

ANALYSIS OF INJURIES' PREVALENCE IN SURFERS FROM PARANÁ SEACOAST

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ABSTRACT

Objective: to analyze the prevalence of musculoskeletal injuries of surfers from the Paraná's seacoast. **Methods:** Sixty men (27 ± 6 years) completed a surf semi structured questionnaire (category, time of daily practice, frequency and exercises performed before and/or after surfing) and characteristics of injuries induced by this sport. A descriptive analysis of the data on distribution of the relative frequency was performed. **Results:** It was found that 70% of the respondents practiced surfing as a relaxing activity, 28% were amateurs and 2% were professionals, who were surfing for 10 years or more. Most of them surfed between 2 to 4 times a week during 2 to 4 hours a day. The most common exercise performed before surfing

was upper and lower limbs stretching and no exercises at all was done after practice. The most common injury was contusion (29%), lower limb was the most affected segment (46%) and the most common cause of injury was due to contact with the board (52%). The interruption period mostly reported was 1-3 months and the most frequent treatment was taking medicines. **Conclusions:** Recreational was the predominant category of surfers with lower limb's contusion as the most common musculoskeletal injury, resulting from contact with the board, being treated with medication and rest. **Level of Evidence II, Retrospective Study.**

Keywords: Athletic injuries. Prevalence. Physical therapy specialty.

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INTRODUCTION

Surfing is a sport that has greatly evolved in recent decades in both the recreational and competitive categories, especially in Brazil, that around the 90's started to be considered the 3rd surf world power, along with the United States and Austrália.¹ In 2004, the number of surfers in the United States was estimated at 2.1 million.² In Brazil, nowadays is estimated 2.7 million, and according to the International Surfing Association the total number of practitioners of this sport in the world is 17 million.³ In Brazil, the sport began to gain popularity in the early 60's, and due to the huge and appropriate country's coastline for its practice, with over 4,000 km long, the Brazilian surfers started to attain a level of recognition on the international competition scenario, both amateur and professionals.⁴

Surf is considered a sport that present more risk to accidents when compared to other sports like skateboarding, windsurfing, canoeing, and scuba diving, among others.⁴ Besides being characterizing as an activity that encompasses intense muscle strength and balance, environmental variation also exerts a direct influence on the physical conditions of the surfer, constantly exposed to weather and the ocean environment changes, such

as winds, the different ocean currents, the type of the ocean bottom, the effect of the moon gravity on the tides, size of the waves, air and water temperature, and contact with the board, among others.^{1,5}

In a prospective study conducted during 32 surf championships (10 amateurs and 22 professional competitions) between 1999 and 2005 in several countries like Hawaii, Australia, California, Argentina and the United States, 116 acute injuries were classified as sprains, muscle strain, laceration, fractures, dislocations, contusions and abrasions, the most common injuries being sprains and strains (39% of the total), Steinman et al.⁴ have shown that most part of the injuries are resulting from trauma, and that collision with the board is responsible for 36% of them. In the same study, lacerations comprised the largest percentage of the injury's type (44%) and recurrent low back pain accounted for 28% of the prevalence of musculoskeletal symptoms. Another study evaluating 1237 acute injuries also showed that 42% of them were lacerations, followed by bruises, sprains and fractures.⁶ Thus, such evidence lead to the interpretation that the lacerations are the most frequent injuries among surfers, such result have also been demonstrated in a

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cross-sectional study, in which lacerations were responsible for 46% of the most frequent types of injuries, followed by sprains, dislocations and fractures.⁷ In the same study, contact with the board corresponded to 45% of the recorded injury mechanism, and the anatomical regions most affected were the lower limbs (45%) followed by the head (26%).⁷ Another issue found in surf practice is the possibility of accidents caused by marine animals, or even secondary infections from other lesions promoted by them.⁸

However, despite the large number of practitioners worldwide, there are still few scientific studies related to surfing. Furthermore, little is known about what happens as a result of its practice and the physiological effects induced by the sport.⁸ Thus, the lack of identification of risk factors arising from surfing, monitoring of athletes by health specialists, no parameters for the physical capabilities needed during practice, limit both the elaboration of preventive strategies as training programs and specific treatments.⁹

Therefore, due to the small number of studies related to injuries resulting from surfing in Brazil, especially in the seacoast of Paraná, the present study aimed to identify and analyze the prevalence of lesions in male surfers at the seacoast of Paraná, subdivided into the professional, amateur and recreational categories, in the cities of Matinhos, Guaratuba and Pontal do Paraná.

