

# Prevalence of musculoskeletal pain in body segments in Judo and Jiu-jitsu athletes

## *Prevalência de dor musculoesquelética nos segmentos corporais em atletas de Judô e Jiu-jitsu*

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### ABSTRACT

**BACKGROUND AND OBJECTIVES:** A notable gap persists in understanding the prevalence of pain and musculoskeletal injuries in combat sports. This study offers a comprehensive exploration of the most affected anatomical regions. Such an investigation is pivotal for refining clinical strategies involving preventive measures and physiotherapeutic interventions.

**METHODS:** This is a cross-sectional observational study. Individuals aged 18 years or over, combat sport modalities practitioners, of both genders, and capable of answering the questionnaire were included. Data were analyzed using descriptive statistics and the Chi-square test.

**RESULTS:** The final sample consisted of 71 athletes. Female athletes practiced 12.65% Judo and 21.51% practiced Jiu-jitsu, while 26.58% of male athletes practiced Judo and 39.24% Jiu-jitsu. The mean age was 31.14±11.75 years, and body mass index of 27.69 kg/m<sup>2</sup> (±5.31). The average time of practice was 8±10.59 years. The regions most affected by pain in the last 12 months were the lumbar spine (90%), knees (90%) and wrists/hands (60%). Female Judo presented a significant index of pain

in the last 12 months in the upper limbs, and the neck was the region identified as most responsible for limiting activities. In the last 7 days, the thoracic and lumbar spine regions were more significant. In female Jiu-jitsu, in the 12-month and 7-day analyses, the ankle/foot were the most affected regions when compared to the male gender, and the knees were identified as most responsible for limiting activities.

**CONCLUSION:** A comprehensive description of the main regions affected by musculoskeletal disorders and pain is of fundamental importance for the development of prevention and physiotherapeutic treatment strategies.

**Keywords:** Athletic injuries, Martial arts, Pain.

### RESUMO

**JUSTIFICATIVA E OBJETIVOS:** Persiste uma lacuna notável na compreensão da prevalência da dor e das lesões musculoesqueléticas nos esportes de combate. Este estudo oferece uma exploração abrangente das regiões anatômicas mais afetadas. Tal investigação é fundamental para refinar estratégias clínicas envolvendo medidas preventivas e intervenções fisioterapêuticas.

**MÉTODOS:** Estudo observacional transversal. Foram incluídos indivíduos com idade igual ou superior a 18 anos, praticantes de modalidades esportivas de combate, de ambos os sexos e capazes de responder ao questionário. Os dados foram analisados por estatística descritiva e o teste Qui-quadrado.

**RESULTADOS:** A amostra final foi composta por 71 atletas. Das atletas do sexo feminino, 12,65% praticavam Judô e 21,51% praticavam Jiu-jitsu, enquanto 26,58% do sexo masculino praticavam Judô e 39,24% Jiu-jitsu. A média de idade foi de 31,14±11,75 anos, e índice de massa corporal de 27,69 kg/m<sup>2</sup> (±5,31). O tempo médio de prática foi de 8 ±10,59 anos. As regiões mais afetadas pela dor nos últimos 12 meses foram coluna lombar (90%), joelhos (90%) e punhos/mãos (60%). O Judô feminino apresentou índice significativo de dor nos últimos 12 meses em membros superiores, sendo o pescoço identificado como o maior responsável pela limitação das atividades. Nos últimos 7 dias, colunas torácica e lombar foram mais significativas. No Jiu-jitsu feminino, em 12 meses e 7 dias, tornozelo/pé foram mais afetados quando comparado ao masculino, e os joelhos foram os maiores responsáveis pela limitação das atividades.

**CONCLUSÃO:** Uma descrição abrangente das principais regiões afetadas por dor e lesões musculoesqueléticas é de funda-

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### HIGHLIGHTS

- The results of this study allow a better understanding of the prevalence of pain and musculoskeletal injuries in combat sports.
- The study presents the most affected anatomical regions, beyond the specificities about gender and type of modality.
- The conclusion helps clinical decision-making, allowing the development of more appropriate strategies involving preventive measures and physiotherapeutic interventions.

