Injuries characteristics and their relationship with age in kitesurfers in Brazil

Características das lesões e relação com a idade em praticantes de kitesurfe no Brasil

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Abstract

Introduction: Kitesurfing is a sport that requires a combination of physical and technical skills, such as balance, strength, coordination, and knowledge of the wind and sea conditions. **Objective:** To evaluate the relationship between age, physical fitness and injuries, in order to understand how these factors impact kitesurfing. **Methods:** This cross-sectional study included male and female kitesurfers ≥ 18 years of age. All participants completed an electronic questionnaire developed by the study researchers, containing open- and closed-ended questions about their profile, physical conditioning, and injury history. **Results:** A total of 28 kitesurfers participated in the study with a mean age of 44.1 (± 7.6) years, 53.6% were married, 46.4% lived in the Southeast and 42.9% in the South of Brazil. The majority (64.3%) has a postgraduate degree, and 14.3% a master's or doctorate degree. Consequently, 78.6% reported a monthly income above 1,333 USD. Regarding injuries, 78.6% reported having experienced at least one, with 53.6% requiring immediate medical attention. Age was positively correlated with both the number of injuries ($r = 0.38$; $p = 0.04$) and time spent warming up before kitesurfing ($r = 0.43$; $p = 0.02$). Lower limb injuries accounted for 61% of all cases: 31% in the ankle/foot, 22% in the knees, and 8.3% in the hips. **Conclusion:** Kitesurfing, commonly practiced by individuals with high educational and income levels, is linked to a high incidence of lower limb injuries. Age appears to be a contributing factor to the increased risk of injury.

Keywords: Water sports. Sports medicine. Trauma in athletes. Quality of life.

Resumo

Introdução: *O kitesurfe é uma modalidade esportiva que requer uma combinação de habilidades físicas e técnicas, como equilíbrio, força, coordenação e conhecimento de vento e mar.* ***Objetivo:*** *Avaliar a relação entre idade, preparação física e lesões para entender como esses fatores impactam a prática do kitesurfe.* ***Métodos:*** *Trata-se de um estudo de delineamento transversal com kitesurfistas, de ambos os sexos e ≥ 18 anos de idade. Todos os participantes preencheram um questionário eletrônico com perguntas abertas e fechadas desenvolvidas pelos pesquisadores do estudo referente ao perfil do kitesurfista, lesões e condicionamento físico.* ***Resultados:*** *Participaram deste estudo 28 kitesurfistas com idade média de 44,1 (± 7,6) anos, sendo que 53,6% eram casados, 46,4% moravam na região Sudeste e 42,9% na região Sul do Brasil. A maioria (64,3%) tinha pós-graduação e 14,3% tinham mestrado ou doutorado; consequentemente, 78,6% dos praticantes possuía renda maior que R$8 mil por mês. Quanto às lesões, 78,6% referiram ter sofrido ao menos uma lesão, sendo que metade delas (53,6%) precisou de suporte médico imediato. A idade se correlacionou com a quantidade de lesões sofridas pelos participantes (r = 0,38; p = 0,04) e com o tempo de aquecimento realizado pré-kitesurfe (r = 0,43; p = 0,02). Lesões de membros inferiores representaram 61% das lesões, sendo elas 31% no tornozelo/pé, 22% nos joelhos e 8,3% nos quadris.* ***Conclusão:*** *O kitesurfe, praticado por uma população com alto nível educacional e de renda, está ligado a uma alta incidência de lesões em membros inferiores. A idade do kitesurfista demonstrou ter uma relação com a maior incidência de lesão.*

Palavras-chave: *Esportes aquáticos. Medicina esportiva. Traumatismos em atletas. Qualidade de vida.*

Introduction

Kitesurfing is a sport that involves the use of a board and kite, requiring a combination of physical and technical skills such as balance, strength, coordination, and knowledge of wind and sea conditions. As a water sport, it consists of gliding over the water on a board pulled by a kite, harnessing wind power for propulsion. The kitsurfers use the wind as a source of energy to propel the kite and slide over the water, performing maneuvers and jumps.