MATERIALS AND METHODS

The present study was a cross-sectional observational analytical type,¹⁰ it has followed the Resolution 196/96 of the Brazilian National Health Council and was approved by the Ethics Research Committee of the Department of Health Sciences, Universidade Federal do Paraná (CAAE: 0197.0.091.000-11).

The study was conducted on the beaches of the seacoast of Paraná at the cities Guaratuba, Matinhos and Pontal do Paraná and the sample was formed by 60 subjects, 20 from each municipality. Male surfers who practiced surfing in the Paraná seacoast for at least two years, aged 18-45 years were included. From this study there were excluded surfers who did not agree to sign the Free and Informed Consent Statement form (FICS) and those who did not fill in the questionnaire completely.

After the project approval by the Research Ethics Committee, the selection process of participants was started. We carried out a personal invitation to surfers at Guaratuba, Matinhos and Pontal do Paraná beaches. In order to clarify the objectives of the research and inform the days and times that the research team would be on the beaches, for distribution of the questionnaires. Stakeholders that met the inclusion criteria and agreed to participate voluntarily began to auto respond the questionnaires. The surfers were informed about the research, and the FICS was presented to all participants. After consent, the printed questionnaire was delivered to the surfers, which were auto filled and returned to one of the researchers along with the FICS form duly signed.

The questionnaire was answered individually to avoid any embarrassment and to preserve the secrecy of items answered. Moreover, when doubts arose during been clarified incompleteness were individually answered, preventing any discomfort that could be caused by the questions.

Data collection was performed using a Adapted Semi-Struc-

ured Questionnaire^{2,11} which included the following items: email, age, surf practice category (professional, amateur or recreational),⁴ characteristics of surf practice (time of practice, frequency, hours per day), duration and type of exercise performed before and/or after the activity (stretching or heating), type of injury caused by sport (laceration-cut; contusion-hit; fracture-bone fracture, dislocation-articulation dislocation; joint sprain- joint twist; muscle or ligament injury; burns), as well as the anatomic region injured (head/neck; torso; arms; legs and feet). We also investigated the mechanisms that promoted the injury, such as maneuvers, contact with the board, marine animals and overtraining. Furthermore, there was a question in the questionnaire about the ocean's conditions during the occurrence of injuries, interruption period and the treatment used for the lesion (s). Before completing the questionnaire it was explained to the participants that stretching refer to static stretching exercise lasting for at least 10 seconds and that warming up should be considered a walk, run or bike ride lasting at least 10 minutes. (Annex 1)

To determine the sample, calculation was performed assuming 95% confidence, a sampling error of 3% and the proportion of surfers in the Brazilian population, which according to Base et al.,³ is 2.7 million. The proportion of surfers was calculated based on the Brazilian population size in 2007, which according to IBGE is 183.9 million inhabitants, resulting in 1.47%. The formula used to calculate the sample was as follows:

$$n = \frac{z^2_{\alpha/2} * N * P * (1 - P)}{\epsilon^2 * (N-1) + z^2_{\alpha/2} * (1 - P)}$$

Where n is number of individuals sampled, $z^2_{\alpha/2}$ is the critical z value that corresponds to the degree of confidence, N is the population size, P is the surfers population in Brazil and, ϵ^2 is the maximum error estimate.

The result assuming these parameters was 62 surfers, from which 60 surfers were finally selected, 20 from each municipality. For statistical analysis of the results obtained from the semistructured adapted questionnaire, a descriptive analysis of data from distribution of relative frequency was performed, by using frequency charts for categorical variables and descriptive statistics (mean and standard deviation) for the quantitative variables, using Microsoft Excel®. Data analysis was performed considering the seacoast of Paraná, with no comparisons between municipalities.