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mental importância no desenvolvimento de estratégias de prevenção e tratamento fisioterapêutico.

**Descritores:** Artes marciais, Dor, Lesões em atletas.

## INTRODUCTION

The classic definition of combat sports is typically rooted in individual contact between opponents and involves distinct sets of rules, along with individual and specific characteristics for each modality. These sets vary significantly among different combat modalities, encompassing striking techniques such as punching and kicking, grappling techniques like joint locks, immobilization, and strangulation in fighting sports, and the amalgamation of these elements in mixed-style sports like Mixed Martial Arts (MMA), which incorporates both characteristics<sup>1</sup>.

The attainment of the maximum score during a fight hinge on the rules of each modality. These rules may include submissions resulting from trapping the opponent on the mat, executing joint locks or strangulation, inducing unconsciousness, or delivering blows such as kicks and punches. Scoring can also result from the cumulative assessment of points, judges' and referees' decisions, and official intervention to determine the fighter's ability to continue or not<sup>2</sup>.

Combat sports are characterized by repeated movements, physical contact, and the execution of various techniques, encompassing projections, immobilization, kicks, punches, grappling, and joint blocks, primarily targeting the arms and legs<sup>3</sup>.

Judo, conceived in the 19<sup>th</sup> century in Japan by Professor Jigoro Kano, incorporates educational values and fundamental principles. Classified as a sport modality, Judo competitions are separated by categories of weight, age, and belt ranks (graduation)<sup>4</sup>.

Jiu-jitsu, known as Brazilian Jiu-Jitsu and represented by the International Brazilian Jiu-Jitsu Federation (IBJJF), also originated in Japan. In feudal times, it encompassed kicks, strikes, strangulation, twists, immobilization, and pitches. By the 16<sup>th</sup> century, it began to be systematically practiced. Similar to Judo, it is organized into categories of weight, age, and rank (graduation)<sup>5</sup>.

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage". Pain, a subjective experience influenced by various factors, including biological, psychological, and social aspects, is a common challenge faced by athletes across different performance levels<sup>6</sup>.

Classifying pain is crucial for understanding its impact on athletes' ability to engage in routine activities. Pain intensity, often measured using the visual analogue scale (VAS) ranging from zero ("no pain") to 10 ("unbearable pain"), provides valuable insights into the athlete's experience<sup>7</sup>.

An essential gap persists in the existing literature concerning the incidence and prevalence of pain and musculoskeletal injuries in combat sports. The present study's objective was to address this gap by providing a comprehensive description of the most affected regions. Such an approach is crucial for enhancing clinical reasoning tailored to this population, particularly in the formulation of preventive strategies and physiotherapeutic treatments.

## METHODS

This observational cross-sectional study was conducted between March and July 2021 in accordance with the guidelines set forth by the Research Ethics Committee (CEP) (CAAE 37942620.0.0000.5116).

It involved individuals of both genders engaged in combat sports. To ensure a precise and comprehensive presentation, the subdivision and description of the topics below are aligned with the items outlined in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist<sup>8</sup>.

### Setting and participants

The participants were selected through the convenience sampling technique, wherein individuals readily available were included as study participants. Participation was voluntary, contingent upon the acceptance of the Free and Informed Consent Term (FICT), and data were collected through an online electronic questionnaire. The inclusion criteria comprised individuals aged 18 years or older, actively practicing combat sports, of both genders, recreational and professional, with minimum three training sessions per week, and capable of completing the electronic questionnaire online.

Exclusions were made for individuals who did not regularly participate in training sessions, resulting in a final sample size of 71 out of the initial 110 practitioners.

