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ADVANCING OUR SPORT THROUGH KNOWLEDGE
FAIRE PROGRESSER NOTRE SPORT PAR LA CONNAISSANCE
ПРОДВИЖЕНИЕ НАШЕГО СПОРТА ЧЕРЕЗ ЗНАНИЕ
PROGRESO PARA NUESTRO DEPORTE MEDIANTE CONOCIMIENTO

International Journal of Wrestling Science

The official journal of the International Network of Wrestling Researchers (INWR)

David Curby, EdD
Editor in Chief

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Reviewers

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THE INTERNATIONAL JOURNAL OF WRESTLING SCIENCE: STATUS AND PERSPECTIVES

BACKGROUND

The ***International Journal of Wrestling Science*** is the only academic journal dedicated to the study of the world's oldest sport. It is published by the International Network of Wrestling Researchers and is officially affiliated with United World Wrestling (UWW). Since its inception in 2011, there have been 26 issues published with a total of 279 scholarly articles. These are available at https://inwr-wrestling.com/international-journal-wrestling-science-2/

The International Journal of Wrestling Science is a peer-reviewed journal for professionals working in in wrestling and wrestling sport science. Issues are published twice a year.

AIMS AND SCOPE

The ***International Journal of Wrestling Science*** is the only journal dedicated to the study of the world's oldest sport. The International Journal of Wrestling Science is an Open Access international, peer-reviewed journal. Issues are published twice a year. The Editorial Board and Reviewers are among the most respected scientists working in wrestling,

The *International Journal of Wrestling Science* regularly features: Original Papers, Review Articles, Technique Analysis, Scoring Analysis, Commentaries/Opinion, Case Studies/Profiles and Letters.

The Journal publishes on behalf of the International Network of Wrestling Researchers IINWR) and in association with the sport's international governing body, United World Wrestling (UWW). The readership for this Journal is varied and ranges from Researchers, Academics, Coaches, Trainers, Physiotherapists, Sports Medicine Professionals, Psychologists, Performance Analysts, Sport Managers, Students, and Elite Athletes and other professional practitioners from a range of disciplines and areas of application. The Journal also welcomes anyone involved in Olympic sport, particularly combative and weight category sports.

REACH OF THE JOURNAL

The journal is shared with UWW leadership, members (500) of the INWR, and is posted on the Face Book group Friends of the INTERNATIONAL NETWORK OF WRESTLING RESEARCHERS (INWR) with 2,000 members.

SUPPORT OF UNITED WORLD WRESTLING

> *I would like to take this opportunity to congratulate the International Network of Wrestling Researchers for its excellent work and the remarkable growth of your membership with a truly world-wide representation. Your publication, the* ***International Journal of Wrestling Science*** *is a scholarly work that is contributing to an understanding of all facets of wrestling. The affiliation between the United World Wrestling and the INWR has contributed to the establishment of a Scientific Commission within UWW. I believe that from our recent challenges, we in wrestling have reacted in in a positive manner that is something of a rebirth. UWW is providing their scientific expertise in presenting solutions to the modern problems we face. Your work has increased international collaboration and will be used to advance the development of our sport in all areas of the world.*
> *Bravo!*
>
> *Nenad Lalovic*
> *President*
> *United World Wrestling*

FUTURE PERSPECTIVES

Preparations for transfer to a new Editor in Chief, as the current one will be retiring at the LA Games. This would be an opportunity to affiliate with a university. Steps should be initiated by the UWW Scientific Commission to identify who is willing to assume the new leadership. This will allow for time to gain instruction in the workings of the journal.

This is an open-access journal and no money is generated from its production, however there are costs that are incurred that are currently met by the editor (web hosting, indexing for example) which the UWW could possibly provide financial support.

Steps should be taken to heighten the visibility of the journal within UWW. There should be pride in the fact that UWW has a dedicated journal with high academic standing.

Sincerely yours in the advancement of Wrestling,

David Curby EdD
Director of the International Network of Wrestling Researchers
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WHO HAS THE ADVANTAGE? RELATIVE AGE EFFECT AND PERFORMANCE OUTCOMES IN U17 EUROPEAN WRESTLING CHAMPIONSHIPS

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ABSTRACT

Purpose: Relative Age Effect (RAE) in sports is a topic of great interest, but has not been studied extensively in wrestling. Thus, the aim of this study was to examine the presence of the **Relative Age Effect (RAE)** among wrestlers participating in the U17 European Wrestling Championship, with attention to style and gender differences.

Methods: A total of 558 athletes (freestyle: n = 186; Greco-Roman: n = 204; women's wrestling: n = 168) were analyzed. Birth dates were categorized into quartiles (Q1: Jan–Mar; Q2: Apr–Jun; Q3: Jul–Sep; Q4: Oct–Dec). Chi-square tests were used to compare distributions, with Cramér's V calculated for effect size. Poisson regression models were applied to assess the relationship between week of birth and athlete representation.

Results: Freestyle wrestlers born in Q1 were significantly overrepresented compared to those born later in the year ($\chi^2 = 8.366$, $p = 0.039$, $V = 0.12$). A similar but nonsignificant trend was observed in Greco-Roman wrestling ($\chi^2 = 6.627$, $p = 0.085$), while no effect was found in women's wrestling ($\chi^2 = 0.333$, $p = 0.954$). Regression analyses confirmed a negative association between week of birth and representation in freestyle ($p = 0.004$, $R^2 = 0.18$) and Greco-Roman ($p = 0.037$, $R^2 = 0.12$), but not in women's wrestling ($p = 0.698$). Interestingly, no significant RAE was observed among medalists.

Conclusion: The findings indicate that RAE exists in male youth wrestling, particularly in freestyle, but is absent in women's wrestling. Although early-born athletes appear to have advantages in selection, the effect diminishes at the elite performance level.

Keywords: Relative Age Effect, wrestling, youth athletes, talent identification, biological maturation

INTRODUCTION

In the realm of athletic development, the precise identification and nurturing of talent stand as paramount objectives for sports scientists, coaches, and governing bodies. The perpetual quest to pinpoint promising individuals, often from an early age, is a cornerstone of success in competitive sport. However, this intricate process is frequently influenced by factors extrinsic to inherent athletic prowess, most notably the **Relative Age Effect (RAE)**. This phenomenon describes the consistent over-representation of athletes born earlier in a given selection year (i.e., immediately following a defined cut-off date) within elite developmental pathways, when compared to their chronologically younger counterparts in the same age cohort (Smith et al., 2020; Timmerman et al., 2022).

The underlying mechanisms driving RAE are diverse and interconnected. Within a single age cohort, the almost 12-month disparity in chronological age can result in marked differences in an athlete's maturational status, especially during the critical adolescent growth period (Grossman et al., 2021). This advancement in biological and psychological development provides relatively older individuals with a temporary but significant edge. These athletes frequently demonstrate superior physical attributes, including greater height, body mass, strength, and speed, along with more refined motor skills compared to their younger peers (Musch & Grondin, 2001). In addition, other advantages that older athletes gain in the same year include access to more advanced training resources, more match or competition time, and exposure to higher-level competition (McCarthy et al., 2017). This inherent physical and cognitive maturity, along with privileged access to environmental conditions, provides them with an immediate performance advantage in demanding sports.

The ramifications of RAE are extensive across various athletic disciplines, impacting talent identification paradigms, athlete participation rates, and long-term athletic progression. While the transient physical advantages may diminish as individuals reach full physiological maturity in adulthood, the cumulative effect of specialized training and competitive exposure during formative years can indelibly shape an athlete's career trajectory. This often results in the premature exclusion or attrition of many potentially gifted individuals born later in the selection period, due to a perceived deficit in ability or limited developmental opportunities (Watt & Wattie, 2021).

The **Under-17 (U17) category**, typically encompassing athletes between 15 and 17 years of age, represents a particularly pertinent context for examining RAE. This period is characterized by considerable inter-individual

variability in pubertal timing and maturational status, which can exacerbate the impact of relative age on crucial physical performance indicators like anaerobic power and capacity attributes vital in demanding sports such as wrestling. In disciplines where physical dominance, speed, and endurance are paramount, even subtle differences in biological maturity within the U17 cohort could confer a distinct advantage to relatively older athletes, thereby influencing match outcomes, national team selections, and overall competitive success (Romann & Cobley, 2018). It is noteworthy that even in sports like wrestling, which employ weight categorization to equalize physical attributes, the enduring disparities in physiological and psychological maturation linked to relative age can still significantly influence performance.

However, the role of gender on RAE, whether the effect differs between male and female wrestlers is a significant research topic. While the literature suggests that RAE is more pronounced in males due to differences in puberty and physical maturation, there is evidence that this effect is either less pronounced or manifests differently in female wrestlers. For example, some studies have detected RAE in male wrestlers (Greco-Roman and freestyle) but not in female wrestlers (Doherty & Gledhill, 2018). These differences may be related to various factors, such as differences in biological maturation rates, the cultural approaches of sport organizations, or variations in sport participation rates.

While there are RAE studies covering different developmental periods in wrestling (pre-adolescence, post-adolescence, and older age groups), no comprehensive empirical research has been found in the literature directly examining the effects of RAE, particularly in the U17 category, which experiences rapid development, and in a large-scale event where elite groups compete, such as the European Championships. This gap is critical for talent identification and long-term athlete development strategies. Accordingly, the current study examined the results of the U17 European Wrestling Championships (Freestyle, Greco-Roman, and Women), aiming to assess the impact of the Relative Age Effect (RAE) in this age category through competition participation, success, and gender differences. The hypotheses of our study are as follows: a: Among athletes participating in the U17 European Wrestling Championships, those born closer to the age group's start date (January-March) will be significantly overrepresented compared to those born in the last quarter of the year (October-December). b: The Relative Age Effect will be more pronounced and statistically significant in male wrestlers, where biological maturation and physical strength provide a more significant advantage, compared to female wrestlers. c: There will be a greater representation of relatively older athletes among medal-winning athletes.

METHODS

Participants

This study included a total of 558 wrestlers, comprising 390 male and 168 female participants, who participated in the U17 European Championships held in Skopje, North Macedonia, in 2025.
In this championship, the participation of men was in Freestyle (n:186) and Greco-Roman (n:204), and Women's wrestling (n:168). Each subject participated in a single style.

Design and procedure

The research was approved by the ethics committee of Akdeniz University (ethical approval code: 07.10.2025-1341249) and was conducted in accordance with the Declaration of Helsinki. Data on the date of birth, gender, and styles competed by all wrestlers participating in the championships were requested from the world governing body, United World Wrestling. In order to evaluate the RAEs, the wrestlers' birth months were divided into four quarters. Since the age cut-off date for the European Championships is January 1, wrestlers born in January, February and March are grouped in Q1; wrestlers born in April, May and June are grouped in Q2, wrestlers born in July, August and September in Q3 and wrestlers born in October, November and December in Q4. See Figure 1.

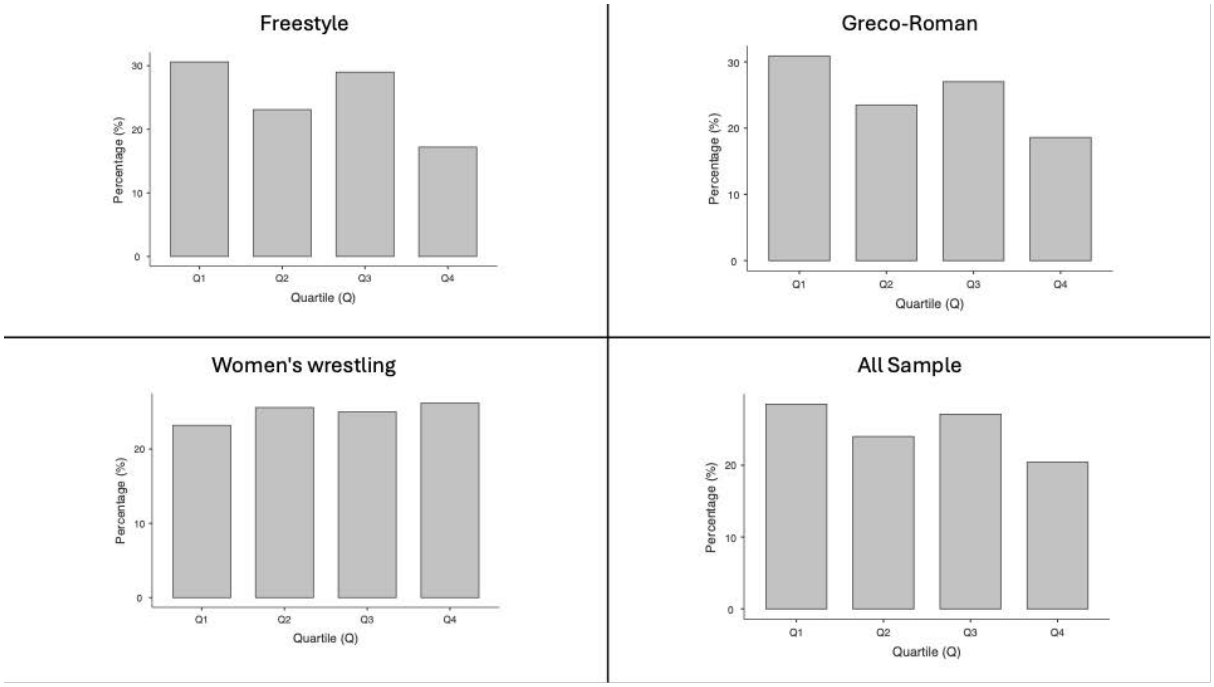

Figure 1

Data analysis

Theoretically, birth rates were assumed to be equal across all quarters (i.e., 8.33 for each month and 25% for each quarter), and Chi-square ($\chi 2$) goodness-of-fit tests were analysed for observed and theoretically expected differences between the distribution of Freestyle, Greco-Roman and Women's wrestling birth dates. Cramér's V was used for effect size, with insignificant, small, medium and large effects being "$0.06 \leq V$", "$V = 0.06\text{-}0.17$", "$V = 0.18\text{-}0.29$" and "$V \geq 0.30$", respectively, as interpreted according to Cramér [34]. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for comparisons ("Q1 vs. Q4", "Q1 vs. Q3", and "Q1 vs. Q4"). In addition, date of birth distribution was treated as a continuous variable to further investigate RAEs and increase statistical power by reducing the number of comparisons (see Figure 2). Therefore, Poisson regression with canonical linkage was performed to analyse the count data using the formula $y = e(b0+b1x)$. The term y represents the frequency of births in each week and the term x is the explanatory variable (i.e. time of birth). Ranging from 0 to 1, the time of birth was calculated considering the formula $TB = (WB - 0.5)/52$. WB represents the week of birth of the athletes (e.g., for players born between January 1 and 7, WB was 1). All data were analysed using Jamovi statistical software.

