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Sports injuries in amateur recreational Taekwondo athletes

Lesões desportivas em atletas recreacionais amadores de taekwondo

Lesiones deportivas en atletas aficionados recreativos de taekwondo

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ABSTRACT | Combat sports are very common in sport mega-events. Taekwondo is a combat sport that prioritizes direct contact between participants, specially by kicks and punches, and provides ambiguity in the health-sport relationship, as its practice could be harmful. This study aimed to quantify the prevalence of injuries in amateur Taekwondo athletes, from training or competitions, and assess their association with intrinsic and extrinsic factors. This is a descriptive, observational, and retrospective study that assessed injuries by a reported morbidity inquiry. Information on sports injuries considered the last six months of 2018. Participants were athletes aged from 12 to 25 years old, of both sexes, practicing Taekwondo in the city of Pelotas, Rio Grande do Sul, Brazil. The prevalence of sports injuries in amateur Taekwondo athletes in Pelotas was 26.2% (n=1), without significant differences between sexes. The main reason for the practice was physical conditioning (35.7%). The main mechanism of injury was kick when attacking (45.4%), followed by impact when defending (27.3%). The most frequent type of injury was sprain (27.3%). followed by contusion (18.2%), and the most injured body parts were knees (36.4%) and ankles (36.4%). The prevalence of sports injuries in amateur Taekwondo athletes in Pelotas was lower than the one found in the literature, and it may be due to the nature of the practice, as they are recreational amateur athletes aiming to improve physical conditioning.

Keywords | Sports Injuries; Martial Arts; Knee Injuries; Ankle Injuries.

RESUMO | As modalidades esportivas de combate (MEC) são muito frequentes em megaeventos esportivos e, dentre elas, destaca-se o taekwondo, que prioriza o contato direto entre os participantes principalmente a partir de chutes e socos, e proporciona ambiguidade na relação saúde-desporto, pois sua prática pode ser lesiva. O objetivo do estudo foi quantificar a prevalência de lesões em atletas recreacionais de taekwondo, oriundas de treinos ou competições, e testar sua associação a fatores intrínsecos e extrínsecos. Trata-se de estudo observacional descritivo, de natureza retrospectiva, que empregou inquérito de morbidade referida para registro dos agravos. As informações quanto à lesão desportiva foram registradas considerando os últimos seis meses de 2018. Participaram atletas com idade entre 12 e 25 anos, de ambos os sexos, praticantes de taekwondo na cidade de Pelotas, no Rio Grande do Sul. A prevalência de lesões desportivas em praticantes recreacionais de taekwondo na cidade de Pelotas é 26,2% (n=1), sem diferenças significantes entre sexos. O principal motivo de prática é o condicionamento para saúde (35,7%); o principal mecanismo de lesão foi chute atacando (45,4%), seguido de impacto ao realizar defesa (27,3%); o tipo de lesão mais frequente foi entorse (27,3%), seguido de contusão (18,2%); e os segmentos corporais mais lesionados foram joelho (36,4%) e tornozelo (36,4%). A prevalência de lesões desportivas em praticantes recreacionais de taekwondo da cidade de Pelotas é inferior à encontrada na literatura, e isto pode decorrer da natureza da prática, dado que eles são atletas recreacionais amadores, com a prática direcionada ao condicionamento para a saúde.

Descritores | Traumatismos em Atletas; Artes Marciais; Traumatismos do Joelho; Traumatismos do Tornozelo.