### Variables and data collection

Data collection was conducted online using Google Forms. After contacting the federations, participants received an access link via email. The initial step involved obtaining FICT. Subsequently, participants provided information on sociodemographic and anthropometric variables, including gender, age, height (cm), weight (kg), and the specific combat sport practiced. The Nordic Musculoskeletal Questionnaire (NMQ), previously validated<sup>9</sup>, was then administered to collect data on the region and intensity of pain. The NMQ displays an image of the human figure, divided into nine anatomical regions: neck, shoulders, upper and lower back, elbows, wrists/hands, hips/thighs, knees, and ankles/feet. The tool is designed to assess the prevalence of musculoskeletal pain in any of these nine anatomical areas, restrictions in performing regular activities, and the need to seek guidance from a healthcare professional.

### Study bias

One notable limitation is the inherent constraint of cross-sectional studies, which provide a snapshot of characteristics at a single point in time. This limitation raises concerns about the representativeness of the observed characteristics, as they may not capture the dynamic nature of participants' experiences over time. In the context of this study, where pain incidence is assessed among male and female participants with varying levels of graduation, such as training sessions per week, the reliance on a single moment in time may introduce bias to the prevalence of pain.

**Statistical analyses**

Descriptive statistic, encompassing mean, standard deviation, and absolute and relative frequency, was employed for data analysis, offering a visual and preliminary analysis. Data normality was assessed using the Kolmogorov-Smirnov test. The non-parametric Chi-square test ( $\chi^2$ ) was applied to compare the location of symptoms on the NMQ, with a significance level set at  $p < 0.05$ . The Statistical Package for the Social Sciences (SPSS) version 23.0 served as the software for the entire study.

**RESULTS**

The study encompasses 71 athletes separated by gender and combat sport modality. Table 1 contains the results regarding socio-demographic and anthropometric variables.

**Table 1.** Sample characterization (n=79)

Variables	
Gender (%)	
Female	34.2
Male	65.8
Age (mean, SD)	31.14±11.75
Body mass index (kg/m <sup>2</sup> )	27.69±5.31
Sport modality (%)	
Female Judo	12.7
Female Jiu-Jitsu	21.5
Male Judo	26.6
Male Jiu-Jitsu	39.4
Practice time (years)	8±10.5

SD = standard deviation.

In the NMQ, the regions that most presented symptoms in the last 12 months were the lumbar (90%), knees (90%), wrists/hands (60%), on the other hand, the thoracic region (30%) and hips/thighs (30%) had fewer symptoms.

According to the comparison between genders in Judo, regarding pain or discomfort in the last 12 months, the Chi-square test verified that female Judo had a higher index in the elbow region ( $\chi^2 = 4.49$ ;  $p=0.03$ ) and wrist/hand region ( $\chi^2 = 4.03$ ;  $p=0.04$ ). For the limitations of normal activities due to any of these problems in the last 12 months, the results showed that the anatomical region of the neck ( $\chi^2 = 4.51$ ;  $p=0.03$ ) was the most affected in the modality of Judo in females, according to presented in table 2.

In the last 7 days, the symptoms of pain or discomfort were higher in the thoracic ( $\chi^2 = 4.49$ ;  $p=0.03$ ) and lumbar ( $\chi^2 = 12.51$ ;  $p=0.00$ ) regions in the male and female Judo sample, respectively. The results are described in table 3.

In the comparison between genders in Jiu-jitsu regarding pain or discomfort in the last 12 months, the Chi-square verified test that female Jiu-jitsu has a higher index in the ankle/foot region ( $\chi^2 = 4.72$ ;  $p=0.03$ ), as shown in table 4.

For the limitations of normal activities due to any of these problems in the last 12 months, it was observed that the knee segment ( $\chi^2 = 5.13$ ;  $p=0.02$ ) was the most affected in females, as shown in table 5.

In the last 7 days, symptoms of pain or discomfort were higher in the ankle/foot region ( $\chi^2 = 6.88$ ;  $p=0.00$  in the Jiu-jitsu sample) in females, as shown in table 6.