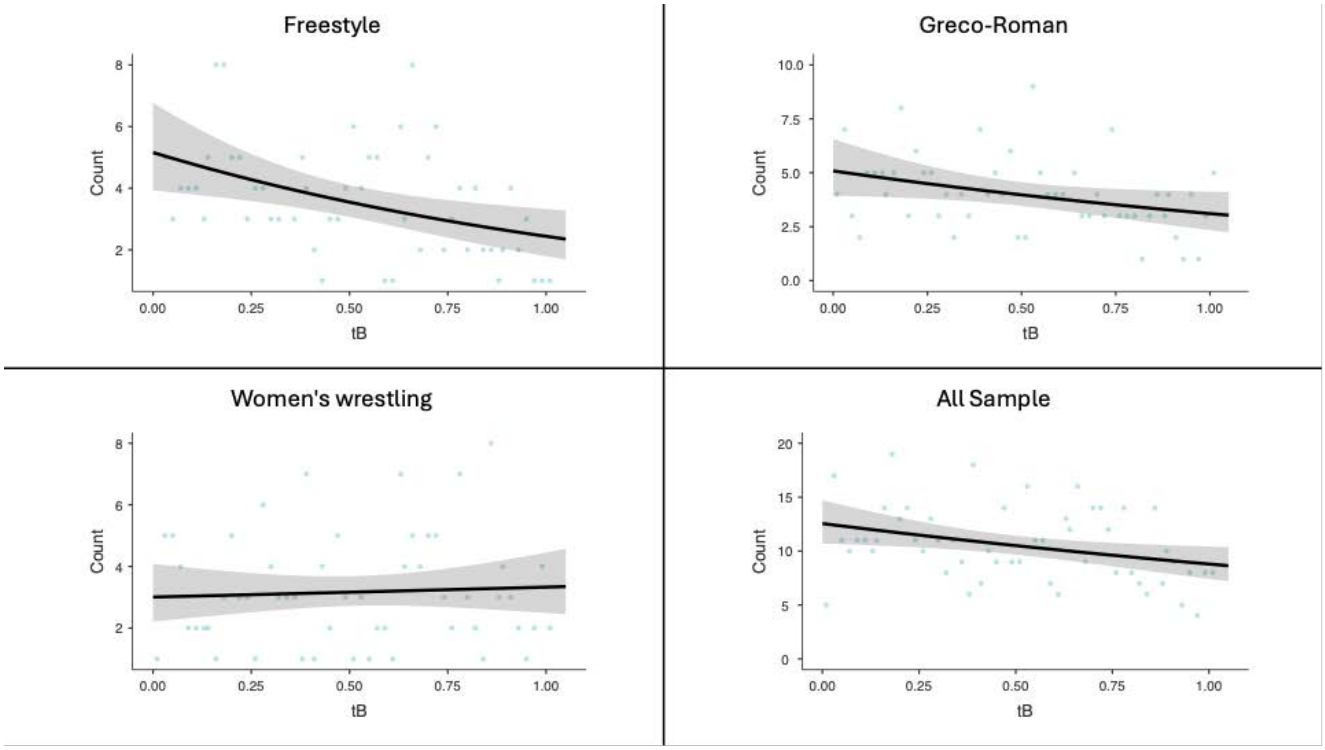

Figure 2. Time of Birth as a Continuous Variable

Results

The distribution of athletes' birth dates across the four quarters of the year differed significantly only in freestyle wrestling (χ^2 = 8.366, p = 0.039, V = 0.12), indicating a small effect size. No RAEs was observed in Greco-Roman wrestling (χ^2 = 6.627, p = 0.085, V = 0.10) or women's wrestling (χ^2 = 0.333, p = 0.954, V = 0.03). Odds ratio comparisons indicated that, although male wrestlers born in the Q1 were more frequently represented than those born in the Q4, the odds ratios were not statistically significant. In women's wrestling, a reverse trend was observed, but again, the odds ratios were not significant. When all participants were analysed together, only the comparison between Q1 and Q4 showed a significant difference (OR = 1.39, 95% CI: 1.00–1.95), (Table 1).

Table 1. Distribution of Players by Quarter of Birth with Goodness-of-Fit Test and Odds Ratio Comparisons

Category	Quarter of birth (% of player)				A chi-square goodness-of-fit test			Odds ratio comparisons (95% confidence interval)		
	Q1	Q2	Q3	Q4	χ^2	p	V	Q1-Q4	Q1-Q3	Q1-Q2
Freestyle (n:186)	57	43	54	32	8.366	**0.039**	0.12	1.78 (0.98-3.23)	1.06 (0.61-1.83)	1.33 (0.75-2.34)
Greco-Roman (n:204)	63	48	55	38	6.627	0.085	0.10	1.66 (0.95-2.90)	1.15 (0.67-1.95)	1.31 (0.76-2.25)
Women's wrestling (n:168)	39	43	42	44	0.333	0.954	0.03	0.89 (0.48-1.63)	0.93 (0.50-1.71)	0.91 (0.49-1.67)
All Sample (n:558)	159	134	151	114	8.552	**0.036**	0.07	**1.39 (1.00-1.95)**	1.05 (0.76-1.46)	1.19 (0.85-1.65)

Q1: (January-March), Q2: (April-June), Q3: (July-September), Q4: (October-December)
small effect: V = 0.06 - 0.17, medium effect: V = 0.18 - 0.29, large effect: V ≥ 0.30

When examining the distribution of successful athletes by quarter of birth with goodness-of-fit test and odds ratio comparisons, no significant RAEs was observed among men, women, or all athletes (Table 2).

Table 2. Distribution of Successful Athletes by Quarter of Birth with Goodness-of-Fit Test and Odds Ratio Comparisons

Category	Quarter of birth (% of wrestlers)				A chi-square goodness-of-fit test			Odds ratio comparisons (95% confidence interval)		
	Q1	Q2	Q3	Q4	χ^2	p	V	Q1-Q4	Q1-Q3	Q1-Q2
Freestyle (n:40)	13	10	11	6	2.600	0.457	0.15	2.17 (0.59-7.99)	1.18 (0.36-3.88)	1.30 (0.39-4.33)
Greco-Roman (n:40)	11	6	14	9	3.400	0.334	0.17	1.22 (0.35-4.24)	0.79 (0.24-2.56)	1.83 (0.49-6.90)
Women's Wrestling (n:40)	9	9	11	11	0.400	0.940	0.06	0.82 (0.24-2.84)	0.82 (0.24-2.84)	1.00 (0.28-3.57)
All Sample (n:120)	33	25	36	26	2.867	0.413	0.09	1.27 (0.62-2.61)	0.92 (0.46-1.83)	1.32 (0.64-2.73)

Q1: (January-March), Q2: (April-June), Q3: (July-September), Q4: (October-December)
small effect: V = 0.06 - 0.17, medium effect: V = 0.18 - 0.29, large effect: V ≥ 0.30

Poisson regression analyses examining the relationship between birth quarter and representation in wrestling indicated small trends in male categories. In freestyle (b_1 = -0.75, R^2 = 0.18, p = .004) and Greco-Roman wrestling (b_1 = -0.49, R^2 = 0.12, p = .037), athletes born earlier in the year tended to be slightly more represented. In women's wrestling, no such association was observed (b_1 = 0.10, R^2 = 0.00, p = .698). For all participants combined, a small but significant negative association was found (b_1 = -0.36, R^2 = 0.10, p = .014) (Table 3).

Table 3. Poisson regression analysis of RAEs in female and male wrestlers

Category	N	W_B	T_B	b_0	b_1	R^2	p
Freestyle	186	24.31 ± 14.17	0.46 ± 0.27	1.64	-0.75	0.18	.004
Greco-Roman	204	24.76 ± 15.02	0.47 ± 0.29	1.64	-0.49	0.12	.037
Women's Wrestling	168	27.46 ± 14.99	0.52 ± 0.29	1.10	0.10	0.00	.698
All Sample	558	25.42 ± 14.77	0.48 ± 0.28	2.53	-0.36	0.10	.014

W_B: week of birth, T_B: time of birth, b_0: intercept term of the exponential model, b_1: coefficient associated with the predictor variable

DISCUSSION

This study aimed to examine the existence of the Relative Age Effect (RAE) and gender and branch differences in athletes participating in the U17 European Wrestling Championship. The findings of this study reveal that small RAEs was observed in male but not in female athletes. Small trends suggested slightly greater representation of earlier-born athletes in male categories, but odds ratios and regression analyses indicated that these effects were generally weak. In women, a reverse or negligible trend was observed. When all participants were considered together, only the comparison between first- and fourth-quarter births showed a small but significant effect.

Athletes born in the first months of the year may possess more advanced physical development, strength, and endurance (Musch & Grondin, 2001; Grossman et al., 2021). This advantage may be influential in national team selection and tournament success in younger age groups. However, the similar effect observed in women's wrestling for international representation could be explained by the fact that participation in the branch is not yet as widespread as in men's sports, the smaller pool of athletes for women, or differences in selection criteria due to sociocultural factors. Furthermore, it is thought that technical and tactical elements, rather than physical developmental differences, may be more dominant in women's wrestling. This is consistent with other studies reporting that RAE is generally weaker in women than in men's sports, although the literature is still lacking in studies on female wrestlers (Smith et al., 2018).

Data showing the effects of birthdate on sporting achievement (medal ranking) can be used for performance planning and predicting sporting performance outcomes. A key finding from the study is that RAE was not evident among medal-winning athletes. No significant difference was observed in the distribution of successful athletes by birth quartile. This suggests that success at the elite level may be driven not only by chronological age advantage but also by technical and tactical skills, psychological resilience, long-term training loads, and motivational factors (McCarthy et al., 2017; Watt & Wattie, 2021). Therefore, RAE, which provides a biological and physiological advantage at an early age for participation or representation, may lose its impact at the elite level of success, where competition is more intense. Although there are differences across age groups, this trend has been maintained in studies conducted on athletes from different sports. For example, in tennis, the RAE effect is high among lower-ranked athletes, while it decreases and disappears as the rankings move up (the top 100 in the world rankings) (Zháněl at al., 2022). Again, recently, similar to our study in the 2024 Junior Padel Tennis European Championship, the relationship between RAE and competition participation and success was examined, and while the RAE effect was evident in the athletes participating in the European Championship, it was observed that this effect disappeared in the medal rankings (Conde-Ripoll at al., 2025). This inverse relationship between RAE and the level of elite performance can be attributed to the progressive predominance of psychological, technical, and experiential factors over biological maturity as athletes advance through developmental stages. As athletes progress to more competitive stages, elements such as accumulated practice, sport-specific expertise, mental resilience, and internal motivation tend to play a more decisive role in achieving success than the relative age advantage (Schorer et al., 2009; Wattie et al., 2008).

In age groups that reflect early stages of athletic development, such as the U17 category, the RAE appears to influence athletes' chances of selection and participation; however, its influence on actual competitive performance outcomes seems to be relatively minor (Cobley at al., 2009; Kelly at al., 2021). While the current study found a significant relationship between birth week and representation in sports when the entire sample was examined together, the low explanatory value suggests that the effect of RAE on performance outcomes in wrestling is limited. Similarly, previous research has shown that RAE in wrestling is particularly effective on

national team selection and championship participation in the early stages, but this effect disappears in indicators of success such as medal earnings or high rankings (Demirkan et al., 2019; Bezuglov et al., 2025). Overall, these findings suggest that RAE at an early age may facilitate access to sport and competitive opportunities, but this advantage does not guarantee elite-level performance.

Our research examines the effects of the RAE on a high-level international championship in early age groups (adolescence). Based on our findings, we can conclude that the RAE had a small effect on participation but almost no impact on medal standings, which are considered a measure of athletic success. However, the presence of the Relative Age Effect (RAE) among athletes competing in an international-level championship can be considered a noteworthy finding for two main reasons. First, given that the participants represented multiple countries, the observed RAE indicates that, within this age group, relative age continues to play a significant role in talent selection and performance potential across European wrestling programs. Second, the absence of a clear association between RAE and competitive success suggests that being relatively older within a cohort does not guarantee superior performance outcomes. Therefore, the current U17 age classification (15–17 years, cadet category) implemented by United World Wrestling (UWW) appears to provide an equitable competitive structure that supports fairness in athlete development and competition. Although the current study focuses on a single competition, it provides data for future studies in this area and can serve as an important reference for potential RAE-based planning. Therefore, understanding the extent of international representation in these age groups, and the impact of gender differences on the RAE, is crucial for ensuring equal representation and fair competition in wrestling, and for planning potential category classifications that reassess the impact of the RAE. Furthermore, based on the effects of RAE on competition participation, it is valuable for determining other athletic performance parameters necessary for medal winning at the elite level and for planning for athletic success. Future studies in this area are recommended to compare competitions held in the same age group in different years to facilitate more optimal planning in this area.

CONCLUSIONS

The current study demonstrates that the Relative Age Effect (RAE) exists among male youth wrestlers competing in the U17 European Championships, but not among female athletes. The significant overrepresentation of relatively older athletes (born Q1), particularly in freestyle wrestling, suggests that biological maturity and physical development may still play a decisive role in early talent identification and national team selection during adolescence. However, the absence of RAE among medal-winning athletes suggests that advantages gained at an early age do not translate into superior performance outcomes at the elite level. From a practical perspective, this is essential for coaches and sports federations to use biological maturation assessments and individualized development models to ensure equitable talent development and reduce the premature exclusion of younger athletes in the same age group. Future research should focus on conducting longitudinal studies of athletes across multiple competitions or multiple studies within the same age group to assess how RAE dynamics may change with age and performance progression.

Limitations

There are some limitations in our research. The first of these is, the data were derived from a single international tournament (U17 European Championships, 2025), limiting the generalizability of results across different competition levels, regions, or age categories. The inclusion of data from other continental and world championships over multiple years would provide a more comprehensive understanding of the persistence or variability of RAE in wrestling. A second and important limitation is that the study relied solely on the athletes' birthdates and could not account for moderator variables that could influence representation and performance, such as training experience, years of participation in sports, biological maturation indicators (e.g., peak height velocity), or anthropometric differences. Future research in this area is recommended to design studies that take these limitations considered.

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PLANNING OF TRAINING LOADS TAKING INTO ACCOUNT OPERATIONAL CONTROL OF MEDICAL AND BIOLOGICAL INDICATORS OF QUALIFIED WRESTLERS

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ABSTRACT
The article presents experimental material on the study of indicators of medical and biological control as markers in the planning of the training process, taking into account the operational state of martial arts athletes. The dynamics of the rate of recovery processes after maximum glycolytic work with and without moderate and high-power pedagogical means of recovery have been revealed. The work used science-intensive and generally recognized standard certified techniques and methods: ergometry, pulseometry, gasometry, and lactometry. The results of the study show that when assessing the rate of recovery processes after maximum glycolytic work using pedagogical means of recovery, the use of locomotion at the level of the threshold of aerobic metabolism is significantly higher than during rest without locomotion and is equal to 12.3%, but when using high-power pedagogical means, the decrease in lactate concentration at the 3rd minute of recovery is even faster and is equal to 21.4%. Thus, it has been established that the specifics of urgent recovery using aerobic-anaerobic (mixed) effects can have a positive impact on repeated physical exertion, which should be taken into account when planning the training process.

Keywords: Greco-Roman wrestling, operational control, planning, medical and biological indicators, restorative processes, aerobic threshold, anaerobic threshold, and maximum oxygen consumption.

INTRODUCTION

The analysis of scientific and methodological literature and practical experience of training in sports has allowed us to identify the actual problem of developing a system of comprehensive control and identifying criteria for sports performance, in accordance with the requirements of the sport [3, 8, 9].

One of the important methods for developing comprehensive control is the program-targeted approach, which is not limited to collecting information about athletes, but also includes the assessment of laboratory indicators, the monitoring of the dynamics of training loads, and other pedagogical observations related to setting target indicators, the conditions of competitive performances, the plan for restorative measures, and more [1].

A modern view of the problem of sports training management can be aimed at finding the factors of sports skills in solving the tasks of sports results, while the main focus should be on the study of the adaptive potential to the impact of training loads of a long-term nature, the mechanism of which is a comprehensive assessment of the permanent state of athletes, taking into account the level of "sports form". Scientific approach to the development of a system of comprehensive control and model characteristics as the main indicators [7] in the search for new solutions to the management of the training process. Modern research has revealed a relationship between functional assessment and athletes' technical skills, indicating the importance of functional support for the cardiovascular, muscular, and respiratory systems [4, 5].

An analysis of scientific and methodological literature has revealed a steady increase in randomized control methods that do not meet the requirements of sports practice and cause dissonance in the information obtained due to the inconsistency of the timing of sports training and the tasks to be solved, which makes it difficult and, in some cases, impossible to provide an objective assessment of the preparation for sports performances [6].

The purpose of our work was to examine the indicators of medical and biological control as markers in the planning of the training process, taking into account the operational status of martial arts athletes.

RESEARCH METHODS AND METHODOLOGY

10 wrestlers, students of the Department of Theory and Methodology of martial Arts RUS "GTSOLIFK" participated in the research work, each test was conducted on a separate day, but no more than 2 test procedures per week. Characteristics of the experimental group: qualification – KMS-MS, height – 171.9 ± 5.6; Weight – 69.4 ± 3.5.

Research methods: - anthropometry (measurement of athletes' weight and height); - ergospirometry (performed on the H/P Cosmos Saturn treadmill (Germany) a) during the test, all athletes were asked to perform a running test with a gradually increasing speed until they "exhausted," and their breathing, cardiovascular, and work performance parameters were recorded, as well as their aerobic and anaerobic thresholds and maximum oxygen consumption; b) the "hold" test required them to accurately set and maintain the maximum speed recorded during the ramp test); - gasometry (performed using the Cortex Metalyser 3B-R2 gas analyzer (Germany), which allows for the analysis of gases released during muscle activity during test procedures); - heart rate monitoring (the study used POLAR heart rate monitors, and the measurements were synchronized and integrated with data obtained using ergometry and gasometry); - lactometry (the analysis of blood lactate concentration was performed using the Biosen-C device); - methods of mathematical and statistical data processing.

