

Prevalence of Injuries in Jiu-Jitsu and Judo Athletes of Portugal South: Associated Injury Mechanisms

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Abstract

This study investigated the prevalence of injuries in martial arts athletes, and determine the possible mechanisms of injury. The sample involved 62 athletes, being 93.5% male who practiced Jiu-Jitsu and judo in Portugal south. A questionnaire was used with questions about the population characterization, aspects related with modalities, specific questions of mechanism of injury and the technique to be used at the time of injury. The athlete had to answer what the most common injury related with the practice of martial art and/or the injury that the more limited and/or prevented them from practicing their modality. Forty-three (69.4%) athletes reported having suffered some type of injury during Jiu-Jitsu or judo, 36 (58.1%) athletes referring injury as the most frequent and 34 (54.8%) referring limiting injury. The techniques that caused more injuries in Jiu-Jitsu athletes included ground (30% frequent injury and 36.8% limiting injury) and grip fighting (25% frequent injury and 10.5% limiting injury). Most of the frequent injuries was caused by the judo thrown techniques (Uke with 43.8% and Tori with 25%) and most limiting injuries was caused by being thrown/Ukemi (40%) and attempting thrown (20%). It was found that the age group of athletes under age have 4.83 (95% CI: 1.50-15.54; $p=0.088$) more probability to have an injury than older athletes. The data obtained found a high prevalence of injuries in martial arts. It is necessary to know the techniques that promote the highest number of injuries in these athletes to developing appropriate preventive strategies.

Keywords: Prevalence; Injury; Judo; Jiu-Jitsu; Martial art

Introduction

Martial arts are antique forms of combat which practice has many benefits for health promotion, such as improving cardiovascular endurance, strength, balance, flexibility, body fat composition, among others. The practice of martial arts is growing with increasing number of practitioners [1,2].

The term martial arts is often used for different fighting styles. The karate and taekwondo are fights that emphasize blows with the feet and wrists. Jiu-Jitsu and judo emphasize maneuvers with arms, assets and projection techniques. Mixed martial arts (MMA) are modern styles that blend the techniques mentioned above [1].

Jiu-Jitsu is a martial art, combat sport, and a self-defense system that focuses on the fight, especially in ground-fighting, and involves projection techniques, twists, assets and lock [3,4].

Judo is a fight created from Jiu-Jitsu by Jigoro Kano who started the martial arts studies to become stronger. Jigoro Kano compiled the best techniques of Jiu-Jitsu in a new art, focused on human development with greater emphasis on projections than the locks. Judo became an official Olympic sport in 1964 [3,4].

The International Judo Federation [4] consists of 200 National Federations on all continents with more than 40 million judo worldwide practitioners. Regarding Jiu-Jitsu, the number of practitioners and competitors has been increasing, and the first European championship held in 2004 attended by dozens of athletes and in 2015 registered 3500 athletes.

Martial arts such as Jiu-Jitsu and judo are becoming popular and the risks associated with lesions can be higher than in team sports [5]. The increase of physical demands of combat sports require athletes to work out close to the maximum exhaustion limits and the characteristics of these martial arts (competitive aspects and characterized by a high direct and continuous body contact) take their practitioners to be more prone to the occurrence of injuries [6-8].

The most common types of injury of martial athletes are sprains, strains and contusions. The least common injuries include fractures and dislocation [1].

Judo was appointed as a sport that has a prominent relative risk of injury compared to other sports [9,10]. In judo the most common mechanism of injury occurs when the athlete is being throw or when it is in fighting for the grips [8,11] and the most common local of injuries involve the upper limbs [11].

The Okada et al. [12] study evaluated 82 athletes from judo and found a prevalence of low back pain (according to weight category) of 34.5% in the lightweight, 32.3% in middleweight and 40.9% in heavyweight athletes. Pocecco et al. [13] conducted a systematic review of the literature, involving articles available by the year 2013, and the results showed that during the Olympic Games in 2008 and 2012, were obtained an average risk of injury between 11% and 12%, with sprains, strains and contusions the most frequent injuries, as those mostly localized lesions in the knees, shoulders and fingers; most of the injuries were due to being thrown.

Considering this high rate of participation of individuals in martial arts, as well as the increased risk of injury in these combat fights, it is necessary to identify risk factors in order to developing appropriate preventive strategies.

The aim of this study was to investigate the prevalence of injuries in martial arts athletes (Jiu-Jitsu and judo), and determine the possible mechanisms of injury.