In addition to enhancing physical conditioning, such as muscle strength, cardiovascular, motor endurance and balance, kitesurfing can also contribute to overall quality of life. The feeling of freedom and connection with nature provided by this sport can promote mental and emotional well-being.[1]

In the light of these aspects, this sport has attracted more and more supporters, becoming popular across the globe at different ages and skill levels. It is estimated that the population of active kitesurfing athletes is smaller than that of surfing or windsurfing,[2] but it is also growing significantly, with up to 3.5 million athletes.[3] Although it is an exciting and challenging activity, it also presents specific risks of injury. For this reason, it is important to analyze the incidence and characteristics of musculoskeletal injuries in kitesurfers in order to better understand the injury risks involved and so seek ways to minimize them.[1,4,5]

Among recreational athletes, injury rates range from 5.9 to 7.0 injuries per 1,000 hours of kitesurfing, with most injuries affecting the musculoskeletal, especially the lower limbs.[6] However, this figure for professional kitesurfers rises to an injury rate of up to 16.6 injuries per 1,000 hours of kitesurfing.[2,5-8]

The most prevalent injuries in kitesurfers are trauma-related, accounting for approximately 80% of cases, with aerial maneuvers posing the greatest risk of injury, often involving the shoulders, hands, and legs.[9,10] Most injuries are classified as mild or moderate, but around 12% of cases are classified as serious or severe enough to require hospitalization.[11] Nevertheless, the use of protective equipment[4] and improving the education and training of kitesurfers[12] could help minimize the risk of some types of injury.

In that regard, analyzing the incidence and characteristics of injuries in kitesurfers, along with factors such as education level and age, can contribute to the development of effective prevention strategies. Therefore, once the most vulnerable areas of the body and the most common causes of these injuries have been identified, training and safety programs can be developed to protect riders and reduce the number of injuries. It is also essential to further understand the aspects related to the aging process and its relationship with greater exposure to the risk of injury, which can help in the development of protective equipment, specific training and treatment of acute and chronic musculoskeletal injuries.

The aim of this study was to describe the profile of Brazilian kitesurfers, considering different age groups and practice levels, as well as correlating age with level of physical preparation and history of injuries.

Methods

This was a cross-sectional study conducted with kitesurfers at Universidade São Judas Tadeu (USJT), approved by the institution's Research Ethics Committee (approval number 6.117.537).

Participants were recruited exclusively through online outreach, including social media and messaging groups, with the recruitment period running from August 24 to September 15, 2023.

A total of 28 participants met the inclusion criteria: aged 18 or older; of any sex; and with at least one year of kitesurfing experience. Participants were excluded if they felt uncomfortable answering any of the questionnaire items and chose to discontinue or withdraw from the study.

Assessment tools and procedures

After signing the informed consent form, participants were granted access to an electronic questionnaire via Google Forms, which contained open- and closed-ended questions covering personal identification, socio-demographic data (age, gender, marital status, income), anthropometric characteristics (weight, height), level of sporting proficiency (duration of practice, experience level), injury incidence (type, anatomical location, severity) and seeking medical treatment.

Statistical analysis

The data were stored and analyzed using Jamovi software, version 2.3.13. Quantitative data were presented as mean, standard deviation, median, minimum and maximum values, while categorical data were expressed as frequency and percentage. The Shapiro-Wilk test was performed to assess the normality of the variables. Spearman's correlation test was used to examine the relationship between age and prevalence of injuries. A significance level of 5% was adopted for all analysis.

Results

A total of 28 kitesurfers participated in the study. Sociodemographic data are presented in Tables 1 and 2. Participants exhibited a high level of education, with 17.9% holding an undergraduate degree, 64.3% having a postgraduate degree and 14.3% a master's or doctorate. Regarding income, 28.6% of the participants reported a monthly income between 1,333 and 2,500 USD, while 50% reported an income of over 2,500 USD (Table 2). Data relating to the sport-specific characteristics are presented in Tables 3 and 4.

Table 1 - Participants' socio demographic data (n = 28), continuous variables

Parameters	Average	Median	Standard deviation	Minimum	Maximum
Age	44.10	41.00	7.60	30.00	63.00
Weight (kg)	78.00	78.00	12.20	52.00	100.00
Height (m)	1.74	1.74	0.08	1.60	1.93
Body mass index (kg/m)	25.80	25.30	2.93	19.57	32.65

Among the main motivations for practicing kitesurfing, 71.4% of participants cited the quest for adrenaline and 78.6% highlighted contact with nature, factors that may increase the injury risk. Approximately 78.6% of kitesurfers reported having sustained some type of injury while kitesurfing, with 53.6% of those requiring immediate assistance (lifeguard, ambulance or medical attention) at the time of the injury. The most common injuries reported were cuts and abrasions (n = 16), followed by subluxations/dislocations (n = 8), sprains (n = 7), contusions (n = 6), fractures (n = 5), ligament injuries (n = 2) and overuse injury (n = 2). The anatomical locations of the injuries are illustrated in Figure 1.

