

PAIN PREVALENCE IN SWIMMING ATHLETES OF SÃO CAETANO DO SUL



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ABSTRACT

Introduction: Swimming is a sport that has been on the high in the last years and requires high levels of training and performance, which can cause overuse on muscular skeletal system, causing injuries to swimmers. **Objective:** To verify the pain prevalence and the body areas with pain, correlating with main style and practice time in swimming athletes from SERC Club in São Caetano do Sul. **Method:** A survey with 19 questions was applied to 71 athletes (30 female and 41 male) in child I (10-12 years old), child II (12-14 years old), juvenile (14-16 years old), junior (16-18 years old) and senior (From 18 years old) categories. The variables were analyzed by Two-Proportional Equality Test and Mann-Whitney Test. **Results:** Pain prevalence was of 74.6% (n = 53; p < 0.001), namely: 39.6% (n = 21) in shoulder and 22.6% (n = 12; p = 0.059) in thighs and the back stroke swim was the only style that had no correlation with pain (p = 1.000) or time of practice (p = 0.075). **Conclusion:** In the studied subjects, there was high pain prevalence, with the shoulder and thigh being the most affected areas, not presenting correlation with the back stroke style neither in sports time of practice.

Keywords: swimming; athletes; pain; physical therapy.

INTRODUCTION

From the health point of view, swimming is a sport which presents prophylactic and therapeutic value, with low risk of trauma and which occurs in an impact-free environment, being the second most practiced modality in Brazil (only after soccer) and which includes many styles: freestyle (crawl), butterfly, backstroke, breaststroke and medley¹.

Brazilian swimming has participated in the Olympics Games since 1920, joined by the first Brazilian Olympic delegation. Nowadays, the country has high-level athletes in national and international competitions who bring an increasing number of good results, such as South-American and world records, finals and medals in the World Championship and Olympic Games. In the last Olympic Games, for example, Brazil fulfilled its duty bringing two medals home: the Thiago Pereira's silver and the César Cielo's bronze. These medals add up to 13 Olympic medals in the history of Brazilian swimming. In world championships, Brazil won three gold, one silver and four bronze medals in the long course pool, and nine gold, five silver and seven bronze medals in the short course pool².

This sport requires very high training levels, which expose the athletes to constant and intense stress, with the possibility of injuries or pain, decreasing hence sports performance and leading to early dropout. One of the most frequent complaints in swimmers is shoulder pain, known as swimmer's shoulder. This syndrome and other injuries may lead to psychological problems since the athlete builds his/her life around the sports modality, and may make him/her unable to continue training and competing. Prevention is a key element here, since it presents a great importance and relevance factor in these cases¹.

The countless movement repetition during many years of intense training joined with the increasing lack of muscular balance of the

scapular waist, are the main etiological factors of the development of the excessive syndrome termed "swimmer's shoulder"³.

Competitive swimming is one of the most demanding sports and which involves the longest time consumption. Elite swimmers train from 20 to 30 hours per week. During one year, an average high-level swimmer performs over 500,000 strokes on each arm, approximately 1,000,000 strokes/year. The search for maximal performance during the abundant competition volume, as well as the workload increase during training are responsible for progressive increase of the number of injuries which always present physical and emotional implications in the athlete⁴.

The injuries in swimming were firstly described by Councilman in 1968⁵, who studied the prevalence of injuries in competitive swimmers and identified more frequency in the shoulder, with 37% out of the total, followed by the knee, with 28%, and the foot and ankle, both with 19%. The author reported that musculoskeletal injuries in swimmers may be of trauma or secondary origin, by overtraining. Acute trauma injuries are rare and injuries by overtraining predominately occur in competitive athletes.

In the study conducted in a club from São Paulo, 63 athletes were assessed where the most frequent injury was tendinitis/bursitis (75.9%), followed by back pain (9.6%) and low back pain (6%). Concerning injuries classified under 'other' (8.4%), we can name: chondromalacia, biceps femoris myalgia, knee sinovitis, injury to medial meniscus, cervicobrachialgia and shoulder sinovitis⁶.

In São Caetano do Sul, a city which has stood out within the Brazilian swimming scenario, there are no studies on the prevalence of injuries in swimmers, showing the importance of this research to verify the physical conditions of its athletes, aiming further research on prevention and rehabilitation which can contribute to the integration of athletes, trainers and the multidisciplinary health team.