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RESUMEN | Las modalidades deportivas de combate (MDC) son muy comunes en los megaeventos deportivos y, entre ellos, destaca el taekwondo, el cual prioriza el contacto directo entre los participantes principalmente a través de patadas y golpes, y proporciona ambigüedad en la relación salud-deporte, ya que su práctica puede ser perjudicial. El objetivo del estudio fue cuantificar la prevalencia de lesiones en atletas recreativos de taekwondo, desde entrenamientos o competiciones, y probar su asociación con factores intrínsecos y extrínsecos. Este es un estudio observacional descriptivo, de tipo retrospectivo, que utilizó una encuesta de morbilidad reportada para registrar las condiciones. La información sobre lesiones deportivas se registró teniendo en cuenta los últimos seis meses de 2018. Los participantes eran atletas de entre 12 y 25 años, de ambos sexos, practicantes de taekwondo en la ciudad de Pelotas, en Rio Grande do Sul (Brasil). La prevalencia de lesiones deportivas en practicantes recreativos de taekwondo en la ciudad de Pelotas es del 26,2% (n = 11), sin diferencias significativas entre sexos. La razón principal de la práctica de los participantes es el acondicionamiento de la salud (35,7%); el principal mecanismo de lesión fue el ataque de patada (45,4%) seguido de impacto al realizar la defensa (27,3%); el tipo de lesión más frecuente fue el esguince (27,3%) seguido de contusión (18,2%); y los segmentos corporales más lesionados fueron la rodilla (36,4%) y el tobillo (36,4%). La prevalencia de lesiones deportivas en practicantes recreativos de taekwondo en la ciudad de Pelotas es menor que la que se encuentra en la literatura, y esto puede deberse a la naturaleza de la práctica, dado que son atletas aficionados recreativos, con la práctica dirigida al acondicionamiento para la salud.

Palabras clave | Traumatismos en Atletas; Artes Marciales; Traumatismos de la Rodilla; Traumatismos del Tobillo.

INTRODUCTION

Combat sports stand out among several sports practices, as they contribute greatly to the distribution of medals in sport mega-events and present high international visibility[1]. However, these sports provide ambiguous outcomes in the health–sport relationship, as they are responsible for most sports injuries[2-3]. Taekwondo is a combat sport that prioritizes direct contact between athletes, by kicks and punches, which makes it inherent to injuries risk[2,4]. The requirements and competitiveness of the sport increase the risk of sports injuries and, despite efforts to reduce it, studies are necessary to assess its prevalence and associated risk factors[5,6].

Sports injuries can be characterized as unwanted injuries that harm an athlete's body. Whether in training or competitions, these injuries occur during the practice, and can keep the athlete away from the sports practice for a long time[1,7,8]. Currently, these injuries are considered a major public health problem—considering their magnitude, transcendence, and vulnerability—and stands out in the ranking of most common injuries in the Western world[2,7]. A study performed with adolescents showed that 40% of medical care is associated with the treatment of sports injuries, with an estimated 8% of young people interrupting their recreational and sports activities every year due to injuries, which also causes a high financial costs[2,9].

Considering that the margin of adjustment and modifications of intrinsic risk factors for injuries is low, several studies have been assessing extrinsic factors associated with sports injuries in combat sports[10,11]. Each sport provide specific injury incidences related to its practice. For Taekwondo, its most common mechanism of injury is the direct contact, especially due to precise kicks when defending and attacking, besides poorly executed or nonexistent blocking skills and inefficient protection[10,12,13]. Sports injuries that most affect Taekwondo athletes are contusions, muscle strains, sprains, and concussions[2]. These injuries affect head, neck, spine, thigh, knees, ankles, and feet[12,14].

The prevalence of sports injuries in Taekwondo competing athletes is high[14,15]. On the other hand, the literature lacks studies that focus on amateur athletes. In this sense, while recognizing the relevance of high-level sports, it is important to understand that most athletes are amateurs and often do not adopt behaviors and habits of professional athletes[16]. Thus, this study aimed to quantify the prevalence of injuries in amateur Taekwondo athletes, from training or competitions, and to assess their association with intrinsic and extrinsic factors.

METHODOLOGY

This is a descriptive and observational study. The following independent variables were considered: sex, age, height, body mass, weekly training volume, and participation in competitions. The following dependent variables were considered: type of injury, mechanism of injury, anatomical site, and time of injury recovery.