To conduct laboratory tests to determine the rate of recovery processes after maximum glycolytic exercise and to design a training process based on medical and biological control, we developed the following study design. At the first stage, individual zones of energy performance were identified in athletes using a ramp test on a treadmill (the aerobic exchange threshold (AET) and the anaerobic exchange threshold (AET) were determined), thus, individual characteristics of athletes, parameters of functional state and the speed at which they passed from one metabolic process to another were investigated. This information is necessary for the implementation of the set goal of the study and the compilation of individual motor modes of various energy orientation during the period of rest after maximum muscle work.

In the second stage, the main experiment was conducted, which consisted of conducting maximum glycolytic power test procedures in the "maximum critical power retention" test. Using this testing procedure, we determined the test for maintaining a fixed maximum speed during the retention test. To solve the problem of determining the rate of recovery processes after maximum glycolytic work, we proposed the following variations: - A test for maintaining maximum speed with 15-minute standing recovery to determine oxygen consumption and debt, thus determining the parameters of recovery processes after maximum-power muscle work without the use of pedagogical recovery methods.

- Test for holding maximum speed followed by 3-minute running at a speed fixed at the aerobic threshold and a duration of 15 minutes, thus the degree of influence of pedagogical means of aerobic orientation was determined by recovery.

- Test for holding followed by 3-minute running at a speed fixed at the anaerobic threshold and a duration of 15 minutes. Thus, the degree of influence of pedagogical means of mixed (aerobic-anaerobic) orientation was determined by recovery. In all these tests, capillary blood was taken to assess the lactate level. The blood samples were taken: immediately after the maximum speed retention test; 3 minutes after the recovery test, which is 2 tests after the end of the pedagogical recovery test; 6 minutes after the maximum retention test; 9 minutes after the maximum retention test; 15 minutes after the end of the maximum retention test.

RESEARCH RESULTS AND THEIR DISCUSSION

After conducting the first stage of the study, we recorded the indicators of aerobic performance when the wrestlers performed the ramp test, the data are presented in Table 1.

Table 1 – Medical and biological indicators characterizing the aerobic performance of qualified wrestlers (n=10)

Metabolic transitions	V, km/h	O_2, ml/min/kg	V'E, l/min	RR, 1/min	RER, y.e.	HR, beats/min
AeT	8,3±0,33	36,7±3,6	54,2±5,1	33±4,3	0,92±0,09	143,3±5,0
AnT	10,9±0,29	45,2±4,8	71,5±4,1	40±4,6	0,99±0,15	161,7±6,1
$O_{2\ max}$	14,8±0,51	56,1±5,2	127,1±8,7	55±5,5	1,25±0,16	188,4±8,2

Note: V, km/h – running speed; O_2, ml/min/kg – relative oxygen consumption; V'E, l/min – pulmonary ventilation; RR, 1/min – respiratory rate; RER, units – respiratory coefficient; HR, beats/min – heart rate.

To solve the purpose and objectives of the study, individual values of aerobic and anaerobic thresholds and maximum oxygen consumption were used at the subsequent stage of the experiment. To perform the maximum speed "hold" test, the IPC speed was used, or the speed at which the athlete stopped after completing the test before "failure" (option 1). And the speed recorded at the aerobic (option 2) and anaerobic thresholds (option 3) as a pedagogical means of recovery in two variants after stopping during the "hold" test, the data are presented in Table 2.

Table 2 – Medical and biological indicators of anaerobic performance and recovery processes in wrestlers

	Retention time	VO2 tot	A VO2	D VO2	La after work	La failure after 3 min. of work	La 3 min rest.	La 6 min rest.	La 12 min rest.
	s	l/min			mmol/l				
Option 1	145±16	9,29± 0,66	8,24± 0,68	1,05± 0,12	11,2± 0,4	12,3± 0,5	12±0,5	8,7± 0,4	7,6± 0,4
Option 2	150±18	10,18± 0,77	9,01± 0,79	1,17± 0,13	11,9± 0,3	14,6± 0,9	12,8± 0,6	10,3± 0,5	7,5± 0,4
Option 3	155±15	9,17± 0,89	8,01± 0,93	1,16± 0,18	12,1± 0,6	14,5± 0,7	11,4± 0,3	9,5± 0,2	7,4± 0,3

Note: VO2 tot - oxygen demand; A VO2 - oxygen intake; D VO2 - oxygen debt; La after work, mmol/L - lactate level after work; La 3 min rest. - lactate level during the recovery period.

According to the results obtained in the sequential experiment, there are no significant differences in the retention time. At the same time, the data on oxygen demand, oxygen supply, and oxygen debt do not differ significantly. However, the most interesting aspect is the dynamics of lactate recovery: the highest values were achieved in the third test, but this can be explained by the fact that the work was performed for a few seconds longer than in the other tests. Moreover, the dynamics of lactate concentration reduction are faster compared to tests that did not involve exercise or testing with subsequent moderate strength training. This may be due to the increased minute blood flow, which is maintained by high-power operation, which in turn activates both oxidative phosphorylation and glycolysis.

CONCLUSIONS

1) When studying the rate of recovery processes after maximum glycolytic work without the influence of pedagogical means of recovery and with pedagogical means of recovery of moderate and high-power zones, it was found that the slowest recovery of the initial level of lactate concentration in the blood was achieved in the test without pedagogical influence by 2.3%. When assessing the rate of recovery processes after maximum glycolytic work using pedagogical means of recovery, the use of locomotion at the level of the aerobic exchange threshold is significantly higher than during rest without locomotion and is equal to 12.3%, but when using high-power pedagogical means, the decrease in lactate concentration at the 3rd minute of recovery is even faster and is equal to 21.4%.

2) Optimal recovery of physiological and biochemical indicators after maximum glycolytic work in terms of the speed of urgent reactions was recorded when performing work at the pulse threshold of anaerobic metabolism (in this experiment, the pulse corresponded to the data for group 161.7±6.1). It is assumed that the specifics of urgent recovery using aerobic-anaerobic (mixed) effects may have a positive impact on repeated physical exertion, which should be taken into account in the operational planning of the training process.

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POWER, IDENTITY AND EQUALITY: THE NEW ERA OF WOMEN'S WRESTLING

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ABSTRACT
The relationship between women and sport is historically charged, as for centuries social perceptions, cultural stereotypes and institutional exclusions limited their participation. From antiquity to the 19th century, sport was viewed as a male activity, while women were confined to marginal or "appropriate" forms of physical exercise. Gradual emancipation and the feminist struggles of the 20th century led to the pursuit of equality, with pivotal developments such as the work of the FSFI and the increasing inclusion of women in the Olympic Games. However, despite institutional progress and European equality strategies, women continue to face inequalities in leadership, funding, media representation and access to professional opportunities. Wrestling is a characteristic example of a sport where gendered perceptions delayed women's acceptance. The first major women's competition was held only in 1987, and Olympic inclusion came in 2004. Today, women's wrestling is expanding rapidly worldwide, with leading nations such as the USA, Japan and Russia, yet progress remains uneven. Factors such as social resistance, lack of infrastructure, financial barriers and limited media exposure continue to hinder many female athletes. Despite these challenges, women's wrestling is becoming a vehicle for empowerment, the dismantling of stereotypes and social change. The strengthening of institutions, the education of coaches, the establishment of safe environments and the promotion of role models are essential prerequisites for sustainable development. The evolution of women's wrestling reflects broader gender equality dynamics in sport, highlighting that women's participation is not merely a matter of athletic opportunity, but also of social justice, recognition and power.
Key words: liberation, recognition, rebirth, dominance, achievement.

INTRODUCTION

The relationship between women and sport in Europe—and globally—is historically, socially and politically charged. Although women's participation in sport has increased dramatically in recent decades, significant inequalities persist, affecting their access to athletic opportunities, their visibility in the media, their involvement in decision-making, and their financial compensation (EIGE, 2017; UNESCO, 2023). Social inequality, cultural norms and long-standing beliefs about supposed "natural differences" between the sexes shaped, for decades, landscapes of unequal treatment and marginalization of women in sport (Hargreaves, 1994; Pfister, 2010).

Gender equality in sport is not merely about numerical representation. It concerns equal access, development, leadership and visibility. Physical activity and sport are not neutral concepts; rather, they reflect and reinforce social power relations, cultural values and the dominant ideologies of each era. Sport, as a profoundly public and spectacular arena, operates simultaneously as a space where strength is showcased and as a field where gender identity is negotiated (Birrell & Cole, 1990). In this context, women's participation in sport serves as an indicator both of the progress of women's rights and of the persistence of social barriers.

From the first tentative female appearances in the Olympic Games of the 20th century to today's struggle for equal representation and media coverage, the European experience reveals a continuous trajectory of struggle, transformation and social advocacy (Krüger & Pfister, 2001). The European Union now recognizes sport as a means of social inclusion, equality and citizen empowerment. The strategy "Equality between women and men in the EU" (2020–2025) includes clear objectives for sport as a vehicle for achieving gender equality (European Commission, 2020).

Nevertheless, the road remains long, especially when one considers the intergenerational reproduction of stereotypes—formed in childhood—that influence girls' participation in sport (Women in Sport, 2024). Despite the significant gains of recent decades, women in sport continue to face a wide range of inequalities: from reduced

access to leadership positions and lower salaries, to limited representation in the media and the perpetuation of gender stereotypes in sporting portrayals (Claringbould & Knoppers, 2012; European Institute for Gender Equality [EIGE], 2020). These inequalities reflect deeper social issues and underscore the need for institutional and cultural reform.

Particularly important is the interaction of gender with other dimensions of identity such as social class, ethnicity, religion, sexual identity or physical ability. The concept of intersectionality (Crenshaw, 1989) offers a valuable analytical tool for understanding how multiple forms of discrimination intersect and affect women's access to sport, revealing that not all women experience sport in the same way.

Even today, despite the widespread rhetoric of equality and female empowerment, professional sport remains a male-dominated arena. Women are often required to prove their athletic worth within a field still perceived as a natural domain of male superiority (Messner, 2002). The commodification of sport and its entanglement with the market and the media further intensify pressures and inequalities, as women's athletic performance rarely receives the same economic and social recognition (Fink, 2015).

The present study aims to present a comprehensive institutional, social and cultural framework within which the position of women in sport is shaped (across different disciplines). Through the synthesis of statistical data, scientific theories, historical overviews and practical examples, it seeks to document both the extent of the progress achieved and the inequalities that persist.

HISTORICAL OVERVIEW

The evolution of women's participation in sport is closely intertwined with the broader social role of women. In ancient civilizations, sport carried strong social and religious dimensions, yet women's participation was almost non-existent or strictly limited. In ancient Greece, physical exercise and athletic contests were a privilege of male citizens, associated with preparation for war and public life (Golden, 2004). Women were excluded from the Olympic Games both as competitors and as spectators, with the sole exception of the "Heraea" Games, in which unmarried women participated in honor of the goddess Hera (Kyle, 2007).

Similar structures can be observed in the Roman Empire, where sport evolved into a spectacular form of entertainment, yet women's involvement was confined to extremely marginal roles, often with a strong sexist or decorative character (Scanlon, 2002). With the spread of Christianity, forms of physical activity associated with hedonism or the public display of the body were deemed sinful, intensifying social constraints on women (Lenskyj, 1986).

Throughout the Middle Ages, sport was not organized as an official social practice, and there were no institutions for mass physical activity or athletic education. Physical exercise appeared in the form of folk games, chivalric tournaments or religious rituals—activities that were almost exclusively male (McIntosh, 1980).

The Renaissance and the Enlightenment laid the foundations for the later acceptance of physical education as an integral part of schooling. However, the notion of gender differences remained powerful. Women were considered biologically and intellectually inferior, more delicate and less capable of physical exertion, especially in activities associated with strength, competitiveness or aggression (Vertinsky, 1994).

Even philosophers who supported women's education, such as Rousseau, proposed forms of exercise aimed at maintaining beauty and health rather than enhancing capability or promoting social autonomy (Rousseau, 1762/1991). The belief that the female body should be kept "healthy" solely for childbirth and reproduction persisted as a dominant ideology for centuries (Hall, 1996).

Among the bourgeois classes of the 18th and 19th centuries, girls' physical training was limited to simple forms of gymnastics, dance and walking—practices that did not threaten their "femininity" nor challenge gender hierarchies (Hargreaves, 1994).

The revival of the Olympic Games in 1896 by Pierre de Coubertin continued the androcentric tradition: women were excluded, as he believed the Games were "neither proper nor interesting" for the weaker sex (Hargreaves, 1994). Nevertheless, just four years later (1900), women succeeded in participating in selected sports such as tennis and equestrian events.

The first half of the 20th century was marked by women's slow but steady struggle for acceptance in sport. The creation of the Fédération Sportive Féminine Internationale (FSFI) in 1921 by French advocate Alice Milliat was a milestone in the history of women's sport. The FSFI organized the first international women's competitions and pressured the International Olympic Committee (IOC) to include more women's events in the Games (Lucas, 2002).

The world wars disrupted sporting activities but also created opportunities for women to assume roles previously denied to them. During World War II, many women worked in factories, joined military units or engaged in physical training as a means of survival, contributing to the post-war shift in attitudes towards them (Cahn, 1994).

After 1945, women's right to participate in sport began to be formally recognized at national and international levels. The IOC gradually increased the number of women in the Olympic Games (albeit slowly), while many European organizations established women's sports federations. The 1970s marked a turning point, as the second wave of feminism brought issues of bodily autonomy, equality and the recognition of women's identity in sport to the forefront (Birrell, 1988).

The progressive inclusion of women occurred at a slow pace, with many Olympic committees delaying the introduction of events such as wrestling or football. A characteristic example is the inclusion of the women's marathon only in 1984 and boxing as late as 2012 (Pfister, 2010; Lenskyj, 2012). At the same time, historical figures such as Alice Milliat—who organized the Women's World Games in the 1920s—played a decisive role in gaining recognition for women in international sport (Guttmann, 1991).

The Olympic Games vividly reflect the evolution of women's presence. The percentage of female athletes has steadily increased over time, as shown in Figure 1.

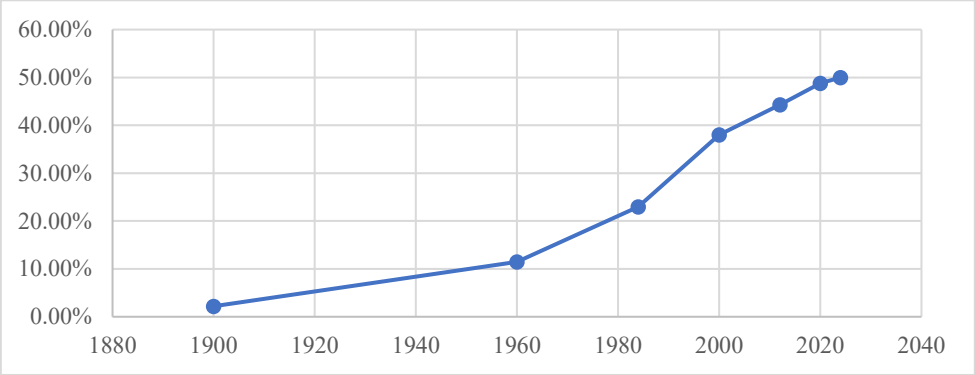

Figure 1. Women's participation in the Olympic Games.

Full gender parity in participation at the Paris 2024 Olympic Games represents a historic achievement; however, qualitative equality—in areas such as sponsorship, media exposure, representation, and judging panels—remains unequal (UNESCO, 2023). Many female athletes report being treated more as "image objects" than as professionals (Bruce, 2016).

In the last decades of the 20th century, there was a significant increase in women's participation in sport at all levels. The ratification of the Amsterdam Treaty (1997) by the European Union enshrined gender equality as a fundamental principle, which also influenced sport-related policies (European Commission, 2007). Concurrently, national governments began implementing measures to strengthen women's presence in mass sport, education, and leadership roles.

