












Musculoskeletal injuries in freestyle wrestling – sport specification

Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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Abstract

Background and Study Aim:

Restricted and very demanding training, rapid weight reduction, and excessive exercise exposes wrestler's body on the increase of risk of injuries and sport related trauma. Understanding the types, frequency, and main causes of injuries and their relation to sport specification can be beneficial in injury prevention and programming the training. Therefore, the aim of this study was to knowledge about the nature and frequency of injuries at a professional level of the freestyle wrestling.

Material and Methods:

Forty-three wrestlers (men) with the 14.7 years' (6 to 22) experience in sport competition retrospectively evaluated wrestling injury history and clinical and demographic data based on completed a structured questionnaire. Wrestlers represented: master class 15 (35%), 1st sports class 23 (53%) and 2nd sports class 5 (12%). Obtained results have been enriched by the information acquired from the analysis of the available medical records submitted by the respondents. The diagnostics was mainly based on the X-ray (58.13%) or ultrasound (55.81%) diagnostic methods.

Results:

The most common injuries of the lower limbs concerned the knee joint (58.13%), the area of the upper limbs – hands (62.79%), and wrist (39.53%), the area of the trunk, the cervical (79.06%) and lumbar spine (48.83%). The nature of the injury most often concerned contusions (each of the wrestlers suffered this type of injury), damage to tendons (55.81%) and damage of articular structures. Unfortunately, 30.2% of the injuries required surgical treatment.

Conclusions:

Injuries of the spine and knee joints mostly are the result (probably) of inappropriate training methods, inadequacy of training to the fitness level of the athlete. It may lead to congestion and temporary disturbances in the normal functioning of the human body, resulting in injuries. Presented results indicate that there is a need to take action – injury prevention methods at the seniors' level to prevent musculoskeletal injuries in freestyle wrestling. On the other hand, presented results shown that there is a need of proper education of trainers responsible for organizing the training sessions.

Key words:

combat sports • division of the combat sports • martial arts • micro traumas

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Wrestling – combat sport involving grappling-type techniques such as clinch fighting, throws and takedowns, joint locks, pins and other grappling holds. Wrestling comes in different forms such as folkstyle, freestyle, Greco-Roman, catch, submission, judo, sambo, sumo, pehlwani and others [2].

Combat sports – competitive contact sports where two combatants fight against each other using certain rules of engagement [7].

Combat sport – *noun* a sport in which one person fights another, e.g. wrestling, boxing and the martial arts [4].

Martial arts – *plural noun* any of various systems of combat and self-defense, e.g. judo or karate, developed especially in Japan and Korea and now usually practiced as a sport [4].

Injury – also known as physical trauma, is damage to the body caused by an external force, according to United World Wrestling it is any type of musculoskeletal or soft tissue complaint newly incurred during the competitions that required medical attention" [28].

Division of the combat sports under forms of the direct confrontation – workings of weapons; hits (strokes); throws and grips of immobilisation of opponent's body [16].

Contact sport – *noun* any sport in which physical contact between players is an integral part of the game, e.g. boxing, rugby or taekwondo [4].

INTRODUCTION

Wrestling is one of the most natural combat sports, with a centuries-old history. Some historical information about development of wrestling we can find date back to the times of the Sumerians and Ancient Egypt. But from 708 B.C., wrestling was the decisive discipline of the Pentathlon during Ancient Olympic Games [1, 2]. At present, there are two main styles of wrestling in the world – classic wrestling (Greco-Roman), which debuted at the modern Olympic Games in Athens in 1896, and freestyle wrestling, included in the 1904 Olympic competition program in Saint Louis. Regardless of the fighting style presented, the main goal of wrestling competition is to immobilize the opponent lying on his back [3-6].

Wrestling training is an important factor stimulating psychophysical development and it contributes to the improvement of the physical condition and affecting mental health [7]. However, due to the specificity of this sports discipline (classified as combat sports based on throws and grips of immobilisation of opponent's body – direct contact with an opponent – see glossary), high intensity as well as stress related to participation in combat matches, combined with insufficient time for rest, may contribute to muscle damage and injuries [8, 7].