RESULTS

In the Paraná seacoast, surfers' age was 27 ± 6 years, and 70% declared themselves as recreational and 2% professionals. It has been found that most of the individuals surveyed (47%) have surfed for 10 years or more; and 65% of people surf two to four times a week for 2 to 4 hours per day (92%). Analyzing the three categories of surfers, it was found that 78% of the individuals surveyed perform stretching exercises before surfing. Stretching exercises are performed especially in the upper (33%) and lower limbs (32%), both lasting about 30 seconds or more. The most common warming up activity practiced before surfing was to the upper limbs (38%) lasting 10 minutes. However, after surfing, most of the subjects (68%) did not perform any type of exercise. (Table 1)

In the professional category, there was a higher prevalence of muscle/ligament injuries and burns (33% each), and the anatomical most affected part was the lower limbs (33%). In the amateur category, it was found that the most frequent injuries were contusions (31%), followed by burns and lacerations (24% and 22%, respectively). The anatomical part most affected was the lower limbs (46%), equally distributed between the legs and feet, and upper limbs (25%). In the recreational category, the most frequent injuries were similar to those of the amateur category, with most frequently contusions (29%), followed by lacerations (25%) and burns (23%). The anatomic part most affected was the lower limbs with 47% of all injuries (27% legs and feet 20%) and upper limbs with 20%. (Table 2)

Overall, we found 387 injuries that occurred among all surfers evaluated on average 6.5 injuries per athlete, 12 of them (3%) in professional surfers. The lower number of injuries in professional surfers may be attributed to the reduced number of surfers in this category in the total sample. On the other hand, amateur and recreational surfers presented 99 lesions (26%) and 276 lesions (71%), respectively. Considering the total sample, the most frequent injuries were contusions (29%), followed by lacerations and burns (23% each), musculoskeletal and ligamentous sprains (9% each), dislocation (4%) and other injuries (2%). The anatomical most affected parts were the lower limbs (46%), especially legs (26%) and feet (20%), followed by upper limbs (22%), head/neck (16%) and torso (15%). Considering each type of injury in various body parts, feet laceration was the most frequent (9%), followed by legs contusion (8%) and burns in the upper limbs (7%). (Table 3)

Regarding the professional surfer, since only one subject from this category participated in this study, there was no prevalence of cause of injury, since the maneuvers, contact with the board and overtraining were reported evenly. Among the amateur surfers maneuvers were the main causes of injuries (41%) and among the recreational surfers category, contact with the board was the most frequent cause (57%). Overall, contact with the board was the most frequent cause of injuries occurred among all practitioners, with a frequency rate of 52%, followed by maneuvers with 47%, marine animals with 27%, overtraining with 17% and other causes with 18%. (Table 4)

Of the 60 surfers evaluated in this study, 35% reported no interruption of activities due to injuries. On the other hand, among surfers who experienced a resting period (60%), the duration was on average 1 to 3 months (23%). (Figure 1)

Forty-seven percent of the respondent surfers reported not having had any treatment for the suffered injuries. On the other hand, those who underwent treatments were mostly drugs based (40%), stretching or resistance exercise (13%), cryotherapy and dressings (7% each). (Figure 2)

Table 2. Lesions due to surf practice by category in surfers of the seacoast of Paraná.

| Cat. | Lesion/Body part | Head/Neck | Torso | Arms | Legs | Feet | Total |
|-------------------------|-------------------------|------------|-------|------|------|------|-------|
| P # | Laceration | 0 | 0 | 0 | 0 | 0 | 0 |
| | Contusion | 0 | 8% | 8% | 8% | 0 | 25% |
| | Fracture | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dislocation | 0 | 0 | 0 | 0 | 0 | 0 |
| | Sprain | 0 | 0 | 0 | 8% | 0 | 8% |
| | Muscle/ Ligament injury | 8% | 8% | 8% | 8% | 0 | 33% |
| | Burn | 8% | 8% | 8% | 8% | 0 | 33% |
| | Others* | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | 17% | 25% | 25% | 33% | 0 | 100% |
| | A | Laceration | 4% | 2% | 4% | 3% | 9% |
| Contusion | | 4% | 7% | 7% | 7% | 6% | 31% |
| Fracture | | 0 | 0 | 0 | 0 | 0 | 0 |
| Dislocation | | 0 | 0 | 3% | 2% | 0 | 5% |
| Sprain | | 0 | 1% | 2% | 3% | 2% | 8% |
| Muscle/ Ligament injury | | 1% | 2% | 2% | 3% | 1% | 9% |
| Burn | | 3% | 5% | 7% | 5% | 4% | 24% |
| Others* | | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | | 12% | 17% | 25% | 23% | 22% | 100% |
| R | | Laceration | 4% | 2% | 3% | 5% | 10% |
| | Contusion | 6% | 4% | 6% | 8% | 5% | 29% |
| | Fracture | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dislocation | 0 | 0 | 1% | 1% | 1% | 4% |
| | Sprain | 1% | 1% | 1% | 4% | 2% | 9% |
| | Muscle/ Ligament injury | 1% | 1% | 2% | 4% | 0 | 8% |
| | Burn | 4% | 5% | 7% | 5% | 2% | 23% |
| | Others* | 2% | 0 | 0 | 1% | 0 | 2% |
| | Total | 18% | 14% | 20% | 27% | 20% | 100% |