Athletes who attended to gyms, clubs, or associations that offered Taekwondo in the municipality of Pelotas, Rio Grande do Sul, were included in this study. Pelotas has about 340,000 inhabitants, of which 28% are aged under 18 years[17]. Considering a cohort of 4,350 young people, out of a total of 5,249 births, the practice of combat sports in Pelotas is calculated to be close to 7%[18]. Thus, about 367 young individuals practice different combat sports. Considering a uniform distribution of Olympic (Judo, Taekwondo, Boxing) and non-Olympic sports (Karate, Brazilian Jiu-Jitsu, Muay Thai, Wushu), about 53 young people practice each sport. Therefore, the management of the data collection process focused on collecting information from at least 80% of the total Taekwondo athletes.

To calculate the sample size, the Epi Info 7 StatCalc software (Centers for Disease Control and Prevention – CDC) was employed. Also, data derived from a previous study were used[20]. Considering a population of 450 Taekwondo athletes in Pelotas who met the inclusion criteria, as well as an 54% expected injury frequency and an acceptable 10% margin of error, 37 people would be necessary. A total of 15% were added for losses and refusals, and the final sample consisted of 42 athletes.

Participants needed to be aged from 12 to 25 years; from both sexes; practicing the sport for more than two months and attending at least two training sessions per week for inclusion in the study. The exclusion criterion was the practice of another competitive sport. Taekwondo training centers were visited and those responsible for the training center were invited to cooperate with the availability of the space and athletes, for conducting the study. All athletes were invited to participate voluntarily. After accepting, a date was set for the interview, in order to explain questions related to the entire research process, mainly regarding data collection, and to solve any doubts. For underage athletes, their legal guardians needed to authorize their participation by an informed consent form, in addition to an assent form signed by the underage athlete.

Data was collected in the first two months of 2019 in the training centers of each athlete, at the scheduled time, according to the participants' availability. Data used in the study were obtained by a reported morbidity inquiry, an appropriate way to obtain information about the health status of specific population groups, as it is easy to apply and presents great objectivity[19]. In this study, as well as in a previous one[20], answers were obtained retrospectively, considering the last six months of practice in 2018.

The reported morbidity inquiry used was modified based on two other studies[19,20], considering the specificities of Taekwondo, and may be directly requested to the authors by email. The inquiry presents spaces to be filled with the athlete's personal information, such as age, body mass, height, sex, and information regarding the practice of the sport (number of training sessions per week and amount of participation in championships). To obtain information regarding the most important injury of the period, type, mechanism, and time of injury, as well as recovery time, questions on the topics were created.

A sports injury was defined as a pain or condition capable of affecting the functional integrity of the athlete. They occur during training or competition and may keep the athlete away from the sports practice temporarily[21]. In order to ensure the reliability of this study, a pilot study was performed with four athletes aged 14–18 years who participated in a social program that offers taekwondo classes in Pelotas, without meeting the inclusion criteria of this study.

For statistical analysis, measures of centrality and dispersion were considered, with data presentation in absolute and relative frequency. In order to compare men and women regarding the characteristics of the athletes and injuries, an unpaired Student's *t*-test was performed for continuous variables, and the chi-square test or Fisher's exact test (when less than two subjects per category) were used for the proportion analyses. To compare the injured and non-injured groups, an unpaired Student's *t*-test was performed. A 5% level of statistical significance was considered.

RESULTS

A total of 42 amateur Taekwondo athletes from Pelotas participated in this study. The mean age was 17.4±2.4 years old. A total of 61.9% (n=26) of individuals were men. On average, the practice time was 4.4±3.1 years and the training lasted 3.1±1.65 hours per week. Regarding belt ranks, most participants had black belts (30.9%) and green belts (23.1%). The main goal of most participants in the practice of Taekwondo is physical conditioning (35.7%).

As the primary outcome of the study, the prevalence of sports injuries in amateur Taekwondo athletes in Pelotas was 26.2% (n=11) (Table 1). Table 2 presents characteristics of Taekwondo athletes from Pelotas according to the occurrence of injury in the last six months. The injured and non-injured groups presented no differences regarding the different variables analyzed.

Table 1. Characteristics of amateur Taekwondo athletes from Pelotas, RS.