Certainly, the frequency of injuries results from the very specificity of wrestling training, but also from the constant striving to win. Among children training wrestling, the frequency of paediatric injury is rated at 9.0 injuries per 1,000 exposed athletes [9]. The high probability of injuries in the early stages of the sports specification entails a significant risk of injuries in the elderly (accumulation of micro-injuries) [10].

Proper understanding of the mechanisms of wrestling injuries is the main key for its prevention and reduction of their risk specially in the professional wrestler's populations. However it is not easy to classify the type of occurred injuries, due the complexity and the specificity of movements in this sport [11].

Most of the scientific research dealing with the wrestling injuries divides them into three specific types, proposed by the United World Wrestling (UWW) and depended on their severity and implemented and necessary procedure in the event of their occurrence. The severity of wrestling injuries is categorized as injuries treated on the mat = mild, injuries were additional medical care is required after the competition = moderate, and the last one were the occurrence of the injury always causes' termination of the match (by the referee or the medical personnel) and the injured wrestler should receive emergency care at an equipped medical centre and be immediately transferred to a nearby hospital [12].

In case of this types of analyses there is always need of preparation of a Injury Report Forms and uploaded them into the secured cloud-based UWW injury surveillance system [13]. This creates an opportunity for proper management with the types of the injuries and present the statistical calculations about the sport related injuries ratios in any selected time period for specific wrestling matches [11].

The importance of injuries in the professional sport is significant and, despite progress in all areas of sporting competition, especially in the case of sport medicine, early diagnostics and medical treatment it is a still very relevant factor that limits sport results and affects sport career of many athletes making it impossible to achieve sports championship. It is essential to understand that such types of calculation are impossible to perform on long "lasting periods" such as a whole sport carrier. Due this fact on this type of populations only a cursory analysis of the injury prevalence is possible to create. Remembering limitations cursory analyses we can see sport related trends in injuries occurrence in professional wrestling that can help in early prevention against most typical wrestling injuries.

Therefore, the aim of this study was to knowledge about the nature and frequency of injuries at a professional level of the freestyle wrestling.

MATERIAL AND METHODS

Participants

Presented study analyse population of 43 male wrestlers, from which 27 wrestlers were former fighters (63% of all respondents), age 41.3 ±8.4 years (min 25, max 55) and 16 (37%) were still active fighters, age 28.2 ±5.0 years (min 23, max 39). According to the sports advancement level, the wrestlers represented: master class 15 wrestlers (35% of all respondents); 1st sports class 23 wrestlers (53%); 2nd sport class 5 wrestlers (12%). The average number of years of competing in competitions was 14.7, the smallest number of years of taking part in competitions was 6, and the highest was 22.

Definition of injury in the study

For the purpose of this study, a reportable injury was defined as any physical injury occurring while wrestling during the match, tournament or a specific wrestling training. For each athlete meeting, the study defined and included a self-assessment of the wrestlers' health status and a paper-based injury report form produced by collecting data on the athlete's injury specifics (e.g., the nature of the injury, body location – lower, upper limbs, trunk, the summary of injuries in the trunk, the list of reported spine ailments, diagnostic methods used to confirm an injury, the used treatment methods, the time required for recovery and training after the injury etc.). Responses regarding the age and the number of years of training were open-ended.

Data collection

A retrospective injury surveillance study was conducted based on a structured freestyle wrestling injuries questionnaire. The wrestlers completed the study and fulfilled a questionnaire to assess wrestling injury history and clinical and demographic data. Furthermore, obtained data have been enriched by the information achieved from the analysis of the available medical records submitted by the respondents.

The distribution of selected types of injuries has been divided into three main body areas: the upper limb with the shoulder joint, the lower limb with the hip joint, and the body trunk as its front and back part. The injury analysis concerned their main types, i.e. fractures, dislocations, sprains, muscle damage, tendons damage, as well as joints and nerves injuries.

Statistical analysis

Outcomes were analysed as the percentage distribution of the types of injuries, the percentage analysis of the location of the injuries in the body area and the percentage distribution of the diagnostic methods used to confirm the types of injuries. One-way ANOVA was used to investigate differences between health self-assessment depending on the number of years of competition. Descriptive statistics: the mean (M) and standard deviation (SD or ±) were used for all measured variables. All calculations and graphics were done in Statistica 12 software (StatSoft, Tulsa, OK, USA). Differences were considered statistically significant at $p \leq 0.05$.

