athletes in both groups *(p>0.05)*.

The study results indicate that Judo athletes exhibit a strength-speed profile of motor fitness, suggesting a hierarchy of motor abilities priorities for optimal training and competition performance in this sphere. In contrast, BJJ athletes displayed an endurance-strength profile. A significant role was attributed to the specific and unique isometric endurance for the discipline, especially of the upper limbs in maintaining a prolonged grip on the kimono. The findings allow for the diagnosis and interpretation of motor fitness competencies along with the profile of their key manifestations in Judo and BJJ, which facilitates the optimization of coaching quality control.

Keywords: *Motor efficiency, combat sports, grappling disciplines, Judo, BJJ.*

INTRODUCTION

In sports activity, motor fitness serves as a fundamental pillar that enables athletes to develop multidimensionally. It is a gateway to shaping and enhancing technical-tactical skills, specialized fitness, mental resilience, and an appropriate mental attitude [1,2].

Due to their functional specificity, combat sports disciplines demand high and varied competencies in motor fitness from athletes, representing a hybrid collaboration of all human motor predispositions and abilities. Combat athletes

must overcome external resistance in the form of an opponent they confront. Consequently, effective competition and training are largely dependent on an above-average level of targeted motor skills, with leading priorities of its components specific to the discipline [3,4]. Identifying these key manifestations in a given activity can be crucial in profiling an effective training process. This allows for intervention in shaping and refining the most important areas of this domain.

This issue appears to be interesting and significant for flagship grappling sports disciplines such as Judo and Brazilian Jiu-Jitsu *(BJJ)*. Classifying their place in the context of motor fitness has shown that athletes require comprehensive motor skills, including a high level of absolute strength and explosive power, to gain a decisive advantage over their opponent. Additionally, they must exhibit above-average muscular endurance to grapple and control their opponent for the duration prescribed by the rules of the bout [5-7]. Judo, being an ancestor of the younger BJJ, naturally shares significant similarities in the training process structure of these disciplines.

Sports competition utilizes grappling techniques such as throws *(nage-waza)*, joint locks *(kansetsu-waza)*, chokes *(shime-waza)*, and scoring technical positions *(osaekomi-waza)* [8,9]. The differentiating factor in Judo is the priority given to positional fighting in standing where most confrontations occur, along with limitations related to ground actions *(ne-waza)* and the prohibition of lower limb grabs [8,10]. In competitive BJJ, the majority of the contest takes place on the ground [11], and leg locks and wrist locks *(in selected divisions)* are permitted [9]. Positions such as mount and back control provide technical points but cannot end the match prematurely, unlike oseakomi-waza *(20s)*. Additionally, BJJ competition is divided into two sub-disciplines: NoGi *(fighting in shorts and a grappling shirt)* and Gi *(fighting in kimonos)* [12].

This raises the question of which specific aspects of motor fitness, in a hierarchical sense, should be developed and refined to optimally support the achievement of training and competition goals. The complexity of the training system for Judo and BJJ, considering technical-tactical and physical fitness aspects, poses a significant challenge for coaches. A review of the literature indicates a subjective assessment of a deficit in comparative studies between representatives of similar combat sports disciplines concerning motor preparation. Additionally, thematic scientific publications report the need for further exploration of these disciplines' environments, along with comparative studies involving representatives of other combat sports [6]. Such a comparison, i.e., comparing a Judo athlete with a BJJ practitioner, can provide valuable scientific and cognitive information as well as practical implications for coaches and athletes in these disciplines.

Considering the above premises, the aim of this study was to assess the level of differentiation in selected aspects of motor fitness among athletes who competitively train in different grappling sports, namely Judo and BJJ.

MATERIAL AND METHODS

Study participants

The study covered a group of 24 competitive athletes combat sports *(only males)*, including 12 Judo and 12 BJJ students.The mean body mass of the participants was 77.95±9.56 kg and the mean body height was 176.60±7.65 cm *(BMI=24.95±2.19)*. The age of the tested athletes ranged from 18 to 27 years *(mean age: 22.36±2.73 years)*. Training experience ranged from 4 to 10 years of regular training, with 4 to 6 training sessions per week depending on the training mesocycle *(mean experience: 7.13±1,76 years)*.

The sample size was determined using G*power *(confidence level 95%, margin of error 5%)*. Two groups were formed based on the calculations: the Judo athletes *(n=12; age years: 20.11±1.39; height: 177.21±7.61 cm; weight: 77.77±11.28 kg; BMI: 24.64±2.03; 8.13±1.46 years of training)* and BJJ practitioners *(n=12; age years: 24.60±1.66; height: 176.00±7.90 cm; weight: 78.14±7.88 kg; BMI: 25.25±2.38; 6.13±1.46 years of training)*. An A213 anthropometer was used for body height measurement evaluation and a certified TANITA TBF-538 electronic scale for body mass measurement according to the anthropometric recommendations [13]. Inclu-sion criteria for the study were at least four years of training experience, no presence of musculoskeletal injuries, good health status confirmed by medical examinations with a positive medical recommendation, no history of serious injuries, and active participation in competitions. The exclusion was the antagonism of the above variables.

The examinations were performed on ath-letes preparatory period. They were also asked to refrain from any strenuous effort 24 h before the testing sessions. Participants were not on a restrictive diet or in any weight loss period. All of the participants had participated in international, national, and local elite competitions. Some had achieved significant sports results, including medals in Europe-an, Polish, and other prestigious grappling competitions. Information on chronological age, activity, and competitive experience was obtained based on a diagnostic survey con-ducted done on athletes and coaches.

All participants were informed in detail about the testing procedure and provided written consent to participate in the him. The study was conducted according to the Declaration of Helsinki and approved by the Bioethics Committee at the District Medical Chamber in Krakow *(No. 226/KBL/OIL/2023)*.

Testing procedures

Measurements took place in a sports hall where sports training of the tested athletes is conducted on a daily basis. All measurements were performed at the same time of day *(i.e., between 5:00 p.m. and 8:00 p.m.)* to avoid any diurnal variation of the performance, at specially designed test stands during 10 standard training sessions, with each training session lasting 90 min. Only one of the observed groups was present in the testing room at a time. The measurements for each group were carried out during five consecutive training sessions. The participants were thoroughly familiarized with all testing procedures.

Motor Fitness Assessements

Selected tests from the EUROFIT battery standardized physical fitness tests were used to assess the level of motor fitness [14]. Additionally, a computer test [15] and a discipline-specific grip endurance test [16,17] were used. Each time before the measurements, both groups participated in a standard 15-min warm-up session consisting of exercises to prepare the body for physical effort. Exercises were conducted in accordance with the principle of formative exercises and involved static and dynamic movements of the arm, trunk, abdomen, back, and legs. The assessment of motor skills was carried out each time in the order established before the measurements.

1. Equilibrium (static balance) - the subject stands up on a bar with a length of 50 cm, height of 4 cm, and width of 3 cm. The subject then holds the free leg bent at the knee from behind the foot. The subject's task is to maintain balance for as long as possible. The measurement ends when the subject loses his or her balance, i.e., lets go of the leg or touches the ground. The subject is allowed to perform one pre-trial prior to the measurement. The time is measured to the nearest 0.01 s [14].
2. Simple reaction time - testing takes place at the computer keyboard. Active Keys: "Enter", on the right for the right hand and "1", on the left for the left hand. The subject places his or her hand next to the keyboard so that it rests comfortably on the table, with their thumb on the active key. When a bright square appears in the center of the screen, the subject is supposed to press the active key as soon as possible. In the test, this process is repeated irregularly as 11 pulses. The faster the response, the better the outcome. The examiner demonstrates the task, then gives instructions and explanations, and the test subject immediately performs a pre-trial of 5 pulses and then proceeds to the main test of 11 pulses [15].
3. Trunk flexibility - the test is performed as a sit-and-reach movement, with the range of motion measured in cm, below the feet level. In a seated position, the subject reaches the arms forward as far as they can. The subject, in a straddle sitting position, reaches forward with the hands as far as possible by sliding the ruler on the surface of the box with a previously prepared scale. The better of the two results is recorded. If the participant reaches 10 cm beyond the toes, they receive a score of 10. The box that is used is 40 cm long, 45 cm wide, and 35 cm high, and a 65 cm long graduated box top protrudes 25 cm over the side wall that marks the width of the box and is used as a feet rest; the box top is fixed in such a way that the graduation mark drawn on it indicates 50 in the place where feet touch the surface of the box; a 30 cm long ruler placed loosely on the surface of the box perpendicularly to its longitudinal axis and used for moving with hands while performing a forward reach [14].
4. Static handgrip strength - the subject stands with a small straddle, with the dynamometer held tightly in the fingers, the arm is positioned along the body so that the hand does not touch the body; the subject performs a short grip on the dynamometer with maximum force, with the other arm along the body. The better result of the two hand tests is recorded to the nearest 1 kg [14].

5. Standing long jump (explosive power) - the subject stands with the feet slightly apart in front of the starting line, bends the knees, and moves the arms backward at the same time, and then he or she performs the arm swing and jumps as far as they can; the landing occurs on both feet while maintaining the upright position; the test is performed twice. The longest of the two jumps measured to the closest mark left by the participant's heel is recorded, with an accuracy of 1 cm. A tape measure, a hard surface, and two gymnastic mattresses connected lengthwise are used [14].
6. Shuttle run 10 × 5 m (speed of muscle mobilization, agility) - The participant runs on a signal to the second line 5 m away, crosses it with both feet, and comes back. They run a distance of 5 m 10 times. The time of the shuttle run is measured and rounded to a decimal place of a second [14]
7. Sit-ups (strength endurance of the abdominal muscles) - Evaluation of abdominal strength: the tested person lies on the mattress with feet 30 cm apart and knees bent. Hands intertwined, resting on the nape of the neck, feet hooked to the ladder so that they remain in contact with the ground. At the signal, the participant sits up to touch the knees with elbows and then returns to the starting position. The exercise duration is 30 s [14].
8. Back extension (strength endurance of the back muscles) - The subject is lying prone on a mattress. Hands are intertwined, resting on the neck. At the signal, the subject, from the lying prone position, bends the trunk backward by contracting the muscles of the back, together with the legs (the body forms an arch), and then returns to the starting position (lying prone) as fast as possible, and repeats this sequence, also as fast as possible, with as many repetitions as possible within 30 s. The examiner counts the number of repetitions performed in 30 s. For example, 18 correctly executed bends, results in 18. The test is performed once [14].
9. Flexed-arm hang in judoga (functional strength/muscle isometrics test): The test involved hanging from a gi, suspended from a bar, with arms maximally flexed at the elbows and maintaining this position for as long as possible. The stopwatch is started at the moment of independent hanging. The time measurement continues until the upper limbs are extended at the elbow joints (exceeding a 90-degree angle between the arms and forearms). The test is conducted once. The hanging time is measured with an accuracy of 0.1 seconds [16,17].

Motor Indices

The results gathered during direct measurements were used for the indirect estimation of the following indices:

1. Relative Grip Strength (SW1) and Hang Time (SW2) [14,18] – calculated as the ratio of:
   - Maximum local static hand strength to body mass
   - Maximum hang time to body mass, according to the formulas:

SW1= *(dynamometer result [kG])/(body mass [kg])*

SW2= *(hang time result [s])/(body mass [kg])*

SW is a strength index representing the ratio of muscle-generated force to total body mass. This measure provides an objective and accurate depiction of actual muscle strength characteristics, which is crucial in weight-class-restricted sports [18], such as Judo and BJJ [8,9].

2. Maximum Anaerobic Work (MAW) [14,18] – calculated as the product of the jump measurement result (m), the body mass of the individual (kg), and gravitational acceleration, according to the formula:

MAW=jump result [m]×body mass [kg]×9,81 [m/s^2]

Maximum Alactic Anaerobic Power *(MAP)* is the ability to perform maximum work as quickly as possible to assess the level of explosive strength capabilities. In indirect studies, it is recommended to measure Maximum Anaerobic Work *(MAW)*, which is highly correlated with and an approximate measure of MAP [18].

Statistical analysis

To process the results of the study, basic statistical methods were used to determine the arithmetic means, standard deviations, minimum and maximum values and coefficients of variation. The degree of intragroup diversity was assessed by interpreting the coefficient of variation values according to the classification: CV<25% indicates low variability; 25%-45% indicates moderate variability, 45%-100% indi-cates high variability; > 100% indicates very high variability [20]. The normality of distri-bution was verified and confirmed using the Shapiro-Wilk test.

The degree of variability between the variables of the study groups was assessed using the Student's t-test for independent variables. Furthermore, the effect size was calculated using Cohen's d index *(d=0.20: weak effect; d= 0.50 moderate effect; d=0.80 strong effect)*. Analysis of the collected material was conducted in Statistica software *(version 13.3, Statsoft, Kraków, Poland)*.

RESULTS

Table 1 presents a comparative summary of the motor skill test variables obtained from the study of Judo and BJJ athletes.

The evaluation indicated that the level of performance in selected motor aspects measured by the tests exhibited significant variation with a strong effect. The analysis revealed a significantly higher effectiveness in static balance, simple reaction time, maximum grip strength, explosive strength, and agility in the Judo group. Conversely, a similar trend was observed in the BJJ group for trunk flexibility, resistance to abdominal muscle fatigue, functional strength in the hanging position with bent arms on the gi, and relative dimensions of isometry in the hanging position *(SW2)*. For resistance to back muscle fatigue, MAW and grip SW1 indicators, the test procedure showed a similar level of performance for athletes of both groups, although with a moderate effect for MAW indicators favoring Judo.

The variability coefficient parameters for the studied athletes indicate that for most of the analyzed variables, the intragroup variability was very low. In the Judo group, the exceptions were balance *(high variability)*, flexibility, hanging, and hanging SW2 *(moderate variability)*. In the BJJ group, the exception was balance *(high variability)*.

Table 1. Motor fitness of studied Judo (n=15) and BJJ (n=15) athletes (n=30).

Variables	Group	$\tilde{X}$	SD	Min	Max	CV	p	d
Static balance [s]	Judo	19.49	9.66	10.42	48.33	49.60	0.0049	1.12**
	BJJ	9.64	7.95	3.77	34.97	82.42		
Simple reaction time [s]	Judo	0.22	0.02	0.18	0.25	8.00	<0.001	1,50**
	BJJ	0.25	0.02	0.21	0.28	6.64		
Trunk flexibility [cm]	Judo	26.33	7.09	15.00	38.00	26.92	0,024	0.87**
	BJJ	32.27	6.62	18.00	40.00	20.51		
Static handgrip strength [kG]	Judo	56.19	6.85	38.60	67.80	12.19	0.039	0.80**
	BJJ	50.17	8.28	39.80	61.10	16.50		
Relative handgrip strength – SW1	Judo	0.73	0.13	0.51	0.97	17.99	0.054	0.67**
	BJJ	0.65	0.11	0.49	0.85	16.91		
Standing long jump (explosive strength) [cm]	Judo	253.07	10.72	237.00	270.00	4.24	<0.001	1.66**
	BJJ	234.13	12.08	210.00	258.00	5.16		

Maximum anaerobic work - MAW [J]	Judo	1926.22	257.04	1513.09	2419.00	13.34	0.185	0.50*
	BJJ	1800.16	251.39	1366.73	2391.78	13.96		
Shuttle run 10 × 5 m [s]	Judo	19.10	1.05	18.08	22.13	5.48	<0.001	1.36**
	BJJ	20.67	1.26	19.00	22.53	6.11		
Sit-ups [reps in 30s]	Judo	30.40	3.18	26,00	38.00	10.46	0,007	1.09**
	BJJ	34.60	4.55	23.00	42.00	13.14		
Back extensions [reps in 30s]	Judo	49.47	5.82	38.00	57.00	11.76	0,776	0.10
	BJJ	50,.7	5.62	38.00	58.00	11.23		
Flexed-arm hang in judoga [s]	Judo	37.70	10.69	25.08	60.63	28.36	0.006	1.08**
	BJJ	50.19	12.44	26.09	71.08	24.79		
Relative strength hang – SW2	Judo	0.51	0.21	0.26	0.96	40.96	0.047	0.74**
	BJJ	0.65	0.17	0.28	0.86	25.43		

X̃ *arithmetic mean; SD standard deviation; Min minimum; Max maximum; CV coefficient of variation; p level of significancefor differentiation; d Cohen effect size for differentiation.*

Note: *statistically significant values have been bolded; * effect size moderate; **efekt size strong.*

DISCUSSION

The aim of this study was to assess and diagnose the diversity of selected aspects of motor fitness among athletes in grappling combat sports, specifically comparing Judo and Brazilian Jiu-Jitsu *(BJJ)* practitioners.

The conducted research revealed a varied motor profile among the studied groups. Analysis of the average test results indicated significant differences between the groups in terms of static balance, simple reaction time, maximal static grip strength, explosive strength, shuttle run performance, muscle mobilization speed, and overall agility. The Judo group demonstrated more favorable outcomes in these aspects.

According to Raczek et al., a component of the coordination motor skills complex *(CMSC)* is the ability to maintain a stable body position and to preserve or regain this state during or immediately after a movement [21]. This ability is crucial for all sports, though its importance varies *(e.g., higher in gymnastics, figure skating, lower in swimming)*. In the context of Judo, it seems to be a critical determinant of training and competition activities. Correspondingly, Judo athletes *(x̃ = 19.49)* showed better results compared to MMA *(x̃ = 8.04)* [4] and Muay Thai athletes *(x̃ = 11.38)* [22], using the same tool and method. Judo practitioners, while executing offensive *(throws, ground control in ne-waza)* or defensive actions *(defense against takedowns)*, continuously utilize the ability to maintain both static and dynamic balance. Describing it as merely useful in this discipline does not fully capture its importance; it is indispensable for counteracting destabilization and quickly regaining control, emphasizing its significance.

Reaction time *(simple and complex)* is the interval between the onset of a stimulus and the initiation of a response [23]. In Judo, reaction time is a crucial aspect of an athlete's motor preparation. Proper neuromuscular excitation allows for faster recognition of the opponent's offensive actions and quicker responses. Examples include hip retraction, jumps, and hand deflections to counter throws. Judo athletes demonstrated higher efficiency in reaction time results *(x̃ = 0.22)* compared to strikers, wrestlers, and grapplers *(x̃ = 0.25-0.27)* [24].