Materials and Methods

The design of this epidemiological study was cross-sectional.

To develop the study we have done a request for informed consent to participants to be informed about the objectives of the study and evaluations to be conducted, all guaranteed fundamental rights or principles applicable to humans by certain codes of ethics. The study was approved by the Ethics Committee of the Regional Health Administration of the Algarve.

Population

The study population involved Jiu-Jitsu athletes registered in clubs in the Algarve region (4 clubs) and judo athletes registered in clubs in Judo District of the Algarve Association (10 clubs), Portugal.

The inclusion criteria involved cumulatively: athletes who practiced the modality in a period exceeding three months, of both sexes, with ages equal to or greater than 18 years, and who wanted to participate voluntarily in the study.

Measures

The instrument of measurement consisted of a questionnaire that was applied only once during February to June 2015. The questionnaire consisted of two parts: Socio-demographic characterization of population, aspects related with modalities and about the injuries, and the other part included specific questions of mechanism of injury and the technique to be used at the time of injury.

The first part of the questionnaire included common questions to the two martial arts and involved questions about the age, sex, professional situation, years of practice, regularity of training per week, duration of each training session, perform other sport with regularly (at least 2 times a week), and participation in championships.

The second part of the questionnaire consisted of questions about the occurrence of injuries. The injuries were considered along the martial art practice, since this star, resulting from the practice of this modality, in order to verify the lifetime prevalence of injury. The athlete should refer two types of injuries: the most common injury that presented and the injury that more limited and/or prevented the athlete from practicing martial art. The most common injury (frequent injury) was one that an athlete had more than once and the injury that more limited and/or prevented the athlete from practicing martial art (limiting injury) was considered the most severe lesion in which the athlete had to cease martial art practice/training or alternatively make training modifications to continue practice as a consequence of the injury. For each injury (the most common injury related to the martial art and/or the injury that the more limited and/or prevented them from practicing their modality), the athlete had to refer the type and location of the lesion, the moment the injury occurred (during training or competitions) and if held some type of treatment, and if so which treatment was performed, the mechanism of injury and the technique to be used at the time of injury.

The Medical Subject Headings (MeSH) [14] defined the lesions as body injury resulting from a direct or indirectly apply external force, with or without disruption of structural continue.

Data analysis

In a first approach, descriptive statistics were analyzed for all variables in the study. The influence of the variables used in this study on the presence of injury was assessed using binary logistic regressions, based on the Enter method (using all selected variables), and crude and adjusted odds ratios (OR) and respective confidence intervals were presented. A final multivariate model was developed, using the forward likelihood method, and its validity, quality of fitting and predictive capacity were assessed by Omnibus and Hosmer-Lemeshow tests and the Nagelkerke correlation coefficient.

The statistical analysis was performed with the Statistical Package for Social Sciences (SPSS), version 22.0.

Statistical significance was set at 0.05.

Results

The sample was consisted of 62 athletes age between 18 and 59 years (31.94 ± 10.59 years), being 58 (93.5%) male and 4 (6.5%) female. Thirty-eight (61.3%) athletes practiced Jiu-Jitsu and 23 (37.1%) practiced judo.

Most athletes trained between 2 to 3 years 17 (27.4%), 10 (25.8%) athletes trained just one year, 7 (11.3%) of 4 and 5 years, 4 (6.5%) trained between 6 and 7 years, 3 (4.8%) between 8 and 9 years and 15 (24.2%) trained 10 years or more. Concerning the frequency of weekly training, 4 (6.5%) athletes trained once a week, 5 (8.1%) athletes twice a week, 30 (48.4%) trained three times a week, 8 (12.9%) trained four and five times per week (each), and 7 (11.3%) every day. Most athletes trained between 1 and 2 hours per day (43; 69.4%), 16 (25.8%) athletes trained between 2 and 3 hours, and 3 (4.8%) between 3 and 4 hours.

Twenty-three (37.1%) athletes performed another type of sport with a weekly frequency equal to or greater than 2 times, plus Jiu-Jitsu and judo.

Nineteen athletes (19; 30.6%) reported having participated of championships for these modalities.

Fourty-three (69.4%) athletes reported having suffered some type of injury during Jiu-Jitsu or judo, 36 (58.1%) athletes referring injury as the most frequent and 34 (54.8%) referring limiting injury. In Jiu-Jitsu, 25 (65.8%) athletes reported having some type of injury, and in judo 17 (73.9%) athletes had some kind of injury related to the modality.