	All participants (n=42)	Men (n=26; 61.9%)	Women (n=16; 38.1%)	p
	N (%)	N (%)	N (%)	
Injury in the last six months	11 (26.2)	8 (30.8)	3 (18.7)	0.39
Practice time in years (mean±SD)	4.4±3.1	4.8±3.34	3.7±2.6	0.26
Training hours per week (mean±SD)	3.1±1.65	3.34±1.8	2.75±1.3	0.26
Belt				0.28
Green	10 (23.1)	7 (26.9)	3 (18.7)	
Yellow	7 (16.7)	4 (15.4)	3 (18.7)	
Black	13 (30.9)	9 (34.6)	4 (25)	
Brown	5 (11.9)	1 (3.8)	4 (25)	
Blue	2 (4.7)	1 (3.8)	1 (6.25)	
Orange	1 (2.4)	1 (3.8)	-	
Red	3 (7.1)	3 (11.5)	-	
Purple	1 (2.4)	-	1 (6.25)	
Main goals in the practice of TKD				
Physical conditioning	15 (35.7)	10 (38.5)	5 (31.2)	0.87
Socialization	4 (9.5)	3 (11.5)	1 (6.25)	0.79
Quality of life	6 (14.3)	4 (15.4)	2 (12.5)	0.39
Competition	12 (28.6)	8 (30.8)	4 (25)	0.32
Self-defense	5 (11.9)	1 (3.8)	4 (25)	0.14
Combat sports				0.24
TKD	37 (88.1)	22 (84.6)	15 (93.7)	
TKD and Muay Thai	1 (2.38)	-	1 (6.25)	
TKD and boxing	3 (7.4)	3 (11.5)	-	
TKD, boxing, and Muay Thai	1 (2.38)	1 (3.8)	-	
Performs flexibility training (n=38)	38 (90.5)	23 (88.5)	15 (93.7)	0.57
Before training	9 (23.7)	4 (17.4)	5 (33.3)	0.52
After training	11 (28.9)	7 (30.4)	4 (26.7)	
Before and after training	18 (47.4)	12 (52.2)	6 (40)	
Duration of flexibility training in minutes (mean±sd)	14±8.2	12.8±8.23	16±8.1	0.24

SD=standard-deviation; TKD= Taekwondo

Table 2. Characteristics of amateur Taekwondo athletes from Pelotas, Rio Grande do Sul, according to the presence of injuries in the last 6 months.

	All participants (n=42)	Non-injured (n=31)	Injured (n=11)	p
	mean±SD	mean±SD	mean±SD	
Hours per week (TKD)	3.11±1.65	3±1.57	3.45±1.91	0.44
Age	16.2±2.76	15.8±2.8	17.4±2.4	0.08
Weight (n=41)*	60.3±12.6	58.7±12.6	65±11.7	0.17
Practice time in years	4.3±3.1	3.9±2.8	5.6±3.5	0.11
Duration of flexibility training in minutes	14±8.2	14±7.9	13.5±9.4	0.79

*A participant weighting 124kg was excluded from the injured group; SD=standard deviation; TKD=Taekwondo

Regarding injuries (Table 3), the main mechanism of injury was kick attacking (45.4%), followed by blow when defending (27.3%), without difference between men and women (p=0.21). The most frequent type of injury was sprain (27.3%), followed by contusion (18.2%), and the most injured body parts were knees (36.4%) and ankles (36.4%). In 81.8% of cases, injuries occurred during training (n=9), most of them in simulated combats (88.9%; n=8) or tactical training (11.1%; n=1). The highest prevalence of injuries was within athletes who trained less than 1,000 hours throughout life (63.6%; n=7).

Table 3. Characteristics of injuries in the last 6 months of amateur Taekwondo athletes from Pelotas, RS, according to sex.