Strength is the ability to overcome external resistance or the body's own resistance, under static conditions [18]. Maximal isometric strength is characterized by a lack of change in muscle length and joint movement during activity, making it a static exercise [25]. Both Judo and BJJ involve significant static muscle work, such as clinching, ground control, and holding the opponent. In this study, Judo athletes *(x̃ = 56.19)* and BJJ athletes *(x̃ = 50.17)* achieved better results than MMA *(x̃ = 46.48; 46.79)* [4,26] and Muay Thai athletes *(x̃ = 44.60)* [22], and also compared to fighters *(x̃=47.20)* studied by Mońka and Pietraszewska [27].

These results suggest that this type of muscle work and generated strength is particularly developed in Judo, where confrontation often revolves around achieving an optimal grip *(kumi-kata)* to execute a standing throw *(nage-waza)*. The

presence of a judogi and specific gripping techniques significantly shape and enhance the ability to generate maximal local static strength of the forearm and overall.

Power is defined as the ability to exert maximum strength in the shortest possible time [18]. A high level of explosive strength enables grappling athletes to gain an advantage over their opponent *(executing a throw, submission action)* [28]. The results for the BJJ group *($\tilde{x}$ = 234.13)* are close to literature values for this sport *($\tilde{x}$ = 234-237)* [29,30]. Comparing this with Judo athletes *($\tilde{x}$ = 253.07)* highlights the need for higher competence in this area and related anaerobic work MAW *(effect size moderate)*. In Judo, a successful throw can immediately end a match *(ippon)* [8], which is highly valued. In BJJ, a successful takedown provides technical points [9] and possible control from a preferred position.

Agility, without clear dominance, lies at the border of endurance, speed and coordination abilities, being structurally complex and hybrid [31]. An element of motor potential is muscle mobilization speed, which manifests as speed ability. Its essence is the ability to quickly activate as many motor units as possible and discharge a large amount of energy in a movement act [18]. In combat sports, many athletes rely on this motor ability. From the first seconds of the fight, they try to impose their fighting style through quick offensive actions aiming for a quick conclusion. Judo competition exemplifies this, with rules and match time *(4 min.)* [8] dictating this model, explaining the observed differentiation in the studied groups.

In BJJ, these motor aspects are also important but seem subjectively more significant in positional standing fight *(nage-waza: tachi-waza/sutemi-waza)*, which is much less prevalent in the discipline [11] *(dominance of ne-waza)*, playing an important but secondary role [32].

The BJJ group showed significantly higher results for trunk flexibility, abdominal muscle fatigue resistance, functional strength in hanging with bent arms on the kimono, and relative isometric dimensions in hanging.

Flexibility is defined as the range of motion in a single or multiple joints [23]. It is an important element for BJJ training, especially in the thoracolumbar spine and hamstrings. High flexibility supports the learning of specific technical skills in the discipline BJJ [33,34]. The results of this study *(BJJ $\tilde{x}$ = 32.27)* are close to those presented by Marinho et al. for state-level athletes *($\tilde{x}$ = 32.00)*, but lower than for international-level BJJ athletes *($\tilde{x}$ = 40.00)* [35].

Muscle endurance, or specific endurance, is the ability to sustain submaximal muscle contractions for a prolonged period. Its development level depends on specific training for the discipline [1]. Comparing Judo and BJJ in terms of endurance use during combat, athletes primarily rely on anaerobic and mixed endurance [1]. They need high muscle endurance to control the opponent throughout the prescribed match time. This ability largely determines success, especially when equally well-trained opponents meet. The dominance in abdominal muscle fatigue resistance among BJJ athletes may result from the discipline's characteristics, such as the nature and duration of fights *(Judo – 4 min.; BJJ – 5 to 10 min, depending on the division)* [8,9].

These results are partially consistent with studies conducted in 2022-2023 among BJJ athletes, compared to MMA [26] and Muay Thai [22] athletes. Significant differences in abdominal muscle fatigue resistance and hanging endurance with bent arms were observed, with BJJ showing an advantage. A systematic review of BJJ literature also reports better hanging endurance results for BJJ practitioners compared to Judo athletes [6]. Regarding grip endurance, a BJJ practitioner must maintain a strong grip on various body parts for most of the match. Key moments require significant endurance to maintain a constant level of strength endurance for an extended period, a consensus in the specialist literature [6].

It seems reasonable to assume that, among other things, an environmental factor in the form of a targeted training process influenced the dominance of a given group in the results of individual fitness tests. Unpublished subjective coaching observations indicate that effective confrontation in Judo is determined by a high level of strength-speed abilities, and the fight is characterized by continuous movement, with a high degree of dynamism and explosiveness. In contrast, in BJJ, the fight is slower, more static-strength oriented, and endurance-strength abilities seem to be a priority.

The results of our own research show that athletes from both groups did not differ significantly in terms of SW1, MAW, and back muscle resistance to fatigue. Therefore, it can be stated that in this regard, the studied groups are characterized by similar competencies, and the mentioned aspects of motor fitness can be similarly developed in the training process of both disciplines.

LIMITATIONS OF THE STUDY

To capture the multifaceted context, further research should aim to expand diagnostics to larger study groups and female athletes, and comparisons with representatives of other combat sports. Future studies should include identification of co-occurrence with training experience and sports results of the subjects. Finally, future work should consider developing experimental training stimuli to optimize the level of priority motor fitness components.

CONCLUSION

Motor fitness significantly differentiates the studied athletes *(Judo vs BJJ)* in terms of static balance, simple reaction time, maximal static grip strength, explosive strength, and overall agility, with Judo athletes showing more favorable results. For the BJJ group, higher results were found for trunk flexibility, abdominal muscle fatigue resistance, grip endurance in hanging with bent arms on the kimono, and relative isometric dimensions in hanging.

The results suggest that Judo athletes exhibit a strength-speed profile of motor fitness with a significant static balance component, indicating a hierarchy of motor skills priorities for optimal training and competition functioning. BJJ athletes, on the other hand, showed an endurance-strength profile, with a significant role attributed to the specific and unique isometric endurance of the upper limbs in prolonged grip holding on the kimono.

PRACTICAL APPLICATIONS

The results of this study can serve researchers for preliminary comparisons and interpretation of indicators based on the average values presented here. Specific indicators allow for the preliminary diagnosis and interpretation of motor fitness competencies, considering the priority components of motor skills in Judo and BJJ, contributing to improved coaching control quality.

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EXPLORING BODY PRESSURE DISTRIBUTION IN MAE UKEMI FALL TECHNIQUE USING E-TEXTILE SENSOR ARRAYS

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ABSTRACT

The "Safe Fall" concept has emerged as a vital innovation for preventing injuries in schools. Falls are a primary cause of accidental injuries among children and adolescents, often resulting in significant physical and emotional consequences. The main objective of this research is to validate the Sensing Text Fitness Mat as a valid tool for measuring the effectiveness of the ukemi "Mae Ukemi" as a safe and protected way to fall during an unintentional forward fall. The results show that it is possible to measure the influence of the fall position on the pressure exerted on the joints that impact the ground. In conclusion, Sensing Text Fitness Mat is a valid tool to study mastery in the application of the safe and secure technique of falling Mae Ukemi.

Keywords: *judo, ukemi, safe fall-safe schools, e-textile pressure sensor arrays, children*

INTRODUCTION

Judo, often known as the "gentle way," is an Olympic and Paralympic sport founded by Jigoro Kano in the late 19th century. It draws inspiration from traditional Japanese martial arts and is practiced in over 200 countries worldwide. The purpose of Judo is to use the opponent's energy and strength against them to throw them. Therefore, one of the key elements in Judo teaching is the emphasis on techniques known as Ukemis *(safe falling) (Sato, 2013)*.

The Safe Fall approach is based on principles of Judo, where learning to fall correctly is an essential skill *(Murayama et al., 2021)*. This method not only prevents injuries during falls but also promotes self-confidence and body awareness among practitioners.

In this context, the concept of "Safe Fall" has become a crucial innovation for injury prevention in the school environment. Falls are one of the leading causes of accidental injuries among children and adolescents, with significant physical and emotional impacts. Implementing training programs that teach safe falling techniques can radically transform how schools approach student safety, a topic addressed by the scientific project funded by the European Judo Union, Safe Fall-Safe Schools *(DelCastillo-Andrés et al., in press)*.

Falls can occur in several directions: backwards *(Ushiro Ukemi)*, sideways *(Yoko Ukemi)*, and forwards *(Mae Ukemi and Mae Maware Ukemi)*. In all cases, there are basic principles to be followed to achieve a safe and protected fall. The proposal presented in this work, Mae Ukemi, prioritizes the analysis of the parameters used to evaluate a safe fall based on the fulfillment of the variables indicated in the Mae Ukemi's Safe Fall-Safe Schools Test *(Figure 1)*.

a)before fall b) body placement c) ground contact

Criterium	Description	YES	NO
Head	Touch the floor		
	Turn face to one side		
Forearm	Land on his/her forearm forming angle ≤90º. During the dumpling, the fingers are extended, closed, palm down		
Torso	Block the torso extended		
Hip	Maintains hip block		

Figure *1. Mae ukemi phases in Mae Ukemi's Safe Fall-Safe Schools and analysis variables*

In summary, we will focus on the subject's control of the head, arms, torso, and hips during this type of forward fall. In this context, a pioneering initiative emerges, a quest to experimentally validate the efficacy of e-textile pressure sensor arrays in analyzing the nuanced intricacies of one of Judo's foundational fall technique, the Mae Ukemi.

This intersection of tradition and technology promises to unveil new dimensions in the timeless pursuit of mastering the art of Judo.

METHODS

The body pressure distribution during Mae ukemi was measured using the Sensing Text Fitness Mat system. This mat features 80 x 20 pressure e-textile sensor arrays spread across a sensing area of 1600 mm x 560 mm, with each sensor having a resolution of 20 mm and a pressure measurement range of 20-10000 mmHg, quantified using a 12-bit ADC. The experiment was also documented with a smartphone to align the pressure map with each stage of the fall.

As part of the development of the Safe Fall-Safe Schools scientific project we will analyze the validity of the Sensing Text Fitness Mat system instrument to assess the effect of a controlled laboratory fall on the technical premises of the Mae ukemi fall *(Mae Ukemi's Safe Fall-Safe Schools Test, Fig. 1)*.

This study received approval from the Ethics Committee of Biomedical Research of Andalusia, ensuring the child's safety throughout the research process.

RESULTS

*Fig*ure 2 illustrates the pressure map during the Falling forward in unprotected position. Prior to the fall, pressure is observed to be concentrated across the entire knees. During ground contact, the maximum pressure increases up to the

support of the hands. We can observe a high pressure in the right hand *(> 2000 mmHg)*, which indicates a high possibility of injury to this joint.

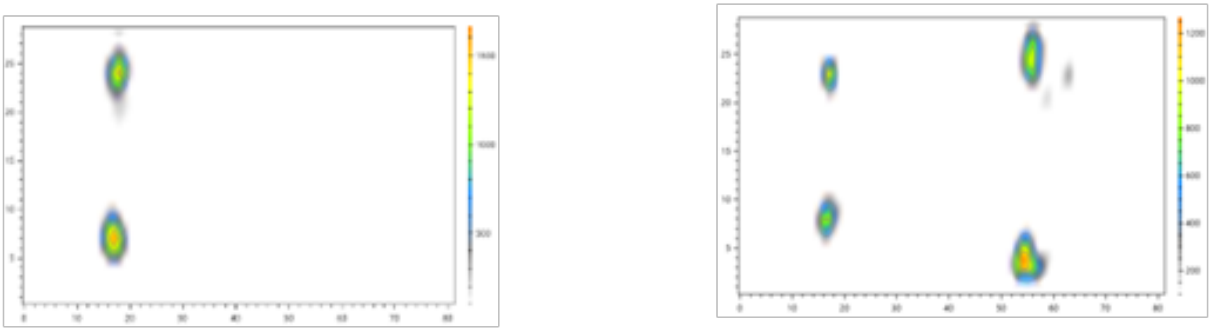

Figure *2. Falling forward in unprotected position*

Now, it is necessary to evaluate the pressure map in a protected forward fall *(adapting the protective position in Mae Ukemi)*. In figure 3, it can be seen that the pressure is distributed over a larger surface area and decreases the pressure in the entire forearm area *(< 400 mmHg)*, which may mean a lower risk of injury.

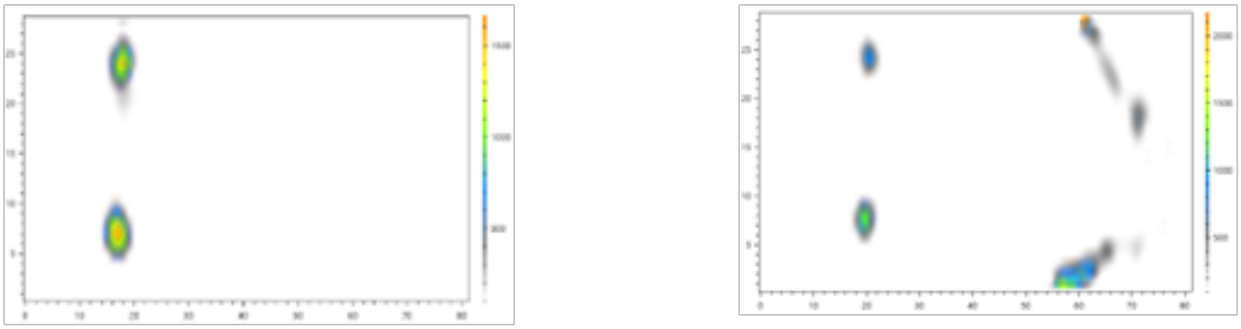

Figure *3. Falling forward in protected position Mae Ukemi*

DISCUSSION

This study experimentally assessed the functionality of the pressure sensor array for evaluating Judo Ukemi techniques. A dynamic pressure map was obtained during the fall, which can be valuable for evaluating and optimizing the technical execution and impact of the Judo fall.

CONCLUSIÓN

Sensing Text Fitness Mat is a valid tool to study mastery in the application of the safe and secure technique of falling Mae Ukemi.

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THE IMPORTANCE OF JUDO TRAINING ELEMENTS AND OTHER COMBAT SPORTS WITHIN THE SUBJECT POLICE PHYSICAL PREPARATION 2

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ABSTRACT

Polytechnic of crime and public safety students in Zagreb within Professional undergraduate study Criminalistics have an option to choose specific police subjects Police physical preparation 1, 2 and 3 as elective courses. Subjects Police physical preparation 1,2 and 3 are saturated with elements of various martial arts *(karate, judo, aikido, boxing)*. The aim of the mentioned elective courses is to improve level of anthropological characteristics of students which eventually impacts on the level of situational efficiency of police officers. Significant part of training elements of Police physical preparation 2 *(PTP2)*, besides elements of police self-defence *(police apprehension, defence against armed or unarmed attacker)*, is saturated with judo training elements in order to improve, to brush up techniques of judo throws *(osoto - gari, o - goshi, tai – otoshi)* as well as basic falls *(Mae ukemi, Zempo Kaiten Ukemi, Ushiro ukemi, Yoko Ukemi, „judo falls into the bridge")*, control grips on the mat, levarage and choking techniques, fights in the standing position and on the mat. Training elements of the subject Police physical preparation 2 should improve protection, defence of police officers against different types of attacks, that is, increase the level of utility of training elements of PTP 2 in different urgent situations to which police officers are exposed to on a daily basis. Judo elements, elements of police self-defence, elements of other martial arts can be used as quality foundation of quality and efficient upgrade of contemporary police self-defence, police training, i.e. modern individual and group tactics of police proceedings.

Keywords: *judo falls, judo throws, police training, police self-defence*

INTRODUCTION

According to different authors *(Sertić et al., 2004; Drid, 2006; Sato, 2013; Sertić et al Segedi, 2013; Zovko, 2020)* judo same as other martial arts belongs to a group of poly-structural acyclic sports which are characterised by acyclic motion with the aim of the final victory on tatami, that is, to avoid defeat. Judo as a sport continuously changed its forms over the history in order to defeat opponent through implementation of defined rules. According to Mekić *(2013)*, great number of specific training exercises which are outcomes of large number of technically and tactically demanding judo elements develop into applicable training elements which are adequate for all ages because they are saturated with factors which unite and balance specific technical, tactical and physical preparation of entities. When practising judo elements *(judo falls)* we should always transform judo falls of different complexity into rolling over the floor in the proper body position, that is, into technique of right and safe landing *(Sertić and Segedi, 2013)*.

According to Kudo *(1976)*, judo represents the way on which we can use our physical and psychological strength in the best way possible. Failure of the opponent is not result of his mistakes but quality performed techniques carried out by competitor, individual who perform desired throwing, where thrown opponent is conquered by throwing on his side or back, by action of mobile force *(hazumi)* and force of motion *(ikioi)*. Judo as a sport is suitable for all tactical athletes *(Alvar et al., 2017)*, tactical workers *(army, police, firefighters and those who come first in emergency)* referred as tactical athletes, they have high needs for physical fitness so they have to endure mentally and physically challenging professional tasks, often in extreme conditions. During situational training, that is, during practising elements which demonstrate specific fighting knowledge *(elements of Police physical preparation 2)* subject often „falls" or „is being thrown", so it is necessary to learn how to fall and how to throw opponent on a safe way with maximum control, in order to minimise potential risk of injuries. So, it is crucial to emphasize importance of knowledge of judo falls, *(Jozić et al., 2019; Lockhart et al., 2022; Jozić et al., 2023)*; high level of trained judo falls is essential in prevention of head and neck injuries, where techniques used by experienced judokas or judoka beginners in this case students, future police officers,

differ. Judo as a sport is suitable for improvement of those knowledge of fighting, elements of proceeding tactics which require quality, quick and safe police proceedings in order to control rioters through individual or group proceedings in life- threatening situations. Judo as a sport is developed all over the world and in a large number of countries is trained in army and police because it significantly develops psycho-physical endurance which is gained through system of specialised drill, trainings and fights which are dominant in surviving processes in highly stressful proceedings *(Lucić and Gržeta, 2007; Agostinho and Francini, 2021)*. Judo is extremely suitable for tactical workers because it offers wide range of „grips", actions and tactics before the attack happened, throwing techniques, transitions from standing to mat fights, where techniques applied on the mat varies depending on complexity of situation itself.