**Table 2.** Pain or discomfort and limitation of activities in the last 12 months in male and female Judo athletes

Pain or discomfort	Female		Male		$\chi^2$	p-value
	Yes	No	Yes	No		
Neck	20%	80%	14.28%	85.71%	0.16	0.68
Shoulders	40%	60%	38.09%	61.90%	0.01	0.91
Elbows	20%	80%	0%	100%	4.49	0.03*
Wrist/hand	40%	60%	9.52%	90.47%	4.03	0.04*
Thoracic region	20%	80%	9.52%	90.47%	0.66	0.41
Lumbar region	60%	40%	42.85%	57.14%	0.79	0.37
Hip/thigh	0%	100%	0%	100%	0.00	0.00
Knees	80%	20%	52.38%	47.61%	2.17	0.14
Ankle/foot	30%	70%	28.57%	71.42%	0.01	0.93
Limitation of activities	Female		Male		$\chi^2$	p-value
	Yes	No	Yes	No		
Neck	50%	50%	14.28%	85.71%	4.51	0.03*
Shoulders	60%	40%	61.90%	38.09%	0.01	0.91
Elbows	50%	50%	23.80%	76.19%	0.39	0.53
Wrist/hand	60%	40%	47.61%	52.38%	0.41	0.51
Thoracic region	30%	70%	4.76%	95.23%	3.83	0.05
Lumbar region	90%	10%	61.90%	38.09%	2.59	0.10
Hip/thigh	30%	70%	23.80%	76.19%	0.13	0.71
Knees	30%	10%	61.90%	38.09%	2.59	0.10
Ankle/foot	50%	50%	33.33%	66.66%	0.79	0.37

\* = indicates statistically significant difference ( $p < 0.05$ ).

**Table 3.** Any problem in the last 7 days in female and male Judo athletes

	Female		Male		$\chi^2$	p-value
	Yes	No	Yes	No		
Neck	10%	90%	4.76%	95.23%	0.30	0.57
Shoulders	40%	60%	38.09%	61.90%	0.10	0.91
Elbows	30%	70%	9.52%	90.47%	2.10	0.14
Wrist/Hand	40%	60%	14.28%	85.71%	2.56	0.10
Thoracic region	20%	80%	0%	100%	4.49	0.03*
Lumbar region	50%	50%	19.04%	80.95%	12.51	0.00*
Hip/thigh	20%	80%	4.76%	95.23%	1.80	0.18
Knees	30%	70%	28.57%	71.42%	0.07	0.93
Ankle/foot	20%	80%	9.52%	90.47%	0.66	0.41

\* = indicates statistically significant difference ( $p < 0.05$ ).**Table 4.** Pain or discomfort in the last 12 months in female and male Jiu-jitsu athletes

	Female		Male		$\chi^2$	p-value
	Yes	No	Yes	No		
Neck	11.76%	88.23%	6.45%	93.54%	0.40	0.52
Shoulders	35.29%	64.70%	51.61%	48.38%	1.17	0.27
Elbows	5.88%	94.11%	6.45%	93.54%	0.00	0.93
Wrist/hand	29.41%	70.58%	16.12%	83.87%	1.17	0.27
Thoracic region	11.76%	88.23%	6.45%	93.54%	0.40	0.52
Lumbar region	52.94%	47.05%	25.80%	74.19%	3.53	0.06
Hip/thigh	0%	100%	3.22%	96.77%	0.56	0.45
Knees	64.70%	35.29%	45.16%	54.83%	1.68	0.95
Ankle/foot	35.29%	64.70%	9.67%	90.32%	4.72	0.03*

\* = indicates statistically significant difference ( $p < 0.05$ ).**Table 5.** Limitation of activities in the last 12 months in female and male Jiu-jitsu athletes

	Female		Male		$\chi^2$	p-value
	Yes	No	Yes	No		
Neck	52.94%	47.05%	35.48%	64.51%	0.46	0.49
Shoulders	70.58%	29.41%	61.29%	38.70%	0.41	0.51
Elbows	11.76%	88.23%	16.12%	83.87%	0.16	0.68
Wrist/hand	64.07%	35.29%	38.70%	61.29%	2.97	0.08
Thoracic region	14.28%	82.35%	16.12%	83.87%	0.18	0.89
Lumbar region	82.35%	17.64%	67.74%	32.25%	1.18	0.27
Hip/thigh	29.41%	70.58%	25.80%	74.19%	0.07	0.78
Knees	94.11%	5.88%	64.51%	34.37%	5.13	0.02*
Ankle/foot	41.17%	58.82%	29.03%	70.96%	0.72	0.39