There was a significant correlation between participants' age and the number of injuries sustained (p = 0.04; r = 0.38), suggesting that older individuals may have a higher susceptibility to injuries. Additionally, age showed a significant correlation with the time spent warming up before kitesurfing (p = 0.02; r = 0.43), indicating that older participants tend to perform longer warm-ups. Finally, the amount of time spent warming up before kitesurfing was correlated with the number of trips taken by kitesurfers throughout the year (p = 0.03; r = 0.43), suggesting that those who travel more tend to invest more time in warming up.

Table 2 - Participants' socio demographic data (n = 28), categorical variables

Parameters	Frequency (%)
Marital status	
Married	15 (53.6)
Divorced	4 (14.3)
Single	9 (32.1)
Region	
South East	13 (46.4)
South	12 (42.9)
North East	3 (10.7)
Education	
High school	1 (3.6)
Graduation	5 (17.9)
Postgraduate (lato sensu)	18 (64.3)
Master's or doctorate	4 (14.3)
Income (USD)	
333 to 1,333	6 (21.4)
1,333 to 2,500	8 (28.6)
> 2,500	14 (50.0)

Note: One minimum wage in Brazil = 1,518 BRL (253 USD).

Table 3 - Characteristics of kitesurfing participants (n = 28), categorical variables

Parameters	Frequency (%)
Level of kitesurfing*	
Beginner	6 (21.4)
Intermediate	11 (39.3)
Advanced	8 (28.6)
Professional	3 (10.7)
Other physical activity	
Yes	10 (35.7)
No	18 (64.3)
Number of kitesurfing mobilities	
1	12 (42.9)
2	10 (35.7)
3	5 (17.9)
4	1 (3.6)
Protective equipment	
Helmet	4 (14.3)
Vest	21 (75.0)
String/Lesh	12 (42.9)
Protection against sun exposure	25 (89.3)

Note: *Autoclassification of skill level in kitesurfing.

Table 4 - Characteristics of kitesurfing participants (n = 28), continuous variables

Parameters	Average	Median	Standard deviation	Minimum	Maximum
Number of trips per year	3.89	2.00	4.25	1.00	20.00
Heating (min)	5.25	5.00	0.72	0.00	15.00
Conditioning level (0-10)*	7.21	7.00	2.01	2.00	10.00
Tired level (0-10)**	5.39	6.00	1.75	1.00	9.00
Sailing time per session (h)	2.57	2.00	1.39	1.00	8.00

Note: *Self-classification of conditioning level for kitesurfing. **Subjective perception of effort after kitesurfing. min = minutes; h = hours.