RESULTS

The average number of years of competing in competitions was 14.7, the smallest number of years of taking part in competitions was 6, and the highest was 22. Each of the wrestlers indicated the answer 5 or more as the number of trainings per week during their career. Everyone has also suffered an injury in the past on different stages of the competition or wrestling training. The most frequent injuries occurred the competition (34.89% of respondents wrestlers, that is 15) whereas during training 7 people (16.27%). Together 51.14% wrestlers suffered injuries during the competition and training. The current and former wrestles did not differ significantly in terms of self-assessment of their health condition (therefore in Table 1 of answers to the question about the health condition and their number of years in competition include $n = 43$).

The analysis showed a significantly lower number of years of participation in competitions of people assessing their health as perfect compared to those assessing their health as: average ($p = 0.008$) and as good ($p = 0.012$). In the group of wrestlers declaring excellent health, half of them did not participate in the competition for more than 11 years, and the experience of the longest competitor is only 13 years. Meanwhile, in the population declaring good health status, at least half of the wrestlers participated (max - 18 years). In case of freestyle wrestlers declaring average health condition, at least half of them showed a training experience of over 19 years, with the maximum 22 years of participating in competitions (Figure 1).

Table 1. Proportion (%) of 43 wrestlers who self-assessed their health.

Health category	Self-assessment of the health condition		Number of competition per year	
	N	%	M & SD	min ÷ max
average	6	13.95	19.5 ± 3.5	12 ÷ 22
good	16	37.20	16 ± 1.5	13 ÷ 18
very good	16	37.20	14 ± 1.75	6 ÷ 18
perfect	5	11.62	11 ± 0.5	10 ÷ 13

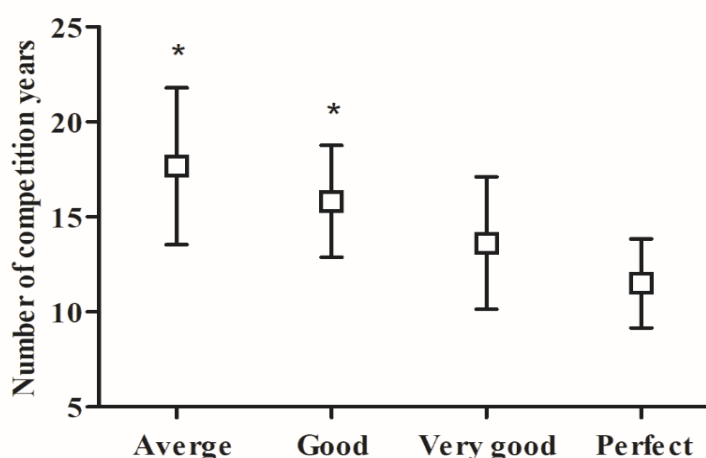


Figure.1. Self-assessment of health condition depending on the number of years of competitions (mean and standard deviation): *significant difference vs. very good and perfect self-assessment of health condition.

Current and former wrestlers declared that the most frequent type of injury of the lower limbs primary concerned the knee (58.13%) and ankle (41.86%). Moreover, it concerned the foot (32.55) and thigh (32.55) areas. The least frequently injured areas were the hip-joint and shank (less than 10%). Analyses of the upper limb revealed that among the most commonly injured were the hands (62.79%), wrists (39.53%), shoulders (32.55%) and elbows (30.23%) joints. Evaluation of body trunk injuries showed that most of the athletes declared cervical (79.06%) and lumbar (48.83%) spine injuries (Table 2, Figure 2).

Distribution of different injury types revealed that every freestyle wrestler suffered from bruises and contusions, and those were revealed to be the most common types of injuries. Additionally, injuries which were the results of the damage of joint structures, tendons, fractures, and torsions occurred almost in fifty percent of the population (Table 3).

The most frequently reported pain symptoms were related to the cervical part of the spine and were confirmed in the entire population. Additionally, wrestlers suffered from degenerative changes in the cervical and lumbar segments of the spine (Table 4).

The most frequent occurrence of lower limb injuries, focused mainly on the structure of the knee joint. Turn meniscus 51.16%, while damage to the joint cartilage declared by 37.2% of wrestlers (Table 5).