Cat.: Category; P: Professional; A: Amateur; R: Recreational. (*) Other lesions include cornea burn, broken teeth, meniscal injury, and tympanic perforation. (†) only one subject.

DISCUSSION

In the present study, it was used an Adapted Semi Structured Questionnaire^{2,11} in order to identify and analyze the prevalence of the most common injuries in male surfers, in the seacoast of Paraná, subdivided into professional, amateur and recreational categories. The results of this study showed that 70% of the sample subjects were recreational surfers, 28% amateurs and 2% professional (a single surfer). The sample was formed by young adults (27 ± 6 years). These outcomes are in accordance to another study,⁴ that also evaluated a sample with recreational prevalence (67%), followed by amateurs (29%) and professional (3%) of the seacoast in Northeastern, Southeastern and Southern states of Brazil, without specifying which state. The majority of the participants in this study reported have been surfing for 10 years or more practicing the sport 2 to 4 times per week for 2 and 4 hours. Similar results were also observed in the study that investigated the northeastern, southeastern and southern states of Brazil,⁴ which found that the evaluated

Table 1. Prevalence of exercises performed before and/or after surfing among surfers in the seacoast of Paraná.

| Body Part | Before | | | | | | | After | | | | | | |
|-----------|------------------|-----|---------|---------------|----|---------|------|------------------|----|---------|---------------|----|---------|------|
| | Stretching (sec) | | | Warm up (min) | | | None | Stretching (sec) | | | Warm up (min) | | | None |
| | 10 | 20 | 30 or > | 10 | 20 | 30 or > | | 10 | 20 | 30 or > | 10 | 20 | 30 or > | |
| Neck | 28% | 20% | 25% | 30% | 3% | 0 | 18% | 12% | 3% | 8% | 5% | 2% | 0 | 73% |
| Torso | 20% | 17% | 30% | 33% | 2% | 3% | 17% | 10% | 7% | 5% | 8% | 0 | 0 | 73% |
| Arms | 22% | 20% | 33% | 38% | 3% | 3% | 8% | 8% | 8% | 10% | 8% | 0 | 0 | 71% |
| Legs | 22% | 22% | 32% | 35% | 5% | 3% | 8% | 7% | 8% | 7% | 8% | 0 | 0 | 73% |

Table 3. Distribution of injuries by body part and type of injury among surfers in the seacoast of Paraná.

| | Head/Neck | Torso | Arms | Legs | Feet | Total |
|-------------------------|------------|------------|------------|------------|------------|-------------|
| Laceration | 4% | 2% | 3% | 4% | 9% | 23% |
| Contusion | 5% | 5% | 6% | 8% | 5% | 29% |
| Fracture | 0 | 0 | 0 | 0 | 0 | 0 |
| Dislocation | 0 | 0 | 2% | 1% | 1% | 4% |
| Sprain | 1% | 1% | 1% | 4% | 2% | 9% |
| Muscle/ Ligament injury | 1% | 2% | 2% | 4% | 0,2% | 9% |
| Burn | 4% | 5% | 7% | 5% | 2% | 23% |
| Others* | 1% | 0 | 0 | 0,5% | 0 | 2% |
| Total | 16% | 15% | 22% | 26% | 20% | 100% |

(*) Other injuries include cornea burn, broken teeth, meniscal injury, and tympanic perforation.

Table 4. Causes of injuries among surfers of various categories in the seacoast of Paraná.

| Cause of the Injury | Maneuvers | Contact with the board | Marine animals | Overtraining | Other injuries* |
|---------------------------|------------|------------------------|----------------|--------------|-----------------|
| Professional [#] | 100% | 100% | 0 | 100% | 0 |
| Amateur | 41% | 35% | 29% | 18% | 29% |
| Recreational | 48% | 57% | 26% | 14% | 14% |
| Total | 47% | 52% | 27% | 17% | 18% |

(*) Other injuries include cornea burn, broken teeth, meniscal injury, and tympanic perforation. (#) only one subject.