THE AIM OF THE PAPER

The main aim of this paper is presentation, explanation of situational importance of judo training elements, police self-defence and other martial arts *(Police physical preparation 2) (PTP 2)* while executing official tasks on a daily basis regarding many endogenous and exogenous factors of restriction which police officers all over world are faced with.

PRESENTATION OF TRAINING PROCEDURE OF POLIC EPHYSICAL PREPARATION 2

Police training contains basic and advanced judo elements, pre-exercising for learning judo falls techniques from lying, sitting, kneeling and squatting positions, judo falls and rising ups and standing/taking guard, breakfalls as a part of police self-defence, simple forward fall *(on the chest)* - mae ukemi, forward rolling breakfall -zempo kaiten ukemi, side breakfall- yoko ukemi, backward rolling breakfall – ushiro ukemi, acrobatic falls, *(Kosanović, 1998; Sertić and Segedi, 2013; Jozić et al., 2019)*. Within Police training PTP 2, holding grips with transitions, leverage techniques, choking techniques and of course different judo throws, as well as police self-defence techniques are trained. Trainings are held according to student schedules *(study weeks)*. During trainings, strength training for muscle groups of entire body is significantly represented. That is, greater part of training is used for improvement of judo throwing techniques *(osoto - gari, o - goshi, tai – otoshi) (Kazuzo, 1976; Sertić and Segedi, 2013)* as well as basic breakfalls *(Zempo Kaiten Ukemi, Ushiro ukemi, Yoko Ukemi (side breakfall)*, „judo falls into the bridge" - *(Kosanović, 1988)* and apprehension grips, tactics of police proceedings against armed and unarmed attacker *(specific fighting knowledge) (Kosanović, 1988; Jozić et al., 2019)*.

DISCUSSION

According to domestic authors Lauš et al., *(2015)* police officers who have 11 or more hours of yearly training of specialised drill when compared to police officers who have 0 to 10 hours of specialised drill at the same period, have demonstrated lower level of anticipated stress in situations when they were attacked and parallelly have greater number of used means of force. Judo as a sport is based on the „unpredictability of moment ", because of the presence of opponent who uses false attacks and „deceptions" in his constant craving of hiding his next judo movement.

That is, judo is situational sport and according to Frassinelli et al., *(2019)* actions in a row which occur under the influence of environmental situations which inherently dynamically change during fight, paring and from fight *(competition)* to fight. Defence, attack actions and judo tactics generally are subordinated to opponent's actions and reactions. In order to quality practise judo techniques, it is necessary to improve those motor regulation mechanisms which are firstly responsible for structuring, control and regulation of movements, together with continuous control of balance and controlled strength exercise *(Popović and Popović, 2023)*.

Optimal level of motor abilities in correlation with other anthropological characteristics probably significantly improve, determine situational level of efficiency in general. Considering judo is Olympic sport whose combat nature is intermittent thanks to a large diversity of technical and tactical operations and constant breaks during competitions, entities should have higher level of muscle strength, of upper and lower extremities, as well as aerobic and anaerobic capabilities. Upper extremities *(their strength, specific endurance)* are engaged in constant dragging and pushing in order to maintain the grip, to control the opponent and to create conditions for attack, where lower extremities undergo through constant efforts, which include powerful actions *(cycles of extension – contraction of muscles) (Kons et al., 2017)*. Subject Police

physical preparation 2 is composed of both, judo throws and judo falls. Regarding importance of judo falls through practising offensive and defensive tactics, it is important to emphasize that judo falls *(ukemi)*, according to Lockhart et al., *(2022)* crucial in a process of preventing head and neck injuries and techniques, differ between experienced judokas and judokas beginners, while mentioned group of authors did not find correlation between strength of neck muscles and improved „ukemi" *(falls)*, that is, statistical correlation is weak.

According to Lockhart et al., *(2022)* negative correlation was found between fatigue and skill of realisation of judo falls, which is very important information for education, i.e., training, as judoka beginners so experienced judokas, and in this case, students, future police officers. Training of judo falls, their raising to a highest level of situational efficiency reduces potential head injuries in a manner to control sudden backward head rotation, which is crucial factor in occurrence of serious head injuries with additional linear acceleration. Furthermore, good, quality performance, training of judo falls significantly reduce both, acceleration values under the limit, which are connected with occurrence of brain concussion *(head contusions)*. Well trained judo falls are efficient protection for judokas against serious head and neck injuries because judo tatami in a training hall *(on the mat)* have not proved safe enough or as proper protection in lowering impact of head and neck injuries of judokas *(Lockhart et al., 2022)*.

When performing judo falls, control of entire body is crucial, including upper and lower extremities, together with head and neck. Through training elements incorporated in the subject „Police physical preparation 2"*(elements of official programme, with emphasis on judo elements) (Drid, 2006; Lucić and Gržeta, 2007; Kons et al., 2017)* we strengthen grip power, where higher isometric strength probably contributes to better efficiency on the competition. Better grip strength for kimono probably protracts critical fatigue of upper extremities in external/internal shoulder rotation and also in the muscle strength of lower extremities *(Kons et al., 2017)*. Of course, aerobic strength and aerobic capacity are considered also relevant as in a system of training, probably so in a judo fight, judo performance and in situational efficiency of police officers. Aerobic capacities are related to quickness of recovery during short periods of breaks between extortion *(intermittent extortions of extremely high intensity)*.

Anaerobic capacities and aerobic strength themselves are dominantly important too in decisive offensive-defensive actions, techniques which depend on powerful and vehement movements which are maximum saturated with explosive strength of throwing type which occurs in performing official tasks of different complexity *(Jozić, 2020)*. Explosive strength of throwing type as capability of performing quick *(explosive)* movements with constant load in very short time periods is significant and it should not be influenced by fatigue in order to overcome opponent and space in the shortest time possible *(Jukić et al., 2008; Kons et al., 2017)*.

CONCLUSION

Elements of PTP 2 with emphasis on the elements of police self-defence, judo training *(judo throws, judo falls, grips, grappling holds, leverage, choking, fights on the mat)*, elements of other martial arts, training elements *(discontinuous running (running up to 3200 m, 5000m, discontinuous running up to 8000m)*), training elements with weights probably have positive impact on the level of anthropological characteristics of students, that is, future police officers. Training of police self-defence elements, judo falls, judo throws and their upgrade to the highest level of situational efficiency reduce potential head injuries because it controls sudden backward head rotation which is crucial factor in serious head injuries. Application of training elements of Police physical preparation strengthen grip strength where higher isometric grip strength probably contributes to a greater efficiency at the competition but also in the situations when is necessary to control rioter by applying arresting technique.

It is important to emphasize probable impact of personalised training of students which have motivationally positive impact on attendees of training elements of PTP 2, elective course which is chosen by highly motivated students, i.e. police officers. Future research should be focused on determining how much training cycles of PTP 2 that have been carried out, improve both, level of motor abilities and anthropological characteristics, and how greater number of personalised training *(analysing of technical abilities)* influence on the level of the anthropological characteristics of students.

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THE INCLUSION OF AUTISTIC CHILDREN IN SCHOOL THROUGH JUDO AND KARATE: A PILOT STUDY

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ABSTRACT

Autism spectrum disorder *(ASD)* children have been recorded as ostracized and are often at risk of isolation. In a recent studies the benefits of a motor and behavioral judo activity and karate activity were demonstrated, but a few studies have been conducted to identify the benefits in inclusive primary school contest.

Methods This research was conducted by "KATAUTISM PILOT PROJECT" of the Italian Judo, Wrestling, Karate and Martial Arts Federation *(FIJLKAM)*, whose objective is the inclusion of autistic children through the practice of judo and karate in primary schools. The study involves 5 ASD children *(n= 5 boys)* between 6 and 10 years old who all partook in an inclusive judo *(n=3)* and karate program *(n=2)* at school with their classmates. Each program includes 2 weekly sessions for 12 weeks, with each session lasting 1 hour. This study analyzes 3 different areas in autistic children: the level of autism, social compromission and gross motor skills

Results. Different levels of autism were involved in this study, and all completed the program with classmates that yielded statistically significant results *($p<0.05$)* in all 3 areas analyzed.

Conclusion Judo and karate activities in primary school have promoted the inclusion of ASD children by significantly reducing social impairment, autistic mannerisms, hetero-aggressive and self-aggressive behaviors, and by improving emotional regulation in all ASD children. The study demonstrated that there were average percentage improvements in GARS, SRS, and TGMD-3.

Keyword: *Autism, judo, karate, social inclusion, primary school.*

INTRODUCTION

Children with special educational needs, such as Autism Spectrum Disorder *(ASD)* children, often find it difficult to be included in inclusive sports contexts *(Cioni L. & Magnanini A., 2022)*. In Italy it is estimated that 1 child out of 77 *(ages 7-9 years)* has autism spectrum disorder with a higher prevalence in males: males are 4.4 times more than females. This national estimate was made as part of the "Observatory Project for Monitoring Autism Spectrum Disorders" coordinated by the National Institute of Health and the Ministry of Health *(2021)*. ASD person exhibit a variety of stereotypical motor behaviors or interests such as hand clapping and body rocking *(Bodfish J.W., 2000)*.

Many studies have demonstrated the effectiveness of motor interventions in ASD people, especially if the interventions are intensive and introduced in the early stages of life *(Corsello C.M., 2005)*. Early therapeutic intervention can be extremely expensive for families of ASD children *(Chasson G.S. et al, 2007)*, with a high cost on individual families and social services. Additional forms of evidence-based treatment are needed to help reduce the maladaptive behaviors associated with ASD and promote positive behaviors in the home, school, and community.

The maladaptive behaviors associated with ASD can sometimes be attributed to stress and anxiety *(Myers S.M. et al, 2007)*. Reviews of the impact of physical activity in ASD individuals *(Langdon K.D. & Corbett D., 2012; Petrus C. et al, 2008; Sorensen C. & Zarrett N., 2014)* have demonstrated significant benefits.

Another review *(Bremer E. et al, 2016)* compared the benefits that different sports have brought to ASD children, the results have shown that physical interventions consisting of jogging, horse riding, martial arts, swimming, yoga/ dance can lead to improvements in numerous problem behaviors, including stereotyped behaviors, social-emotional functioning, cognition and attention. It should also be noted that horse racing and martial arts produce the most

significant improvements. In the 1970s the Italian school chose the path of inclusion and integration of all students, profoundly renewing teaching.

There are no studies in the literature that analyze the adaptations of ASD subjects in inclusive school contexts through the practice of judo and karate. Starting from this theoretical background, research conducted in the FIJLKAM *(Italian Judo Fight Karate and Martial Arts Federation)* project "KATAUTISM, with the aim of including autistic children through practice of judo and karate in a school environment.

METHODS

The children of the pilot project were 5 boys from 5 different classes *(1 ASD child per class)*, 3 classes have followed the judo program and 2 have followed the karate program. The average age was 7.2. The project lasted 12 weeks with a frequency of twice a week and each session lasted 1 hour. Each class had to have an autistic child and the age range involved was 6 to 10 years old. The staff involved in the research was composed of 2 judo coaches, 2 karate coaches and 2 psychologists experienced in autism. All the staff have followed a specific training course. T

he psychologist was an observational figure supporting the coaches during all lessons. The project used an adapted methodology with specific tools. The research analyzed the changes determined by a Judo and Karate protocol in the three specific areas of autistic children: 1) to identify autism and assess the severity of symptoms with Gilliam Autism Ration Scale *(GARS) (Gilliam, J.E.. 2014)*, to measure the social impairment associated with autism spectrum disorders with Social Responsiveness Scale *(SRS) (Constantino, J. N., & Gruber, C. P.,2012)* and the gross motor area with the Test of Gross Motor Development-Third Edition *(TGMD-3) (Ulrich, D. A., 2019)*.

The scientifically validated tests were administered at the beginning and end of the project. The GARS was compiled by the psychologist expert in autism, always present during the judo lessons and the part dedicated to developmental disorders by parents. The SRS was completed by the child's class teacher with the support of the coordinator and the psychologist for the compilation, The TGMD-3 was administered by the project coordinator expert in sport sciences.

The tests were developed with a multidisciplinary approach to have different perspectives from the experts. GARS is a checklist developed for use by professionals, educators and rehabilitators, both to identify autism and to rate the severity of its symptoms for individuals aged 3 to 22 years. GARS are based on DSM V and are grouped into 4 subtests that describe specific, observable and measurable behaviors. SRS is used to measure the degree of social impairment associated with autism spectrum disorders, is a 65-item questionnaire that assesses the reciprocal social, communicative and repetitive and stereotyped behaviors characteristic of ASD aged between 4 and 18 years. It can be completed by a teacher, parent, or other caretaker who is familiar with the individual's current behavior and developmental history. The elements are the same for teachers or parents, but the score profiles are specific to each group.

A total score provides a measure of the severity of the social deficit and allows for comparisons across different contexts and raters. TGMD-3 helps identify children ages 3 to 11 who are significantly behind their peers in gross motor skill development and who should be eligible for special education services in physical education. T

he TGMD-3 consists of 13 skills, 6 for locomotor skills *(running, gallop, single foot hops, hopping step, standing long jump, lateral canter)* and 7 for ball skills *(two-handed hitting of a ball at rest, forehand, dribbling in place with one hand, catching a ball with two hands, kicking a ball at rest, high pass and low pass)*. The study did not adopt any inclusion/exclusion criteria for ASD children.

RESULTS

Table 1. Guide to data interpretation GARS

GUIDE TO DATA INTERPRETATION GARS			
STANDARD SCORE SUBTEST	QUOTIENT AUTISM	DEGREE OF SEVERITY	AUTISM PROBABILITY
17-19	131+		VERY HIGH
15-16	121-130		HIGH
13-14	111-120		ABOVE THE AVERAGE
8-12	90-110		AVERAGE
6-7	80-89		BELOW AVERAGE
4-5	70-79		LOW
1-3	?69		VERY LOW

Table 2. Results Gars Subscale , Average pre and post, delta, p-value and variation % of 5 ASD children

GARS SCALE	AVAREGE PRE	AVAREGE POST	DELTA	P-VALUE (Paired t-test post vs pre	VARIATION %
GARS Stereotyped Behaviors	10,4	8,4	-2	0,003	-18,92
GARS Communication	10,2	9	-1,2	0,033	-13,21
GARS Social Interaction	9,4	7,4	-2	0,003	-21,66
GARS Developmental Disorders	7,8	7,8	0		0
Gars Total	37,8	32,6	-5,2	<0,001	-13,95
Gars Quotient autism	96,2	87,6	-8,6	0,002	-8,86

Table 3. Guide to data interpretation

SCORE	GUIDE TO DATA INTERPRETATION SRS
60-75	60 to 75 (range mild to moderate): Scores in this range indicate a deficit in reciprocal social behavior that is clinically significant and interferes with daily social interactions to a slight to moderate degree. Scores in this range are typical for individuals with high-functioning or mild autism spectrum disorder, such as PDD-NOS and Asperger's Disorder.
>76	76 or more (severe range): Scores in this range are strongly associated with a clinical diagnosis of Autistic Disorder, Asperger's Disorder, or more severe cases of PDD-NOS. This suggests a serious interference in daily social interactions

Table 4. Results SRS Subscale , Average pre and post, delta, p-value and variation %

SRS SCALE	AVAREGE PRE	AVAREGE POST	DELTA	P-VALUE (Paired t-test post vs pre)	VARIATION %
SRS CNS (SOCIAL AWARNESS)	77,2	71,2	-6	0,011	-8,02
SRS CGS (SOCIAL COGNITION)	86,6	80,6	-6	0,005	-6,85
SRS CMS (SOCIAL COMUNICATION)	79,2	74,2	-5	0,02	-6,47
SRS MS (SOCIAL MOTIVATION)	82	73,6	-8,4	0,003	-10,94

SRS MA (AUTISTIC MANNERISM)	94,2	83,6	-10,6	0,004	-11,53
SRS TOTAL	88	80,2	-7,8	<0,001	-9,14

Table 5. Guide to data interpretation tgmd-3

SCALE SCORE	GUIDE TO DATA INTERPRETATION TGMD-3 DESCRIPTEVE TERM	INDEX SCORE
1--3	IMPAIRED OR DELAYED	<70
4--5	BORDERLINE INPAIRED OR DELAYED	70-79
6--7	BELOW AVERAGE	80-89
8--12	AVERAGE	90-109
13--14	ABOVE AVERAGE	110-119
15--16	SUPERIOR	120-129
17--20	GIFTED OR VERY ADVANCED	>129

Table 6. Results TGMD-3 Subscale , Average pre and post, delta, p-value and variation %

TGMD-3 SCALE SCORE	AVAREGE PRE	AVAREGE POST	DELTA	P-VALUE (Paired t-test post vs pre)	VARIATION %
TGDM-3 Locomotor Scaled	3,6	10	6,4	<0,001	347,17
TGDM3 Ball Scaled	2,2	7,8	6,4	0,03	251,67
TGDM3 Totale Scaled	5,8	17,8	12	0,001	289,83
TGDM3 GMI	58,2	93	34,8	0,001	59,42

DISCUSSION

In table 1, we find the guide for GARS data interpretation. The reduction of problematic behaviors in the 5 autistic children is highlighted by the results related to the GARS, showing a decrease in the average percentage variation of -18.92% *(Table 2)*. This behavioral improvement facilitated the inclusion process of autistic children within the classes. In Table 3 there is a guide for SRS data interpretation. This is also confirmed in the results of the SRS total, which shows a decrease in the average percentage variation equal to -9.14% *(Table 4)*. The use of specific tools provided by the intervention protocol helped the children with emotional regulation and participation in the proposed activities. In Table 5 there is a guide for TGMD-3 data interpretation.

Gross motor skills improved significantly and this is confirmed by the average percentage variation of the TGMD-3 GMI data equal to 59.42% *(Table 6)*. Table 2 shows the score related to the GARS, which includes adaptations of stereotyped behavior, communication, social interaction and development. From the results it can be seen that the children started the process with a score related to the autism quotient at an average level 96.2, while at the end of the research project it dropped below average 87.6 *(Table 2)*. It is also highlighted that in the subscales there is a greater decrease in the subscale related to social interaction -21.66% followed by stereotyped behaviors -18.92% *(Table 2)*.