In the 21st century, gender equality in sport is increasingly framed as an issue of social justice, democracy, and fundamental rights. The Council of Europe, through the European Sports Charter, explicitly calls for equal access for women to all forms of sporting activity (Council of Europe, 2010). It also recognizes the need to combat violence, sexual harassment, and discrimination.

Nevertheless, progress is neither linear nor uniform. In many countries, women continue to face exclusion from professional sport, remain underrepresented in leadership positions, and are largely invisible in the public sphere

of sport (EIGE, 2020). The challenge today is not only to increase participation, but also to transform cultural perceptions that continue to present the male as the norm and the female as inferior.

Table 1: Key Milestones in Women's Participation in Sport[1]

Period	Event / Milestone	Description
Antiquity	Heraean Games (6th century BCE)	The only athletic competitions for women in ancient Greece.
19th century	Establishment of women's physical education schools	Focused mainly on urban women (e.g., Sweden, England).
1896	First modern Olympic Games	Complete exclusion of women.
1900	First participation of women in the Olympics	Only in five sports (e.g., tennis, golf).
1921	Founding of FSFI (Fédération Sportive Féminine Internationale)	Beginning of international women's competitions.
1948	Increased participation of women in the Olympics	Following World War II.
1970–1980	Influence of the second wave of feminism	Campaigns for equal rights in sport.
1997	Amsterdam Treaty	Gender equality is incorporated into EU law.
2020	Update of EU equality policies	Focus on leadership, education, and equal visibility.

INSTITUTIONAL AND SOCIAL BARRIERS TO GENDER EQUALITY IN SPORT

Gender-based discrimination in sport is a deeply rooted social phenomenon that manifests at every level: from preferences in sport disciplines to the distribution of roles in clubs and leadership positions. Stereotypes are reproduced from early childhood, when girls' participation is confined to "appropriate" feminine sports such as rhythmic gymnastics or ballet, while they are discouraged from engaging in more "tough" sports like wrestling or weightlifting (Coakley & Pike, 2014).

Sexual harassment, psychological abuse, and gender-based violence are ongoing threats to the safety and dignity of women in sport. In a pan-European study (Vertommen et al., 2018), 38% of female athletes reported having experienced some form of abuse during their sporting careers.

Such incidents are often covered up by governing bodies or go unreported due to fear of stigma or exclusion. In wrestling, physical proximity and the requirement to train in mixed environments make the sport particularly vulnerable. Denmark and the Netherlands have implemented protection protocols and reporting hotlines for female athletes, while UWW has recently introduced mandatory coach education (UWW, 2022).

Even today, in several European societies the perception persists that sport is a "male domain" in which women either do not belong or hold a marginal role (Pfister, 2010). This is reinforced by the lower visibility of female athletes, their underrepresentation in sport governance, and the unequal allocation of resources.
The underrepresentation of women in leadership positions in sport is a long-standing challenge. According to EIGE (2022), only 14% of presidential positions in EU sports federations are held by women, despite existing recommendations and strategic frameworks. The lack of institutional presence has serious consequences for the representation of female athletes' needs and the implementation of gender equality policies. Globally, while some countries such as New Zealand and Sweden have introduced quotas or mandatory representation on boards, the vast majority of international sport bodies remain male-dominated. In the United World Wrestling (UWW), for example, until 2020, women made up only 15% of the Executive Board (UWW, 2021).

The way media portray women in sport contributes to the reproduction of discrimination. Research shows that coverage of women's sports is dramatically limited, while emphasis is often placed on appearance rather than

[1] *International Olympic Committee (IOC).*

athletic performance (Bruce, 2016). For example, at the Rio 2016 Olympics, media covered only 38% of women's events compared to 62% of men's (IOC, 2017).

In wrestling, media visibility of female athletes is minimal. Their matches are often not broadcast live, professional profiles on official websites are lacking, and they are largely absent from advertising campaigns. This undermines social recognition and discourages girls from participating.

Women and girls face significant economic barriers to accessing and remaining in sport. These include the cost of club membership, equipment, travel, as well as the lack of women's locker rooms or safe facilities. In many European countries, especially in Eastern Europe, funding for women's sport is limited or absorbed by men's departments (Koca, 2009).

A European Commission (2014) study showed that girls drop out of sport at a 2:1 ratio compared to boys due to a combination of family responsibilities, lack of support, and financial factors. The phenomenon is more pronounced in sports that require constant travel or professional support, such as wrestling or cycling.

WOMEN'S WRESTLING ON THE GLOBAL MAP

Women's wrestling is one of the fastest-growing sports worldwide, with increasing participation at the international level. However, its development shows significant variations depending on geographical, social, cultural and economic factors. Wrestling, as one of the oldest sports, has been referenced since antiquity, but women's participation was extremely limited or non-existent for centuries. The first official competition was the Women's World Championships, held in 1987, while women's wrestling made its Olympic debut at the 2004 Athens Games (United World Wrestling, 2023). Social acceptance and traditional gender roles play a central role in the development of women's wrestling. In countries with more conservative societies, access to contact sports is difficult (Saavedra, 2009). In contrast, in countries with more egalitarian social structures, women's wrestling flourishes (Pfister, 2010).

Development of Women's Wrestling (Countries – Continents)

The United States has emerged as a global leader in women's wrestling, thanks to university programs such as NCAA Women's Wrestling, which promote the sport among young athletes and offer scholarships (Wolfe, 2016). In 2024, more than 6,000 women's wrestling teams were recorded in schools and colleges (National Wrestling Alliance, 2024).

Japan leads the way in Asia, with well-organized sports schools and support from national governing bodies. Wrestling is considered an important sport for enhancing women's physical fitness (Kobayashi & Nakata, 2019). Notably, champion Saori Yoshida has claimed 13 world titles and 3 Olympic medals (United World Wrestling, 2023).

India is experiencing rapid progress, with Vinesh Phogat becoming a symbol of development (International Wrestling Federation, 2022).

China is heavily investing in sports, and women's wrestling has gained ground through school-based programs.

Europe presents a high degree of variation in its level of development. Traditionally strong wrestling nations such as Russia, Ukraine, Belarus and Sweden have robust teams and high participation. Additionally, countries such as France, Italy, Turkey and Poland have made significant progress in recent years.

Russia: According to the Russian Wrestling Federation (2023), women's participation in wrestling increased by 20% over the past five years, with a high number of athletes in national and international championships.

Ukraine: Despite sociopolitical challenges, Ukraine maintains high participation levels and has produced world champions (Ukrainian Wrestling Federation, 2023).

Sweden: With 2,500 registered athletes in 2023, Sweden actively promotes women's wrestling through school and club programs (Swedish Wrestling Federation, 2023).

France: France has increased investment in wrestling, recording a 15% annual growth in women's participation (French Wrestling Federation, 2023).

Italy: With a strong historical wrestling tradition, Italy supports women's wrestling through the national sports network (Italian Wrestling Federation, 2023).

Turkey: Turkey invests in youth development and women's participation, achieving significant growth (Turkish Wrestling Federation, 2023).

Poland: Poland shows steady growth in women's participation, with a 12% annual increase (Polish Wrestling Federation, 2023).

Women's wrestling in Africa is still in an early stage of development due to social and economic barriers, but countries such as Nigeria, Egypt, Morocco and South Africa show clear signs of improvement.

Nigeria: Blessing Oborududu has become a role model, winning numerous medals in continental and world competitions (United World Wrestling, 2023).

Egypt: Promotes women's wrestling through state-supported sports programs (Egyptian Wrestling Federation, 2023).

Morocco: Develops new academic and athletic programs for women (Moroccan Wrestling Federation, 2023).
South Africa: Significant growth in school programs in recent years, with a 10% increase in participation since 2018 (South African Sports Commission, 2022).

Women's wrestling in Oceania—especially in Australia and New Zealand—shows steady development with an emphasis on school and university programs.

Australia: Participation increased by 18% over the past five years (Australian Wrestling Federation, 2023).

New Zealand: Actively promotes the sport within local communities (New Zealand Wrestling Federation, 2023).

Table 2 presents statistics (number of female athletes and percentage increase in participation over the last five years) for women's wrestling at the global level.[2]

Table 2. Summary Statistics for Women's Wrestling at the Global Level

Region	Number of Female Athletes	Participation Increase (Last 5 Years)	Key Countries
North America	15,000+	+40%	USA, Canada
Europe	14,000+	+25%	Russia, Ukraine, Sweden
Asia	12,000+	+45%	Japan, India, China
Africa	4,000+	+20%	Nigeria, Egypt, South Africa
Oceania	1,500+	+18%	Australia, New Zealand

CONCLUSIONS

Women's wrestling has undergone a long trajectory of development, moving from complete absence for many decades to being recognized as an official sport with international competitions and inclusion in the Olympic Games. This sport is not merely an opportunity for physical expression and athletic participation, but also a vehicle for social change, equality and the empowerment of women on a global scale. Participation of women in a sport such as wrestling often challenges traditional gender roles and social norms. In many parts of the world, particularly in societies with conservative views on the role of women, wrestling is met with caution or even resistance. Empowerment through athletic involvement—especially in contact and strength-based sports—poses a challenge not only for the athletes themselves but also for the communities that surround them.

[2] United World Wrestling, 2023; NCAA, 2023; Russian Wrestling Federation, 2023.

Nevertheless, the development of women's wrestling contributes to a wider shift in mindsets, promoting equality, self-confidence and the recognition of women as equal athletes. In the Americas and Europe, where social attitudes tend to be more progressive, women's wrestling has become a fully accepted sport, with thousands of young female athletes participating in school, collegiate and national championships. However, the challenge persists in regions where gender roles are more strictly defined. The sustainable development of women's wrestling requires the presence of organized structures, funding, coach education and programs specifically designed for women. Countries with well-developed sports systems—such as the United States, Japan, Russia and various European nations—demonstrate greater success and consistent growth in participation (Green & Oakley, 2001).

Investment in infrastructure and injury-prevention programs, as well as the creation of incentives for young female athletes, is crucial for the long-term stability of the sport. Collaboration with schools and universities, where women's wrestling has developed as an academic sport (such as within the NCAA in the United States), serves as a model that can be applied in other countries as well (Wolfe, 2016). The global landscape shows significant diversity in development. The United States stands out for its mass participation and competitive success. Japan and Russia maintain a high level of elite performance, while countries such as India and China are investing in new generations Of athletes, producing internationally recognized champions.

In Europe, the range is broad. From historically established wrestling nations like Russia and Ukraine to emerging countries such as Turkey and Poland, women's wrestling evolves under varying conditions, shaped by social and economic factors.

In Africa and Oceania, despite an initially slower progression, positive indicators suggest that wrestling is becoming increasingly popular and accessible, primarily through school programs and national initiatives.

The future development of women's wrestling will depend on multiple factors: social acceptance, support from sports organizations, equality-driven policies, and financial investment. It is vital that efforts continue towards:

- Training and education of coaches specialized in women's wrestling.
- Creating safe and welcoming training environments.
- Promoting wrestling in schools and universities.
- Raising societal awareness of the value of women's participation in sports.
- International cooperation for the exchange of expertise and best practices.

With the right support, women's wrestling can become a powerful example of social change, offering women not only athletic opportunities but also a strong message of equality and empowerment.

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COMPARATIVE ANALYSIS OF SPEED CHARACTERISTICS WHEN USING CLUSTER SETS IN BENCH PRESS FOR GRECO-ROMAN WRESTLERS

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ABSTRACT
In the course of the pilot study, the effectiveness of traditional strength training and the cluster set method was compared with an equal ratio of load and rest time for Greco-Roman wrestlers in terms of the speed of the bench press. The analysis was carried out on the basis of kinematic characteristics during the exercise. The results showed that the use of cluster approaches contributes to achieving higher acceleration values compared to the traditional training method. However, the revealed differences did not reach statistical significance with a confidence level of $p < 0.05$. The data obtained indicate the prospects of using cluster training as a tool for individualizing and optimizing athletes' strength training.

Keywords: cluster sets; traditional strength training; speed and strength training; intra-set rest; bench press; neuromuscular fatigue; Greco-Roman wrestling; perceived load; kinematics of movement.

INTRODUCTION

Sport involves performing motor actions (jumps, punches, lunges, throws) with high speed and strength. Therefore, the development of speed and strength qualities is one of the key tasks of sports training. The effectiveness of strength training is determined by a combination of parameters: load, intensity, duration, number of repetitions and rest intervals [6, 7]. In the traditional method (Traditional resistance training (TRT)), exercises are performed continuously within the approach, which contributes to the development of muscle mass and strength [11, 12]. However, the question arises about the comparative effectiveness of alternative load management schemes. One of these techniques is cluster training. Cluster Sets (CS) involve dividing the approach into mini-blocks with a short intra-network rest. This helps to reduce the severity of fatigue and improve the quality of exercise [13, 15]. Modern research shows the positive effect of CS on strength, power, and athletic performance [1, 5]. Among the various CS variants, the scheme with an equal Work-to-Rest Ratio (EW: R) is of particular interest [14]. Currently, five concepts have been formulated in the theory of cluster training: intra-set rest (IR), inter-set rest (IRR), rest-pause (RP), rest-redistribution (RR), and equal the ratio of work and rest (equal work-to-rest ratios (EW: R)) [5, 14].

PURPOSE

The purpose of the study was to evaluate the effect of cluster sets on the speed of bench press of Greco-Roman wrestlers.

ORGANIZATION AND RESEARCH METHODS

The experiment was conducted in January 2025 at the Department of Theory and methodology of martial Arts RUS "GTSOLIFK". 10 Greco-Roman wrestlers (age 18 ± 2 years) took part in the experiment. Prior to the start of the experiment, one repeated maximum (1PM) was determined in the bench press. The study participants came in the morning and performed complex I and complex II sequentially, with a 30-minute break between the complexes. Each athlete performed both sets, first TRT, then CS. The protocol of the exercises performed by the study participants:

TRT (Complex I): 3×8 repetitions (24 in total), load 85% 1PM, inter-approach rest (IRR) - 60 seconds.

CS (Complex II, EW: R): 24 repetitions at 85% 1PM, performed in 8 mini-sets of 3 repetitions each. The IR was calculated using the formula:

$$IR = \frac{2 \times IRR}{(N/3) - 1}, \quad N = 24,\ IRR = 60$$

$$IR = \frac{120}{7} \approx 17{,}1 \text{ сек.}$$

METHODS

The kinematic analysis of the rod movement was carried out using an inertial measurement system. Data processing included the calculation of descriptive statistics, analysis of variance (the Kruskal–Wallis criterion) and regression modeling. All calculations were performed in the Python environment (Jupyter Notebook, Google Colab).

RESULTS AND DISCUSSION OF THE STUDY

The comparison of the techniques was carried out based on the analysis of the kinematic parameters of the movement of the bar. For the initial assessment of the data, descriptive statistics of the exercise were calculated according to the two schemes under study. Results on barbell accelerations during bench press according to the cluster set scheme (Table 1).

Table 1 Parameters of descriptive statistics of bar accelerations (m/s2) when performing bench press according to CS scheme

Parameter	Athlete №							
	1	2	3	4	5	6	7	8
Mean	0.965	0.972	0.983	0.971	0.946	0.989	0.996	0.992
Standard deviation	0.348	0.351	0.265	0.269	0.212	0.267	0.315	0.276
Minimum	-0.559	-0.789	-0.378	-0.362	-0.513	-0.405	-1.333	-1.052
25th percentile	0.840	0.893	0.937	0.885	0.872	0.918	0.934	0.938
The median	0.952	0.972	0.991	0.974	0.964	0.988	0.990	0.989
75th percentile	1.039	1.023	1.032	1.023	1.016	1.016	1.046	1.024
Maximum	4.599	5.041	3.936	4.719	2.176	2.809	4.105	2.846

Slight differences between the mean and median values indicate that the distribution is close to normal. At the same time, various strategies for controlling the movement of the projectile can be traced: the first and fourth athletes focus on acceleration followed by smooth braking; the second and seventh emphasize both acceleration and deceleration; the third and eighth mainly focus on the deceleration phase; the fifth and sixth prefer to perform the exercise smoothly, with relatively small accelerations. Examples of differences in the distribution of accents by module depending on the approach number (Fig. 1).