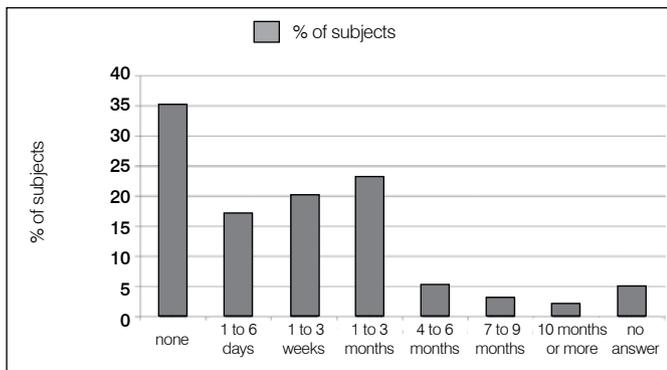


Figure 1. Period of absence from sport after injury in surfers of the seacoast of Paraná.

surfers practiced the sport on average 2.6 days/week, for an average time of 2.68 hours/day.

All subjects evaluated in this study reported some type of injury, as described by Base et al.³ in which most of the lesions found in professional surfers were contusions (29%), followed by lacerations (23%). However, other authors reported that 44% of the lesions were lacerations, and 17% of contusions, the most frequent lacerations frequent being in the lower limbs,⁴ among them in the feet (22%) and legs (11%). In the present study, the most prevalent type of injury was contusion (29%), however, considering the body parts, foot lacerations were the most common (9%). In another study,² lacerations and contusions were the 2nd and the 3rd most common type of injury, respectively. However, these authors reported that the most common injuries in amateur surfing are lacerations to the head and lower limbs,² data similar to those found in the present study, in which the most frequent injury among amateur surfers were lacerations in feet (9%). Thus, the evidence demonstrates that the surfers

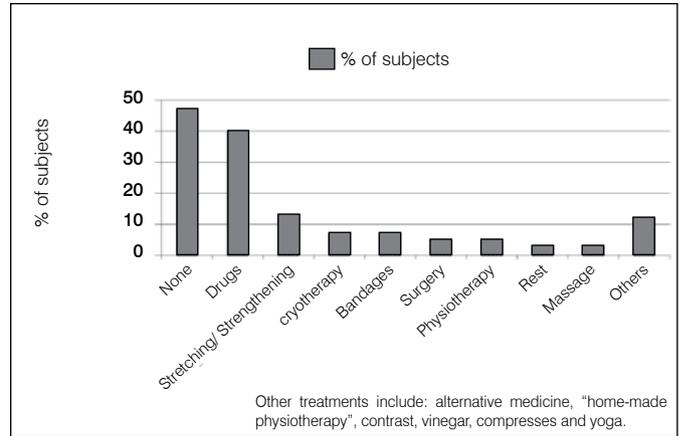


Figure 2. Types of treatment for injuries in surfers of the seacoast of Paraná.

in the seacoast of Paraná showed the same types of lesions observed in other parts of Brazil, occurring most frequently contusions and lacerations.

Among the surfers of Paraná, those participants in this study, the most affected body parts were the lower limbs, with 46% legs and feet, followed by upper limbs (22%), head/neck (16%) and torso (15%). Previous studies also cite lower limbs as the region most affected by surf injuries.^{2, 3, 6, 7}

It has been reported that direct contact with the board is the main mechanism of surf injury due to trauma.³ Most lacerations and contusions are caused by fall against the board, especially contact with the fins, tip and tail, and overuse injuries can predispose the surfer to traumatic muscle-ligament injury.⁴ There have been suggested preventive campaigns that emphasize the importance of using nose guard, less sharp edges and rubber made keels.⁴ Among the surfers' sample of Paraná seacoast who participated in this study, the most common cause of injury was a result of contact with the board (52%), followed by maneuvers (47%), contact with marine animals (27%), excessive training (22%) and other factors (17%). In the literature regarding this topic, there is often mention on contact and collision with the board as the main evidence of injury causes^{2,4,7}, followed by maneuvers^{3,4} contact with the ocean bottom and hydraulic force of the wave (18%).²