The entirety of medical diagnostics conducted in the studied population of wrestlers concerned mainly on the use of X-Ray, and the ultrasound examination. Furthermore, medical diagnosis was based on a CT scanning and electromyography (EMG / SEMG). Various types of injuries forced the athletes to maintain a specific recovery period. The undertaken treatment methods often forced a longer duration of regeneration (Table 6).

Table 2. Number (ordinal variable) and proportion (%) of injuries within individual body areas of the examined wrestlers (n = 43).

Lower limb			Upper limb		
body area	n	%	body area	n	%
Knee	25	58.13	hand	27	62.79
Ankle	18	41.86	wrist	17	39.53
Thigh	14	32.55	shoulder joint	14	32.55
Foot	14	32.55	elbow joint	13	30.23
hip-joint	4	9.30	arm	7	16.27
Shank	3	6.97	forearm	3	6.97

Body trunk		
body area	n	%
cervical spine vertebrae	34	79.06
lumbar spine vertebrae	21	48.83
thoracic spine vertebrae	10	23.25
torso front part	6	13.95
Sacral	3	6.97

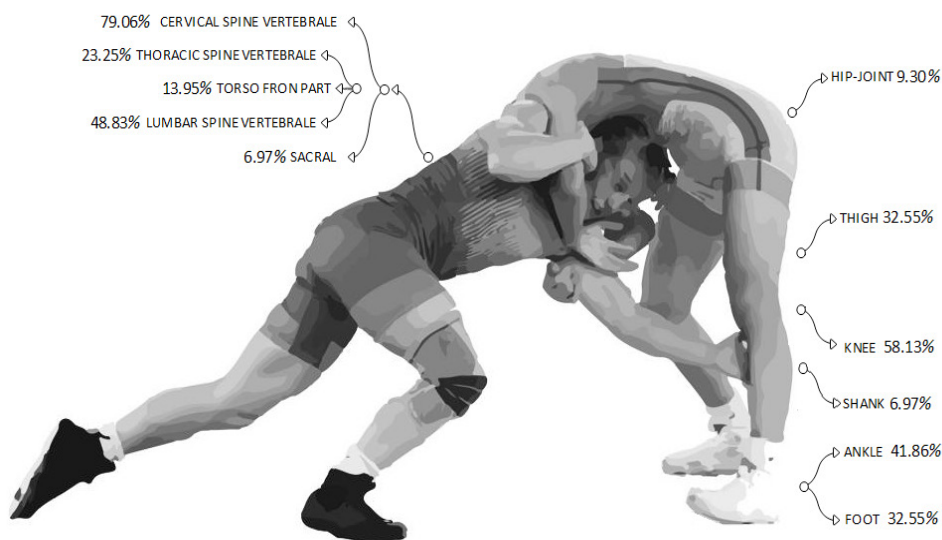


Figure 2. Location and percentage distribution of freestyle wrestling injuries (prepared independently).

Resting was the main treatment method (100%). Certainly, in the case of some injury types, Necessary surgical procedures concerned 13 (30.2%) cases (Table 7).

Analysis of the time necessary to return to health and training after obtaining injuries is directly dependent on the type of the injuries. Injuries with a 75% nerve damage occurred at the end of

the career in a single case. Moreover, in the case of every injury where the surgical treatment was necessary, the healing period lasted more than six months. Due to the fact that every athlete suffered from the bruises, the full recovery lasted less than a month. Sprains, torsions, muscle and tendons injuries required from one to three months of healing, and Injuries of a joint structure lasted between three to six months (Table 8).

Table 3. Number (ordinal variable) and proportion (%) of different types of injuries of the examined wrestlers (n = 43).

Type of injury	n	%
bruise	43	100
joint structure injury	27	62.79
damage to the tendons	24	55.81
fracture	23	53.48
torsion	21	48.83
muscle damage	18	41.86
sprain	13	30.23
nerve injury	8	18.60

Table 4. Number (ordinal variable) and proportion (%) of pain symptoms reported of the examined wrestlers (n = 43).

Reported ailments	N	%
pain in the cervical segment	43	100
degenerative changes in the cervical segment	25	58.13
lumbar pain	22	51.16
discopathies and protrusions, hernia of the vertebrae	17	39.53
degenerative changes in the lumbar section	16	37.20
chest pain	16	37.20

Table 5. Number (ordinal variable) and proportion (%) of damage within of the knee joint of the examined wrestlers (n = 43).