Table 4 of the SRS shows that from the beginning of the project, total social impairment decreased by 9.14%: the subscales show a greater decrease in the area of autistic mannerisms -11.53% and social motivation -10.94%. These data confirm that the judo and karate activities have positively contributed to the reduction of social impairment in children. In Table 5 there is a guide for data interpretation of TGMD-3. The TGMD-3 test showed a general improvement in the gross motor area.

The children initially had an average TGMD-3 GMI score in the compromised or delayed area 58.2, while following the practice of judo and karate, at the end of the project, they placed themselves in the middle area 93 *(Table 6)*. It is interesting to highlight the average percentage variation equal to 59.42% *(Table 6)*. All autistic children completed the program and always participated in activities with their classmates.

The research highlighted that through the inclusive practice of judo and karate in the school environment ASD children showed a significant decrease in problematic behaviors, greater emotional regulation, a reduction in social impairment and an improvement in the gross motor area. In a recent studies the benefits of a motor and behavioral judo activity *(Morales J. et al, 2022; Rivera P. et al., 2020; Pierantozzi E. et al., 2022)* and karate activity *(Bahrami F. et al., 2012; Movahedi A. et al., 2013)* were demonstrated.

There are studies that have shown that ASD children face greater difficulties in motor development compared to their peers *(Miyahara M., 2013)*. Another study found a relationship between gross and fine motor skills and the severity of ASD *(MacDonald M. et al., 2014)*. The research reported significant results for gross motor skills, behavioral and social inclusion. Supporting this observation, some researchers found links between motor problems and the development of linguistic and cognitive skills *(Bedford R. et al., 2016)*.

CONCLUSION

The improvements of ASD children had a significant impact on the social inclusion process confirming the initial hypothesis of the study. Classmates showed a gradual disposition to interact with their peers and practice judo and karate together. To improve the children's availability, it was crucial to use specific tools that guaranteed the predictability of the proposed activity and understanding the execution of the exercise, providing a clear definition of the activity, its progression and duration. We can conclude that the activities of judo and karate have facilitated the inclusion of children within the classmates. It is important to highlight the importance of specialized training for coaches which, with the support of psychologists experienced in autism, allowed them to understand the needs of ASD children and adapt motor activities in an inclusive context.

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PHASE ANGLE AND ITS POTENTIAL FOR DETERMINING THE LEVEL OF FITNESS IN YOUTH JUDOKAS MEASURED BY BIOELECTRICAL IMPEDANCE ANALYSIS

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ABSTRACT

Objective: The literature reported that Bioelectrical impedance analysis *(BIA)* and its Phase angle *(PhA)* can efficiently assess adolescent athletes' physical condition. Therefore, this study aimed to explore correlations of PhA with hand grip strength *(HGS)* and isokinetics of knee joints as indicators of physical fitness in youth judokas. Methods: Body composition with the PhA was measured by Inbody 720 BIA.

Additionally, the HGS was test evaluated by Camry EH101 electronic dynamometer and knee joint isokinetic strength on iMOMENT, SMM isokinetic machine at the testing speed of 60˚/s on a sample of 5 judokas *(age=16.34 ± 0.95 years; weight=72.92 ± 13.94 kg; height=16.34 ± 0.95, body fat %= 9.2 ± 6.1)*. Pearson correlation coefficient test was used to analyse possible associations between selected variables with statistical significance set at $p \leq 0.05$. Results: A significant strong positive correlation between PhA and right Quadriceps peak torque *(p=0.031; r=0,856)*, left Quadriceps peak torque *(p=0.013; r=0,952)* and left Hamstring peak torque in concentric testing mode *(p=0.033; r=0,907)* were established.

Conclusion: The study presents whole-body PhA, which can be measured quickly by the BIA, and has shown a significant positive association with selected isokinetic strength parameters. The results show that PhA presents a promising variable that can be quickly obtained and is highly associated with the fitness levels of youth judokas. However, further research on a larger sample, both genders and taking into account weight categories is needed to provide a more firm interpretation, conclusion, and practical application to explore PhA's full potential to predict the levels of physical fitness in youth judokas.

KeyWords: *combat sports, body composition, performance, testing,*

INTRODUCTION

Today's elite athlete training is based on a carefully planned and supervised regimen that includes methods needed to achieve the set goals for transforming the athlete and their form. To aid in this process, sports testing should be there to support monitoring and guiding this process *(Šimenko, 2016)*. Bioelectrical impedance analysis *(BIA)* is a widely used, fast, non-invasive and reliable method for assessing body composition and other related variables that are important for athletes *(Moon, 2013)*.

These are especially of great importance in weight-sensitive sports. Another variable being assessed via BIA is the Phase Angle *(PhA) (Hetherington-Rauth et al., 2021)*. PhA reflects the relationship between the resistance *(R)* and reactance *(Xc)* of the body's tissues measured at the 50 kHz frequency and is calculated by the following formula: [arctangent *(Xc/R)* × 180°/π] *(Yamada et al., 2022)*.

The PhA has been used to assess cellular health, body cell mass, and the integrity of the cell membrane *(Silva et al., 2020)*. Also, high correlations were shown with Hand grip strength *(HGS)* in adolescents and young adults *(Sacco et al., 2021)* and isokinetic knee joint flexors and extensors strength *(Rosa et al., 2024)*. It is also a biomarker of muscle quantity and functional muscle mass, and it was reported to predict the intracellular-to-extracellular water ratio in athletes *(Campa et al., 2022)*.

According to the literature, the higher PhA values are associated with subjects with higher levels of muscle mass and a higher content of intracellular fluids *(Campa et al., 2020)*. In judo, it was highlighted that PhA might indirectly indicate muscular function in elite athletes *(Matias et al., 2015)*.

Furthermore, recent studies have shown a significant positive association between PhA and skeletal muscle mass and the average anaerobic power of youth judo athletes *(Šimenko, 2022)*. It was also reported that BIA and its PhA can be efficiently used to assess adolescent athletes' physical condition and sports performance *(Obayashi et al., 2021)*. Therefore, this study aimed to explore correlations of PhA with HGS and isokinetics of knee joints as indicators of physical fitness in youth judokas.

METHODS

Participants

The sample included five youth judokas *(age=16.34 ± 0.95 years; weight=72.92 ± 13.94 kg; height=16.34 ± 0.95, body fat %= 9.2 ± 6.1)*. Athletes were in the competitive part of the season. However, they were not in any weight loss regime at the time of measurement.

Data collection

Testing was done in the morning between 9 am and 12 am. Body height was measured with a GPM *(Switzerland)* stadiometer. An InBody 720 Tetrapolar 8-Point Tactile Electrode System *(Biospace Co., Ltd., Seoul, Korea)* BIA was used in the data acquisition. All necessary guidelines were followed *(Rauter & Simenko, 2021)* and the body weight, body fat % and whole body PhA variables were taken into further analysis.

The testing session started with a warm-up consisting of cycling for 6 min at a moderate pace *(50–100 W)*, followed by a 15 s stretch of Quadriceps *(Q)* and Hamstrings *(H)* and a 10x elastic band uchi komi pull at a moderate pace. All participants were given a detailed explanation of the testing procedures. HGS was measured with an electronic hand-held dynamometer Camry EH101 *(USA) (Ciaccioni et al., 2019)* and reported in kg. The testing was performed in a standing position three times on one body side with 1-minute intervals between efforts.

The starting hand was randomly chosen by the participants. Athletes were asked to create the greatest force in 3–5 s with fully extended elbows and arms beside their body, and self-selected wrist and leg postures were taken. For the analysis, the highest value for each side was utilised *(Ceylan et al., 2022)*. Afterwards, the isokinetic testing took place. Testing was performed for the quadriceps and hamstrings in concentric and also for the hamstring in eccentric mode.

The iMoment, SMM isokinetic dynamometer *(SMM, Maribor, Slovenia)* was used for testing *(Šimenko et al., 2022)*. The knee joint rotation axis was identified through the lateral femoral condyle and aligned with the motor axis. A range of motion of 60˚ was set from 90˚ to 30˚ knee flexion *(full flexion considered 0)*. Testing was performed at 60˚/s for both Hand Q in concentric and H eccentric contraction modes. Gravity error torque was recorded for every subject.

Before testing, each participant performed a series of 20 submaximal repetitions at a given velocity in a continuous passive mode *(CPM)* followed by a 3-minute break. After the initial CPM set, each participant performed 5 maximal contractions in the following order: *(1)* five consecutive concentric Q and H contractions followed by a 60 s pause, *(2)* five eccentric H contractions.

When testing of one side was completed, a 3-min break followed, during which the machine setting was changed to accommodatefor the opposite leg. The first tested leg was assigned randomly for each subject. The main outcome measure was peak torque *(PT)* in Nm which was later normalised for body weight *(BW)* and expressed as PT/BW *(Nm/kg)*.

Statistical analysis: Data were analysed using the SPSS 28.0 software for Windows. We used descriptive statistics to analyse the variables. Shapiro-Wilks test was used to test normality. The Pearson correlation coefficient was used to check the association between variables. The statistical significance was set at $p \leq 0.05$.

RESULTS

Table 1 presents descriptive data on the hand grip strength, isokinetic knee joint variables and BIA phase angle.

Table 1. Descriptive statistics of measured variables

Variables	BODY SIDE			
	RIGHT		LEFT	
	Mean	SD	Mean	SD
HGS (kg)	50,72	12,56	48,36	12,65
QUADRICEPS - con (Nm)	233,36	85,14	248,84	87,06
HAMSTRING - con (Nm)	143,07	51,62	152,38	38,67
HAMSTRING - ecc (Nm)	140,72	54,40	131,34	35,86
Q/BW (Nm/kg)	3,14	0,77	3,35	0,71
H/BW (Nm/kg)	1,96	0,55	2,11	0,43
Hecc/BW (Nm/kg)	1,93	0,59	1,83	0,46
PhA (°)	6,4 ± 0,46			

Con – *concentric testing mode; ecc – eccentric testing mode; Q-quadriceps; H- Hamstring; BW-body weight; HGS – hand grip strength*

Table 2 presents significant strong positive correlations between PhA and right Q peak torque *(p=0.031; r=0,856)*, left Q peak torque *(p=0.013; r=0,952)* and left H peak torque in concentric testing mode *(p=0.033; r=0,907)*.

Table 2. Pearson Correlation Coefficient of PhA with tested variables.

Variables	BODY SIDE			
	RIGHT		LEFT	
	sig.	r	sig.	r
HGS (kg)	0,064	0,856	0,096	0,811
QUADRICEPS - con (Nm)	0,031*	,912	0,013*	,952
HAMSTRING - con (Nm)	0,150	0,743	0,033*	,907
HAMSTRING - ecc (Nm)	0,256	0,629	0,116	0,784
Q/BW (Nm/kg)	0,152	0,741	0,066	0,854
H/BW (Nm/kg)	0,543	0,367	0,667	0,265
Hecc/BW (Nm/kg)	0,632	0,293	0,823	0,140

DISCUSSION

Our findings demonstrate a significant and strong positive association between the whole-body PhA and the left and right quadriceps and left hamstring isokinetic strength parameters. Present study results are in line with current research *(Rosa et al., 2024)*. However, this is the first time the isokinetic variables have been associated with the PhA in a judo population.

The overall PhA of 6.4 ± 0,46 compared to the published reference percentiles for men judokas puts the mean results of youth judokas between the 5th - 6.3 *(95% CI; 6.2 - 6.4)* and 15th - 6.8 *(95% CI; 6.7 - 6.9)* percentile. However, these normative values have been developed mainly from an adult judo athletes population with an average age reported at 26.2 ± 8.9 years and on a relatively small sample of 53 athletes for the development of normative values *(Campa et al., 2022)*.

Therefore, they need to be interpreted cautiously and separate youth athletes normative values for PhA should be developed in the future.

It is worth mentioning that HGS values were close to the significance limit with 0.06 and 0.09, respectively. Here, the low sample size might contribute to the result's lower significance and the fact that the judokas were from various weight categories. Therefore, further studies should take these limitations into account.

BIA is a fast, reliable, and accessible method. The PhA parameter provides valuable insights into the muscular functions of youth judokas, especially when time, funding, or equipment is limited. The PhA shows promise for sports scientists and coaches in judo, but further research on a larger sample of youth judokas is necessary to confirm its practical applicability and develop specific normative values for this group. It has already been shown that PhA correlates significantly with anaerobic power in youth judokas *(Šimenko, 2022)* and now with isokinetic strength.

The potential to determine the physical fitness of youth judokas is definitely there, however, further studies are needed to explore the full prediction potential of PhA, and they should also be done on the female judokas and taking weight categories and weight loss regimes into account.

CONCLUSION

The study presents the significant association of whole-body PhA measured quickly by the BIA with selected isokinetic strength parameters. The results show that the PhA is a promising variable that can be quickly obtained and is highly associated with the fitness levels of youth judokas. However, more research is needed to provide a more firm interpretation, conclusion, and practical application.

Therefore, further studies are needed to explore PhA's full potential to predict the levels of physical fitness in youth judokas.

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EPIDEMIOLOGICAL STUDY OF INJURIES AMOUNG ELITE JUDO ATHLETES IN THE SPANISH NATIONAL TEAM: A RETROSPECTIVE STUDY

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INTRODUCTION

Judo is an Olympic sport originating from Japan, created by Jigoro Kano in 1882. It made its Olympic debut in the 1964 Tokyo Games, initially for men only, across four weight categories. Currently, since 1992, the competition includes both men and women in seven weight categories *(International Judo Federation)*.

The technical and tactical demands contribute to judo's complexity. These diverse demands are crucial for injury prevention and achieving winning results in competitions *(Gutiérrez-Santiago et al., 2019)*, especially when combined with an optimal anthropometric profile *(Casals et al., 2017)*. Additionally, judo matches require energy from all three metabolic systems, both anaerobic and aerobic, with the latter predominating from the first minute *(Franchini et al., 2013; Julio et al., 2017)*.

In the past 20 years, modifications have been made to the Olympic judo rules, one of the objectives being to reduce the number of injuries. Nevertheless, injury rates have been reported to range between 11% and 30% of all participating judokas in competitions *(Akoto et al., 2018; Engebretsen et al., 2013; Pocecco et al., 2013; Akoto et al., 2018)*. Additionally, the incidence rate of injuries per 1,000 athlete exposures ranged from 41.2 to 81.6 *(Pocecco et al., 2013)*, with knee and shoulder injuries being the most frequent and severe *(Akoto et al., 2018; Madaleno et al., 2022)*, causing athlete inactivity for months to years *(Akoto et al., 2018)*.

Injury surveillance is essential to protect the health of elite judokas. Specific epidemiological and health data by sex enable the development of surveillance, prevention, and rehabilitation methods for injuries *(Chandran et al., 2019)*. However, despite numerous studies aiming to determine the incidence of injuries in elite judokas, few have compared injury rates between sexes or documented the injury rate during training.

Based on the aforementioned, the objective of this study was to analyze the injury profile of elite male and female judokas from the Spanish national team, along with the injury incidence rate, affected tissues, and injury mechanisms.

MATERIALS AND METHODS

Study Population

This study included 32 elite judokas aged between 18 and 32 years. Among the participants, 13 were female and 17 were male

Data Collection

In September 2023, athletes completed a survey to determine the injury/hour ratio for both men and women. The survey consisted of 9 items, which included:

1. Informed consent
2. Athlete ID
3. Date of birth
4. Weight category
5. Competition level
6. Sex/Gender

7. Weekly training hours
8. Number of injuries in the last year
9. Injury location and type (injury mechanism)

RESULTS

A total of 58 injuries were recorded, 23 of which occurred in female athletes and 35 in male athletes. The annual injury rate per athlete was 1.8.

Number of Injuries by Weight Category

Judokas were classified into Olympic weight categories:

- Light weight (U48 and U52 kg for women; U60 and U66 kg for men)
- Middle weight (U57, U63, and U70 kg for women; U73, U81, and U90 kg for men)
- Heavy weight (U78 and +78 kg for women; U100 and +100 kg for men) (Čierna et al., 2019; Kim & Park, 2021; Kim & Park, 2021b)

Men

- U60 kg: n = 2 → 4 injuries
- U66 kg: n = 3 → 7 injuries
- U73 kg: n = 5 → 14 injuries
- U81 kg: n = 2 → 5 injuries
- U90 kg: n = 1 → 1 injury
- U100/ +100 kg: n = 4 → 5 injuries

Sample number and percentage of total men:

- Light weight (n = 5, 29.4%): 11 injuries (18.9%)
- Middle weight (n = 8, 47%): 19 injuries (32.7%)
- Heavy weight (n = 4, 23.5%): 5 injuries (8.6%)

Gender	Weight	n	(%)	Injuries	(%)
Men	Light	5	29.4	11	18.9
	Middle	8	47	19	32.7
	Heavy	4	23.5	5	8.6

Women

- 48 kg: n = 5 → 6 injuries
- 52 kg: n = 3 → 6 injuries
- 57 kg: n = 2 → 4 injuries
- 63 kg: n = 3 → 7 injuries

Sample number and percentage of total women:

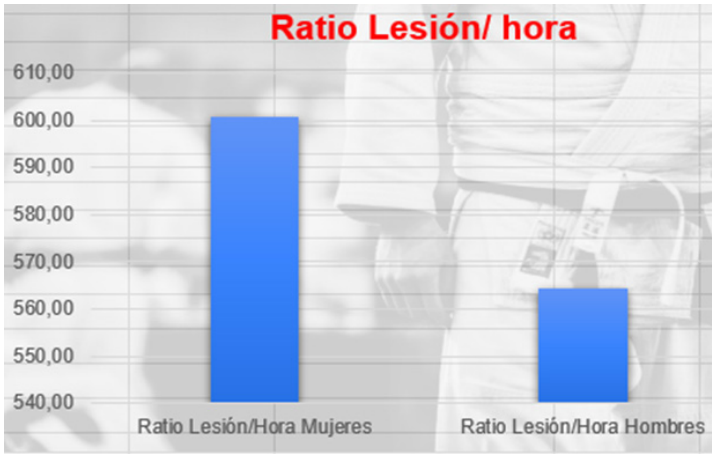
- Light weight (n = 8, 61.5%): 12 injuries (20.6%)

- Middle weight (n = 5, 38.5%): 11 injuries (18.9%)

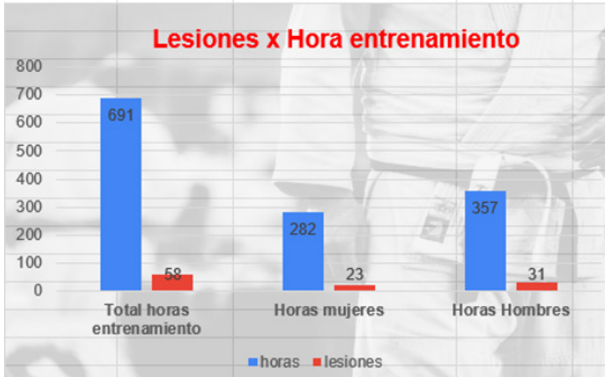
Gender	Weight	n	(%)	Injuries	(%)
Women	Light	8	61.5	12	20.6
	Middle	5	38.5	11	18.9

Training Hours Ratio

The athletes trained a total of 33,859 hours per year, with women training 13,818 hours and men 17,493 hours. The average Injury/Hour Ratio was 583.78 for women and 564.29 for men. The ratio per 1,000 hours of exposure was 1.71, higher in men *(2.0)* than in women *(1.66)*.