Within the 36 (100%) athletes who reported frequent injury, 34 (94.4%) reported that the injury occurred during training and only 2 (5.6%) athlete said the injury occurred during the competition. Most athletes (25; 69.4%) said they did some kind of treatment to treat the injury, and the majority opted for physical therapy (8; 32%), followed by the rest (6; 24%) and immobilization (4; 16%).

With regard to injury more limiting and/or preventing the athlete to practice their sport, 32 (94.1%) athletes reported that the injury occurred during training and 2 (5.9%) that occurred during competitions. Twenty-five (73.5%) athletes had some kind of treatment to treat injuries, and the majority held physiotherapy 8 (29.6%), 5 (18.5%) rest, 4 (14.8%) had surgery and immobilization, each.

Tables 1 to 4 show the relative and absolute frequency of type, local and mechanism of injury, and the technique that caused the frequent and limiting injury for each type of modality.

Type of injury	Jiu-Jitsu		Judo	
	Frequent injury	Limiting injury	Frequent injury	Limiting injury
Bone	3 (15%)	2 (10.5%)	2 (12.5%)	4 (26.7%)
Ligament	6 (30%)	2 (10.5%)	2 (12.5%)	4 (26.7%)
Meniscal	0	1 (5.3%)	0	2 (13.3%)
Muscular	4 (20%)	5 (26.3%)	5 (31.3%)	1 (6.7%)
Articular	3 (15%)	7 (36.8%)	6 (37.5%)	4 (26.7%)
Tendon	4 (20%)	1 (5.3%)	1 (6.3%)	0
Other	0	1 (5.3%)	0	0
Total	20 (100%)	19 (100%)	16 (100%)	15 (100%)

Table 1: Type of injury.

Local of injury	Jiu-Jitsu		Judo	
	Frequent injury	Limiting injury	Frequent injury	Limiting injury
Cervical spine	0	2 (10.5%)	1 (6.3%)	0
Thorax/Chest	1 (5%)	3 (15.8%)	0	0
Lumbar spine	1 (5%)	0	0	1 (6.7%)
Shoulder	8 (40%)	5 (26.3%)	7 (43.8%)	3 (20%)
Arm	1 (5%)	0	1 (6.3%)	2 (13.3%)
Elbow	2 (10%)	2 (10.5%)	0	1 (6.7%)
Forearm	0	1 (5.3%)	1 (6.3%)	0
Hands and fingers	1 (5%)	0	2 (12.5%)	0
Pelvis	0	1 (5.3%)	0	0
Thigh	0	0	1 (6.3%)	0
Knee	4 (20%)	3 (15.8%)	1 (6.3%)	6 (40%)
Leg	1 (5%)	0	0	0
Ankle	0	1 (5.3%)	0	0
Foot and fingers	1 (5%)	1 (5.3%)	2 (12.5%)	2 (13.3%)
Total	20 (100%)	19 (100%)	16 (100%)	15 (100%)

Table 2: Location of injury.

Injury mechanism	Jiu-Jitsu		Judo	
	Frequent injury	Limiting injury	Frequent injury	Limiting injury
Direct impact with another fighter	5 (25%)	7 (36.8%)	4 (25%)	5 (33.3%)
Torsion	8 (40%)	8 (42.1%)	3 (18.8%)	4 (26.7%)
Stretch	3 (15%)	2 (10.5%)	2 (12.5%)	1 (6.7%)
Fall/Ukemi	2 (10%)	2 (10.5%)	5 (31.3%)	4 (26.7%)

Unknown	2 (10%)	0	2 (12.5%)	1 (6.7%)
Total	20 (100%)	19 (100%)	16 (100%)	15 (100%)

Table 3: Injury mechanism.

Technique that caused the injury	Jiu-Jitsu		Judo	
	Frequent injury	Limiting injury	Frequent injury	Limiting injury
Being thrown/ Ukemi	1 (5%)	2 (10.5%)	7 (43.8%)	6 (40%)
Performing thrown/Tori	1 (5%)	1 (5.3%)	4 (25%)	2 (13.3%)
Attempting thrown	1 (5%)	1 (5.3%)	1 (6.3%)	3 (20%)
Ground/Ne-Waza	6 (30%)	7 (36.8%)	0	1 (6.7%)
Lock/Katame-Waza	3 (15%)	3 (15.8%)	0	1 (6.7%)
Grip fighting /Kumikata	5 (25%)	2 (10.5%)	2 (12.5%)	1 (6.7%)
Knock/Atemi Waza	0	2 (10.5%)	1 (6.3%)	0
Warm-up	1 (5%)	0	1 (6.3%)	0
Others	2 (10%)	1 (5.3%)	0	1 (6.7%)
Total	20 (100%)	19 (100%)	16 (100%)	15 (100%)

Table 4: Technique that caused the injury.