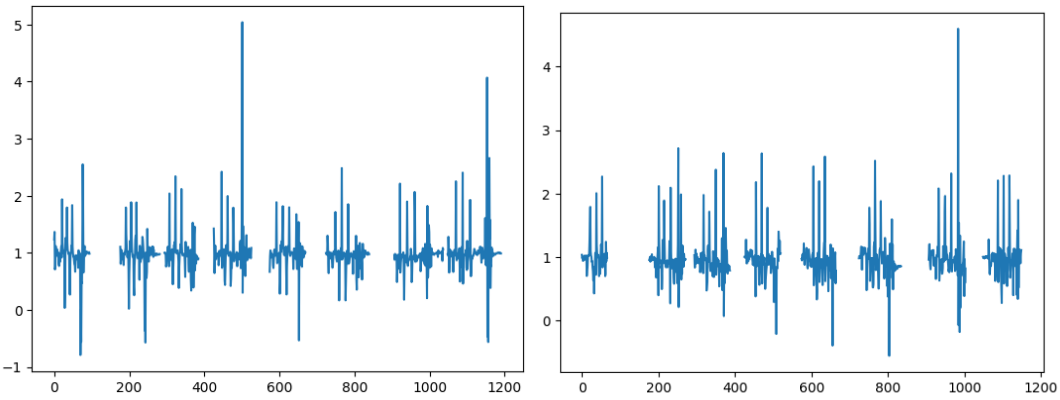

Fig. 1. Acceleration values (m/s2) when performing CS exercises with an emphasis at the end of the series and in the middle, with lower acceleration values at the end

For comparison, let's consider the descriptive statistics of barbell accelerations when performing bench press according to the traditional scheme (Table 2).

Table 2. Parameters of descriptive statistics of bar accelerations (m/s2) when performing bench press according to the TRT scheme

Parameter	Athlete №							
	1	2	3	4	5	6	7	8
Mean	0.979	0.947	0.985	0.920	0.916	0.941	0.967	0.986
Standard Dev.	0.358	0.301	0.267	0.262	0.236	0.306	0.292	0.338
Minimum	0.277	0.395	0.420	0.209	0.015	-0.655	-0.637	-0.833
25th Percentile	0.872	0.875	0.918	0.877	0.812	0.827	0.893	0.921
Median	0.981	0.952	0.986	0.976	0.944	0.963	0.985	0.985
75th Percentile	1.070	1.005	1.033	1.021	1.012	1.005	1.044	1.028
Maximum	2.502	2.502	4.333	2.228	2.485	2.516	3.664	4.575

We observe a similar pattern in terms of the proximity of the mean and median values, as well as the presence of different approaches to focusing on acceleration and deceleration of projectile movement. Considering all the available execution styles, it can be noted that the first emphasis, determined by the value of the module, falls on the third, and more often the fourth movement. This corresponds to the consideration of accelerations when performing exercises according to the traditional scheme (Fig. 2).

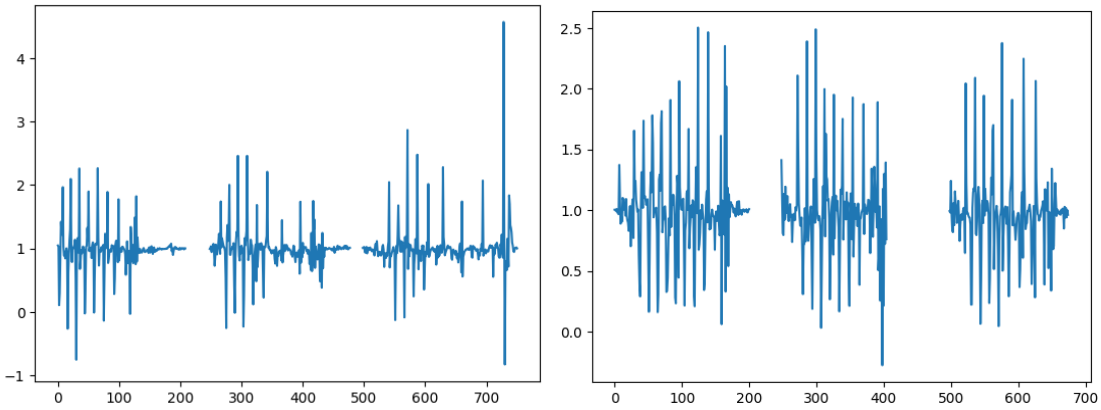

Fig. 2. Acceleration values (m/s2) when performing exercises according to the TRT scheme with an emphasis at the end of the series and in the middle, with lower acceleration values at the end

For the TRT scheme, the "smooth" execution of exercises without pronounced accents can be considered typical, while there are cases of emphasis on the last movement of the series. This situation may indicate that during the first three lifts of the barbell, the athlete develops and adapts to the exercise, after which he can consciously emphasize individual movements of the series. Among other things, the individual characteristics of athletes can be traced, who either perform the entire series "smoothly" avoiding accents, or at the end of the workout they try to immediately show their maximum capabilities, or "save resources" to show the maximum at the end of the exercise. At the same time, it is worth noting that in most cases athletes achieve high acceleration values when performing exercises according to the CS scheme. Individual differences do not allow us to claim a single model of exercise performance inherent in all athletes, and in the future it is advisable to compare the results by average and median values. It should be noted that the interval in which the acceleration values change is somewhat smaller than in the CS scheme. Among other things, according to the analysis of descriptive statistics, athletes achieve slightly higher acceleration values when performing CS exercises based on average and median values. To clarify the significance of these differences, a variance analysis was performed (Table 3).

Table 3. The results of the variance analysis of the exercises according to the studied schemes

Execution scheme	Average acceleration value	Median Acceleration	Median acceleration H-Kruskal–Wallis criterion	*p*-value
8×3	0.97675	0.9775	2.482	0.115
3×8	0.95513	0.9715	1.220	0.269

The multidimensional Kraskel-Wallis H-criterion was used for the analysis as it is less demanding on the distribution features of the studied quantity. As a result, it was noted that despite the tendency to increase acceleration values in terms of both the average and median values of significant differences in speed and strength training of athletes when using the two schemes under study with specified accuracy criteria ($p<0.05$), the differences did not reach statistical significance.

LIMITATION OF THE STUDY

Despite the popularity of VBT (velocity-based training) with speed loss control (VL) in sports [10] and meta-analysis data confirming its effectiveness for developing strength and power [2, 16], the practical application of the method is limited. The main problems are related to the instability of the VL threshold and the low accuracy of its prediction [4], the high cost and technical complexity of equipment, the need to train specialists, as well as ignoring interindividual differences in athletes' reactions. An additional factor is the limited validity of studies performed primarily in the laboratory (for example, using the Smith simulator [9]), which reduces the possibility of transferring the results into practice. Meta-analyses also did not reveal convincing advantages of VBT compared to traditional methods [8]. Thus, the use of the speed loss threshold can be considered as an additional tool in the trainer's arsenal, especially in the framework of individualized programs, where it is possible to control conditions and accurately measure speed [3].

CONCLUSION

The pilot study made it possible to evaluate the influence of cluster sets (CS, 8x3, EW:R scheme) and traditional techniques (TRT, 3x8) on the speed and strength indicators of Greco-Roman wrestlers. The following conclusions can be drawn from the results obtained:

1. When performing CS, athletes, as a rule, achieved higher acceleration values compared to TRT, although no statistically significant differences were found ($p < 0.05$).
2. Different emphasis distribution strategies indicate individual characteristics of motor control and fatigue.
3. Cluster sets can be considered as an effective alternative to the traditional method, which reduces fatigue and increases the variability of movements.

The results require confirmation in an expanded sample, but they already indicate the expediency of using CS as a tool for individualizing and optimizing strength training. Additional randomized controlled trials in this area are required.

The authors' contribution to the publication. A.V. Shevtsov, A.B. Miroshnikov – concept and design of the study; A.V. Shevtsov – collection of material and writing of the text. Other authors A.I. Laptev, A.V. Ermakov – collection of material.

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COMPARATIVE ANTHROPOMETRIC ASSESSMENT OF HEIGHT AND WEIGHT IN WRESTLERS FROM SPECIALIZED SPORTS SCHOOLS AND NON-ATHLETE HIGH SCHOOL STUDENTS IN BULGARIA

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ABSTRACT
The present study aims to analyze and compare the anthropometric indicators of height, weight, and Body Mass Index (BMI) among students from sports schools practicing freestyle wrestling and their peers from general education high schools. The research sample included 60 students (33 boys and 27 girls). The main anthropometric measurements—body weight and height—were used to calculate BMI according to the Quetelet formula (1835). The results indicate that the average BMI values of wrestling students (22.7) were lower than those of high school students (25.2). It was found that 15% of the wrestling students were overweight, compared to 39.2% among the general high school group. The findings confirm the positive impact of systematic wrestling training on body composition, proportions, and physical development. The study highlights the essential role of sports as an effective means for preventing overweight and promoting healthy physical activity habits among adolescents.
Keywords: anthropometry, body mass index, sports schools, high schools, wrestling, physical development

INTRODUCTION

In recent decades, humanity has undergone a profound transformation in lifestyle, largely driven by the rapid integration of modern technologies into all spheres of society. Although technological progress undoubtedly offers significant benefits, it has also led to a substantial reduction in physical activity and exertion both in the workplace and in daily life. The World Health Organization (2024) emphasizes that physical inactivity is one of the leading risk factors for premature mortality and the development of chronic non-communicable diseases such as cardiovascular disorders, type 2 diabetes, depression, and certain types of cancer. Research by Lee et al. (2012) confirms that the absence of regular physical activity shortens life expectancy and significantly increases the incidence of major socially significant diseases. Furthermore, the contemporary lifestyle—characterized by prolonged sitting and limited movement—is associated with various metabolic disturbances, even among individuals who meet the minimum recommended levels of physical activity (Owen, Healy, Matthews, & Dunstan, 2010). These trends have led to a rapid increase in the global prevalence of overweight and obesity, which have reached "epidemic proportions." Meta-analyses by Guh et al. (2009) indicate that obesity is a major etiological factor in the development of numerous chronic diseases, including cardiovascular, musculoskeletal, and degenerative conditions. Thus, maintaining an optimal level of physical activity is not only a matter of individual health but also a strategic public health priority.

Anthropometric indicators such as height and body weight are among the most important parameters for evaluating physical development, body composition, and the health status of adolescents. They provide objective information about growth, body proportions, and physical fitness, while also serving as indicators of the effects of systematic physical activity and lifestyle (Malina, Bouchard, & Bar-Or, 2004). The measurement and analysis of these parameters enable well-grounded conclusions about the relationship between physical activity and morphological development in school-aged youth.

Wrestling is a unique sport in which the optimal balance between body weight, strength, and endurance is crucial for athletic performance (Iliev, 2016). Moreover, the issue of weight reduction has always been relevant in weight-category sports (Makaveev & Nikolov, 2013). Systematic wrestling training significantly affects athletes' somatic characteristics by increasing muscle mass and reducing subcutaneous fat. Wrestlers typically display a mesomorphic body type characterized by well-developed musculature and balanced proportions, which provides an advantage in dynamic competitive encounters (Sterkowicz-Przybycien, Sterkowicz, & Zarow, 2011).

During adolescence, systematic wrestling training plays a significant role in the body's adaptive processes. Numerous studies show that regular wrestling practice improves muscle strength, endurance, and bone density, as well as induces beneficial changes in body composition (Cvetkovic, Maric, & Marelic, 2005). The authors note that sport-specific loads and training frequency stimulate processes that increase muscle mass and bone mineral content—key factors for physical preparedness and resilience in young wrestlers. However, particular caution is required when planning training during puberty, a period marked by disproportionate development of organs and systems and substantial endocrine changes, which can lead to diminished adaptive capacity, reduced work capacity, and slower post-exercise recovery (Iliev & Nikolov, 2013).

Studies on schoolchildren of different ages reveal that regular physical activity is negatively correlated with elevated BMI levels (Janssen & LeBlanc, 2010). Students who participate in sports programs or attend sports schools have a significantly lower risk of overweight and better muscle tone compared to their peers from general high schools (Mota et al., 2005).

Among wrestlers, compared to non-athlete peers, lower levels of body fat, higher relative muscle mass, and better proportionality of body segments are often observed (Kraemer et al., 2001). These characteristics reflect physiological adaptations to the specific training demands involving high intensity, frequent practice, and a combination of strength and aerobic exercises typical of wrestling.

Research on young wrestlers indicates that systematic and intensive training, combined with an appropriate nutritional regimen, does not hinder growth; on the contrary, it supports normal development and mineralization of the musculoskeletal system (Camic et al., 2009). These findings highlight the importance of a well-structured training process among students in sports schools, where training loads are daily and intensive, and where physical development must be continuously monitored by coaches and specialists.

In Bulgaria, systematic participation in wrestling has long-standing traditions, and the sport continues to produce the highest number of Olympic and world medalists. Therefore, studying the physical characteristics of young wrestlers is essential both from a sports science and a social perspective.

We assume that the body mass index (BMI), determined through measurements of body weight and height among students from specialized sports schools who actively practice freestyle wrestling, will be more favorable compared to the BMI of students from general education high schools.

PURPOSE OF THE STUDY

The purpose of the study was to determine and compare the body mass index (BMI) by measuring body weight and height among students from specialized sports schools practicing freestyle wrestling and students from general education high schools.

The object of the study includes body weight and height measurements of students (boys and girls) from sports schools specializing in freestyle wrestling, as well as students from general high schools.
The study encompassed a total of 60 students (33 boys and 27 girls) with an average age of 15.6 ± 1.2 years. Participants were divided into two groups: 30 students from sports schools (7 girls and 23 boys) and 30 students from general high schools (19 girls and 11 boys).

METHODOLOGY

1. **Review and theoretical analysis of specialized literature.**
   Throughout the study, relevant literature sources in Cyrillic and Latin, as well as online scientific resources, were examined.
2. **Anthropometric measurement methods.**
   For the purposes of the research, two primary anthropometric indicators were used—height and body weight. Based on these measurements, and with the use of Table 1, individual body mass index (BMI) values were calculated according to the Quetelet formula (Quetelet, 1835).

Based on the obtained BMI values, the students were classified into the following categories:

- **Underweight:** BMI below 18.5
- **Normal weight:** BMI between 18.5 and 24.9
- **Overweight:** BMI between 25.0 and 29.9
- **Obesity:** BMI above 30

This classification made it possible to evaluate the body status of the examined students.

Table 1. Classification for Determining Body Mass Index (BMI)

Underweight	Below 18.5
Normal weight	18.5 – 24.9
Overweight	25 - 29.9
Obesity	30 +

3. **Formula for calculating BMI (Body Mass Index)**, developed by Quetelet (1830), where BMI is calculated as body weight (m) divided by height (h) squared:
   BMI = Weight (m) / Height (h)²

- (m) represents body weight in kilograms.
- (h) represents body height in centimeters.

The mathematical and statistical processing of the data was carried out using Microsoft Office Excel 2020.

RESULTS

The average height values (Figure 1) among students from the sports schools were 169 cm, with an average of 165 cm for girls and 170 cm for boys.

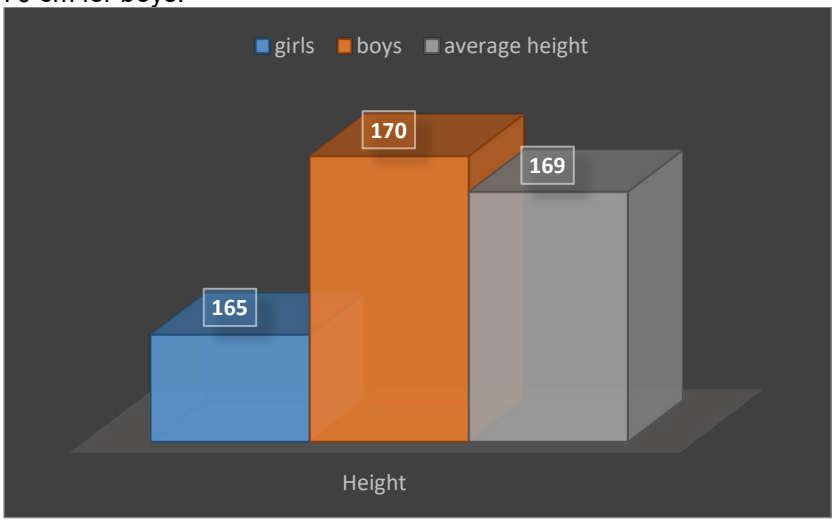

Figure 1. Average height values – boys and girls (sports school)

In terms of body weight distribution (Figure 2), the following results were recorded: 69 kg for boys and 57 kg for girls, with an overall average of 66 kg.