\* = indicates statistically significant difference ( $p < 0.05$ ).**Table 6.** Any problems in the last 7 days in female and male Jiu-jitsu athletes

	Female		Male		$\chi^2$	p-value
	Yes	No	Yes	No		
Neck	5.88%	94.11%	9.67%	90.32%	0.20	0.64
Shoulders	12.09%	76.47%	29.03%	70.96%	0.16	0.68
Elbows	5.88%	94.11%	6.45%	82.85%	0.00	0.93
Wrist/hand	29.41%	70.58%	19.35%	80.64%	0.62	0.42
Thoracic region	11.76%	88.23%	9.67%	90.32%	0.05	0.82
Lumbar region	29.41%	70.58%	16.12%	83.87%	1.17	0.27
Hip/thigh	5.88%	94.11%	5.88%	96.77%	0.19	0.66
Knees	35.29%	64.70%	38.70%	61.29%	0.05	0.81
Ankle/foot	29.41%	70.58%	5.88%	96.77%	6.88	0.00*

\* = indicates statistically significant difference ( $p < 0.05$ ).

## DISCUSSION

The anatomical regions most frequently affected by pain or discomfort among athletes were the lumbar spine (90%), knees (90%), and wrists/hands (60%). These study findings revealed a heightened relevance in the female population.

The authors<sup>10</sup> investigated the prevalence of low back pain in a school setting, evaluating both girls and boys. Judo ranked second among sports contributing to this condition. The study suggested that certain Judo techniques, such as passing changes and guard sweeps, could induce spinal loads due to alternating movements between maximum flexion and extension. To mitigate this, the authors<sup>11</sup> recommended the use of the half-guard during training to prevent excessive weight transfer onto the guard fighter, consequently reducing lumbar spine overload<sup>11</sup>.

A study conducted a comprehensive research on musculoskeletal injuries across various sports, including Judo, Brazilian Jiu-jitsu, Kickboxing, MMA, and Wrestling. In combat sports, joint injuries were predominant (76.70%), particularly in the knee region<sup>12</sup>. Brazilian Jiu-jitsu's characteristic techniques, involving joint locks with high rotational torque, were identified as a significant risk factor for knee injuries.

Another study investigated injuries in Brazilian Jiu-jitsu, Judo, and mixed martial arts athletes. Notably, Jiu-jitsu (41%) and Judo (38%) athletes showed significant hand injuries, primarily strains/sprains, whereas MMA athletes experienced a higher frequency of fractures (47%)<sup>13</sup>. The nature of these injuries is closely linked to the unique demands of each combat sport, such as changing grips in Judo and Brazilian Jiu-jitsu.

In terms of gender-specific pain experiences, female Judo athletes exhibited a significant prevalence of upper limb pain or discomfort in the past 12 months compared to their male counterparts, with the wrist/hand region (40%) and elbows (20%) being particularly affected, attributed to the manual skills involved in Judo techniques<sup>14</sup>. This observation emphasizes the significance of comprehending and addressing gender-specific pain patterns in combat sports.

The present study's findings highlight the neck region (50%) as the most constraining for normal activities in the last 12 days among female Judo practitioners. A study involving combat sports athletes reported neck pain as one of the most frequently reported symptoms<sup>15</sup>. Possible explanations for these findings stem from strangulation and immobilization during ground techniques, often associated with projections against opponents who, in attempting to evade throws, may execute takedowns incorrectly.

In the female Judo modality, over the past 7 days, the lumbar (50%) and thoracic (20%) spine regions were notably affected. The authors<sup>16</sup> stress the importance of good spinal mobility, especially in throwing conditions, like the *goshi* strike, which relies on pelvic girdle movement<sup>16</sup>. Judo extensively involves trunk rotation, a vital movement in ground fights and standing positions.