	All injured participants (n=11)	Men (n=8)	Women (n=3)	p
	N (%)	N (%)	N (%)	
Time of injury				0.42
Training (p=0.57)	9 (81.8)	7 (87.5)	2 (66.7)	
Tactical training	1 (11.2)	1 (14.3)	-	
Simulated combat	8 (88.8)	6 (85.7)	2 (100)	
Competition	2(18.2)	1 (12.5)	1 (33.3)	
Type of injury				0.29
Muscle strain	1 (9.1)	1 (12.5)	-	
Sprain	3 (27.3)	3 (37.5)	-	
Fracture	1 (9.1)	1 (12.5)	-	

Table 3. Continuation

	All injured participants (n=11)	Men (n=8)	Women (n=3)	p
	N (%)	N (%)	N (%)	
Contusion	2 (18.2)	1 (12.5)	1 (33.3)	
Dislocation	1 (9.1)	1 (12.5)	-	
Subluxation	1 (9.1)	-	1 (33.3)	
Nonspecific acute pain	1 (9.1)	-	1 (33.3)	
Other	1 (9.1)	1 (12.5)	-	
Anatomical site				0.12
Hands and fingers	1 (9.1)	1 (12.5)	-	
Knee	4 (36.4)	1 (12.5)	3 (100)	
Leg	1 (9.1)	1 (12.5)	-	
Ankle	4 (36.4)	4 (50)		
Feet and toes	1 (9.1)	1 (12.5)		
Mechanism of injury				0.21
Strength work	1 (9.1)	-	1 (33.3)	
Blow while defending	3 (27.3)	3 (37.5)	-	
Kick when attacking	5 (45.4)	4 (50)	1 (33.3)	
Kick when defending	2 (18.2)	1 (12.5)	1 (33.3)	
Time of injury				0.23
Individual technical training	1 (9.1)	1 (12.5)	-	
Collective technical training	1 (9.1)	-	1 (33.3)	
Attack training	6 (54.5)	5 (62.5)	1 (33.3)	
Defense training	1 (9.1)	1 (12.5)	-	
Attacking during competition	1 (9.1)	1 (12.5)	-	
Defending during competition	1 (9.1)	-	1 (33.3)	
Recovery time				0.52
From 2 to 6 days	2 (18.2)	2 (25)	-	
7 days	2 (18.2)	1 (12.5)	1 (33.3)	
From 8 to 15 days	1 (9.1)	1 (12.5)	-	
From 16 to 30 days	3 (27.3)	1 (12.5)	2 (66.7)	
More than 1 month	1 (9.1)	1 (12.5)	-	
More than 2 months	1 (9.1)	1 (12.5)	-	
More than 3 months	1 (9.1)	1 (12.5)	-	
After injury, needed to:				
Medical care	5 (45.4)	4 (50)	1 (33.3)	0.62
Surgery	-	-	-	-
Physical therapy	2 (18.2)	2 (25)	-	0.62
Injury occurred repeatedly	3 (27.3)	2 (25)	1 (33.3)	0.78
Symptoms after injury	2 (4.76)	1 (3.85)	1 (6.25)	0.72
Injuries prevent TKD practice	3 (7.14)	2 (7.7)	1 (6.25)	0.86
Practiced weight training before the most important injury	2 (18.2)	2 (25)	-	0.33
Used to stretch before the most important injury	8 (72.7)	6 (75)	2 (66.7)	0.78
Sparring gear				0.08
Shin guard	1(9.1)	-	1 (33.3)	
Shin and chest guard	1(9.1)	-	1 (33.3)	
None	2(18.2)	2 (25)	-	
Other	7(63.6)	6 (75)	1 (33.3)	

DISCUSSION

Our study aimed to quantify the prevalence of sports injuries in amateur Taekwondo athletes and to assess their association with different risk factors. The prevalence of sports injuries in amateur Taekwondo athletes in the municipality of Pelotas was relatively low (26.2%), especially when compared with data from available

studies, which indicates a high prevalence of injuries in Taekwondo[22]. In a study performed with 195 Taekwondo athletes from Central Portugal, the incidence of injuries was higher in groups of athletes aged from 12 to 17 years old (51%) and from 18 to 34 years (58%)[23]. Young athletes and older athletes present a 20% and 33% incidence of injuries in their respective groups. However, most studies involve adult and professional athletes, and they present higher risk of injuries than amateur athletes[24,25].