Table 5 shows the relationship between the presence of injury and gender, age group, modality, years of modality practice and duration of training daily, and participation in championship obtained from the application of logistic regression models. In the adjusted model, the

values obtained in Omnibus, Hosmer and Lemeshow test and Nagelkerke for the absence and presence of injury variable adjusted for the others variables were respectively: $p=0.006$, $p<0.001$ and $R^2=0.164$.

Variables	odds ratio _{crude} (CI 95%); p	odds ratio _{adjusted} ** (CI 95%); p	odds ratio _{adjusted} *** (CI 95%); p
Gender (female*) male	1.35 (0.13-13.9); $p=0.801$	1.33 (0.83-21.13); $p=0.841$	_____
Age group (≥ 30 years*) between 18 and 29 years	4.49 (1.41-14.29); $p=0.011$	3.93 (1.14-13.47); $p=0.030$	4.83 (1.50-15.54); $p=0.088$
Modality (judo*) Jiu-Jitsu	1.47 (0.47-4.67); $p=0.508$	0.91 (0.21-4.05); $p=0.841$	_____
Years of modality practice (over 6 years*) until 5 years	2.70 (0.77-9.50); $p=0.122$	2.17 (0.47-9.96); $p=0.032$	_____
Duration of training daily (between 1 and 2 hours*) from 2 to 4 hours	2.97 (0.95-9.34); $p=0.062$	2.61 (0.72-9.40); $p=0.143$	_____
Participation championship (no*) yes	0.49 (0.14-1.77); $p=0.281$	0.62 (0.15-2.55); $p=0.505$	_____

* Class reference; ** adjusted for gender and age group (Enter model); *** adjusted for gender and age group (Forward LR model)

Table 5: Relationship between the event the presence of injury and variables about non-modifiable sample factors and characteristics of training modality.

It was found (in the adjusted model) that the age group of athletes under age have 4.83 (95% CI: 1.50-15.54; $p=0.088$) more probability to have an injury than older athletes.

Discussion

The data obtained in this study found a high prevalence of lesions in both modalities (69.4%). Regarding Jiu-Jitsu, 65.8% of athletes reported having some type of injury related to the modality. The Carvalho et al. [15] study evaluated 59 athletes from São Paulo, Brazil, and found the presence of 139 lesions, 86 (62%) lesions in advanced level athletes and 53 (38%) in the initiation athletes. Souza et al. [16]

found 160 injuries in 41 athletes from Jiu-Jitsu. In the studies referred previously, the authors don't refer to a percentage of injuries or a limit of injuries per athlete, that is, the same athlete may have had more than three injuries increasing the number of injuries in the total sample. Despite the similar prevalence lesion values obtained with these studies, in this study each athlete only had the possibility of referring the two maximum injuries (the most frequent and/or limiting injuries). Different values were obtained in the study of Kreiswirth et al. [17] which evaluated 951 athletes enrolled to compete in the World Jiu-Jitsu No-Gi Championship 2009, finding only 62 injuries (6.5%).

In the classification of the most common injury, ligament injury (30%) was the most prevalent type of the lesions classified as the most frequent injuries, followed by muscle and tendon injury (20% each) and the joint (36.8%) and muscle injury (26.3%) were the most prevalent in the types of limiting injuries. Kreiswirth et al. [17] found that a total of 40 of the 62 injuries affected the joints. Carvalho et al. [15] found that joint injury also were the most prevalent (22.6% in initiation athletes and 25.5% in the advanced level). This study didn't take into account the division of the injuries by the levels of the modality (beginners versus advanced levels).