Reported ailments	N	%
torn meniscus	22	51.16
other (including pain areas)	21	48.83
damage to the joint cartilage	16	37.20
injury to the ligaments in the knee joint	15	34.88
injury of the patella	5	11.62

Table 6. Number (ordinal variable) and proportion (%) of used diagnostic methods confirming the injury of the examined wrestlers (n = 43).

Diagnostic method	N	%
X-ray	25	58.13
ultrasound examination	24	55.81
computer tomography (CT)	19	44.18
magnetic resonance (MR)	12	27.90
electromyography (EMG / SEMG)	8	18.60

Table 7. Number (ordinal variable) and proportion (%) of the main treatment methods of the examined wrestlers (n = 43).

Treatment methods	N	%
rest – self removal of symptoms	43	100
conservative treatment (pharmacotherapy, physiotherapy, kinesiotherapy)	20	46.5
surgical treatment	13	30.2

Table 8. Number (ordinal variable) and proportion (%) of time (months) necessary to return to health and training after injury of the examined wrestlers (n = 43).

Duration	N	%
less than a month	43	100
from 1 to 2 months	19	44.18
from 2 to 3 months	16	37.20
from 3 to 6 months	6	13.95
more than 6 months	5	11.62
injury ended my sports career	1	2.32

DISCUSSION

Sport training is associated with many potential threats for the athlete’s health. It is mostly due to the training discipline specificity, the conditions in which training sessions and sport matches are being performed. and accidental external factors. Furthermore, very important thing that always affects the athlete’s health is the way that the trainer and the athlete themselves strive to achieve better and better results, often accepting the high cost of their health worsening. Despite the fact that even in semi-professional and amateur sports, injuries take place, affecting the health of every athlete. Injuries may occur in all sport, but the frequency of their occurrence tend to vary between disciplines. In most cases, it is a constant value characterizing any given sport discipline. According to literature, wrestling is classified as a discipline with a high injury rate [9, 4, 14, 15].

However, delving further into this topic, we have to take into account its specificity; moreover, it should be mentioned that comparing wrestling to other sports can only occur if the other sport discipline in question consists of a full body contact (with the opponent and with the environment

ex. the ring, the mat. etc.). Wrestling – as it was emphasized in the introduction – belongs, among of combat sports, to a group “throws and grips of immobilisation of opponent’s body” [16]. Therefore, studying works dedicated to injuries in other combat sports belonging to the same group is a basic research challenge from the perspective of developing optimal methods of prevention [17]. Of the Olympic combat sports, judo injury analysis is closest to wrestling [18-20]. However, overall analyses show that freestyle wrestling injury rates appear as comparable with the injury rates in other sports [21].

In the presented study we have evaluated 43 wrestlers on a different level of sports advancement. Most of the wrestlers were in the 1st sport class, so in the case of such a specific discipline like wrestling, it allowed to include good characteristics of the studied population and its specificity. Due to the limited number of wrestlers, some of the obtained results should be taken with caution. However, undoubtedly, the result indicating a much smaller number of years of participation in professional wrestling competitions of people assessing their health condition as excellent compared to those assessing their health as average ($p = 0.008$) and as good ($p = 0.012$) is consistent with the reality.

Every professional sport is associated with a high and intensive workload and a statistically higher risk of musculoskeletal system injuries rather than in amateur sports. Such a situation always affects one’s general health [22]. The same case happened in our study, where at least half of analysed population which showed an internship trained for over 19 years, declaring average health condition. One of the main reasons for such a state is the fact that the professional sport competition always leads to the overlapping of micro traumas and a greater likelihood of a joint damage and dysregulation of the locomotor apparatus. As a result of this situation, most of the retired athletes suffer from past injuries and have many musculoskeletal problems that affect the comfort in life.

During the wrestling competition, where full body contact with the opponent occurs, there is a high possibility of injuring one another and collapsing on the mat. with the mostly common injury types being the bruises and contusions. The whole population in the presented study declared this type of injury during a sports competition.