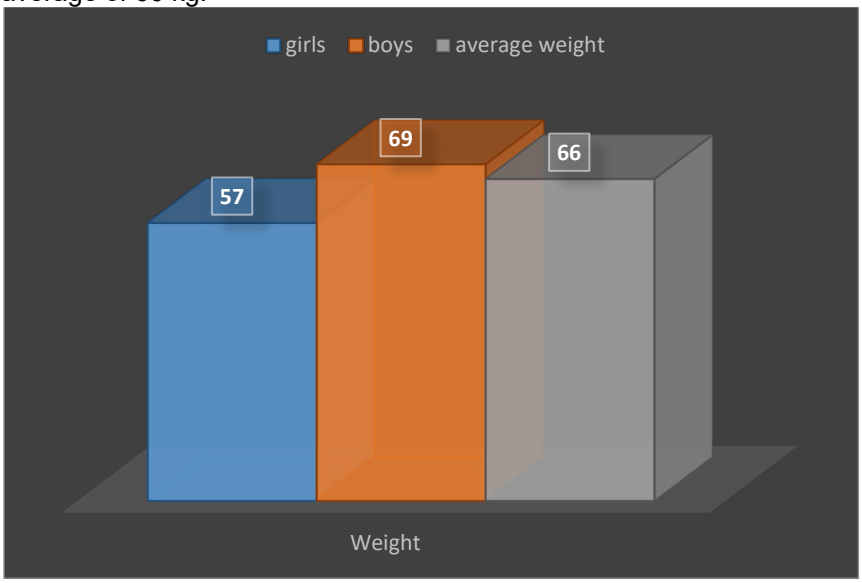

Figure 2. Average body weight – boys and girls (sports school)

The distribution of body mass index (BMI) yielded values of 23.5 for boys, 20.1 for girls, and an overall average of 22.7, presented in Figure 3.

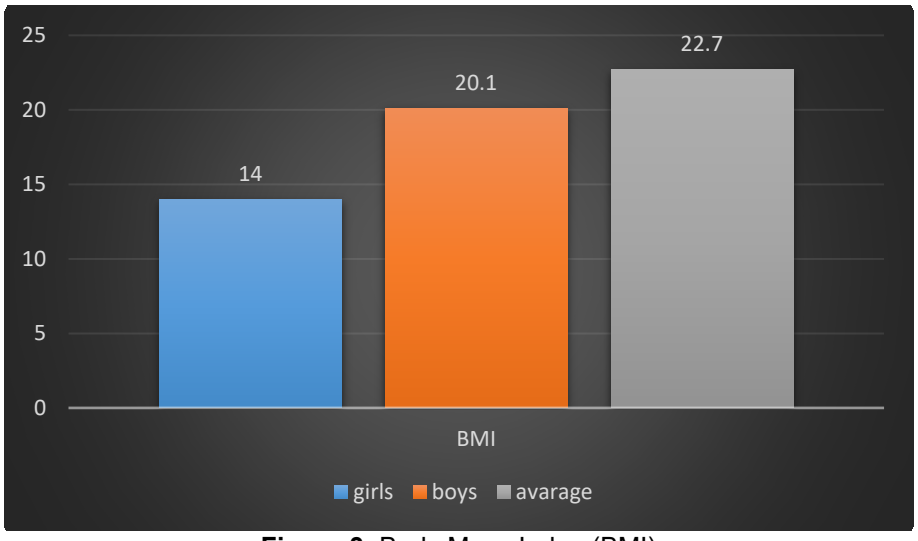

Figure 3. Body Mass Index (BMI)

Within the entire sports school group, 15% of the students were classified as overweight. Among the girls, the average rate was 14%, with only one out of the seven freestyle wrestling athletes being overweight. One female student (approximately 5%) was categorized with Class I obesity. Among the boys, 17% (4 students out of 23) were classified as overweight.

The average height values among high school students were 164 cm, with 158 cm for girls and 172 cm for boys, as shown in Figure 4.

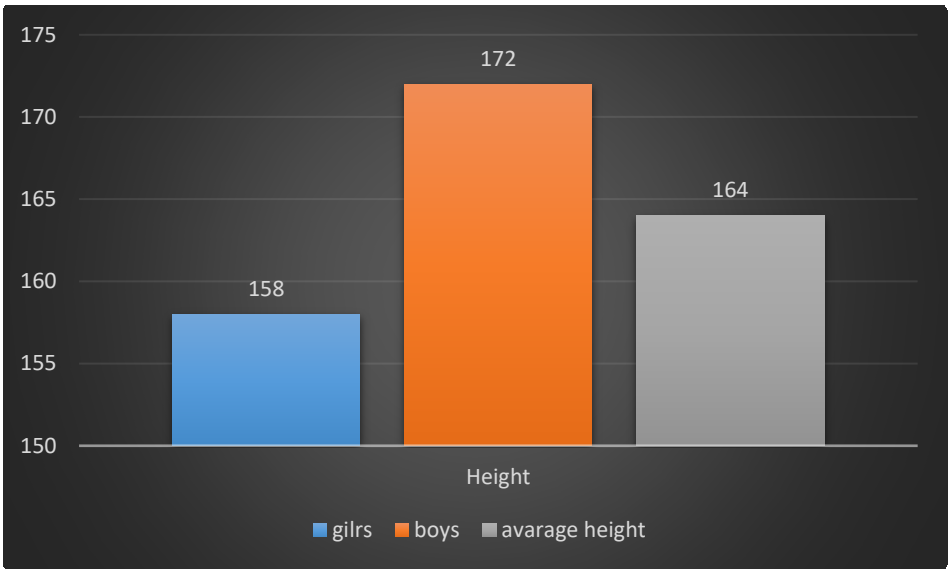

Figure 4. Average height values – boys and girls (high school)

For body weight (Figure 5), the results showed 75 kg for boys and 64 kg for girls, with an overall average of 68 kg.

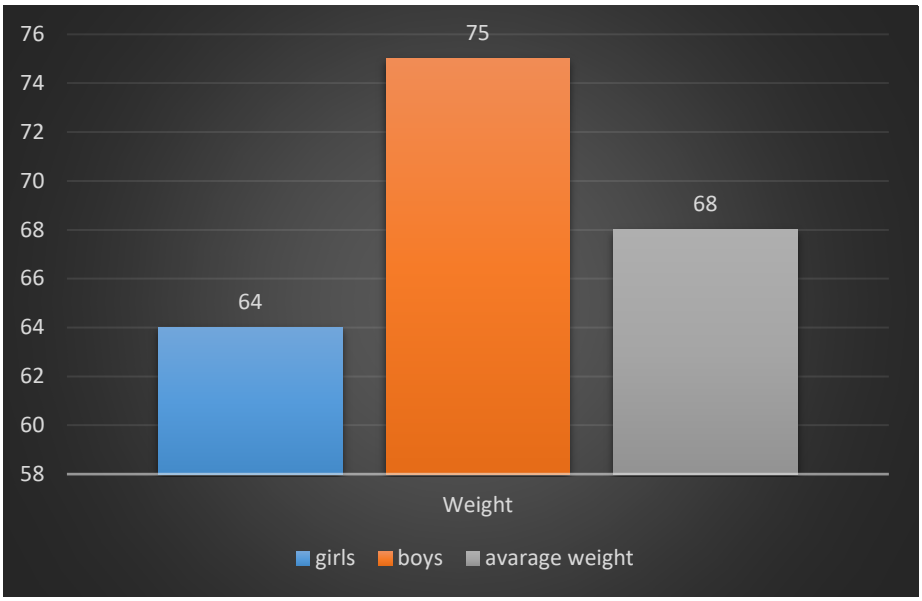

Figure 5. Average body weight – boys and girls (high school)

Figure 6 presents the distribution of BMI values. The results showed a BMI of 25.25 for boys, 25.28 for girls, and an overall average of 25.265.

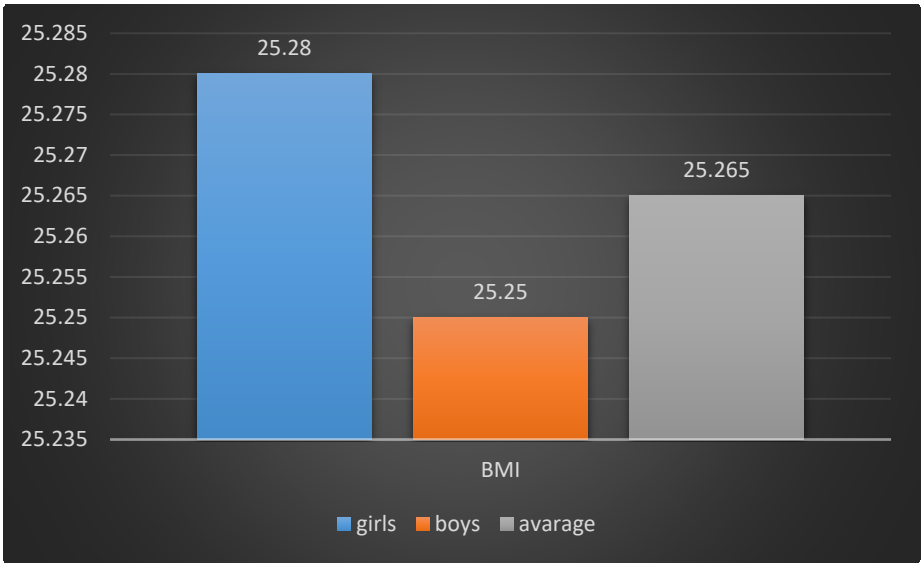

Figure 6. Body Mass Index (BMI)

It was established that 39.2% of the entire high school group were overweight. Among the girls, 31% were overweight, and 5% (one student) were classified with Class II obesity. Among the boys, 58% were overweight. When comparing the overall results for BMI between the sports school and high school students, the average BMI in the sports schools was 22.7, while that of the high school students was 25.2, representing a difference of 2.5, with the upper limit of normal being 24.9 (Figure 7).

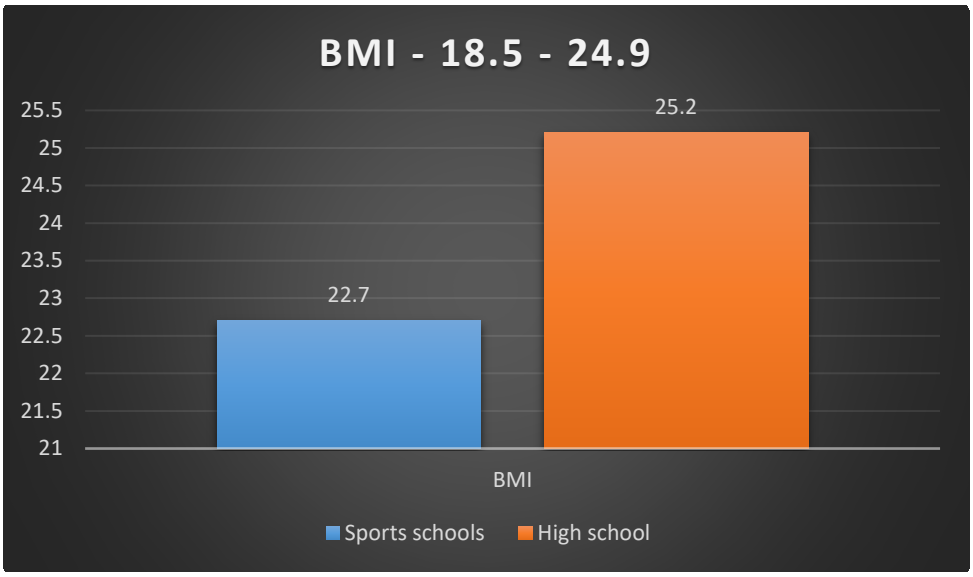

Figure 7. Body Mass Index (BMI) – sports schools vs. high school

The obtained data confirm the initial hypothesis that participation in freestyle wrestling has a positive influence on body mass index (BMI). Measurements of body height and weight among students from sports schools actively practicing freestyle wrestling showed more favorable values compared to those of students from general education high schools.

We believe that the higher BMI values observed among wrestlers from the sports schools are justified by the presence of greater muscle mass, as well as the inclusion of athletes competing in heavier weight categories, which contributes to increased body weight due to the greater density and mass of muscle tissue.

DISCUSSION

The results clearly demonstrate distinct differences between students engaged in athletic training and those who do not participate in regular sports activities. The actively training wrestlers exhibit more favorable values of body composition and BMI, which confirms the importance of systematic physical activity for maintaining optimal body weight and proportions.

The lower BMI observed in the athletic group indicates better muscle tone, a lower percentage of subcutaneous fat, and a healthier metabolic profile. Conversely, the higher BMI among non-athlete high school students suggests reduced physical activity levels, which may increase the risk of overweight, obesity, and related health problems later in life.

These findings align with the conclusions of numerous researchers emphasizing that sports participation during school age has a preventive function and contributes to the development of healthy habits and proper physical culture.

The comparative analysis of anthropometric indicators between athletic and non-athletic students reveals that regular training in specialized sports schools leads to better physical development, an optimal body mass index, and more balanced height–weight proportions.
The study confirms the significant role of sport—and wrestling in particular—as a powerful tool for physical education, health promotion, and social integration among adolescents.

Recommendations

- Based on the results, we recommend wrestling as an effective component in comprehensive weight-management strategies for overweight youth.
- Increase the duration and frequency of structured physical activity within schools.
- Implement individualized motor activity programs tailored to age and sex differences.
- Conduct regular anthropometric assessments to monitor physical development and early identify deviations.

CONCLUSION

A comparison of height and weight data between student wrestlers and non-athlete high school students provides valuable insight into the impact of systematic physical activity on growth and overall physical status. The conclusions and recommendations derived from this study may be beneficial for current and future coaches, parents, and educators. It is essential to adopt comprehensive approaches that involve active participation from children, their parents, and close family members.

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SUMMARY OF COMPETITION PERFORMANCE AT THE SENIOR WORLD WRESTLING CHAMPIONSHIPS (ZAGREB, 2025)

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GENERAL INSIGHTS

EUROPE BRINGS QUANTITY – ASIA BRINGS QUALITY

Nearly half of all competitors came from Europe (49.2%), but Asia proved far more efficient – with 22.7% of their wrestlers' winning medals

ALL STYLES

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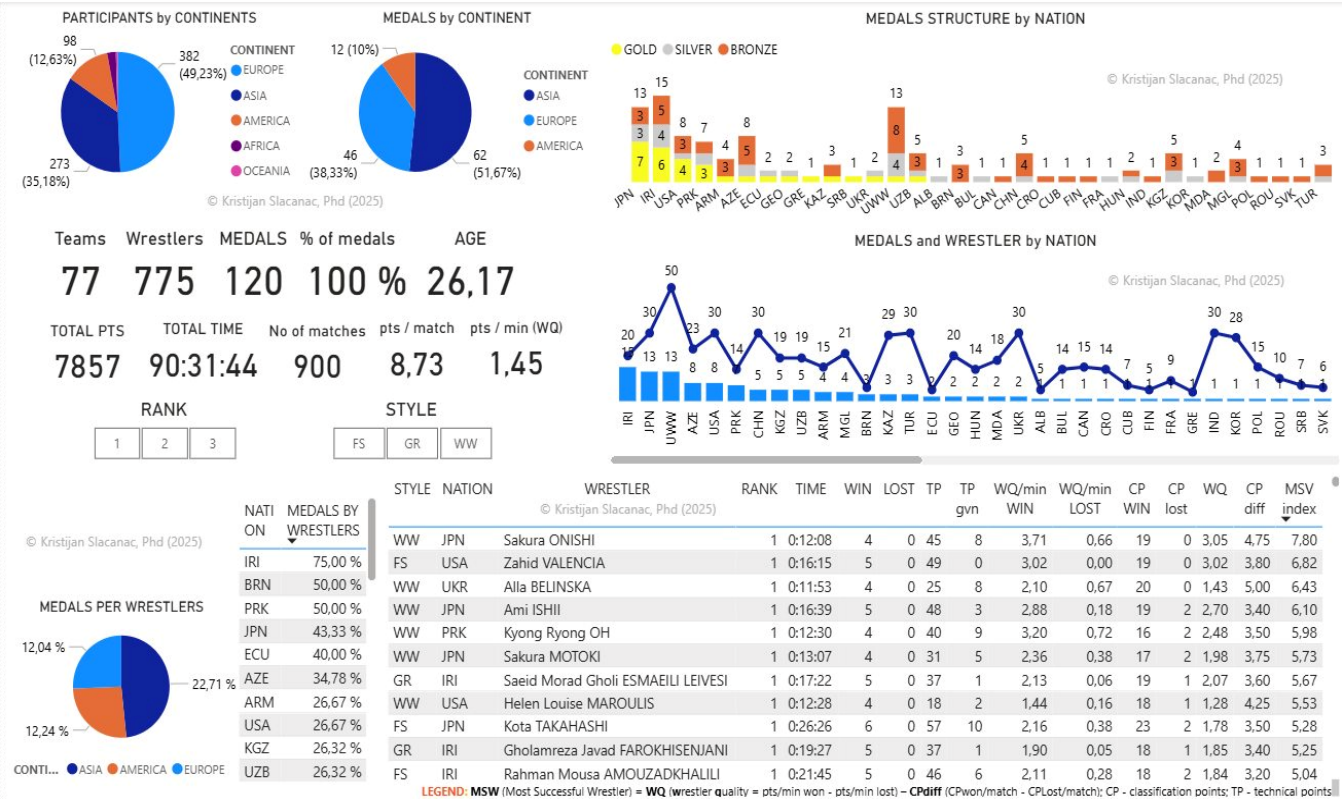


Iran was the most successful by efficiency: 75% of their wrestlers took medals, followed by Bahrain (50%) and PRK (50%).