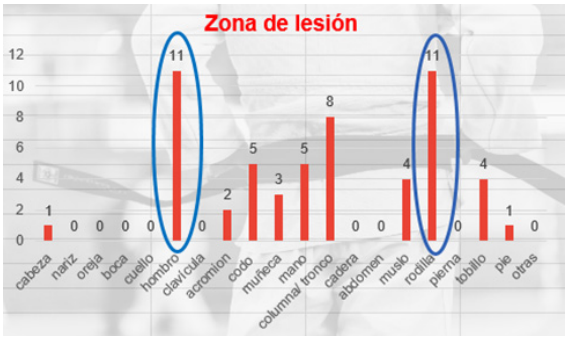


Ratio hours of training / number of injuries



Injury Location

The knee *(11 injuries, 20%)* and shoulder *(11 injuries, 20%)* were the most frequently injured joints. In women, the most common injury was to the knee *(6 injuries)*, whereas in men, it was to the shoulder *(6 injuries)*. The difference is minor but noteworthy given the smaller sample size for women. Percentages were calculated using a sample size of 55 instead of 58.



Type of Injury

Sprains *(19 injuries, 34.5%)* and muscle tears *(20 injuries, 36.3%)* were the most frequent types of injuries.

DISCUSSION

The annual incidence rate in this study was 1.8 per judoka. However, other studies reported higher rates, ranging from 2.57 *(Kim & Park, 2021)* to 2.73 *(Park & Jeong, 2022)* injuries per athlete per year. This discrepancy might be due to the larger sample sizes in those studies compared to this one.

Regarding the injury rate per 1,000 minutes, the result was higher for men than women, contrasting with another study *(Čierna et al., 2019)* where women had a higher risk, though these differences were not statistically significant, as were the 95% confidence intervals.

The distribution of injuries by anatomical location and type was relatively similar to previous reports on elite adult judo injuries *(Kim & Park, 2021; Kim & Park, 2021; Kim et al., 2015; Madaleno et al., 2022; Park & Jeong, 2022; Rodríguez González et al., 2022)*. However, two studies reported head and neck injuries as the most common *(Čierna et al., 2019; Frey et al., 2019)*, comprising 41% of the evaluated sample *(Čierna et al., 2019)*, unlike this study where the value for this area was 11 times lower than the most frequent injury areas. These differences may be related to different training methods, combat styles, and weight categories in the evaluated populations.

The 32.7% of injuries in men occurred in the middle weight category, consistent with findings by Čierna et al. *(2019)*, unlike other studies which found higher injury incidences in the light weight categories *(Kim & Park, 2021; Kim et al., 2015)*. The lack of correlation between this study's results and previous studies may be due to the smaller sample size in this category.

CONCLUSIONS

Weight category and training hours are significant risk factors for injury. There is a higher prevalence of knee and shoulder joint injuries. The most recurrent injuries are sprains and muscle tears.

DIFFICULTIES

Despite the small sample size, it is a relevant representation of the national judo elite. Additionally, the data can sometimes be difficult to classify, complicating categorization.

FUTURE PROSPECTS

Future research is encouraged to investigate the actual severity of judo injuries and to identify potentially modifiable risk factors to mitigate the risk of injury in judo.

Future research is encouraged to examine the true extent of judo injuries and to identify potentially modifiable risk factors to reduce the risk of injury in judo. Such studies should focus on longitudinal analyses to track injury patterns over time, enabling a comprehensive understanding of how different training methods, protective equipment, and athlete conditioning impact injury rates. Additionally, interdisciplinary collaboration between sports scientists, medical professionals, and judo coaches will be crucial in developing and implementing effective injury prevention strategies tailored to the unique demands of the sport.

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TRAINING EXPERIENCE AND MATURATIONAL, MORPHOLOGICAL, AND FITNESS ATTRIBUTES AS SJFT PERFORMANCE PREDICTORS IN MALE AND FEMALE UNDER-16 PORTUGUESE JUDO PLAYERS

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ABSTRACT

The study analyzed the relationship between biological maturation, morphological characteristics, and fitness attributes in 12- to 16-year-old participants of the Talent Program and members of the national judo team. The study aimed to determine the individual contributions of physical fitness, training experience, and maturation as indicators of performance and judo-specific assessments in young athletes, specifically youth and cadet categories. A total of 910 Portuguese judo players under the age of 16 *(male, n = 584; female, n = 326)* were evaluated in this cross-sectional study. In our study, maturational parameters *(maturity offset and predicted age at peak height velocity: PHV)*, morphological attributes *(body mass, height, body mass index: BMI, body fat %)*, and fitness *(jumping, upper-body strength, sit-ups, push-ups, flexibility, and VO2máx)* attributes were measured. In addition, Special Judo Fitness Test *(SJFT)* performance was assessed. Independet T-test and a multiple linear regression were conducted, with the level of significance set at 5%.

As a result, significant differences in physical fitness and maturation were observed in both sexes, particularly between the groups of youth athletes and male cadets *($p<0.05$)*. The main results indicated handgrip strength and cronological age are predictors performance in the Throw SJFTTT. In males, also push-ups and body mass, and in females, body fat % and BMI were also predictors, and explaining approximately 39.8% SJFTTT performance in males and 38.2% in females.

For the SJFTIndex, the predictors differed between males and females. In males, the predictors included body fat percentage, sitting height, push-ups, and countermovement jump *(CMJ)*, while in females, handgrip strength *(HGS)* on the right side and PHV were significant predictors. These predictors explained approximately 20% and 22% of the variance in SJFTIndex performance for males and females, respectively.

In male young judo players, body mass, CMJ, LBJ, HGS, training experience, and body fat % emerged as strong predictors, collectively explaining 81.3% of the variance in medicine ball throw *(MBT)* performance. Conversely, in female judokas, BMI, height, standing broad jump *(SBJ)*, sit-ups, and training experience accounted for 51.7% of the variance in MBT performance.

Regarding the HGS, similar physical parameters were observed to explain performance variation in this test for both males and females. Specifically, BMI, maturity offset, sit and reach test, and sit-ups, as well as the SJFT, collectively explained 61.2% of the variance in HGS for males and 43.3% for females.

Lastly, for male judo players, body fat %, sit-ups, LBJ, SJFTTT, HGS, and training experience collectively explained 42.1% of the variance in VO2max. Conversely, for female judokas, push-ups, SJFTTT, BMI, and sit-ups explained 34% of the performance variance in VO2max.

The prediction model for female judo players suggested that maturity offset, practice experience, and handgrip strength were the most robust predictors of judo performance in SJFT. The maturity of male judokas exhibited superior results in jumping tests, medicine ball throw, and long board jump, indicating greater power. Conversely, chronological age showed a stronger association with VO2max and neuromuscular endurance. Multiple regression analysis revealed that collectively, handgrip strength, long board jump and medicine ball throw can be considered robust predictors of performance in the SJFT, and indicative of good physical fitness among young judo players.

In conclusion, the present study suggest that during the puberty period, the physical fitness attributes of young judo players of both sexes are closely related to performance parameters in SJFT and are influenced by training experience. Various regression models have been estimated to predict the performance of youth judo players of both genders across different parameters.

Keywords: *young; judo players; Special Judo Fitness Test; maturation, exercise testing; physical fitness; strength*

INTRODUCTION

Practicing judo during childhood and adolescence offers numerous benefits. During this critical phase, the maturity status and timing are crucial for young athletes and should be considered in youth training programs, particularly for those beginning or already engaged in formal training and competitions *(Athayde et al., 2023)*. Literature indicates that the main physical fitness attributes for judo performance include aerobic and anaerobic capacity *(Franchini et al., 2011)*, muscle strength, and the power of both the upper and lower limbs *(Kons et al., 2020)*. Monteiro et al. *(2024)* found that top-elite judokas significantly outperformed others in all upper-body neuromuscular attributes. Therefore, the impact of training and maturation on the physical fitness characteristics of young judo players needs to be clearly understood.

In this context, assessing the biological maturation and growth of young athletes involved in judo training programs is essential for talent identification, selection, and development models *(Gonçalves, Rama, & Figueiredo, 2012)*. Despite the extensive evidence on these topics, the relationship between biological maturation, body size, adiposity, training experience, and both general and sport-specific physical attributes in combat sports has not been extensively studied, particularly in young judo athletes.

This study aims to determine the individual contributions of physical fitness, training experience, and maturation as indicators of performance and judo-specific assessments in young athletes, specifically in the youth and cadet categories. It is hypothesized that during puberty, the physical fitness attributes of young judo players of both sexes are closely related to performance parameters in the Special Judo Fitness Test *(SJFT)* and are influenced by training experience.

METHODS

A total of 910 Portuguese judo players of the Talent Program and members of the national judo team in 12-to 16-year-old *(male, n = 584; female, n = 326)* were evaluated in this cross-sectional study. In our study, maturational parameters *(maturity offset and predicted age at peak height velocity: PHV)*, morphological attributes *(body mass, height, body mass index: BMI, body fat %)*, and fitness *(jumping, upper-body strength, sit-ups, push-ups, flexibility, and VO2máx)* attributes were measured. In addition, Special Judo Fitness Test *(SJFT)* performance was assessed. Independet T-test and a multiple linear regression were conducted, with the level of significance set at 5%.

RESULTS

In the Table 1 and 2 were observed significant differences in physical fitness and maturation in both sexes, particularly between the groups of youth athletes and male cadets *($p<0.05$)*.

Table 1. Comparative values in training experience, maturational parameters, morphological and fitness characteristics, and performance indicators of youth and cadets male judo players

	Youth (n = 378)		Cadets (n = 206)		P-Value
	Mean ± SD	95% CI	Mean ± SD	95% CI	
Chronological age (years)	13.28 ± 0.73	(13.16 - 13.32)	15.07 ± 0.76	(14.88 - 15.13)	0.001
Training experience (years)	6.41 ± 2.84	(5.76 - 6.93)	6.69 ± 2.74	(5.57 - 7.57)	0.636

Maturity offset (y)	-0.50 ±1.20	(-0.40 -0.66)	0.99 ± 1.17	(0.73 - 1.08)	0.001
Age-PHV (years)	14.20 ± 0.91	(14.12 - 14.31)	14.41 ± 0.82	(14.29 - 14.55)	0.009
Sitting height (cm)	124 ± 6	(123 - 124)	129 ± 5	(128 - 129)	0.001
Morphology					
Body mass (kg)	52.5 ± 12.27	(50.84 - 53.50)	61.25 ± 13.02	(58.76 - 62.99)	0.001
Height (cm)	161 ± 10	(160 - 162)	1.69 ± 0.08	(1.67 - 1.70)	0.001
BMI (kg/m2)	19.93 ± 2.93	(19.60 - 20.24)	21.24 ± 3.17	(20.71 - 21.73)	0.001
Body fat (%)	12.52 ±5.53	(11.85 - 13.10)	12.12 ± 5.07	(11.32 - 12.96)	0.413
Fitness					
SJFTTT (#)	23.19 ± 2.69	(22.02 - 22.97)	25.04 ±2.94	(22.79 - 24.60)	0.001
SJFTIndex	13.68 ± 2.10	(13.36 - 14.16)	12.91 ±1.76	(12.55 - 13.65)	0.001
BeepsTT (#)	71.10 ± 20.74	(71.07 - 77.80)	77.66 ±18.60	(73.58 - 83.35)	0.001
VO2máx (ml/kg/min)	42.84 ± 6.77	(42.89 - 45.03)	44.88 ±6.11	(43.16 - 46.57	0.002
MBT (m)	3.86 ± 0.92	(3.82 - 4.14)	4.50 ±0.84	(4.08-4.53)	0.001
Standig MBT (m)	4.73 ± 1.09	(4.66 - 5.01)	5.53 ±1.06	(4.99 - 5.61)	0.001
HGS Rigth (kgf)	32.03 ± 8.98	(29.37 - 32.25)	38.45 ±9.71	(33.02 - 37.76)	0.001
HGS Left (kgf)	29.55 ± 9.00	(27.75 - 30.70)	36.92 ±7.76	(31.86 - 36.58)	0.001
Sit-ups (#)	46.23 ± 9.57	(44.87 - 48.15)	49.30 ± 9.12	(45.90 - 50.79)	0.001
Push-ups (#)	36.43 ± 15.13	(30.79 - 35.61)	45.52 ±15.45	(35.60 - 42.69)	0.001
SBJ (cm)	1.88 ± 0.25	(1.84 - 1.93)	2.03 ±0.23	(1.91 - 2.04)	0.001
SJ height (cm)	22.59 ± 4.92	(20.90 - 22.43)	25.28 ±5.69	(23.02 - 25.14)	0.001
CMJ height (cm)	27.94 ± 5.38	(28.07 - 29.90)	29.90 ±5.22	(29.11 - 31.94)	0.001
Sit and reach (cm)	33.48 ± 14.93	(27.96 - 35.07)	33.78 ±15.77	(16.48 - 29.00)	0.829

Age-PHV: age of peak height velocity, BMI = body mass index, SJFTTT: Special Judo Fitness Test—total throws,Test, SBJ: standing board jump test, MBT: medicine ball throw test, HGS: handgrip strength. VO2máx: maximum oxygen consumption, SJ: squat jump, CMJ: countermovment Jump sit and reach: flexibilitY, CI = confidence interval

Table 2. Comparative values in training experience, maturational parameters, morphological and fitness characteristics, and performance indicators of youth and cadets female judo players

	Youth (n = 208)		Cadets (n = 118)		
	Mean ± SD	95% CI	Mean ± SD	95% CI	
Chronological age (years)	13.39 ± 0.71	(13.20 - 13.42))	15.03 ± 0.74	14.88 - 15.13)	0.001
Training experience (years)	6.69 ± 2.81	(5.93 - 7.33)	7.43 ± 3.99	(4.81 - 9.31)	0.247
Maturity offset (y)	1.13 ± 0.73	(1.00 - 1.21)	2.12 ± 0.70	(1.95 - 2.24)	0.215
Age-PHV (years)	12.68 ± 0.67	(12.58 - 12.78)	13.18 ± 0.71	(13.04 - 13.33)	0.533
Sitting height (cm)	123 ± 4	(122 - 123)	126 ± 5	(124 - 126)	0.255
Morphology					
Body mass (kg)	54.06 ± 12.90	(51.97 - 55.74)	57.55 ± 10.93	(55.63 - 60.27)	0.261
Height (cm)	158 ± 6	(1.57 - 158)	162 ± 6	(160 - 163)	0.621
BMI (kg/m2)	21.56 ± 4.09	(20.96 - 22.15)	22.03 ± 3.50	(21.40 - 22.88)	0.028

Body fat (%)	19.26 ± 6.49	(18.36 - 20.31)	20.42 ± 5.82	(19.89 - 22.04)	0.379
Fitness					
SJFTTT (#)	22.27 ± 2.89	(20.66 - 22.82)	24.05 ± 2.9844	(22.67 - 24.67)	0.001
SJFTIndex	14.58 ± 2.44	(13.67 - 15.54)	13.63 ± 1.89	(13.02 - 14.41)	0.004
BeepsTT (#)	51.06 ± 14.96	(46.21 - 56.39)	55.43 ± 16.69	(49.95 - 59.03)	0.031
VO2máx (ml/kg/min)	37.71 ± 6.39	34.47 - 38.01	38.95 ± 6.66	35.88 - 39.00	0.142
MBT (m)	3.26 ± 0.59	(3.01 - 3.37)	3.32 ± 0.47	(3.11 - 3.46)	0.478
Standig MBT (m)	3.90 ± 0.72	(3.49 - 3.93)	4.16 ± 0.57	(4.03 - 4.44)	0.016
HGS Rigth (kgf)	27.60 ± 5.24	(24.71 - 28.01)	30.91 ± 4.89	(27.86 - 31.09)	0.005
HGS Left (kgf)	25.87 ± 4.92	(24.45 - 27.81)	29.38 ± 4.86	(26.63 - 30.14)	0.001
Sit-ups (#)	40.02 ± 9.29	(34.11 - 40.68	43.30 ± 8.36	(40.22 - 45.39)	0.002
Push-ups (#)	29.10 ± 13.58	(21.42 - 29.03)	32.91 ± 13.84	(22.50 - 30.19)	0.021
SBJ (cm)	1.65 ± 0.20	(1.51 - 1.64)	1.70 ± 0.22	(1.60 - 1.73)	0.048
SJ height (cm)	19.55 ± 4.27	(18.21 - 21.07)	20.30 ± 4.90	(19.04 - 21.31)	0.208
CMJ height (cm)	22.64 ± 4.71	(21.90 - 25.08)	23.91 ± 5.00	(23.03 - 26.05)	0.054
Sit and reach (cm)	42.45 ± 12.58	(34.53 - 46.26)	36.32 ± 16.75	(22.67 - 35.49)	0.001

Age-PHV: age of peak height velocity, BMI = body mass index, SJFTTT: Special Judo Fitness Test—total throws,Test, SLJ: standing board jump test, MBT: medicine ball throw test, HGS: handgrip strength. VO2máx: maximum oxygen consumption, SJ: squat jump, CMJ: countermovment Jump sit and reach: flexibility, CI = confidence interval

In Table 3 and 4, the main results indicated handgrip strength and cronological age are predictors performance in the Throw SJFTTT. In males, also push-ups and body mass, and in females, body fat % and BMI were also predictors, and explaining approximately 39.8% SJFTTT performance in males and 38.2% in females.