In the present study, we observed a large number of injuries such as burns, caused by marine animals (23%), when compared to other studies,^{3,4} which reported only 9% of injuries caused by jellyfish burns,⁴ which also reported that burns in general were responsible for only 8% of all lesions.³

Unlike other studies,^{3,4, 6} we did not find fractures caused by surf practice. Other authors observed that fractures comprised either 8% of all injuries;⁶ 5% of all injuries,³ and 2% of all injuries.⁴ Perhaps the present study did not report any fracture because of the sample size, not because it is a small sample size, but perhaps small enough to show fractures, since the frequency of this type of injury observed in other studies is low.

In the present study, we reported only one case of perforation of the tympanic membrane due to fall, and one case of corneal burn due to marine animals, both during recreational surfing. The rupture of the tympanic membrane is essentially due to an injury of the mechanical force of the wave in direct contact with the surfer's ear when he falls from the board.¹² In the

study of Taylor et al.,⁷ it has been reported that the rupture of the tympanic membrane was present among the 5% of other types of injuries occurred among the interviewed surfers, along with head trauma, pneumothorax, rib fracture and broken teeth, the latter being also found in this study, with three cases in recreational surfing.

Despite having been described only one case of corneal burn in our study, there is a specific study on eye injuries due to surfing.¹³ In this study, Lawless et al.,¹³ described three cases of eye injuries as a result of surfing due to contact with the board, unlike our study, which was caused by the interaction with marine animals.

Although we did not reported any severe injuries in this study, other more serious injuries from surfing are cited in the literature such as the non-traumatic spinal cord injuries associated with surfing, which hit inexperienced surfers, causing localized pain in the posterior torso, paraparesis and urinary retention. The authors believe that one of the causes of the surfer's myelopathy is the position of the spinal cord in hyperextension during rowing.¹⁴ There is a case report of an inexperienced 37 years old male surfer, who started with localized pain in the lumbar region 20 minutes after the end of his surf class, progressing to numbness in the lower limbs, followed by loss of sensation and paralysis of the legs, suggesting an ischemic lesion of the spinal cord, probably related to hyperextension of the spine during surf.¹⁵

Yet, in another study, a male surfer developed a pseudo tumor caused by a fall during surf four years before. This pseudo tumor was called "surfinome" because it was caused by a fragment of the board that remained inside the patient's body after injury, inducing an inflammatory reaction of the "foreign body" type. The authors suggest the importance of radiographs after an accident, especially when there are missing parts of the object used in the sport activity.¹⁶

In this study, the most frequent exercise before sports practice was stretching (78%), predominantly held in the arms and legs, lasting for thirty seconds (33% and 32%, respectively). The warm-up exercise before the practice was carried out by 52% of individuals interviewed, and the most frequent exercise was with the upper limbs lasting 10 minutes (38%). However, in most cases, no exercise of any kind was performed after surfing.

In studies on the effects of stretching on performance and prevention of muscle injuries, the authors concluded that when the sport requires maximum performance strength and muscle power, stretching exercise, from 30 sec. before sports, may decrease these valences, and it is not associated with fewer lesions.¹⁷⁻²⁰ In the present study, it was found that most surfers performed the stretching exercise before sport, especially in the lower and upper limbs. These were the same body parts that showed a higher prevalence of lesions in our study, suggesting that unassisted stretching exercises before surfing do not prevent injuries. On the other hand, warming up performed before physical exercise can increase the speed and force of muscle contraction, due to the increase in metabolic reactions, oxygen supply to the muscles by hemoglobin and acceleration of the speed of nerve conduction. Such metabolic reactions contribute to the reduction of the reaction time and viscosity of the muscle, which decreases the likelihood of lesions.^{21, 22}

When analyzing the importance of warming up and stretching

in the sport, emphasis has been done to the importance of warming up before performing a sport activity and stretching after practice.²³ In the present study, it was found that stretching was more performed than warming up before surfing and most of the investigated surfers did not do any kind of exercise after sport, raising the hypothesis that such behavior increases the chance of occurrence of injuries among surfers in the seacoast of Paraná, requiring continuing education as a way to prevent injuries.