Most injuries occurring in athletes of Jiu-Jitsu were located on the shoulders (40% frequent injury and 26.3% limiting injury) and knees (20% frequent injury and 15.8% limiting injury). The Machado et al. [18] study evaluated 265 athletes competing in the World Jiu-Jitsu Championship and the World Cup of Jiu-Jitsu 2006 and also found that the regions most affected by the athletes were the knee (28.4%) and the shoulder (15.6%). The same was verified by Carvalho et al. [15], getting the knee joint a prevalence of 17.4% of the lesions and the shoulder joint with 15.1% of lesions in advanced level athletes and in initiation athletes the knee and the shoulder accounted for 18.8% of injuries each. Souza et al. [16] also found that the site of highest number of injury was the knee (16.3%), followed by shoulder (14.4%). Oliveira et al. [19] evaluated 61 athletes of Jiu-Jitsu participants of the championship held in the city of Catalão-GO, Brazil, and said it was the knee that was most commonly affected (21.5%) and the shoulder obtained a prevalence of 13.9%.

Several factors may be responsible for knee injuries of jiu-jitsu fighters, since in many movements of the struggles they are in unconventional positions, under pressure from the opponent to make the crossing guard. Sprains are also very common in the moment that it is supported on the ground and slightly flexed, being subjected to a strong stress, breaking the functional limit of ligaments. Another way to damage the ligament knee is after a fall, with the body supported only on one leg. The shoulder is an anatomical area very involved in injuries, particularly injuries of acute character, although the overload also present. The main rotations technical are directed to the shoulders; these techniques are attacks on joint structures, subjecting them to range of motion beyond supported by them.

The techniques that caused more injuries in Jiu-Jitsu athletes included ground/Ne-Waza (30% frequent injury and 36.8% limiting injury), grip fighting/Kumikata (25% frequent injury and 10.5% limiting injury) and in the limiting injury, the lock/Katame-Waza technique (15.8%). The Carvalho et al. [15] study found that the techniques that led to more injuries in initiation athletes were the thrown (32%), torsion and lock (26.4%), choke (7.8%), immobilization (3.3%) and in advanced level athletes were the thrown (43%), torsion (29%), lock (16.2%), choke (8.1%) e immobilization (3.4%). In the Oliveira et al. [19] study the most common techniques were lock (34.1%), sweep (25%) and thrown (25%).

Regarding judo, 73.9% of the athletes reported having some type of injury related to the modality. Souza et al. [8] evaluated 93 athletes from São Paulo State Championship of Judo and identified 110 injuries. The results obtained in this study differ from those obtained in the studies of Green et al. [20] which evaluated 392 judokas and the data revealed that only 13.5% of the athletes suffered some kind of injury and the James & Pieter research (2003) which revealed a prevalence of lesions in 12.9% of 116 British athletes. Pierantozzi et al. [7] evaluated 83 videos of athletes during the International Tournaments (2006 and 2007) and identified 27 lesions in 24 athletes (28.9%).

The most common types of injuries presented by judo athletes in this study was classified as articular, which included luxation, dislocation and sprain (37.5% athletes mentioned as the most frequent injury and 26.7% as more limiting injury). Souza et al. [8] also find that the most common types of injuries were sprain (26.4%) and dislocation (18.2%), followed by bruises (15.5%), strain (14.5%) and ligament injury (12.7%). Kujala et al. [5] evaluated 9936 Finnish judo athletes during 1987 to 1991 and found that the most common type of injury was sprains and strains section (44.7%). In the study of James et al. [21] the most common injuries were luxation's and bruises (20% each). In the study by Green et al. [20] the most common types of injuries was bruises (34.6%), strains (23%), the cuts (17.3%) and sprains (17.3%).

With regard to location of the lesion in judo athletes, the most frequent injuries was located on the shoulder (43.8%), followed by hand and fingers and foot and fingers (12.5% each) and in limiting injuries, the most common sites was the knee (40%) and shoulder (20%). Similar data were observed by Green et al. [20], where the most common sites of injury was the fingers (11 injuries), knees (7 injuries), and shoulders (6 injuries) and Souza et al. [8] where the parts of the body most affected were the knee (26.3%), shoulder (21.8%) and fingers (17.3%). Barsottini et al. [22] evaluated 78 athletes from judo and found that the knee (23%), fingers of hands and feet (22%) and shoulder (16%) were the sites of injuries with higher prevalence. Carazzato et al. [23] evaluated 129 athletes and observed that the shoulder was the most injured joint (72.1%), then knee (63.6%), hand (62%) and foot (53.5%).