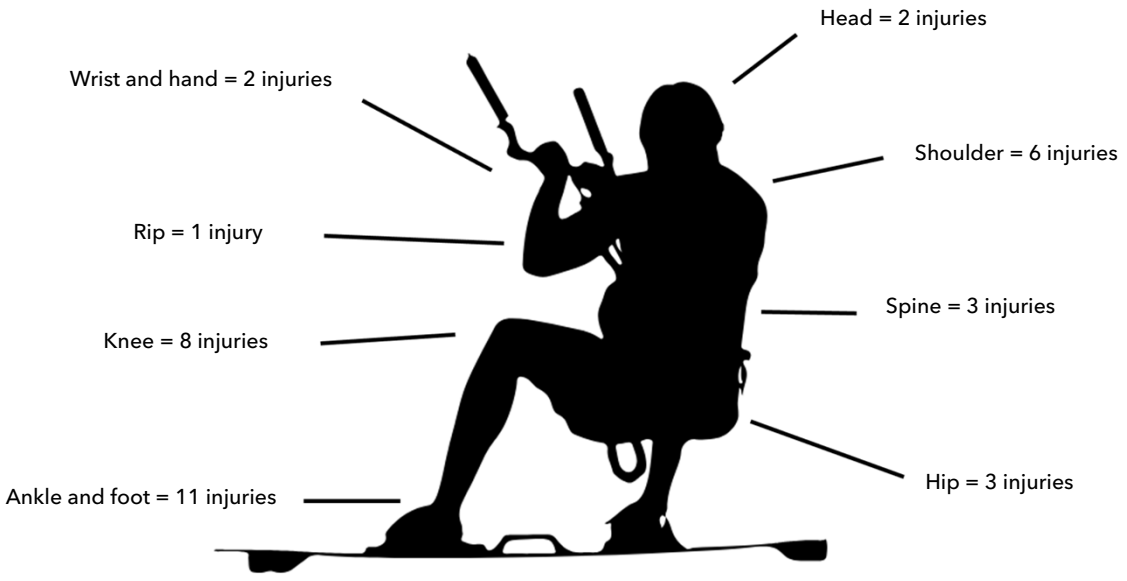

Figure 1 - Description of lesions location in the study participants (n = 28).

Discussion

The main findings of this study indicate that the participants were young adult kitesurfers with high levels of education and income. Most of them (78.6%) reported having suffered at least one injury, and a considerable proportion (53.6%) required immediate medical assistance. Age showed a positive correlation with the number of musculoskeletal injuries.

Regarding the demographic characteristics of the kitesurfers in this study, 53.6% were married and the majority resided in the Southeast (46.4%) and South (42.9%) regions of Brazil, additionally, 64.3% did not live in the city where they kitesurf. In terms of socioeconomic characteristics, 64.3% has a postgraduate degree, and 14.3% held a master's or doctoral degree. Consequently, a high-income level was observed among the participants: 50% reported earning more than 2,500 USD per month, while 28.6% reported earning between 333 and 2,500 USD per month. In addition, kitesurfers reported taking an average of 3.9 trips a year to practice kitesurfing. It can therefore be highlighted that this sport is associated with a profile of kitesurfers with good socioeconomic and professional stability, involving purchasing power much higher than the average for the Brazilian population.

This may be associated with the high cost of equipment for practicing the sport, where the average price of equipment for beginners is approximately 3,728 USD, as well as the need for travel costs, since many live in cities other than those where they usually practice.[13] In this sense, practicing the sport remains largely inaccessible to a large part of the Brazilian population, due to the costs involved in equipment, travel and accommodation.

Although the average age of the participants was 44.1 years (± 7.6), age was positively correlated with the number of injuries reported ($p = 0.04$; $r = 0.38$), i.e. indicating that older kitesurfers tend to report more injuries, which may be related to the aging process, particularly the decline in muscle strength,[14,15] which is essential for practicing extreme sports. However, age was also positively correlated with the duration of warm-ups before kitesurfing ($p = 0.02$; $r = 0.43$), suggesting that older kitesurfers are more likely to engage in adequate warm-up routines, which may help reduce the risk of injury.[16]

Similar to the study by van Bergen et al.,[5] 10.7% of the kitesurfers in this study were professionals, while 28.6%, 39.3% and 21.4% had advanced, intermediate and beginner levels, respectively. On average, the participants rated their physical conditioning as high (7.2 out of 10 conditioning points), with an average session

lasting 2.6 hours per session. Additionally, 92.9% reported engaging in another physical activity besides kitesurfing to maintain overall fitness.

In this study, the use of vests was common (75%), whereas only 42.9% of participants reported using safety leash. In contrast to these findings, Torland et al.[17] and Exadaktylos et al.[18] reported that none of the participants used vests. Regarding helmet use, although low adherence was observed in the present study (14.3%), van Bergen et al.[5] found an even lower rate (4%), while Torland et al.[17] reported higher adherence (33%). The use of safety equipments in kitesurfing is believed to significantly reduce the severity of acute head and neck trauma, raging from minor lacerations injuries to more serious conditions such as concussions, which can result in loss of consciousness and, without a vest, increase the risk of drowning. These findings suggest that many kitesurfers may lack awareness of the importance of using safety equipment. Nickel et al.[6] also emphasize the relevance of protective gear, such as gloves and forearm guards.