Thirty-five percent of the surfers participating in this study did not interrupt their sport activities for health treatments. Other authors have studied surfers of UK, in which most of the injuries are of low complexity, that is, do not require hospital admission for treatment.²⁴ These authors also recommend the importance of preventing injuries by use and adapting individual protective equipment.^{6, 24}

Moreover, most surfers of the present study reported the need to interrupt sport for 1 to 3 months. The most common treatments reported were medication, stretching and resistance exercises. Other authors have also indicated drug therapies for the treatment of wound infections and tympanic lesions.²⁵

The present study has some limitations with respect to the adapted questionnaire, in which the terms contusion and muscular lesion were used as different types of injuries. Contusion, depending on its intensity, can cause muscle injury. In addition, the terms warming up and stretching were also used, whereas, depending on the type and duration of stretching exercises, it can be considered warm up exercise. However, before completing the questionnaire it was explained to the participants that stretching refers to static stretching exercise lasting for at least 10 seconds and that warming should be considered a walk, run or bike ride lasting for at least 10 minutes.

Therefore, it is suggested for future studies adaptation of the terms, as well as construct validity for the use of questionnaires that aim to assess the prevalence of injuries arising from surfing. Another suggestion for investigation studies on the causes of injuries in surfers would be to conduct monitoring of surfers through a prospective longitudinal study, with questionnaires applied at short intervals.

CONCLUSION

The category of recreational young adult surfers was predominant in the study, and all participants presented some type of injury. Before practicing surf most performed stretching was the exercise most performed by the participants before surfing, especially in upper and lower limbs. The higher prevalence of lesions was in the lower limb, and the most common type of injury being contusion. Regarding the nature of the injuries, they were mostly traumatic, and contact with the board was the main injury mechanism. Most surfers required a period of interruption of sport practicing for health treatment as a result of injuries.

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REFERENCES

- Brasil FK, Andrade DR, Oliveira LC, Ribeiro MA, Matsudo VKR. Frequência cardíaca e tempo de movimento durante o surfe recreacional – estudo piloto. *Rev Bras Cienc Mov.* 2001;9(4):65-75.
- Nathanson A, Bird S, Dao L, Tam-Sing K. Competitive surfing injuries: a prospective study of surfing-related injuries among contest surfers. *Am J Sports Med.* 2007;35(1):113-7.
- Base LH, Alves MAF, Martins EO, Costa RF. Lesões em surfistas profissionais. *Rev Bras Med Esporte.* 2007;13(4):251-3.
- Steinman J, Vasconcellos EH, Ramos RM, Botelho JL, Nahas MV. Epidemiologia dos acidentes no surfe no Brasil. *Rev Bras Med Esporte.* 2000;6(1):9-15.
- Filho GS, Cavalcante AB, Araújo PCA, Silva MVBO. Ação neuromuscular relacionada à postura e equilíbrio corporal para a prática do surfe: revisão da literatura. *Mov Percepção.* 2010;11(16):162-8.
- Nathanson A, Haynes P, Galanis D. Surfing injuries. *Am J Emerg Med.* 2002;20(3):155-60.
- Taylor DM, Bennett D, Carter M, Garewal D, Finch CF. Acute injury and chronic disability resulting from surfboard riding. *J Sci Med Sport.* 2004;7(4):429-37.
- Navarro F, Danucalov MA, Ornellas FH. Consumo máximo de oxigênio em surfistas brasileiros profissionais. *Rev Bras Cienc Mov.* 2010;18(1):56-60.
- Vagheti CAO, Roesler H, Andrade A. Tempo de reação simples auditivo e visual em surfistas com diferentes níveis de habilidade: comparação entre atletas profissionais, amadores e praticantes. *Rev Bras Med Esporte.* 2007;13(2):81-5.
- Marques AP, Peccin MS. Pesquisa em fisioterapia: a prática baseada em evidências e modelos de estudo. *Fisioter Pesqui.* 2005;11(1):43-8.
- Jamtvedt G, Herbert RD, Flottorp S, Odgaard-Jensen J, Håvelsrud K, Barratt A, et al. A pragmatic randomised trial of stretching before and after physical activity to prevent injury and soreness. *Br J Sports Med.* 2010;44(14):1002-9.
- Zoltan TB, Taylor KS, Achar SA. Health issues for surfers. *Am Fam Physician.* 2005;71(12):2313-7.
- Lawless M, Porter W, Pountney R, Simpson M. Surfboard-related ocular injuries. *Aust N Z J Ophthalmol.* 1986;14(1):55-7.
- Thompson TP, Pearce J, Chang G, Madamba J. Surfer's myelopathy. *Spine (PhilaPa 1976).* 2004;29(16):E353-6.
- Avilés-Hernández I, García-Zozaya I, DeVillasante JM. Nontraumatic myelopathy associated with surfing. *J Spinal Cord Med.* 2007;30(3):288-93.
- Squire T, Sherlock M, Wilson P, Tan B, Hope N, Anderson SE. Surfingoma: a case report on a pseudotumor developing after a surfing sports injury. *Skeletal Radiol.* 2010;39(12):1239-43.
- Almeida PHF, Barandalize D, Ribas DIR, Gallon D, Macedo ACB, Gomes ARS. Alongamento muscular: suas implicações na performance e na prevenção de lesões. *Fisioter Mov.* 2009;22(3):335-43.
- Simic L, Sarabon N, Markovic G. Does pre-exercise static stretching inhibit maximal muscular performance? A meta-analytical review. *Scand J Med Sci Sports.* 2013;23(2):131-48.
- Siatras TA, Mittas VP, Mameletzi DN, Vamvakoudis EA. The duration of the inhibitory effects with static stretching on quadriceps peak torque production. *J Strength Cond Res.* 2008;22(1):40-6.
- Herbert RD, de Noronha M, Kamper SJ. Stretching to prevent or reduce muscle soreness after exercise. *Cochrane Database Syst Rev.* 2011;(7):CD004577.
- Camargos JR, Ferreira WG. Análise dos efeitos da flexibilidade pré e pós testes no treinamento para nadadores amadores. *Rev Treinam Desportivo.* 2008;9:29-32.
- Woods K, Bishop P, Jones E. Warm-up and stretching in the prevention of muscular injury. *Sports Med.* 2007;37(12):1089-99.
- Alencar TAM, Matias KFS. Princípios fisiológicos do aquecimento e alongamento muscular na atividade esportiva. *Rev Bras Med Esporte.* 2010;16(3):230-4.
- Hay CS, Barton S, Sulkin T. Recreational surfing injuries in Cornwall, United Kingdom. *Wilderness Environ Med.* 2009;20(4):335-8.
- Taylor KS, Zoltan TB, Achar SA. Medical illnesses and injuries encountered during surfing. *Curr Sports Med Rep.* 2006;5(5):262-7.