Comparing trends with the Paris 2024 Olympic Games:
Asia increased its medal share (50.0% → 51.7%).
America fell sharply (22.2% → 10.0%).

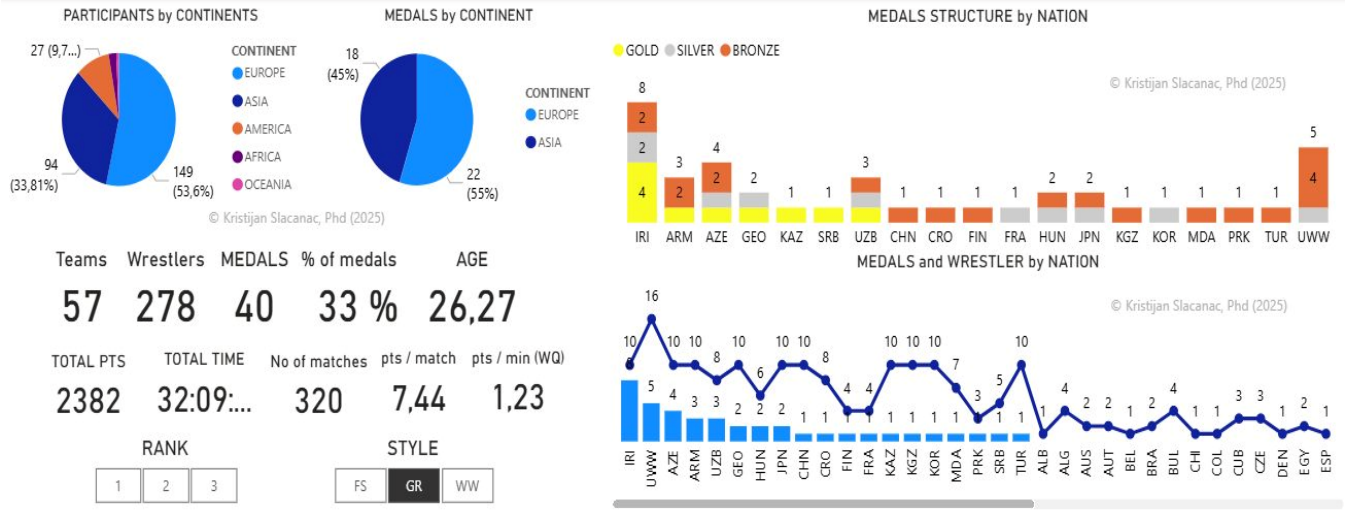
By style: Asia dominated FS (57.5%) and WW (52.5%), while Europe led in GR (55.0%). Notably, American wrestlers did not win a single GR medal.

33 national teams won medals. Top performers were:
Japan: 7 Gold – 3 Silver – 3 Bronze
Iran: 6 Gold – 4 Silver – 5 Bronze
USA: 4 Gold – 1 Silver – 3 Bronze

Some large delegations struggled with efficiency:
KAZ (29/3), TUR (30/3), UKR (30/2), IND (30/1), KOR (28/1).

Performance stats:
Medal winners: 7.7 pts/match and 2.65 pts/min.
Average age: 26.2 years (gold medallists slightly younger at 25.5).

GRECO-ROMAN



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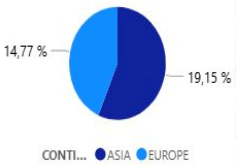
MEDALS PER WRESTLERS



NATION	MEDALS BY WRESTLERS
IRI	80,00 %
AZE	40,00 %
UZB	37,50 %
HUN	33,33 %
PRK	33,33 %
UWW	31,25 %
ARM	30,00 %
FIN	25,00 %
FRA	25,00 %

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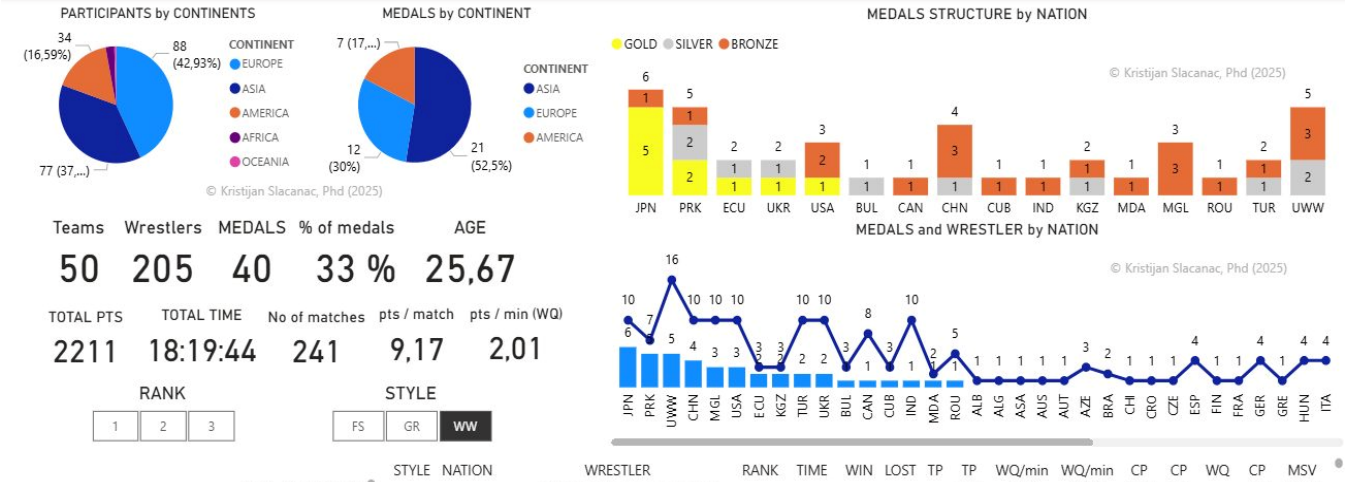
STYLE	NATION	WRESTLER	RANK	TIME	WIN	LOST	TP	TP gvn	WQ/min WIN	WQ/min LOST	CP WIN	CP lost	WQ	CP diff	MSV index
GR	IRI	Saeid Morad Gholi ESMAEILI LEIVESI	1	0:17:22	5	0	37	1	2,13	0,06	19	1	2,07	3,60	5,67
GR	IRI	Gholamreza Javad FAROKHISENJANI	1	0:19:27	5	0	37	1	1,90	0,05	18	1	1,85	3,40	5,25
GR	UZB	AYTJAN KHALMAKHANOV	1	0:16:12	4	0	27	1	1,67	0,06	14	1	1,60	3,25	4,85
GR	PRK	Se ung RI	3	0:14:08	3	1	27	1	1,91	0,07	14	3	1,84	2,75	4,59
GR	KAZ	Aidos SULTANGALI	1	0:22:16	5	0	38	6	1,71	0,27	18	4	1,44	2,80	4,24
GR	IRI	Amin MIRZAZADEH	1	0:17:06	4	0	21	7	1,23	0,41	15	2	0,82	3,25	4,07
GR	IRI	Seyed Danial Seyed Shamsollah SOHRABI	3	0:17:26	4	1	39	6	2,24	0,34	17	7	1,89	2,00	3,89
GR	UWW	Pavel HLINCHUK	3	0:20:36	4	1	32	5	1,55	0,24	17	5	1,31	2,40	3,71
GR	ARM	Malkhas AMOYAN	1	0:26:47	5	0	30	4	1,12	0,15	17	4	0,97	2,60	3,57
GR	AZE	Eldaniz AZIZLI	3	0:14:15	3	1	23	4	1,61	0,28	12	4	1,33	2,00	3,33

LEGEND: **MSW** (Most Successful Wrestler) = **WQ** (**w**restler **q**uality = pts/min won - pts/min lost) – **CPdiff** (CPwon/match - CPLost/match); CP - classification points; TP - technical points

WOMEN'S WRESTLING

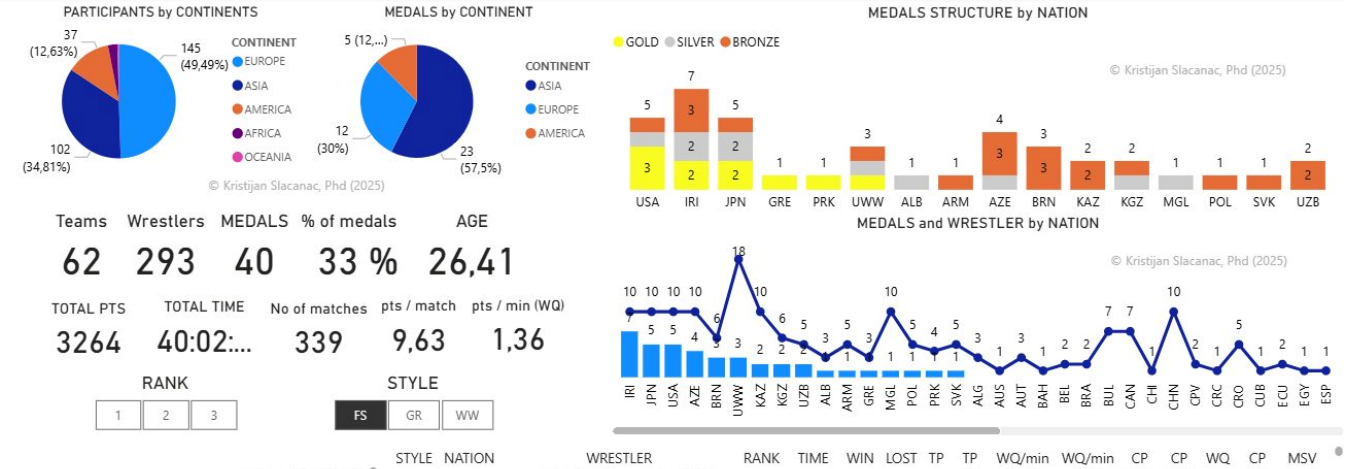


NATION	MEDALS BY WRESTLERS
PRK	71,43 %
ECU	66,67 %
KGZ	66,67 %
JPN	60,00 %
MDA	50,00 %
CHN	40,00 %
BUL	33,33 %
CUB	33,33 %
UWW	31,25 %

STYLE	NATION	WRESTLER	RANK	TIME	WIN	LOST	TP	TP gvn	WQ/min WIN	WQ/min LOST	CP WIN	CP lost	WQ	CP diff	MSV index
		© Kristijan Slacanac, Phd (2025)													
WW	JPN	Sakura ONISHI	1	0:12:08	4	0	45	8	3,71	0,66	19	0	3,05	4,75	7,80
WW	UKR	Alla BELINSKA	1	0:11:53	4	0	25	8	2,10	0,67	20	0	1,43	5,00	6,43
WW	JPN	Ami ISHII	1	0:16:39	5	0	48	3	2,88	0,18	19	2	2,70	3,40	6,10
WW	PRK	Kyong Ryong OH	1	0:12:30	4	0	40	9	3,20	0,72	16	2	2,48	3,50	5,98
WW	JPN	Sakura MOTOKI	1	0:13:07	4	0	31	5	2,36	0,38	17	2	1,98	3,75	5,73
WW	USA	Helen Louise MAROULIS	1	0:12:28	4	0	18	2	1,44	0,16	18	1	1,28	4,25	5,53
WW	JPN	Miwa MORIKAWA	1	0:19:57	4	0	34	2	1,70	0,10	14	1	1,60	3,25	4,85
WW	CUB	Milaimy De La Caridad MARIN POTRILLE	3	0:12:11	3	1	33	5	2,71	0,41	13	3	2,30	2,50	4,80
WW	PRK	Il Sim SON	2	0:17:47	4	1	35	5	1,97	0,28	19	4	1,69	3,00	4,69
WW	PRK	Hyogyong CHOE	3	0:16:07	3	1	30	2	1,86	0,12	14	3	1,74	2,75	4,49

LEGEND: **MSW** (Most Successful Wrestler) = **WQ** (**w**restler **q**uality = pts/min won - pts/min lost) – **CPdiff** (CPwon/match - CPLost/match); CP - classification points; TP - technical points

FREESTYLE



NATION	MEDALS BY WRESTLERS
IRI	70,00 %
BRN	50,00 %
JPN	50,00 %
USA	50,00 %
AZE	40,00 %
UZB	40,00 %
ALB	33,33 %
GRE	33,33 %
KGZ	33,33 %
PRK	25,00 %

STYLE	NATION	WRESTLER	RANK	TIME	WIN	LOST	TP	TP gvn	WQ/min WIN	WQ/min LOST	CP WIN	CP lost	WQ	CP diff	MSV index
		© Kristijan Slacanac, Phd (2025)													
FS	USA	Zahid VALENCIA	1	0:16:15	5	0	49	0	3,02	0,00	19	0	3,02	3,80	6,82
FS	JPN	Kota TAKAHASHI	1	0:26:26	6	0	57	10	2,16	0,38	23	2	1,78	3,50	5,28
FS	IRI	Rahman Mousa AMOUZADKHALILI	1	0:21:45	5	0	46	6	2,11	0,28	18	2	1,84	3,20	5,04
FS	JPN	Yoshinosuke AOYAGI	1	0:19:15	4	0	34	1	1,77	0,05	14	1	1,71	3,25	4,96
FS	IRI	Amir Hossein Abbas ZARE	1	0:18:42	4	0	33	3	1,76	0,16	14	1	1,60	3,25	4,85
FS	UWW	Zavur UGUEV	1	0:20:13	4	0	45	7	2,23	0,35	14	3	1,88	2,75	4,63
FS	USA	Trent Niemond HIDLAY	1	0:23:37	5	0	55	16	2,33	0,68	18	4	1,65	2,80	4,45
FS	GRE	Georgios KOUGIOUMTSIDIS	1	0:24:25	5	0	40	5	1,64	0,20	17	2	1,43	3,00	4,43
FS	PRK	Chongsong HAN	1	0:22:53	5	0	38	13	1,66	0,57	18	2	1,09	3,20	4,29
FS	AZE	Nuraddin NOVRUZOV	3	0:13:29	3	1	30	7	2,22	0,52	14	4	1,71	2,50	4,21
FS	BRN	Shamil Magomed A SHARIPOV	3	0:18:37	4	1	27	13	1,45	0,70	20	3	0,75	3,40	4,15

LEGEND: **MSW** (Most Successful Wrestler) = **WQ** (**w**restler **q**uality = pts/min won - pts/min lost) – **CPdiff** (CPwon/match - CPLost/match); CP - classification points; TP - technical points

Overall wrestling quality (WQ – pts/min): 1.45, lower than OG_2024 (1.80).
Style breakdown: WW = 2.01, FS = 1.26, GR = 1.23 (all lower vs OG_2024).
These results confirm the shift of global wrestling power towards Asia, confirming that wrestling is a sport of young champions and high dynamics.