Additionally, many wrestlers reported that during their sport careers, they suffered from injuries which resulted in the damage of joint and their structure (tendons, bones, muscles etc.). Those are the typical types of injuries that occur when the external force [6] is put on the body, and when there is mostly no specific way to protect against their occurrence. with the exception of maintaining the safety rules of sports competition and sports training [23].

Combat sports are characterized by direct contact during combat, the consequences of which can be observed based on many bruises and contusions that occur in every single fight. Most athletes cannot even pinpoint the exact situation in which this type of injury has occurred but it can be always observed. Additionally, other types of injuries include the following: the damage of muscles, joints, tendons, fractures, and joint dysregulation (dislocations, sprains) takes place due the influence of external force. The frequency of obtaining these injury types varies greatly. However, there are some trends of present of some types of injuries associated with the weight [9, 4, 14, 15]. It is due to the fact that with the higher “hitting force” can occur a higher possibility of structural damages.

Keeping in mind that all the fight techniques during wrestling start with the standing position (disregarding the situation of resuming the fight from the “forced horizontal posture” – speaking in scientific language, not jargon, the occurrence of trunk injuries can be defined as a sport associated type of injury [10, 11]. Especially during the freestyle wrestling competition, due to the specificity of this discipline, a greater share injuries in of the upper part of the trunk/neck area and a lower limb strains/sprains can take place [6]. The main reason for this state is the fact that during the freestyle wrestling fight. most of the used techniques start from the standing position and they are based on execution of throws when wrestlers are being driven into the mat. That is the main case in which fighter can injure the upper parts of his body [22]. Moreover, during the attack on one of the fighter’s hits/grabs. his opponent’s legs result in knees injuries [23].

Additionally, a great share of throws in the wrestling match is the main reason why upper limbs injuries take place, when the fighter protects himself against hitting the mat in the situation of being thrown in the air. Moreover, lower limbs

injuries among wrestlers are most likely sustained when their legs are twisted or strained as they either use their legs to secure a hold or defend against an attack [6].

In the presented population, most of the wrestlers suffered from spine injuries. Every wrestler reported pain in the cervical segment. In most cases, the main reason for that is the specificity of training methods used in wrestling preparation. Wrestlers hold the position of the body only through the contact of the head with the ground, and by increasing the tension of back muscles. This is one of the basic exercises to learn the defence against the body being pressed to the mat.

Moreover, in some situations during the fight, the wrestler hits the ground with his back (spinal column) or with the cranial vault (which receives the greatest overload). Increased high compression on the vertebral column is being transferred to further body areas (the first part is cervical segment). Moreover, many athletes declared lumbar pain and chest pain due the specific of their exercises and intensive physical activity [24]. Most of the injuries in those areas are related to the incorrect way of holding the opposite fighter or throwing a hit to the mat or they are induced by the significant mobility of these body parts, and a very high muscle pressure rate during the competition.

More than half of the population suffered from the degenerative changes in the cervical and lumbar segments. Observed trends are similar to those presented by Cohen and Hooten [22]. Other types of injuries such as discopathies, Protrusions, and a herniated vertebrae appeared in the case of almost forty percent of the population. Presented dysfunctions of the spinal cord are related to the abnormal physical training and increased overload of the movement apparatus [25]. Adaptation abilities of the spinal cord are limited which is why some of the premature degenerative changes take place.

During the situation of an attach and throwing the opponent, most of the power is aimed at a lower limb. Most of the lower limb injuries focus mainly on the structure of the knee. Wrestlers suffered from the following injuries: the knee meniscus injury, ligaments injuries, the patella injury, and the articular cartilage. Almost half the population (48.83%) suffered from other types of injuries, including pain symptoms. The

presented characteristic is related to the attack/ defence situation against the opposite wrestler and the inappropriate position of the leg (in a situation when the external force of the attacking wrestler body is put directly on the lower limbs of the defending wrestler).

The entirety of medical diagnostics conducted in the presented population mainly concerned the use of X-Ray, and the ultrasound examination. Those two methods are the cheapest and easiest to perform medical diagnostic methods in sport and medicine [26].

In most of the cases of the wrestling injuries, those two methods present a full picture of the damaged tissues, which can be a beginning point for the future healing process. Furthermore, medical diagnosis was based on a CT scanning, the magnetic resonance imaging (MRI), and electromyography (EMG/SEMG). Certainly, using those precise and expensive diagnostic methods allowing to create a full picture of the injured tissues (even nerves, tendons, cartilage, etc.) but in most cases, there is no need to use such specific diagnostic tools [27].