Within the Jiu-jitsu modality, the present study's results indicate that lower limbs, specifically the ankle/foot segments, exhibited significant pain or discomfort in the last 12 months and the last 7 days for females. This pattern in distal regions can be explained by the barefoot nature of competitions and training, where the foot may become entangled in the opponent's kimono or on the mat during a guard pass<sup>17</sup>. The submission technique's mechanics, progressively increasing rotational torque and lever arm during movement, contribute to heightened stress in knee hyperextension<sup>18</sup>.

The observed difference in pain sensitivity between genders is a consistent finding across multiple studies, attributed to various factors, including biological, psychological, and social influences<sup>19</sup> generally exhibiting a lower pain threshold and tolerance in response to diverse stimuli compared to men<sup>19</sup>. The present study's outcomes highlight the female population as particularly significant in this regard, possibly influenced by the duration of their practice, with a majority being beginners.

Judo and Jiu-jitsu share similar combat characteristics, and the heightened incidence of lower limb injuries in these sports may be attributed to these common features. Notably, Jiu-jitsu predominantly involves ground fighting, utilizing finishing techniques such as "braces" that push the opponent's joint to its maximum range of motion. This action overloads the dynamic stabilizers, including bone structures, tendons, ligaments, and muscles, potentially leading to pain and discomfort, ultimately compelling the opponent to concede<sup>20</sup>.

While Judo and Jiu-jitsu both fall under the category of grappling combat sports, their physiological responses and fight characteristics differ. Judo primarily focuses on standing fighting, aiming to throw the opponent onto the ground with their back, interspersed with brief ground fighting intervals where competitors strive for quick submissions or immobilizations<sup>21</sup>.

The observed contrast in the present study's findings highlights a higher prevalence of musculoskeletal pain or discomfort in Judo's upper limbs (elbow, wrist/hand), as well as the neck, thoracic, and lumbar spine. Conversely, Jiu-jitsu demonstrates a predominance of musculoskeletal issues in the lower limbs, including the knee, ankle, and foot. These disparities can be attributed to the distinct kinematics inherent in each modality. Judo, with its emphasis on takedowns and standing maneuvers, recruits more movement from the upper limbs. In contrast, Jiu-jitsu is characterized by basic ground-fighting techniques. Both Judo and Brazilian Jiu-Jitsu are recognized as physically demanding sports.

Understanding the specific regions where musculoskeletal disorders are most prevalent in a particular sport is crucial for recognizing trauma mechanisms. Consequently, it enables the development of more comprehensive prevention programs and more efficient rehabilitation strategies.

It is important to note that this study was conducted during the COVID-19 pandemic, a period marked by the suspension of many athletes' training activities. As a potential

limitation, individuals practicing one or more sports may experience overtraining and overload, posing a significant risk of pain that could originate from other athletic activities. Consequently, future studies should incorporate intervention programs during the training and competition calendar, assessing the interaction of multiple factors across the sporting spectrum.

## CONCLUSION

The findings reveal distinct patterns of pain prevalence in specific anatomical regions among female Judo and Jiu-jitsu practitioners compared to their male counterparts. Notably, the lumbar spine, knees, and wrists/hands emerged as the most affected regions across both genders. Female Judo participants exhibited a significant prevalence of pain in the upper limbs, specifically the elbows and wrists/hands, when contrasted with their male counterparts. Additionally, the neck region emerged as the primary factor limiting activities in this subgroup. Conversely, in female Jiu-jitsu practitioners, the ankle/foot region experienced heightened pain compared to males, with the knees identified as the primary source of limitations in activities.

This nuanced understanding of pain distribution is crucial for devising targeted prevention strategies and physiotherapeutic interventions tailored to the specific needs of athletes engaged in combat sports. By comprehensively characterizing the main regions affected by musculoskeletal conditions, particularly pain, it's possible to contribute valuable insights to the ongoing efforts in optimizing the well-being and performance of individuals practicing these demanding sports.

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## AUTHORS' CONTRIBUTIONS

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Statistical analysis, Data Collection, Conceptualization, Project Management, Research, Methodology, Writing - Preparation of the original, Writing - Review and Editing, Supervision, Validation, Visualization

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