Letter to the Editor:

Why Is Institutional Memory Being Sidelined? A Cross-Generational Issue That Transcends Borders

This text is not written as a grievance, but as a record of a recurring global pattern.

Today, across many countries, cultures, and systems, we encounter a similar contradiction:
Institutions spend years—sometimes decades—building knowledge, experience, and human capital. Yet when new generations step onto the stage, this accumulated memory is quietly pushed aside.

Sport is merely one of the most visible examples of this broader picture. A lifetime spent within sport—on the field, in training environments, and in academia—reveals the repetition of the same cycle. Performance athletes eventually become coaches, educators, and researchers. They build systems, develop programs, train professionals, and contribute to the international circulation of knowledge. The experience generated through this process forms the foundation of modern sport structures.

Over time, however, this foundation begins to be perceived not as a resource, but as an obstacle. This is not a matter of personal recognition or authority. It is about how societies relate to experience.

In today's systems, younger generations are well educated, technologically capable, and confident. They are respectful, polite, and expressive of appreciation. Yet that appreciation often remains rhetorical. Genuine collaboration, shared responsibility, and a culture of intergenerational co-creation are steadily weakening.

They listen, but they do not invite.
They consult, but they do not walk together.
They appreciate, but they keep their distance.

This pattern is neither coincidental nor an innocent generational difference. It represents a selective disengagement observed on a global scale.

Rarely does anyone openly state, "We do not want experience." Yet in decision-making processes, strategic planning, and long-term development models, experience is systematically excluded. Doors remain symbolically open, but functionally closed.

The issue is not merit; in most cases, there is substantial competence and accumulated expertise. It is not financial; collaboration is often offered without material expectation. It is not positional; there is no competition for status. The real issue is the courage to confront the standards that experience brings.

Experience is not merely knowledge; it is context, perspective, and proportion. It introduces standards—not to control, but to ensure accountability.

In systems where speed is glorified and short-term success is prioritized, this is often perceived as a burden.

As a result, many young professionals seek:
freedom without continuity,
innovation without memory,
and speed without foundation.

Yet avoiding experience does not create freedom. It accelerates the repetition of the same mistakes.

Today, the same pattern can be observed across many fields—including sport, education, science, and public administration: systems rediscover old problems, reinvest in familiar errors, and celebrate short-term achievements while neglecting long-term development. In cultures that achieve sustainable success, bridges between generations are deliberately built. Experience is not idolized, but integrated. Dialogue is continuous. Authority is shared. Institutional memory is treated as part of the infrastructure. Where these bridges are not built,

each generation is forced to start from scratch. This is not merely a loss for sport. It is a loss for society as a whole.

Because knowledge does not disappear when it is not transferred; it disappears when it is consciously removed from circulation.

This text is not an accusation. It is a warning grounded in observation. Experienced individuals are still here—with their knowledge, perspectives, and goodwill. But it must be understood: knowledge that is consistently kept at the margins eventually falls silent. And when institutional memory falls silent, errors begin to speak.

Final Reflection

This text is not a narrative of disappointment. It is a record of collective forgetting.

When decades of accumulated knowledge, experience, and effort are respectfully acknowledged yet systematically excluded from collaboration, what emerges is no longer a generational difference, but a structural rupture. No one is standing in the way of progress. The intention has always been to walk side by side.

What remains is a matter of courage. Because genuine development belongs not to those who walk alone, but to those who are able to build contact across generations.

“When experience, science, and merit are excluded, outcomes are never accidental.”

“Those who bypass experience, circumvent science, and postpone merit do not move forward—they repeat.”

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Letter to the Editor:

Talent Selection and Coach Competence in Sports: An Overlooked Fundamental Element

In recent years, talent selection, also known as talent screening, has become an increasingly common practice in many branches of sports. This process is typically conducted on children who have never participated in sports; the aim is to train future performance athletes by enrolling selected candidates in club youth programs. However, talent selection is an extremely complex process due to the interaction of various physiological, psychological, motoric, and environmental factors, and its results are unpredictable. Talent cannot be definitively determined by a single measurement, test, or expert assessment, and it is also known that predictions made at an early age are not always confirmed later in life.

In this context, while the scientific tools and screening models used in athlete selection are important, the process does not always produce the expected results. While some individuals considered talented fail to meet performance expectations in later years, some children who are initially unnoticed can reach much higher performance levels. Therefore, the concept of "certain talent" is largely misleading regarding early years.

However, a critical element is often overlooked in the literature and in practice:
The care and investment invested in the search for talented athletes is not reflected with the same meticulousness in coach selection.

The professional competence of the coach, one of the most powerful variables determining athlete development, is often overlooked in talent selection or viewed as a secondary element. However, regardless of an athlete's biological potential, the ability to translate this potential into performance depends largely on the coach's:

- field knowledge
- pedagogical skills
- communication skills
- athlete-centered approach
- adaptability to developmental differences
- ethical understanding and professional qualifications.

Therefore, talent screening programs conducted solely focused on the athlete struggle to produce desired long-term outcomes when coach competence is not considered. True performance development occurs at the intersection of the athlete's natural talent and the coach's professional competence.

In conclusion, one of the key factors determining success in sports is not simply finding talented athletes; it is entrusting these talents to the right, well-equipped, visionary, and pedagogically sound coaches. Rather than a criticism, this approach is a strategic necessity that should not be overlooked in terms of sports science's understanding of sustainable success.

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AN OBJECTIVE METHOD TO IDENTIFY THE MOST OUTSTANDING WRESTLER IN A COMPETITION

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"Performance Data Analysis" (PDA), developed through the great efforts of Milorad Dokmanac in collaboration with other wrestling and IT experts, utilizes Microsoft Power BI to analyze competitions, focusing on technical and other points. It considers factors like weight categories, countries, and time of scoring to generate visual reports. PDA benefits coaches, athletes, and referees by offering insights for training and judgment improvement. Additionally, it aids UWW Technical Commission in decision-making and accelerates wrestling research. United World Wrestling has been recording major competitions since 2020, providing valuable data to stakeholders. The PDAs for major competitions since 2021 are available on the UWW website at: uww.io/wpar

One interesting aspect of the PDA the determination of the Most Successful Wrestlers (MSW). PDA results from the Senior World Championships, Zagreb 2025 is the example presented in this article
This value is computed using the following data points for each wrestler (see Tables 1-3):

Elapsed Time on the mat (Time)
Number of Matches
Total Points Won (TP Win)
Total Points Lost (TP Lost)
WQ/min(Win) Number of points won per 1 minute of wrestling
WQ/min(Lost) Number of points lost per 1 minute of wrestling
CP Win – Classification points won
CP Lost – Classification points lost

FORMULA
MSW = (WQ/min(Win) – WQ/min(Lost)) + (CPWin/#matches – CPLost/#matches)

Classification Points (Article 41 of Wrestling Regulations)
The classification points awarded to a wrestler shall determine his final ranking.

5 points for the winner and 0 for the loser:
- Victory by fall (with or without technical point for the loser) (VFA 5:0)
- Injury (VIN 5:0)
    - If an athlete is injured before or during a bout and the injury is certified by the UWW Doctor
- 3 cautions during the bout (VCA 5:0)
- Forfeit (VFO 5:0) – refer to article 14
    - If an athlete doesn't show up on the mat
    - If an athlete doesn't attend or fail the weigh-in
- Disqualification (DSQ 5:0) – refer to article 14
    - If an athlete is disqualified before or during the bout in case of unfair behavior

4 points for the winner and 0 for the loser (VSU 4:0):
- Victory by technical superiority (8 points difference in Greco-Roman style and 10 points in Freestyle during the bout), with the loser scoring no technical points

4 points for the winner and 1 point for the loser (VSU1 4:1):
- Victory by technical superiority during the bout with loser scoring technical points.

3 points for the winner and 0 for the loser (VPO 3:0):
- When the wrestler wins at the end of the two periods by 1 to 7 points in Greco Roman style and 1 to 9 points in Freestyle with the loser scoring no point.

3 points for the winner and 1 point for the loser (VPO1 3:1):
- When the bout ends by a victory by points at the end of the regular time and the loser scoring one or several technical points.

0 point for the red wrestler and 0 point for the blue wrestler:
- In case both wrestlers have been disqualified due to infraction to the rules (2DSQ 0:0).
- In case both wrestlers are injured (2VIN 0:0).
- In case both wrestlers have been eliminated due to forfeits (2VFO 0:0).

One can see that the MSW index rewards the maximization of scoring points, as well as superb defense by incorporating values from both the match scoring and classification points. The index supports and encourages the necessity for action and excitement. In this objective method, the criteria are straight forward and known in advance, therefore not subject to a voting of judges, or collaboration of nefarious pressure from outsiders.

From the 2025 Senior World Championships we see the Most Successful Wrestlers for each style:

Freestyle 86 kg
Zahid Valencia, USA
MSW Index 6.82

Greco-Roman 67 kg
Saied Esmaeili IRI
MSW Index 5.67

Womens Wrestling 59 kg
Sakura Onishi, JPN
MSW Index 7.80

Table 1 FS / MOST SUCCESSFUL WRESTLER (MSW - INDEX) / WCH SENIOR –Zagreb (CRO)

Wrestler, Team, Weight	Time	# of matches	TP Win	TP Lost	WQ/min (Win)	WQ/min (Lost)	WQ Diff	CP Win	CP Lost	CP Win/ # of match	CP Lost / # of match	CP Diff	MSW Index
VALENCIA Zahid, USA, SENIORS FS 86	0:16:15	5	49	0	3,02	0,00	3,02	19	0	3,80	0,00	3,80	6,82
TAKAHASHI Kota, JPN, SENIORS FS 74	0:26:26	6	57	10	2,16	0,38	1,78	23	2	3,83	0,33	3,50	5,28
AMOUZADKHALILI Rahman Mousa, IRI, SENIORS FS 65	0:21:45	5	46	6	2,11	0,28	1,84	18	2	3,60	0,40	3,20	5,04
AOYAGI Yoshinosuke, JPN, SENIORS FS 70	0:19:15	4	34	1	1,77	0,05	1,71	14	1	3,50	0,25	3,25	4,96
ZARE Amir Hossein Abbas, IRI, SENIORS FS 125	0:18:42	4	33	3	1,76	0,16	1,60	14	1	3,50	0,25	3,25	4,85
UGUEV Zavur, UWW, SENIORS FS 61	0:20:13	4	45	7	2,23	0,35	1,88	14	3	3,50	0,75	2,75	4,63
HIDLAY Trent Niemond, USA, SENIORS FS 92	0:23:37	5	55	16	2,33	0,68	1,65	18	4	3,60	0,80	2,80	4,45
KOUGIOUMTSIDIS Georgios, GRE, SENIORS FS 79	0:24:25	5	40	5	1,64	0,20	1,43	17	2	3,40	0,40	3,00	4,43
HAN Chong Song, PRK, SENIORS FS 57	0:22:53	5	38	13	1,66	0,57	1,09	18	2	3,60	0,40	3,20	4,29
SNYDER Kyle Frederick, USA, SENIORS FS 97	0:20:45	4	28	3	1,35	0,14	1,20	13	2	3,25	0,50	2,75	3,95
Ukupno	**3:34:16**	**47**	**425**	**64**	**1,98**	**0,30**	**1,68**	**168**	**19**	**3,57**	**0,40**	**3,17**	**4,86**

Table 2 GR / MOST SUCCESSFUL WRESTLER (MSW - INDEX) / WCH SENIOR –Zagreb (CRO)

Wrestler, Team, Weight	Time	# of matches	TP Win	TP Lost	WQ/min (Win)	WQ/min (Lost)	WQ Diff	CP Win	CP Lost	CP Win/ # of match	CP Lost / # of match	CP Diff	MSW Index
ESMAEILI LEIVESI Saeid Morad Gholi, IRI, SENIORS GR 67	0:17:22	5	37	1	2,13	0,06	2,07	19	1	3,80	0,20	3,60	5,67
FAROKHISENJANI Gholamreza Javad, IRI, SENIORS GR 82	0:19:27	5	37	1	1,90	0,05	1,85	18	1	3,60	0,20	3,40	5,25
KHALMAKHANOV Aytjan, UZB, SENIORS GR 63	0:16:12	4	27	1	1,67	0,06	1,60	14	1	3,50	0,25	3,25	4,85
SULTANGALI Aidos, KAZ, SENIORS GR 60	0:22:16	5	38	6	1,71	0,27	1,44	18	4	3,60	0,80	2,80	4,24
MIRZAZADEH Amin Mohammadzaman, IRI, SENIORS GR 130	0:17:06	4	21	7	1,23	0,41	0,82	15	2	3,75	0,50	3,25	4,07
AMOYAN Malkhas, ARM, SENIORS GR 77	0:26:47	5	30	4	1,12	0,15	0,97	17	4	3,40	0,80	2,60	3,57
GANIZADE Ulvu, AZE, SENIORS GR 72	0:24:00	4	23	5	0,96	0,21	0,75	12	2	3,00	0,50	2,50	3,25
LOLUA Vakhtang, GEO, SENIORS GR 55	0:22:26	4	23	12	1,03	0,53	0,49	13	4	3,25	1,00	2,25	2,74
SARAVI Mohammadhadi Abdollah, IRI, SENIORS GR 97	0:24:00	4	11	3	0,46	0,13	0,33	12	3	3,00	0,75	2,25	2,58
KOMAROV Aleksandr Andreevitch, SRB, SENIORS GR 87	0:30:00	5	16	9	0,53	0,30	0,23	15	5	3,00	1,00	2,00	2,23
Ukupno	**3:39:36**	**45**	**263**	**49**	**1,20**	**0,22**	**0,97**	**153**	**27**	**3,40**	**0,60**	**2,80**	**3,77**

Table 3 WW / MOST SUCCESSFUL WRESTLER (MSW - INDEX) / WCH SENIOR –Zagreb (CRO)

Wrestler, Team, Weight	Time	# of matches	TP Win	TP Lost	WQ/min (Win)	WQ/min (Lost)	WQ Diff	CP Win	CP Lost	CP Win/ # of match	CP Lost / # of match	CP Diff	MSW Index
ONISHI Sakura, JPN, SENIORS WW 59	0:12:08	4	45	8	3,71	0,66	3,05	19	0	4,75	0,00	4,75	7,80
BELINSKA Alla, UKR, SENIORS WW 72	0:11:53	4	25	8	2,10	0,67	1,43	20	0	5,00	0,00	5,00	6,43
ISHII Ami, JPN, SENIORS WW 68	0:16:39	5	48	3	2,88	0,18	2,70	19	2	3,80	0,40	3,40	6,10
OH Kyong Ryong, PRK, SENIORS WW 55	0:12:30	4	40	9	3,20	0,72	2,48	16	2	4,00	0,50	3,50	5,98
MOTOKI Sakura, JPN, SENIORS WW 62	0:13:07	4	31	5	2,36	0,38	1,98	17	2	4,25	0,50	3,75	5,73
MAROULIS Helen Louise, USA, SENIORS WW 57	0:12:28	4	18	2	1,44	0,16	1,28	18	1	4,50	0,25	4,25	5,53
MORIKAWA Miwa, JPN, SENIORS WW 65	0:19:57	4	34	2	1,70	0,10	1,60	14	1	3,50	0,25	3,25	4,85
MURAYAMA OKUNO Haruna, JPN, SENIORS WW 53	0:27:20	5	36	1	1,32	0,04	1,28	17	1	3,40	0,20	3,20	4,48
WON Myonggyong, PRK, SENIORS WW 50	0:24:23	5	43	12	1,76	0,49	1,27	17	3	3,40	0,60	2,80	4,07
REASCO VALDEZ Genesis Rosangela, ECU, SENIORS WW 76	0:18:00	4	24	7	1,33	0,39	0,94	13	3	3,25	0,75	2,50	3,44
Ukupno	**2:48:25**	**43**	**344**	**57**	**2,04**	**0,34**	**1,70**	**170**	**15**	**3,95**	**0,35**	**3,60**	**5,31**

INSTRUCTIONS FOR AUTHORS

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