For the SJFTIndex, the predictors differed between males and females. In males, the predictors included body fat percentage, sitting height, push-ups, and countermovement jump *(CMJ)*, while in females, handgrip strength *(HGS)* on the right side and PHV were significant predictors. These predictors explained approximately 20% and 22% of the variance in SJFTIndex performance for males and females, respectively.

Table 3. Predictors of SJFT, Matturity and physical tests performance and the respective indicator in Young (youth and cadets) male judo players

Dependent variable	R2 Adjusted	Predictors	Standardized	P-Value
SJFTTT (#)	0.398			0.05
		Push-ups	0.037	0.001
		HGS right	0.074	0.002
		Body mass	-0.040	0.04
		Cronological age	0.281	0.04
SJFTIndex	0.202			0.05
		Body fat	0.075	0.001
		Sitting height	-5.725	0.005
		Push-ups	-0.021	0.008
		CMJ	-0.047	0.04
Matturity Offset	0.526			0.01

		HGS right	0.054	0.0001
		MBT	0.344	0.0001
		CMJ	-0.049	0.0001
		Push-ups	0.008	0.02
		Body fat	0.024	0.02
		HGS left	0.028	0.04
		LBJ	0.521	0.05
MBT (m)	0.813			0.001
		Body mass	0.041	0.0001
		CMJ	0.021	0.0001
		LBJ	0.484	0.001
		HGS left	0.015	0.002
		Training experience	0.052	0.01
		Body fat	-0.018	0.02
HGS right	0.612			0.001
		BMI	1.129	0.0001
		Matturity Offset	1.906	0.0001
		LBJ	8.545	0.0001
		SJFTTT	0.576	0.001
		Sit and reach	0.064	0.001
		MBT	1.383	0.001
		Sit-ups	-0.106	0.002
		Push-ups	0.067	0.003
VO2máx (ml/kg/min)	0.421			0.04
		Body fat	-0.416	0.0001
		Sit-ups	0.164	0.0001
		LBJ	3.886	0.008
		SJFTTT	0.252	0.03
		HGS	0.075	0.03
		Training experience	0.474	0.05

BMI = body mass index, SJFTTT: Special Judo Fitness Test—total throws,Test, SLJ: standing board jump test, MBT: medicine ball throw test, HGS: handgrip strength. VO2máx: maximum oxygen consumption, SJ: squat jump, CMJ: countermovment Jump sit and reach: flexibility.

For the SJFTIndex, the predictors differed between males and females. In males, the predictors included body fat percentage, sitting height, push-ups, and countermovement jump *(CMJ)*, while in females, handgrip strength *(HGS)* on the right side and PHV were significant predictors. These predictors explained approximately 20% and 22% of the variance in SJFTIndex performance for males and females, respectively.

In male young judo players, body mass, CMJ, LBJ, HGS, training experience, and body fat % emerged as strong predictors, collectively explaining 81.3% of the variance in medicine ball throw *(MBT)* performance. Conversely, in female judokas, BMI, height, standing broad jump *(SBJ)*, sit-ups, and training experience accounted for 51.7% of the variance in MBT performance.

Table 4. Predictors of SJFT, Matturity and physical tests performance and the respective indicator in Young (youth and cadets) female judo players

Dependent variable	R2 Adjusted	Predictors	Standardized Coeffi-cients (β)	P-Value
SJFTTT (#)	0.382			0.05
		Cronological age	0.787	0.0001
		Body fat	0.120	0.003
		HGS right	0.120	0.006
		BMI	-0.167	0.03
SJFTIndex	0.22			0.05
		HGS right	-0.116	0.0001
		BeepsTT	-0.037	0.001
		Age-PHV	-0.502	0.054
Matturity Offset	0.343			0.05
		HGS right	0.051	0.001
		MBT	0.317	0.003
		CMJ	0.033	0.007
		Body fat	0.021	0.02
		VO2máx	0.017	0.03
		HGS left	0.032	0.03
MBT (m)	0.517			0.01
		BMI	0.083	0.0001
		Height	3.979	0.0001
		LBJ	1.168	0.0001
		Sit-ups	0.009	0.03
		Training experience	0.052	0.01
HGS right	0.434			0.01
		Matturity Offset	2.410	0.0001
		BMI	0.565	0.0001
		SJFTIndex	-0.545	0.01
		Sit and reach	0.045	0.007
		Sit-ups	0.077	0.02
VO2máx (ml/kg/min)	0.340			0.05
		Push-ups	0.163	0.0001
		SJFTTT	0.503	0.001
		BMI	-0.354	0.007
		Sit-ups	0.095	0.05

BMI = body mass index, SJFTTT: Special Judo Fitness Test—total throws,Test, SLJ: standing board jump test, MBT: medicine ball throw test, HGS: handgrip strength. VO2máx: maximum oxygen consumption, SJ: squat jump, CMJ: countermovment Jump sit and reach: flexibility.

Regarding the HGS, similar physical parameters were observed to explain performance variation in this test for both males and females. Specifically, BMI, maturity offset, sit and reach test, and sit-ups, as well as the SJFT, collectively explained 61.2% of the variance in HGS for males and 43.3% for females.

Lastly, for male judo players, body fat %, sit-ups, LBJ, SJFTTT, HGS, and training experience collectively explained 42.1% of the variance in VO2max. Conversely, for female judokas, push-ups, SJFTTT, BMI, and sit-ups explained 34% of the performance variance in VO2max.

DISCUSSION

This study aimed to determine the individual contributions of physical fitness, training experience, and maturation as indicators of performance and judo-specific assessments in young athletes, particularly in the youth and cadet categories. The prediction model for female judo players suggested that maturity offset, practice experience, and handgrip strength were the most robust predictors of judo performance in the Special Judo Fitness Test *(SJFT)*.

For male judokas, maturity exhibited superior results in jumping tests, medicine ball throw, and long board jump, indicating greater power. Conversely, chronological age showed a stronger association with VO2max and neuromuscular endurance. Multiple regression analysis revealed that handgrip strength, long board jump, and medicine ball throw collectively serve as robust predictors of SJFT performance and indicative of good physical fitness among young judo players. In boys, peak height velocity *(PHV)* occurs around 14 years of age but can vary from 12 to 16 years. Following PHV, there is a peak period of muscle mass gain, directly associated with increased testosterone production.

This accounts for the significant differences between youth and cadet categories. Girls typically reach PHV around 12 years of age. Our results align with literature regarding the biological age of boys and girls. Maximum strength *(HGS)* was more noticeable in boys, where several physical fitness tests, maturity offset, BMI, and SJFT were identified as positive and significant predictors, explaining a variation of 61.2%, which may be related to greater force production. These findings are consistent with Detanico et al. *(2020)*, who noted the practical relevance of grip strength in combat, as it is a crucial component of judo *(Calmet, Miarka, & Franchini, 2010)*.

Some methodological limitations of this study include the use of prediction equations. The estimated age at PHV was used, and the maturity status indicator may underestimate or overestimate the chronological age at PHV during the early adolescence period *(12–16 years)*. Future studies should employ more precise and laboratory-based measures. Additionally, the influence of psychological factors and social status on physical performance in young athletes should be explored.

It is important to highlight that maturation appears to be more relevant than chronological age in its effects on growth and physical performance. Individual differences in the adolescent growth spurt should be considered when developing person-specific training routines, which will be influenced by body size and composition and, consequently, past physical performance.

CONCLUSION

In conclusion, the present study suggest that during the puberty period, the physical fitness attributes of young judo players of both sexes are closely related to performance parameters in SJFT and are influenced by training experience. Various regression models have been estimated to predict the performance of youth judo players of both genders across different parameters.

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CURRENT TRENDS AND PERSPECTIVES FOR JUDO IN JAPAN'S AGING SOCIETY

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ABSTRACT

This paper is discussing current trends and perspectives for judo in Japan from the perspective of demographic change. Recent All-Japan Judo Federation guidelines imply a shift in policies from competitive judo to a more diverse approach, adapting to the needs of Japan's aging society. Within this framework, a fall-prevention project aimed at senior citizen without prior judo experience was launched in 2022. While still at its beginning stage, the project could also contribute to the development of safe teaching methods for older practitioners in the future.

Keywords: *Demographic change, Federation policies, Fall-prevention, Life-long judo*

INTRODUCTION

Despite remaining the top nation in competitive judo, Japan is facing a rapid decline in judo population. According to the "All-Japan Judo Federation *(AJJF)* Individual Membership Statistics 2004~2023", the overall number of registered members declined from 202,025 in 2004 to 124,559 in 2023 *(AJJF, 2024)*. This paper will analyze current trends and policies regarding judo as a life-long activity from the perspective of demographic change. We will discuss judo-based exercise and fall-prevention programs targeting seniors without prior judo experience and how these programs can contribute to safe judo instruction for older practitioners in Japan.

METHOD

First, we will examine how the overall demographic change in Japanese society and the judo population influence AJJF policies by analyzing the AJJF Medium- and Long-term Basic Plan and the "Long-Term Development Plan" *(Koyama and Ishii, 2023)*. Based on this we will have a look on the recently established AJJF Fall Prevention Project and discuss the Safe-falling Manual aimed at Seniors. Finally, we will discuss how the AJJF Fall Prevention project fits into the framework of federation policies and which kind of measures need to be implemented to provide safe judo training for older practitioners with prior judo experience.

RESULTS

According to the "2023 Annual Report on the Aging Society" *(Cabinet Office Japan, 2023)*, senior citizen of age 65 and above accounted for 29 percent of the Japanese population in October 2022 *(2023, 2)*. This age group is expected to grow until 33.9 percent by 2037 *(2023, 3)*. Also, Japan has one of the highest life expectancies in the world. In 2021, the life expectancy at birth was age 85 and above. Also, the life expectancy for Japanese senior citizen at age 65 was 21.6 years and over in 2021 *(United Nations Department of Economic and Social Affairs, 2022)*. In the face of Japan's aging society, it is necessary to reconsider the value of judo as a life-long activity, embracing the needs of the older population.

The AJJF individual membership statistics *(AJJF, 2024)* also reflect the need to adapt to the demographic change occurring in Japanese society. While the number of adult practitioners increased from 20,530 in 2004 to 24,924 in 2023, the age groups primarily engaging in competition, including children at primary school-, middle and high-school age and university students continue to decline. Based on this data, especially the age group for adults has potential for future

growth. Therefore, attracting older people without prior judo experience, keeping older practitioners active after their competition career and creating a safe and attractive environment for older practitioners to start judo are crucial.

While the AJJF "Medium- and Long-term Basic Plan from 2020 to 2028 still stresses raising the level of competitive judo as one major development goal, it also recognizes the need for further dissemination of judo in face of the declining membership *(AJJF, 2020)*. Measures to keep and increase membership in adults include age-group tournaments aimed at older judoka, creating an environment to enable women to engage in and continue judo, like increasing the number of female officials and providing child care at tournaments *(AJJF, 2020)*.

However, the "Long-Term Development Plan" *(Koyama and Ishii, 2023, 2)* identifies declining birthrates and aging population as major issues of Japanese society, while stressing the need for judo to adapt to this social-demographic challenge and fulfill its role in Japanese society *(Koyama and Ishii, 2023, 2)*. The plan identifies "Creating opportunities to implement the diverse values of judo and proposing pathways for athletes"," Supporting the challenge towards oneself and others based on a framework of diverse values", "Safe and appropriate coaching with consideration for individual needs", "Supporting practitioners to encourage the life-long practice of judo", "Expanding the pool of instructors and increase the network of people associated with judo in order to cater to all generations", "Clarifying and defining the goals of moral and intellectual education through judo" as the six core directives for judo long-term development policies *(Koyama and Ishii, 2023, 11-12)*.

The plan also identifies six stages of judo separated by age and goal of training ranging from the entry stage of judo for young children at pre-school age to the final stage of judo for adults, who are past competition age and pursue judo as a life-long activity. Stage 6 corresponds with judo as a recreational activity and as a martial art, connecting Japanese culture with an active lifestyle. *(Koyama and Ishii, 2023, 22)*.

The AJJF Fall Prevention Project targeting seniors fits into stage 6 of this framework, as it aims to support an active and healthy life-style for senior citizen. The project was launched as a new working group within the Education and Diffusion Committee in 2022, with the goal of developing a program for fall-prevention utilizing judo break-falls aimed at senior citizens without prior judo experience *(AJJF, 2022a, 17)*. The AJJF fall prevention project aimed at senior citizens is part of a larger "Safe-Fall Project", which originally started with programs aimed at pre-school and primary children *(AJJF, 2022b, 11)*. Adapting the instruction manual "Safe Falling for Children" *(Tanaka et al, 2023)* for the needs of the elderly, the group is currently working on the compilation of an instruction manual for fall-prevention targeting senior citizen without prior judo experience *(AJJF Fall-Prevention Project, 2024)*..

The new manual will include theory, covering mechanisms and phases of fall, frequency of falls, aging process and the status-quo of fall-prevention programs outside of Japan, including the "Carefree Falling Project for Elderly People" *(Dziergwa, 2022)*, "Dynamic Balance for Life" *(Jadczak et al, 2023)*, "Judo 4 Balance" *(Arkkukangas et al, 2022)* and the German Judo Federation's Taiso Project *(Andree et al, 2020)*.

The practical part covers the mechanism of break-falling and discusses frequent fall patterns in the elderly and introduces basic break-falling and physical training for fall-prevention, including strength training aimed at core and lower extremities and balance training utilizing Tai-sabaki movements *(All-Japan Judo Federation Fall-Prevention Project, 2024)*. The manual also includes a brief introduction of Yawarachan-taiso, an exercise program developed by members of the AJJF medical commission in 2018 *(Kamitani, 2018)*. A study, conducted by Callan et al *(2022)* in Great Britain, showed that Yawarachan-taiso significantly reduced the fear of falling in older adults ranging from age 71 to 83 after 4 sessions *(Callan et al, 2022, p.3)*.

DISCUSSION

Compared with the already existing programs outside of Japan, the AJJF fall-prevention program, while still being in progress, is centered on the application of judo-based falling techniques. While the program does include some exercises to improve balance and basic strength, exercises corresponding to all phases of falling should be further implemented, including exercises for dynamic balance, simulating the process of regaining balance before a fall occurs and standing up safely and regaining balance after a fall. Also, in order to provide safe instruction for elderly participants, appropriate assessment tools need to be implemented.

CONCLUSION

While fall-prevention through judo is an important contribution to Japan's aging society, providing safe and systematic instruction for older judo practitioners-including systematic and age-appropriate teaching of break-falls and judo techniques, and adapting randori and kata to the individual needs of older judoka-is another important aspect. Within the framework of the AJJF "Long-term Development Plan", the realization of "Safe and appropriate coaching with consideration for individual needs" of older practitioners and "Supporting practitioners to encourage the life-long practice of judo" *(Koyama and Ishii, 2023, 11-12)* are directives that are essential for the future of judo in the country of its origin.

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*****(References in Japanese language, reference titles and content translated by the authors.)*

PRE-COMPETITION ANXIETY AMONG JUDO REFEREES

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ABSTRACT

This study aimed to assess pre-competition anxiety levels among Croatian judo referees.The study involved 17 judo referees *(13 men, 4 women)* with at least one year of officiating experience. Participants were categorized into three groups: first-category national referees *(n=3)*, second-category referees *(n=3)*, and third-category referees *(n=11)*. The modified Competitive State Anxiety Inventory-2 *(CSAI-2)* was used to measure anxiety levels. Descriptive statistics were calculated using Statistica 13.0. The CSAI-2 questionnaire results showed lower cognitive and somatic anxiety levels and higher confidence among judo referees compared to athletes. Specifically, the cognitive anxiety mean was 3.97 *(SD = 0.82)*, somatic anxiety was 4.14 *(SD = 0.90)*, and confidence was 3.78 *(SD = 0.91)*. These findings suggest lower pre-competition stress levels among referees, likely due to the less critical nature of the local tournament observed. Study highlights low cognitive and somatic anxiety levels and high confidence among judo referees before a local competition. The results emphasize the unique psychological attributes of judo referees and the importance of psychological preparation in officiating quality.

Keywords: *combat sports, questionnaire, psychological characteristics*

INTRODUCTION

Anxiety is defined as an unpleasant feeling of unease, fear, and tension accompanied by the activation of the autonomic nervous system *(Stanović, Milić & Grgantov, 2020)* Competitive state anxiety and self-esteem in youth female volleyball players of different player roles and competitive efficacy. The state of anxiety, which results from environmental stimuli, is associated with an increase in arousal. Pre-competitive cognitive anxiety begins at a relatively high level and remains high and stable as the competition approaches. In contrast, somatic anxiety remains relatively low until approximately 24 hours before the event, and then rapidly increases as the event draws near. When the competition starts, somatic anxiety quickly dissipates, while the cognitive state of anxiety fluctuates during the competition depending on changes in the probability of success/failure *(Hardy, Parfitt & Pates, 1994)*.

Anxiety before or during competition can interfere with the performance of athletes, referees, and other stakeholders. While a certain level of physiological arousal is beneficial and prepares individuals in sports for competition, excessive physical symptoms of anxiety can seriously impair performance. A certain amount of concern about performance can be beneficial in competition, but at the same time, negative attitudes, thoughts, and expectations, as well as fear of failure, can lead to poor performance.

Based on previous research in team sports, there are indications that anxiety among referees in general could affect their fear of making mistakes during officiating *(Ntasis, Panagi, Strigas, Koronios, and Dashi 2021)*. Additionally, higher levels of emotional stability and better stress-coping strategies have been found in higher-level referees *(Neil, Bayston, Hanton & Wilson, 2013)*. However, to the authors' knowledge, pre-competitive anxiety parameters among judo referees have not been analyzed to date. Therefore, the primary aim of this study is to determine the level of anxiety among Croatian judo referees before a competition.

METHODS

The sample consisted of 17 judo referees, including 13 men and 4 women. All surveyed referees had a minimum of 1 year of officiating experience. Of the entire sample, three referees were classified as first-category national referees, three were second-category referees, and the remaining were third-category referees.