Analyses of the time necessary to return to health and training after suffering the injuries depends directly on the type of the injuries. Injuries where nerve damage was observed in 75% of the cases occurred at end of the career. Moreover, every injury where the surgical treatment requires the healing period lasted more than six months. Due to the fact that every athlete suffered from the bruises, the full recovery lasted less than a month. Sprains, torsions, muscle, and tendons injuries required from one to three months of healing, and injuries of a joint structure lasted between three to six months.

This study found that freestyle wrestlers sustained a greater share of lower limb injuries and a big share of upper body parts injuries. Additionally, we were able to identify that pulling/twisting forces delivered by the opponent along with direct blows from an opponent, which resulted in a bigger number of freestyle wrestling injuries.

Summing up the whole analysis, we can conclude that freestyle wrestling is associated with some typical injury types that are associated with the sport movement, both during defensive or offensive situations. It can be assumed that during the professional wrestling training, there is a need of

regular medical care on the sportsmen specially in case of a vertebral column conditions – avoiding exercises that contribute to the deepening of the dysfunctions of the physiological curves of the spine, learning and controlling the correct grapple of the opponent and the defence against falling and hitting the mat during the competition.

CONCLUSIONS AND PERSPECTIVES

To our knowledge, there are still few studies showing the specificity of the freestyle wrestling injuries. and attempting to show why presented types of injuries took place during freestyle wrestling training and matches thorough the whole carrier. In our opinion, this phenomenon is one of the most important issues of the new, developing sub-discipline of science of martial arts [28]. Conclusions and recommendations from future research will certainly be used in the prevention of body injuries in many areas of human physical activity. An

important implication is that wrestling (like other combat sports that develop, among others, such an important the body balance disturbances tolerance skill [29, 30]) can only be adapted to a limited extent in the prevention of bodily injury among groups at increased risk, including unintentional falls [31].

This is why, future studies should focus on ,among others, the injury rates and patterns among wrestlers of various ages, skill levels (sport classes. etc.), to determine whether observed trends are characteristic specify in the context of sport related injuries ratios. Such analyses in context of sport matches may lead to development of injury targeted training programs focused only on the injuries related with the sport performance.