The shoulder injuries can result from a strong impact after a knock during a fall or of a fall on his opponents, causing overload once the impact involves your weight with added strength and speed. The fingers are subjected to differentiated aggression in the moment when there is a contest for the best grip, allowing athletes to apply the most appropriate technique, or simply to be more aggressive in combat. Acute injuries such as sprains may be caused by falls and injuries in the moment when the opponent's hand is removed from the judogi and chronic injury by prolonged and exhaustive training that can lead to arthritis. The injuries in the knees can be attributed to several rotations performed by the athletes when they try to apply a particular technique or receiving, since these rotations when performed abruptly generate movements which exceed the limits joint functionality [8]. James & Pieter [21] obtain different data from this study, the most common sites of injury being the head and neck (40% - 6 athletes) and elbows (13.3% - 2 athletes).

Most of the frequent injuries were caused by the judo thrown techniques (Uke with 43.8% and Tori with 25%) and most limiting injuries were caused by being thrown/ Ukemi (40%) and attempting thrown (20%). Green et al. [20] found that most injuries was caused by being thrown (15 athletes), attempting thrown (13 athletes) e grip

fighting (12 athletes). James & Pieter [21] found that the most frequent injuries was the result of performing thrown (20%-3 athletes), being thrown (20%-3 athletes), ground work (13.3%-2 athletes) and arm lock (13.3%-2 athletes). Pierantozzi & Muroi [7] also found that the most common mechanisms of injury was standing fight when the athlete was being thrown (37%) and gripping fight (29.7%).

Considering both modalities, most athletes said that the injuries occurred during training (94.4% frequent injury and 94.1% limiting injury), the same was observed in the study of Barsottini et al. [22], where 71% of the injuries occurred in training and in the Machado et al. [18] study with 67.4% of injuries occurring during training. However, these data differ from those obtained by Souza et al. [8], where 49% of injuries occurred in competitive situations. Since the greater number of injuries occurred during the training of athletes, it is suggested that clubs include in their training sessions an appropriate period of warm-up and return to rest, also including proprioceptive and plyometric exercises that simulate the most the movements common to these modalities as a way of preventing injuries and improving physical performance of the athletes.

Most athletes of both modalities said they did some kind of treatment to treat the injuries, with the majority of athletes performing physiotherapy, rest and immobilization for the treatment of frequent and/or limiting injury. Regarding the treatment of limiting injury, one form of treatment also involved surgery. In the Carvalho et al. [15] study advanced level athletes performed as treatment the rest (26.1%), immobilization (18.9%), physiotherapy (16.2%), surgery (8.1%) and initiation athletes performed the rest (35.6%), physiotherapy (26%), immobilization (17.8%) and surgery (5.4%).

The data from this study found that younger athletes, with a shorter modality practice were those most susceptible to injury, data that differ from the study of Green et al. [20] in which the judokas with three or fewer years of training experience revealed a 14.6% injury rate, against 21.9% of judokas who had trained for 4 years or more, and judokas who trained less than 3 hours per week showed a prevalence of injury of 21.6%, and those training over 3 hours showed a 18.5% rate of injury.

The Oliveira et al. [19] study found that athletes with less practice time (white, yellow and green belts) showed similar injuries values during training as the intermediate level athletes (blue belts) (27.8%); as in competition, initiation athletes (white, yellow and green belts) had 8.3% of the lesions and intermediate level athletes (blue belt) showed 16.7% of lesions. Already in the advanced level athletes the injury during training was 13.9% in athletes with purple belt, 8.3% in the brown belt and a higher prevalence of injuries (22.2%) in black belt athletes, and in the championship athletes with purple belt were 8.3% of injuries, 16.7% of injuries in brown belt athletes, and black belt athletes with 50% of injuries. Kreiswirth et al. [17] also found that the more experienced athletes (brown and black belt, 8.3% each) had higher risk of injury than less experienced athletes (blue belt 5.7% and purple belt 5%). Considering Mixed martial arts (MMA) athletes, the Rainey [2] study found that athletes with lower belts had more injuries than the most advanced belt.

The present study has limitations such as the small sample size, however, considering athletes with ages greater than or equal to 18 federated in the Algarve region, this number is low, and thus suggested future studies involving other regions of the country in order to increase the sample size.

The data obtained in this study found a high prevalence of injuries in Jiu-Jitsu and judo athletes. The techniques that caused more injuries in Jiu-Jitsu athletes included ground and grip fighting. Most of the frequent injuries was caused by the judo thrown techniques and most limiting injuries was caused by being thrown and attempting thrown. The age group of athletes under age have more probability to have an injury than older athletes. It is necessary to know the techniques that promote the highest number of injuries in these athletes to developing appropriate preventive strategies.

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