To determine the anxiety levels of the participants, a modified CSAI-2 *(Competitive Anxiety in Sport Inventory)* questionnaire *(Cox, Martens & Russel 2003)* was used. This questionnaire measures the state of pre-competitive anxiety in sports and assesses the tendency towards anxiety in competitive circumstances.

Descriptive statistics parameters were calculated for all variables: arithmetic mean, standard deviation, mean value, median, minimum results, maximum results, coefficient of skewness, and coefficient of kurtosis. All calculations were performed using the software Statistica 13.0 *(StatSoft, Tulsa, USA)*.

RESULTS

Tables 1, 2, and 3 display the descriptive parameters of all items in the CSAI-2 questionnaire, while Table 4 presents the summary data of the three dimensions of pre-competitive anxiety among the surveyed judo referees. It is important to note that in the calculation, the two anxiety scales *(both items and the total scale score)* are reversed in a positive direction. This means that a higher score represents both a more positive and more desirable result, i.e., a lower level of anxiety.

Table 1. Descriptive characteristics of items and scale for cognitive anxiety (n = 17)

variable	mean	SD	MIN	MAX
CSAI_01_R	3.88	0.99	2	5
CSAI_04_R	4.41	0.62	3	5
CSAI_07_R	3.71	1.21	1	5
CSAI_10_R	3.47	1.23	1	5
CSAI_13_R	4.06	1.09	2	5
CSAI_16_R	4.18	1.07	2	5
CSAI_19_R	3.76	1.09	1	5
CSAI_22_R	4.18	1.01	1	5
CSAI_25_R	4.06	1.09	2	5

Table 2. Descriptive characteristics of items and scale for somatic anxiety (n = 17)

variable	AS	SD	MIN	MAX
CSAI_02_R	3.88	0.99	2	5
CSAI_05_R	4.24	1.03	2	5
CSAI_08_R	4.12	1.11	2	5
CSAI_11_R	4.18	1.29	2	5
CSAI_14	3.53	1.01	2	5
CSAI_17_R	4.35	1.06	2	5
CSAI_20_R	4.59	0.87	2	5
CSAI_23_R	4.29	1.16	2	5
CSAI_26_R	4.12	1.17	2	5

Table 3. Descriptive characteristics of items and scale for confidence (n = 17)

variable	mean	SD	MIN	MAX
CSAI_01_R	3.59	1	2	5
CSAI_04_R	3.71	1.1	2	5

CSAI_07_R	3.82	1.13	2	5
CSAI_10_R	3.88	1.05	2	5
CSAI_13_R	3.88	0.93	2	5
CSAI_16_R	3.82	0.95	2	5
CSAI_19_R	3.71	1.21	2	5
CSAI_22_R	3.65	1.17	1	5
CSAI_25_R	4	1.06	2	5

Table 4. Descriptive characteristics of the CSAI-2 Scale

variable	mean	SD	median	MIN	MAX	K-S
cognitive anxiety	3.97	0.82	4.11	2	4.89	$p > 0.20$
somatic anxiety	4.14	0.9	4.67	2.22	5	$p < 0.20$
confidence	3.78	0.91	4	2.22	5	$p > 0.20$

DISCUSSION

The primary aim of this study was to determine the parameters of pre-competitive anxiety among judo referees. The obtained results indicate that the values of somatic and cognitive anxiety are somewhat lower, while the values of confidence are higher compared to athletes, i.e., judo competitors *(Filaire et al., 2001)*. These results are expected, as pre-competition stress among athletes is anticipated to be more pronounced compared to referees. Additionally, pre-competition stress increases with the importance of the competition for both athletes and referees *(Filaire et al., 2001; Castillo Rodrigues et al., 2020)*. Considering that for this study, referees were surveyed one hour before a local, lower-quality tournament, it was expected that the referees would also demonstrate lower levels of anxiety.

Compared to referees of other sports *(Ntasis et al., 2021)*, judo referees showed slightly lower values of somatic and cognitive anxiety but higher levels of confidence. In addition to the fact that this was a local, lower-quality competition, it is possible that judo referees generally have a different psychological profile compared to referees of some team sports. Namely, in judo, referees are usually recruited from the group of former competitors, and it is known that martial arts athletes have specific psychological characteristics compared to athletes of some other sports *(Schaal et al., 2011)*.

In future research, it would be interesting to determine the state of pre-competitive anxiety among referees before a very important competition. Additionally, it would be desirable to determine the differences between referees with varying levels of experience and quality. Despite the fact that high levels of anxiety were not found among the surveyed referees, it is essential to work on its prevention, especially among referees with less officiating experience. Psychological preparation before a competition would certainly impact achieving a higher level of confidence, thereby reducing the level of anxiety and ultimately leading to better quality officiating.

CONCLUSION

This research was conducted with the aim of determining the parameters of pre-competitive anxiety among judo referees. Basic statistical procedures were calculated, and low levels of cognitive and somatic anxiety, as well as high levels of confidence, were found among the respondents. This is interpreted as a result of the specific psychological profile of judo referees and the lower level of quality and importance of the competition before which they were surveyed.

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TO WHAT EXTENT ARE THE INTERNATIONAL JUDO FEDERATION SAFEGUARDING OR SAFE SPORT POLICIES AND PROCEDURES ABLE TO MEET THE RESPONSIBILITIES OF AN INTERNATIONAL FEDERATION

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ABSTRACT

This paper explores to what extent the International Judo Federation *(IJF)* safe sport or safeguarding policies and procedures are able to meet the responsibilities of an International Federation. International media reports contain cases of abuse within the Olympic sport of judo. Judo is a high intensity contact sport and injuries occur during competitions as well as during training. There are clear indications that several serious injuries concerned non-accidental violence. The research focus is to establish in accordance with current academic literature as well as good practice, what measures an international sport federation should have in place, to then review IJF policies to ascertain if they meet the 5 R Framework of Readiness, Recognition, Reporting, Response and Remedy. Additionally, to consider whether a sixth R of Reach should be included for an international federation, which may clarify the boundaries or responsibilities of a world governing body, in contrast to a continental governing body and a national governing body.

KeyWords: *Judo, Safeguarding, Safe Sport.*

INTRODUCTION

International media reports contain cases of abuse within the Olympic sport of judo. Examples include: a judo coach who slapped, kicked and beat female athletes in the run-up to London 2012 *(McNeill, 2013)*, a German female athlete who publicly defended her coach for violently shaking and slapping her face when he performed a pre-fight ritual during the 2021 Tokyo Olympics insisting it had been at her request *(Zoellner, 2021)*, as well as sexual assaults of two underage girls by a high-profile judo coach, who was imprisoned for five years *(Reuters, 2019)*.

The examples above pose a question as to what extent are the International Judo Federation *(IJF)* safe sport or safeguarding policies and procedures able to meet the responsibilities of an International Federation.

Judo is a high intensity contact sport and injuries may occur during competitions *(Blach et al., 2022)*. Research with a focus on the diagnosis of tissue injury occurrence of top-level judo athletes during competition indicated that the most frequent injury was the sprain *(43%)*. In contrast, Judo classes and associated activities conducted under the supervision of schools in Japan, showed that 76 deaths were caused by actions specific to judo *(Uchida, 2011)*. There was a clear indication that many serious injuries concerned non-accidental violence.

The international federation responsible for organising Olympic judo, World Championship judo and a world tour, is the International Judo Federation *(IJF)*. Safeguarding arrangements within the IJF are at an early stage and although an IJF policy titled Safeguarding from harassment and violence exists *(International-Judo-Federation, 2021)*, it was not introduced until 15/7/2021.

Do IJF responsibilities relate just to field of play at major events *(slapping)* or do they include training scenarios *(beating female athletes)* as well as school activities *(fatal accidents)*, which could be considered the responsibility of a national federation, and how should the IJF address criminal acts committed by high profile personalities within the sport *(sexual assault)*.

METHODS

The research focus is a review of documented policy, procedures and associated material that contain definitions or explanations of abuse, reporting mechanisms, case management, whistleblowing *(reporting)*, sanction and corrective action. The researcher's philosophical stance is constructivist, and the analysis will be principally qualitative.

Referring to the principles set out in the *(Mackenzie & Knipe, 2006)* explanation of a research journey, I commenced with a broad notion of the discipline, which is to consider the adequacy of the policies and procedures for managing the integrity of abusive and harassing behaviours in IJF level judo. This also described the area of investigation which is safeguarding procedures within the International Judo Federation. A literature review followed, and the data type identified was overwhelmingly qualitative. The data collection method selected was document analysis, and the data to be used is principally published policy and procedure. Data was collected through internet search; documents collected were listed on an Excel spreadsheet and analysis as well as coding was carried out by use of NVivo software. Data was read and re-read in advance of coding which is sometimes described as immersion in data *(Rivas, 2012)*. Writing up the findings is the concluding step.

The literature review sought initially to look at the history of safeguarding and to then clarify the meaning of the terms safeguarding and safe sport. There is an absence of distinction between two apparently similar yet different terms that appear at times to be used interchangeably.

The literature on sexual harassment and abuse, as well as emotional abuse is diverse in nature *(Sisofo, 2019)*, although it was still possible to identify two key documents relevant to this research. The first document is the Fourth Review of International Federation Governance *(ASOIF, 2022)* and the second document is, the Journey to Reporting Child Protection Violations in Sport: Stakeholder perspectives *(Tuakli-Wosornu et al., 2023)*.

The Fourth Review of International Federation Governance *(ASOIF, 2022)* was prepared by the Governance Task Force *(GTF)* of The Association of Summer Olympic International Federations *(ASOIF)*. The GTF aims to assist the summer IFs with promotion of improved governance ensuring they are fit for purpose. Safeguarding was included within the self-assessment process, but it was only one small component of the exercise. The review *(ASOIF, 2022)* rated thirty-three international federations *(IF)* and placed them into five tiers. The top tier consisted of the following seven federations: BWF *(Badminton World Federation)*, *(FEI)* Federation Equestre Internationale, FIFA *(Federation Internationale de Football Association)*, ITF *(International Tennis Federation)*, UCI *(Union Cycliste Internationale)*, World Athletics and World Rugby. The third or middle tier of five, was where the IJF was placed.

The Journey to reporting child protection violations in sport: Stakeholder perspectives *(Tuakli-Wosornu et al., 2023)* proposes a pathway to incident reporting in sport which is summarised as the 5 R Framework. Readiness, Recognition, disclosure and Reporting, Response and Remedy. It is also explained that the 5 R Framework is similar though not identical to trauma frameworks.

RESULTS

There does not appear to be a compelling academic argument to settle the debate as to whether the term safe sport or safeguarding should be prioritised for use over and above the other term. The word safeguarding according to the research in this document is in far more frequent use. IJF favour within their published literature and articles the term safeguarding.

Readiness is cultural preparedness as well as the willingness shown by a sport's organisation to engage with the existence of all categories of abuse. Recognition is a clear and shared understanding of that which may constitute or does constitute a safeguarding violation. Reporting including disclosure includes issues of trust, reluctance to come forward or a decision to not report abuse and a complainants need to know how to report and to whom. The response by a federation should be supportive of athletes or victims who may feel that they are not believed and are not protected. Remedy, the outcome and final stage of the reporting journey is healing. Justice in the form of an effective remedy is required and organisations should be willing to learn constructively from cases *(Tuakli-Wosornu et al., 2023)*.

The seven highest ranking international federations in terms of governance representing the sports of Badminton, Equestrian, Football, Tennis, Cycling, Athletics and Rugby all had arrangements in place to address the 5 R Framework. IJF policies also meet the requirements of the 5 R Framework.

In addition to the IJF policy titled Safeguarding from harassment and violence introduced in 15/7/2021, documents reviewed that are relevant to this subject because they include references to safeguarding are: IJF Sport and Organisation Rules, IJF Judo Integrity document, IJF Code of ethics, an IJF Safeguarding Flyer, Athletes rights and responsibilities declaration, IJF Governance Policies document, IJF Vision Mission and Goals, Risk Management Module and a Judo integrity document, all of which include commentary on safeguarding or preventing harassment and abuse. This research will closely review those IJF policies to discover and discuss any perceived vulnerabilities.

DISCUSSION

A potential sixth R *(Reach)* has been identified. This involves scope, range or jurisdiction. Further possible additions to the 5 R's were considered in the early stages of analysis such as anonymity and confidentiality although on closer examination of the material, these aspects appear to be adequately addressed already.

The IJF within their Code of Ethics sets out the standards of conduct that may entail the initiation of disciplinary action under the IJF disciplinary Code. The phraseology used is: "offences committed by the IJF, the Continental Unions, the Members, sports organisations participating in the competition system of the IJF, the Continental Unions or the Members, athletes registered *(certified)* by the Continental Unions or the Members, sports officials, referees, officials of the judo sport". It appears that the aim is to encapsulate all offenders, but phraseology used may not be sufficient to include all within an athlete entourage or spectators at an event. Do current procedures prevent a judo coach escaping punishment by transferring from country-to-country to avoid investigation and sanction.

CONCLUSION

The International Judo Federation has in place sufficient policies to satisfy the 5 R framework. Significant progress has been made in recent years with training of safeguarding officials and introduction of new IJF Governance Policies as recent as February 2024. The IJF Governance Policies document specifically refers to harassment and abuse and signposts readers to reporting mechanisms. The safeguarding arena is changing, and research indicates a shift of emphasis in the sport safeguarding arena from understanding instances of abuse to understanding the management of safeguarding. This moves the field from analyses of what has occurred towards frameworks that look to prevent abuse in all its configurations from taking place *(Kavanagh et al., 2020; Rhind & Owusu-Sekyere, 2020)*. The IJF policies provide evidence of safeguarding progress, and the IJF position appears to be in concert with the academia that influences safeguarding policy.

Further research to test for knowledge of IJF policies, implementation, and use of the stated procedures, during real world activity is desirable.

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EFFECTS OF JUDO RULE CHANGE ON THE EFFECTIVENESS OF FLOOR TECHNIQUES IN COMPETITORS

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ABSTRACT

The International Judo Federation *(IJF)* has often changed the rules to protect judokas, increase the intensity of competitions, score more, and achieve greater attention and popularity. This research aims to determine the impact of judo rule change on the effectiveness of floor techniques in competitors at the Europa Judo Open in Sarajevo 2021-2022. The research was conducted on a sample of *(n=217)* senior fights and a sample of *(n=130)* senior women's fights in 2021. and a sample of *(n=206)* senior fights and a sample of *(n=119)* senior women's fights in 2022. in all 7 weight categories at the Sarajevo European Open. It was found that the most commonly performed techniques of procedures are hon-gesa-gatame, yoko-shiho-gatame and sankaku-jime. The highest percentage of osaekomi-waza *(holding in the grip)* is immediately after the throw, and the highest percentage of shime-waza *(choking techniques)* were performed after a failed opponent's attack. The percentage of kansetsu-waza *(leverage)* is reduced. By analyzing, we found that in the lower weight categories there was an increase in ground wins *(senior men category: 60kg 7 % in 2021, 19% in 2022,66 kg 22% in 2021, 28% in 2022, 73 kg 11% 2021,32% in 2022)*, that is, generally the application of parter techniques during the combat, while in the larger weight categories *(81, 90, 100, +100)* the percentage of wins in ne-waza decreased slightly *(category 81 kg 18% in 2021, 12% in 2022,90kg 19% in 2021, 18% in 2022, 100 kg 18% in 2021, 7% in 2022, +100kg 33% in 2021, 22% in 2022)*.

In the women's categories 48 kg, 52 kg and +78 kg, significant progress was observed *(senior women category 48kg 18,75% in 2021, 38,46% in 2022,52 kg 20% in 2021, 25% in 2022, +78 kg 33.33% in 2021, 55,56% in 2022)*, while in other female weight categories, the efficiency in ne-waza was higher in 2021 *(57 kg 32% in 2021,26,32% in 2022, 63kg 31,50% in 2021, 25% in 2022,70 kg 34,78% in 2021, 11,54% in 2022, 78 kg 26,67% in 2021, 25% in 2022)*. In seniors, control techniques improved slightly while senior women performed better at performing shime-waza and kansetsu-waza techniques compared to 2021 *(15,15% in 2021, 25,81% in 2022)*.

With the introduction of new rules in judo, more time space was given to the ne-waza so that growth was recorded in osaekomi-waza, while the number of kansetsu-waza and shime-waza decreased.

Keywords: *combat sports; gender; regulation of sport; Rules; floor; Analysis; efficiency*

INTRODUCTION

Judo is a combat sport that aims to bring a man through his exercises and methods to a state of complete emotional, psychological and physical stability and maturity. Equality was achieved at the Olympics, in which women also performed 1988. Judo is now unique to all age groups, for both sexes. Judo sport with its specific structure of movements, a large range of throwing techniques and floor techniques as well as the characteristics of competitors, requires

exceptional psychological preparedness that can significantly compensate for the lack of physical, functional and technical skills. Judo technique is defined as the permitted movements of the body that a fighter applies in combat, for the purpose of attack, defense and counterattack, to achieve victory or for him a favorable result. Analyzing the ways in which some judo techniques were performed then and today, it is difficult not to see their diversity and the fact that in some only the idea and principle remained the same. In the development of the judo technique, a number of details were changed both in the floor and in the standing position, and at the same time many new techniques were created. As a result of such dynamic development of judo, both the way and the rules of struggle changed. All judo techniques are classified into one of three groups and each of these groups is further divided into subgroups.

The basic 3 groups are nage-waza *(throwing techniques)*, katame-waza *(control techniques)*, atemi-waza *(punching techniques)*.

The floor technique *(katame-waza)*, often referred to as non-waza *(ground fighting)*, is a group of techniques of holding *(osaekomi-waza)*, choking *(shime-waza)* and leverage on the elbow joints *(kansetsu-waza)*. Rules are regulations that specify all the necessary conditions for athletes to compete. The basics of judo rules are to protect athletes and sport as a whole, while promoting judo to be more dynamic, more attractive to the public and the media *(Barta, 2022.)*.

In early 2022, the IJF presented new judo rules for the 2022.-2024. Olympic cycle *(IJF, 2022)*, through 12 decisions. The advantages of updating the rules by the IJF are reflected in the continuity of action, falls and application of judo techniques in the accepted repertoire *(gokyo)* system, but also in the clarification of waza-ari, new penalties, the possibility of skillful changes of kumi-kata and the safety of judokas, especially in the use of the head when throwing *(Messner, 2022.)*. The aim of this research is to determine the impact of judo rule change on the effectiveness of floor techniques in competitors at the Europa Judo Open in Sarajevo 2021.-2022.