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REFERENCES

- Barlow DH. Unravelling the mysteries of anxiety and its disorders from the perspective of emotion theory. *Am Psychol* 2000; 55(11): 1247-1263
- Bromber A, Krawietz B, Petrov P. Wrestling in multifarious modernity. *Int J Hist Sport* 2014; 31(2): 391-404
- Martin WR, Margherita AJ. Wrestling. *Phys Med Rehabil Clin N Am* 1999; 10(1): 117-140
- Dictionary of Sport and Exercise Science. Over 5.000 Terms Clearly Defined. London: A & B Black; 2006
- Grindstaff TL, Potach DH. Prevention of common wrestling injuries. *Strength Cond J* 2006; 28: 20-28
- Yard EE, Comstock RD. A comparison of pediatric freestyle and Greco-Roman wrestling injuries sustained during a 2006 US national tournament. *Scand J Med Sci Sports* 2008; 18(4): 491-497
- Piskorska E, Mieszkowski J, Kochanowicz A et al. Mental skills in combat sports-review of methods anxiety evaluation. *Arch Budo* 2016; 12(1): 301-313
- Agel J, Ransone J, Dick R et al. Descriptive epidemiology of collegiate men's wrestling injuries: National Collegiate Athletic Association Injury Surveillance System. 1988-1989 through 2003-2004. *J Athl Train* 2007; 42(2): 303-310
- Pasque CB, Hewett TE. A prospective study of high school wrestling injuries. *Am J Sports Med* 2000; 28(4): 509-515
- Caine DJ, Maffulli N. Epidemiology of children's individual sports injuries. An important area of medicine and sport science research. *Med Sport Sci* 2005; 48: 1-7
- Molnár S, Hunya Z, Gáspár K et al. Moderate and Severe Injuries at Five International Olympic-Style Wrestling Tournaments during 2016-2019. *J Sports Sci Med* 2022; 21(1): 74-81
- Wrestling UW. Official injury report form. [accessed 2022 May 14]. Available from: URL:https://unitedworldwrestling.org/sites/default/files/2019-12/injury_report_new_bs_cr_final_version_dec2019.pdf
- Bahr R, Clarsen B, Derman W et al. International Olympic Committee consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport 2020 (including STROBE Extension for Sport Injury and Illness Surveillance (STROBE-SIIS)). *Brit J Sports Med* 2020; 54(7): 372-389
- Shadgan B, Feldman BJ, Jafari S. Wrestling injuries during the 2008 Beijing Olympic Games. *Am J Sports Med* 2010; 38(9): 1870-1876
- Kordi R, Akbarnejad A, Wallace WA. Catastrophic injuries in the Olympic styles of wrestling in Iran. *Br J Sports Med* 2010; 44(3): 168-174
- Kalina RM. Teoria sportów walki. Warszawa: Centralny Ośrodek Sportu; 2000 [in Polish]
- Kamitani T, Malliaropoulos NG, Omiya M et al. On the way to the Tokyo Summer Olympic Games (2020). Prevention of severe head and neck injuries in judo: it's time for action. *Brit J Sports Med* 2017; 51(22): 1581-1582
- Kamitani T, Nimura Y, Nagahiro S et al. Catastrophic Head and Neck Injuries in Judo Players in Japan From 2003 to 2010. *Am J Sports Med* 2013; 41(8): 1915-1921
- Akoto R, Lambert C, Balke M et al. Epidemiology of injuries in judo: a cross-sectional survey of severe injuries based on time loss and reduction in sporting level. *Brit J Sports Med* 2018; 52(17): 1109-1115
- Blach W, Malliaropoulos N, Rydzik Ł et al. Injuries at World and European judo tournaments in 2010-2012. *Arch Budo* 2021; 17: 127-133
- Rechel JA, Yard EE, Comstock RD. An epidemiologic comparison of high school sports injuries sustained in practice and competition. *J Athl Train* 2008; 43(2): 197-204
- Cohen SP, Hooten WM. Advances in the diagnosis and management of neck pain. *BMJ* 2017; 358: j3221
- Palmer D, Cooper DJ, Emery C et al. Self-reported sports injuries and later-life health status in 3357 retired Olympians from 131 countries: a cross-sectional survey among those competing in the games between London 1948 and PyeongChang 2018. *Brit J Sports Med* 2021; 55(1): 46-53
- Pawlak M, Jażdżewska A, Leźnicka K. Can physical activity modulate pain perception during ontogenesis? *Balt J Health Phys Activ* 2019; 11(3): 90-100

25. Fiani B, Jarrah R, Wong A et al. Repetitive Traumatic Discopathy in the Modern-Era Tennis Player. *Cureus* 2020; 12(8): e9783
26. Pishbin E, Ahmadi K, Foogardi M et al. Comparison of ultrasonography and radiography in diagnosis of rib fractures. *Chin J Traumatol* 2017; 20(4): 226-228
27. Romano N, Federici M, Castaldi A. Imaging of cranial nerves: a pictorial overview. *Insights Imag* 2019; 10(1): 33
28. Barczyński BJ, Kalina RM. Science of martial arts – Example of the dilemma in classifying new interdisciplinary sciences in the global systems of the science evaluation and the social consequences of courageous decisions. *Proc Manuf* 2015; 3: 1203-1210
29. Jagiełło W, Wójcicki Z, Barczyński BJ et al. Optimal body balance disturbance tolerance skills as a methodological basis for selection of the firefighters to solve difficult tasks of rescue. *Ann Agric Environ Med* 2014; 21(1): 148-155
30. Litwiniuk A, Knas M, Grants J. The diagnostic value of the 'Rotational Test' in preclinical studies – an example of combat and non-combat sports athletes research before and after an alpine skiing course. *Arch Budo* 2021; 17: 357-370
31. Blach W, Dobosz D, Gasienica-Walczak B et al. Falls Are the Leading Cause of Injuries among Farmers – Limitations of Practicing Judo in Preventing These Incidents. *Appl Sci* 2021; 11: 7324
32. Shadgan B, Molnar S, Sikmic S et al. Wrestling injuries during the 2016 Rio Olympic Games. *Brit J Sports Med* 2017; 51(4): 387

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