Annex 1. Adapted Semi structured questionnaire.

| | | | | | | | |
|--|------------------------------|---|------------------------|--|------------------------------------|---------------------------|------|
| Category: () recreational () amateur () professional | | Age: _____ e-mail: _____ | | How many times a week: () 1 () 2 () 3 () 4 () 5 () 6 () 7 | | | |
| Practice surf for: () 2 years () 3 to 5 years () 6 a 9 years () 10 years or more | | How many hours a day: () 1h () 2h () 3h () 4h () 5h () more than 5h | | | | | |
| Do you make any kind of exercise before/after surfing? For how long? | | | | | | | |
| | Stretching (before) | Warm up (before) | None (before) | Stretching (after) | Warm up (after) | None (after) | |
| Neck | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | |
| Torso | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | |
| Arms | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | |
| Legs | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | () 10s () 20s () 30s or > | () 10min () 20min () 30min or > | | |
| Have you suffered from any injury due to surfing? | | | | | | | |
| | Laceration (cut) | Contusion (hit) | Fracture (broken bone) | Dislocation (articulation dislocation) | Sprain (articulation sprain) | Muscle or Ligament Injury | Burn |
| Head/neck | | | | | | | |
| Torso | | | | | | | |
| Arms | | | | | | | |
| Legs | | | | | | | |
| Feet | | | | | | | |
| Others, specify: _____ | | | | | | | |
| What was the cause of the lesion (s)? () Maneuvers () Contact with the board () Marine animals () Overtraining () Other, specify: _____ | | | | | | | |
| Describe the ocean's conditions when the lesions occurred (wave size, water temperature, ocean bottom type)? _____ | | | | | | | |
| Did you interrupt surf practicing due to injury? For how long? _____ Did you undergo any kind of treatment? Describe. _____ | | | | | | | |