In this study, the percentage of sports injuries in males was higher than in females (30.8% and 18.7%, respectively), with no statistical differences (p=0.39). This is probably because both sexes are similar when compared regarding practice time, training hours per week, belt rank, and flexibility training. Few studies analyze the distribution of injuries in combat sports according to sex. Previous studies addressing other combat sports present contradictory results[26,27] and no evidence exclusively regarding Taekwondo athletes.

Male and female combat sports athletes—including Taekwondo—present structural differences, especially regarding physical fitness[28] and body proportions[29]. However, unlike judo[26], our study with Taekwondo athletes presented no differences between sexes regarding the variables related to sports injuries, which implies the absence of specific clothing adjustments and lack of difference in the rules of combat and training and competition structures.

Physical conditioning was the main goal of most athletes (35.7%). The practice of combat sports is steadily increasing in relation to the promotion of quality of life among young people. In a study by Del Vecchio et al.[20], performed with different combat sports athletes, 76.8% of the participants aimed to improve physical fitness and health by practicing combat sports, 54.4% aimed at self-defense, 53.65% aimed to improve quality of life, and 32% aimed at competitions. The practice of martial arts and combat sports can improve the quality of life, especially regarding physical and psychological components of amateur athletes[20]. Moreover, the meta-analysis that assessed the effects of training Taekwondo on physical fitness factors showed improvement in cardiopulmonary resistance and muscle endurance of young people[30].

Regarding injuries quantified in this study, the main mechanism of injury was kick when attacking (45.4%), followed by blow when defending (27.3%), without difference between men and women (p=0.21). Due to the high acceleration and great power [31], the impact of soft tissues (muscles) with harder regions (bones and joints) can injure those who receive the blow. Pieter, Fife, and O'Sullivan showed that spinning kick seems to be the main mechanism of injuries, responsible for 56.9% of all injuries in men and 49.8% in women[32].

In this study, sprain was the most frequent type of injury, followed by contusion. Generally, the body region most often affected in competitions involving amateur and professional Taekwondo athletes were the lower limbs[3,12]. Among the most injured body parts, knees and ankles stood out, corroborating with the specific technical literature[3,12]. Probably, sports injuries in these joints are prevalent because lower limbs are the body regions most used to attack in this sport. They are exposed to a large amount of stimuli, such as damping, rotations, and several impacts[12].

This study reinforces the idea of the "epidemiological iceberg" of sports injuries[6], since most studies address only injuries in competitions. In 81.8% of cases, injuries occurred during training, most of them in simulated combats (88.9%) or tactical training (11.1%). Del Vecchio et al.[20] found similar results, since the highest prevalence of injuries was in simulated combat (43%), followed by technical training (26%)—only 10% occurred in competitions. These figures indicate that as athletes spend more time in training than in competitions, injuries are more commonly in training[23].

This study presented limitations. The use of the reported morbidity inquiry is not yet the gold standard for the analysis of this phenomenon, although it is the most usual tool. However, in a previous study, medical records were corroborated by the reported morbidity inquiry[23]. Moreover, this study presents a possible memory bias, since participants may not accurately remember the characteristics of the last injury. We tried to mitigate this limitation by limiting a six-month period. This study is relevant because we carried it out with an understudied population (according to the data available in the literature) that involves most Taekwondo athletes: amateur recreational athletes. The results show that Taekwondo is less harmful when practiced aiming at physical conditioning. These data are useful to improve the athletes' experience with their sport and allow for greater insertion of new athletes.

CONCLUSION

The prevalence of sports injuries in amateur Taekwondo athletes from the municipality of Pelotas was

26.2%, lower than the found in the literature. It is probably because most amateur recreational Taekwondo athletes aimed at physical conditioning. The most prevalent mechanism of injury was kick when attacking, followed by impact when defending. Regarding the characteristics of the injuries, sprain was the most prevalent type of injury, followed by contusion. Lower limbs were the most affected region and occurred more often in training than in competitions. We found no statistically significant associations between sports injuries and the following variables in our sample: practice time, training hours per week, belt rank, main goals, combat sport, flexibility training, sex, age, and body mass.

The authors Duarte VT and Del Vecchio FB designed the study and collected data. All authors participated in the data analysis and interpretation of the results, as well as in the writing and final reviewing of the manuscript.

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