According to Bourgois et al.,[8] the high incidence of kitesurfing injuries is associated with the significant stress placed on the musculoskeletal system, resulting from the combination of high speed with acrobatic maneuvers and variable environmental conditions. In addition, Baumbach et al.[4] emphasize another factor related to the injury mechanism: the influence of kitesurfing equipment, which can either significantly decrease or increase injury rates. Thus, the importance of preventive measures for the practice of the sport is underscored, both related to better physical conditioning of practitioners and the use of protective equipment for safe practice, which can help minimize the injury risk.

In this study, 46 injuries were reported by the 28 kitesurfers, including cuts and abrasions (n = 16), subluxations/dislocations (n = 8), sprains (n = 7), contusions (n = 6), fractures (n = 5), ligament injuries (n = 2) and overuse injuries (n = 2), these findings corroborate previous studies regarding the characteristics of injuries in kitesurfers.[5,9,17] However, in a study of 45 participants, Berneira et al.[1] identified sprains as the most prevalent injury, accounting for 30.8% of cases. The authors noted that 57.7% of the injuries affected the lower limbs.[1] According to Silva et al.,[9] the knee is the most commonly affected area of the lower limb. Similarly, this study found that the lower limbs were the most affected region in kitesurfers, accounting for 61% of injuries, 31% in the ankle/foot, 22% in the knees and 8.3% in the hips.

In this study, 28.6% of the participants reported knowing someone who had suffered a fatal accident while kitesurfing. Nickel et al.,[6] in a prospective study conducted over six months with 235 kitesurfers, reported one fatal accident caused by polytrauma. In the present study, 71.4% of participants look over the sport seeking an adrenaline rush, which may be linked to greater exposure of injury risk. Moreover, 78.6% stated that their motivation to practice kitesurfing is the connection with nature. While this fosters an exchange with the environment, it also involves the unpredictability of conditions, such as changes in wind direction and intensity, which can increase the risk of more complex injuries. Thereby, a sport that takes place in a dynamic and unpredictable environment, such as kitesurfing, demands considerable strength and speed, and lack of training and physical conditioning can increase the chances of injury. The fact that the environment is dynamic and unpredictable means that kitesurfing can undergo major changes in the demands placed on the kitesurfers' body such as a rapid increase or absence of wind, heavy rain, or even storms. These conditions may lead to greater overload on the kitesurfers´ musculoskeletal system or even expose them to the risk of injury.

In this study, as previously described, 78.6% of kitesurfers reported having already experienced some type of injury while kitesurfing, 53.6% of whom needed some kind of support (from a lifeguard, ambulance or doctor) at the time of the injury, and 42.9% needed follow-up care with a physician and physiotherapy for rehabilitation. Given this context, it is important for healthcare professionals to gain a deeper understanding of this growing sport in Brazil, including its link with tourism, so they are familiar with the kitesurfer profile and the main injuries associated with the practice. Thus, the clinical relevance of this study is evident, as it enables healthcare professionals to better understand injury incidence and consequently help in the process of preventing the risks and also in the clinical management of injured kitesurfers.

This study presents some important limitations. The small sample size, due to the use of convenience sample and a short data collection period, limits the generalizability of the findings to the broader population of Brazilian kitesurfers. Furthermore, as this was an electronic questionnaire in which participants had to

report their perception of the questions, the research methodology has important limitations related to memory bias, self-reporting and self-perception. Nevertheless, this study offers relevant insights into the profile of kitesurfers, the prevalence of injuries, as well as risk factors associated with the sport, emphasizing the need for preventive strategies and appropriate treatment to reduce the risks involved in the sport.

Conclusion

The practice of kitesurfing is linked to a high incidence of injuries, primarily affecting the lower limbs, especially the ankle and knee. In Brazil, Kitesurfing tends to be practiced by individuals with high educational and income levels, likely due to the significant costs associated with equipment and travel. Despite the high risk of injury, few kitesurfers use protective equipment such as helmets, while most use vests. Age was found to be positively correlated with both the incidence of injuries and the duration of warm-ups sessions.

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Authors' contributions

JVPM and GCB were responsible for contextualizing the study; JVPM, FRS, SCPM, GRG, KSA and ET, for data collection; GCB, for the formal analysis; JVPM, FRS, SCPM, GRG and KSA, for writing the original manuscript; and RNS and GCB, for supervising the project. All the authors actively participated in the discussion, revision, and approval of the final version.

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