METHODS

Sample of respondents

The research was conducted on a sample of 217 senior combats and 130 senior women's combats in 2021, and a sample of 206 senior combats and 119 senior women's combats in 2022, in all 7 weight categories at the Sarajevo European Open.

Sample variables

Analysis of the effectiveness of combats in the floor before and after the change of judo rules through the osaekomi-waza, kansetsu-waza and shime-waza, individual techniques, scored points. The sample of variables consists of all ne-waza techniques according to the Kodokan Institution *(Kodokan, 2024.)*.

Procedures

The data were collected on the basis of a notational analysis of video recordings of applied parter techniques at the Sarajevo Open 2021. and Sarajevo Open 2022.

RESULTS

The analysis of the efficiency of floor techniques after the change of judo rules was made on the basis of the results achieved at the Sarajevo Open championships in 2021 and 2022.

The percentage of wins in the floor in 2022 was 26.05% for senior women, which is a lower percentage of achieved victories than those in 2021, where the percentage was 30%, while in seniors the percentage of wins was 20.87% in 2022, which is higher compared to the victories achieved in 2021 when the percentage of wins was 17.05%.

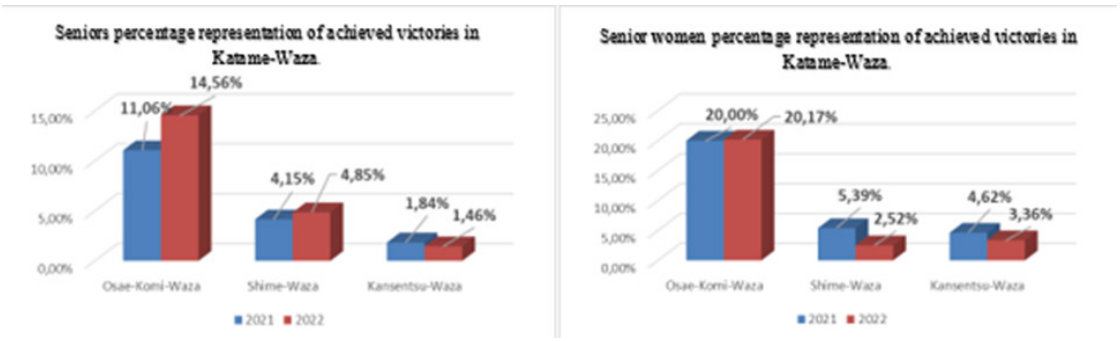

Fig. *1 and Fig. 2: percentages obtained by waza according to gender 2021-2022.*

By analyzing the combats in these competitions, it was found that in ne-waza the most victories were achieved in osaekomi-waza in the competition of senior men and senior women. In the seniors, the fights ended in suffocation in more cases than leverage in both competitions. In 2021, there were more suffocations in senior women, while in 2022 the percentage of levers compared to suffocations was higher.

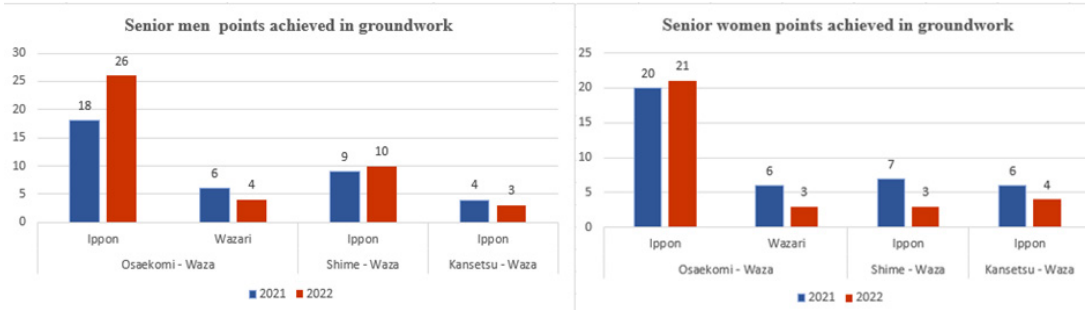

Fig. *3 and Fig. 4: A numerical representation of the points that achieved ne-waza wins according to gender.*

For seniors, the total number of Ippons in 2022 grew by 25.81%, while in senior women the number of ippons decreased by 15.15% compared to 2021.

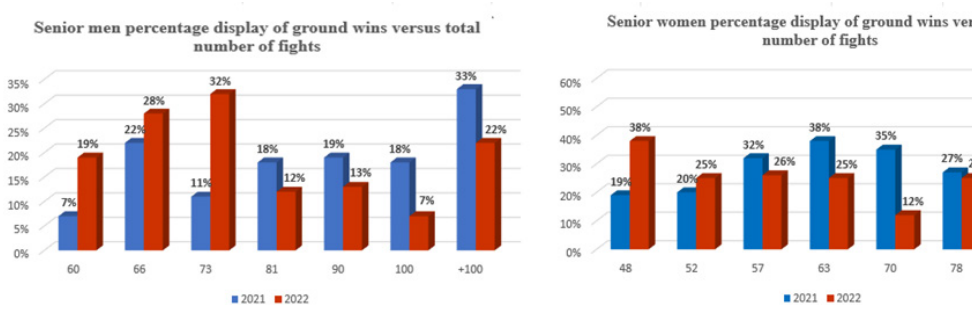

Fig. *5 and Fig. 6: Percentage display of ne-waza wins against total number of fights according to gender.*

For seniors in smaller weight categories, the percentage of ground wins compared to the total number of fights was higher in 2022., while in larger weight categories the number of wins was lower compared to 2021. Significant growth in floor wins in 2022. compared to 2021. was in the category up to 73 kg, a percentage growth of 250%.

The analysis found that in the categories of 48 kg and +78 kg there was a significant increase in ne-waza victories compared to the total number of combats in 2022. In the categories 57 kg, 63 kg, 70 kg and 78 kg there was less use of parter.

In the most numerous categories for women 57 kg, 63 kg and 70 kg, more floor wins were achieved in 2021 than in 2022. The ratio of wins in the 52 kg and 78 kg categories remained the same, while in the category of 48 kg and +78 kg, more victories were recorded in the competition in 2022 compared to 2021.

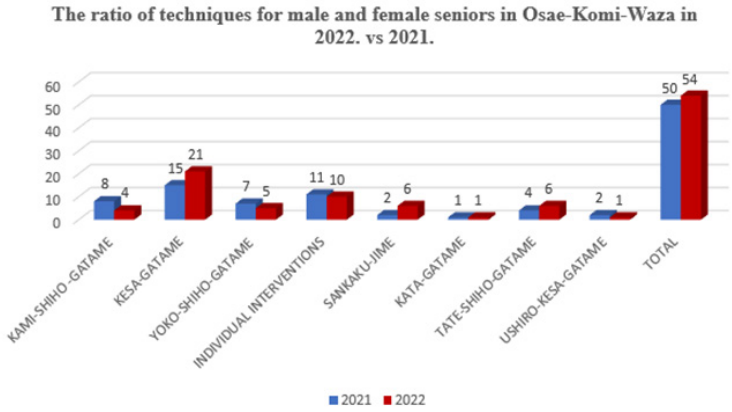

Fig. *7: Frequency techniques for seniors in osaekomi-waza 2022. vs 2021.*

Kesa-gatame technique is the technique that was mostly used in the floor competitions at the Sarajevo Open 2021. and 2022. competitions. From the above analyses and results, we can see that there have been some changes in the efficiency of performing ne-waza techniques after the change of The IJF rules in 2022.

DISCUSSION

The analysis of the effectiveness of the techniques in the ne-waza in judo was done on the basis of an overview of the fights from the Sarajevo Open competitions in 2021 and 2022. There were almost the same number of fights in both competitions, so the analysis was done on almost the same sample. By categories, there was a significant increase in ground wins in the women's category +78, and in men in the category up to 73 kg. The number of achieved Ippons in men grew in 2022., while in women there was a lower percentage of the same. The number of waza-ari achieved in the floor for each gender is lower in 2022 compared to 2021. As for ne-waza, judges pay more attention to ne-waza combat and scoring points in the new rules, although we still notice some inconsistency in scoring ne-waza. Compared to the research conducted in 2017. by Ceylan and Balci *(2017.)*, the conclusion is that there was an increase in kansetsu-waza and a decrease in shime-waza, and the application of the new rules was changed referring to the Sarajevo Open 2021-2022 competition. In the men's competition, the number of kansetsu-waza decreased significantly, and the percentage of shime-waza increased. This is due to the fact that certain techniques are prohibited by the new rules. The flying juji-gatame, which was often used in lower weight categories, was banned. The fact that the throws were not scored during the roller throw, left more space for shime -waza. As in the research from 2012 *(Adam, et al., 2012)*, this competition was the most victorious with kesa-gatame's intervention.

Ceylan and Balci *(2017)* investigated the effects of new rule changes in judo by comparing points scored with Paris GS between 2016 and 2017. The results showed that the frequency of ippons did not change significantly after the new rules in men and women, while there was an increase in waza-ari for both groups.

Adam and others *(2012)* came up with indicators that in 2008, 2009 and 2012, the most efficient holding of kesa-gatame belongs to the top ten dominant techniques. During the 2011 World Cup and OG 2012, the jugi-gatame appears in the top ten dominant techniques.

Kulesh *(1985)* investigated the relative effectiveness of judo techniques. The results of the World Cup in Judo in 1979 and 1981 *(Paris, Maastricht)* were analyzed. Nearly half of ippons were achieved in ne-waza. The 1979 and 1981. ne-waza victories were achieved using identical techniques. Posture procedures are the most effective means of achieving victory, and of them yoke-shiho-gatame and kusure-yoke-shiho-gatame were the most effective. Of the techniques on the ground, osaekomi-waza are the most commonly tried groups of techniques, shime-waza twice as much, and kansetsu-waza are very rarely tried, although the percentage of successful endings with these techniques is very large.

CONCLUSIONS

It was found that the most commonly performed techniques of procedures are hon-gesa-gatame, yoko-shiho-gatame and sankaku-jime. The highest percentage of osaekomi-waza in the grip is immediately after the throw, and the highest percentage of shime-waza techniques were performed after a failed opponent's attack.

In seniors, control techniques improved slightly while senior women performed better at performing shime-waza and kansetsu-waza compared to 2021.

The percentage of kansetsu-waza has been reduced, one of the reasons is the ban on the so-called "flying" jugi-gatame.

By analyzing, we found that in lower weight categories there was an increase in floor wins, while in larger weight categories *(81,90, 100, +100)* the percentage of wins in ne-waza decreased slightly. In the women's categories 48 kg, 52 kg and +78 kg, significant progress was observed, while in other women's categories, efficiency in ne-waza was higher in 2021. In 2022., the percentage of tachi-waza wins versus ne-waza is 77.3% vs. 22.7%. In the coming period, it is necessary to investigate the success of parterre techniques, but also techniques in standing position in different age categories and genders of the Judo Federation of BiH.

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THE CONNECTION OF SUCCESS AT THE JUDO TOURNAMENT AT THE OLYMPIC GAMES WITH THE FINANCIAL STRENGTH OF THE STATE

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ABSTRACT

It is very often the case that in today's modern sport, success results from the overall financial strength of an individual country. Financial strength most often affects the overall investment in sports, so greater success on the sports arena can be expected. The results presented in this paper confirm the argument that judo sport is not such a case.

Keywords: *judo, medals, money*

INTRODUCTION

Judo is a modern martial art and sport that originated in Japan and is practiced by over 20 million people in over 200 countries around the world *(1)*. It was developed by Jigoro Kano in the late 19th century as a way of combining and perfecting the traditional Japanese martial arts techniques of ju-jitsu into a comprehensive system of physical training and self-defense. The word "judo" translates to "gentle way", reflecting the art's emphasis on using the opponent's strength and action to achieve victory, rather than relying solely on brute force. Judo is not only a physical activity, but also a valuable educational tool that promotes character development, discipline and social skills. Sertić and colleagues conducted a two-year study and concluded that practicing judo in children in pre-puberty has a more significant and positive effect on changes in anthropological status than in children who played team sports or did not additionally play sports *(2)*. Judo is a complex martial art that contains a great wealth of technical elements that can be divided into eight groups of techniques: stances, movements, falls, grips, throws, armlocks, chokes and holds *(3)*.

Judo made its Olympic debut at the Summer Olympics in Tokyo in 1964. At first, only male competitors participated. Women's judo was introduced as a demonstration sport at the 1988 Seoul Olympics and became an official medal event at the 1992 Barcelona Olympics. Judo competitions are divided into weight classes to ensure fairness. At the Olympic Games, there are seven weight categories for men and women. Judo bouts last four minutes for men and women, and if the bout is tied, a "golden score" period is used to determine the winner. Judo points are awarded for throwing techniques, hold down techniques, armlock techniques and choke techniques.

Data on Olympic placings were taken from the official website of the International Judo Federation *(https://www.ijf.org/)*. The International Judo Federation *(IJF)* is the sport's governing body, responsible for organizing international competitions and ensuring compliance with sporting rules at the Olympic Games.

The subject of this research is to determine the relationship between the weighted number of first to fifth place finishes at the Olympic Games and GDP per capita *($)*. GDP was measured by the method of purchasing power parity per capita *(PPPPC)*. It is the value of final goods and services produced in a particular country in a particular year, converted according to the market exchange rate into US dollars and divided by the average population of that year or the population in half of that year. The PPP method is more useful for comparing living standards between countries, as it considers the cost of living and the rate of inflation, rather than a simpler comparison of nominal amounts that may not reflect true income differences. PPPPC data were taken from the official websites of the World Bank *(https://www.worldbank.org/)* and the International Monetary Fund *(https://www.imf.org/)*. Previous research results suggest that “both a large population and higher per capita GDP are needed to generate high medal totals.” *(4)*

METHODS

For the purposes of this paper, information was collected on placings up to 5th place at the Olympic Games in Tokyo, Rio de Janeiro, London, Beijing, Athens and Sydney, as well as information on PPPPC for each country at the time of the Olympic Games. To obtain a total number that indicates success at individual Olympic Games, a certain number of points are added to the placements, namely: 1st place – 8 points; 2nd place – 5 points; 3rd place – 3 points; 5th place – 1 point. The total number of points is presented separately for male and female competition, and a correlation analysis was made between the number of points and the PPPPC of each country.

RESULTS AND DISCUSSION

Tables 1 to 6 show the results of the correlation between the success achieved at individual Olympic Games in men's and women's competition and the PPPPC of each country.

The results indicate that there is no connection between success in judo at the Olympic Games and the PPPPC of an individual country. The results also show an uneven connection between success at the Olympic Games in men's and women's competition.

Table 1. Correlation of Points Won in Men's Women's Competition with PPPPC at the Tokyo 2020 Olympic Games.

	MAN	WOMAN	PPPPC
MAN	1,000000	0,599016*	0,013847
WOMAN	0,599016*	1,000000	0,065660
PPPPC	0,013847	0,065660	1,000000

Legend: MAN – success at the Olympic Games in men's competition; WOMAN - success at the Olympic Games in women's competition; PPPPC - purchasing power parity per capita

Table 2. Correlation of Points Won in Men's Women's Competition with PPPPC at the Rio de Janeiro 2016 Olympic Games.

	MAN	WOMAN	PPPPC
MAN	1,000000	0,093921	-0,026499
WOMAN	0,093921	1,000000	0,056257
PPPPC	-0,026499	0,056257	1,000000

Legend: MAN – success at the Olympic Games in men's competition; WOMAN - success at the Olympic Games in women's competition; PPPPC - purchasing power parity per capita

Table 3. Correlation of Points Won in Men's Women's Competition with PPPPC at the London 2012 Olympic Games.

	MAN	WOMAN	PPPPC
MAN	1,000000	0,093921	-0,026499
WOMAN	0,093921	1,000000	0,056257
PPPPC	-0,026499	0,056257	1,000000

Legend: MAN – success at the Olympic Games in men's competition; WOMAN - success at the Olympic Games in women's competition; PPPPC - purchasing power parity per capita

Table 4. Correlation of Points Won in Men's Women's Competition with PPPPC at the Beijing 2008 Olympic Games.

	MAN	WOMAN	PPPPC
MAN	1,000000	0,215673	-0,080886
WOMAN	0,215673	1,000000	-0,012751

PPPPC	-0,080886	-0,012751	1,000000

Legend: MAN – success at the Olympic Games in men's competition; WOMAN - success at the Olympic Games in women's competition; PPPPC - purchasing power parity per capita

Table 5. Correlation of Points Won in Men's Women's Competition with PPPPC at the Athens 2004 Olympic Games.

	MAN	WOMAN	PPPPC
MAN	1,000000	0,508089*	0,035211
WOMAN	0,508089*	1,000000	0,151503
PPPPC	0,035211	0,151503	1,000000

Legend: MAN – success at the Olympic Games in men's competition; WOMAN - success at the Olympic Games in women's competition; PPPPC - purchasing power parity per capita

Table 6. Correlation of Points Won in Men's Women's Competition with PPPPC at the Sydney 2000 Olympic Games.

	MAN	WOMAN	PPPPC
MAN	1,000000	0,320847	0,268308
WOMAN	0,320847	1,000000	0,033684
PPPPC	0,268308	0,033684	1,000000

Legend: MAN – success at the Olympic Games in men's competition; WOMAN - success at the Olympic Games in women's competition; PPPPC - purchasing power parity per capita

It is very often the case that in today's modern sport, success results from the overall financial strength of an individual country. Financial strength most often affects the overall investment in sports, so greater success on the sports arena can be expected. The results presented in the tables confirm the argument that judo sport is not such a case. Success at the Olympic Judo Games is not conditioned by the "financial strength" of the state. The correlation between men's and women's results in the last two Olympic Games indicates a significant connection. These results suggest a simultaneous trend in the development of men's and women's judo in the states. It will be interesting to see if such a trend will continue at the upcoming games in Paris.

CONCLUSION

Although to make some more significant and concrete conclusions it is necessary to carry out a more detailed analysis of all parameters, the results presented in this paper give an idea of the value of judo sport - universality and non-discrimination. Judo is conceived as a sport in which every athlete can achieve success regardless of their anthropological characteristics, and judging by the results of this work, regardless of the financial strength of the state.

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