Thus, the aim of this study was to verify the prevalence of pain in swimmers from São Caetano do Sul, to identify which are the body regions with most pain and correlate pain complaint with the main style and the time of swimming practice.

METHOD

A clinical, observational, analytical and transversal study performed in a single center, initiated after free and clarified consent from the athletes in the 11-12; 13-14;15-16; 17-18-year-olds and masters age groups from the swimming team of SERC (Sports Recreational and Cultural Society) from São Caetano do Sul and was approved by the Ethics and Research Committee of the City of São Paulo University under the number PP 13507959.

The investigation selected athletes with over one consecutive year of training, healthy, aged between 10 and 30 years, of both sexes, and excluded those with less than one consecutive year of training, over a month of absence and/or who underwent recent surgeries.

A questionnaire composed of personal information and 18 questions 12 open and six closed (Appendix 1) was designed for evaluation of the prevalence of the pain sites, searching for information related to the athlete, type of training and possible injuries. These athletes were gathered on the bleachers of the training premises, followed by the trainer in charge for the age group, where the researcher read the questionnaire outloud to each age group separately, ranging approximately between 20 and 30 swimmers. The researcher remained available for any clarification, while the athletes answered the questions, with the use of a clipboard, pencil and blue or black pen.

The information was collected at the training climax, with high mileage in swimming pool and higher physical training intensity, at which period the athletes could be more overloaded both physical and psychologically. Finally, the athletes and trainers were joined and received feedback about the findings.

It is worth mentioning in this research that any symptom related to discomfort, weight sensation, decrease of functional capacity, pain complaint itself and any other manifestation of deficit of the physical wellness normality status was considered "pain".

The age group, sex, and questions 1 to 18 data were filed in the Microsoft Excel® 2007 program, and percentage, mean and standard deviation were analyzed with SPSS V11.5® software (SPSS Inc.®, São Paulo, Brazil) and the preliminary tests for normal distribution and sample calculation were performed with the *Minitab 14®* software (*Globaltech®*, Minas Gerais, Brazil). Two-way equality test was applied for the variables pain areas, style, age group, specialty, level, when pain gets worse, what does to obtain relief, if underwent treatment, which treatment, if general or local improvement occurred., while for the variables time of practice x pain, the Mann-Whitney test was used. The significance level was set at 5% ($p < 0.05$) and the results were presented in percentage and p-value when the two-way equality test was used, and in mean, median and standard deviation when the Mann-Whitney was used.

RESULTS

73 athletes were invited to participate in this investigation, and two were excluded for having undergone recent surgery. Therefore, 71 athletes remained, where 57.5% ($n = 41$) were male and 42.25%

($n = 30$) female, aged between 10 and 23 years, mean of 13.9 ± 0.6 years.

Generally speaking, it was observed that out of the 71 interviewed athletes, 74.6% ($n = 53$; $p < 0.001$) presented complaint of moderate intensity pain through the visual analog scale (VAS) 5.09 ± 1.84 ; being the shoulder 39.6% ($n = 21$) and thigh 22.6% ($n = 12$; $p = 0.059$) the most reported, as shown in table 1.

Pain presented correlation with style practiced, except for the backstroke, as seen in table 2.

Concerning time of practice, it was observed that the athletes with pain presented time of practice (7.06 years) longer than those without complaint (7.0 years); however, this difference was not considered significant ($p = 0.075$; Mann-Whitney).

The categories were presented in table 3 with the number of athletes, sex, age, specialty, level, style practiced, time of practice and weekly frequency.

It was observed that pain presented correlation with the most advanced categories, with all specialties and with competitive levels which demand higher performance, as seen in table 4.

It was also seen that the majority of the athletes (37.7%), presented pain worsening immediately after training, while no significant differences have been observed in the specific, strength or physical trainings. What the athletes did to obtain relief was for the majority (34.0%) to search for medical/physiotherapeutic help, followed by application of ice and do "nothing", as pointed in table 5.

It was observed that the majority (52.8%) did not search for treatment; however, out of the ones who did (47.2%), they chose conservative and/or physiotherapy treatment ($p < 0.001$), obtaining improvement in the majority of the cases (54.7%), but without significant difference, as evidenced in table 6.

Among the athletes who underwent treatment, only the low back region presented significant difference between the improvement percentage 88.9% ($n = 8$; $p < 0.001$; two-way equality test), the other regions did not present significant difference (shoulder $p = 0.123$; thigh $p = 0.201$; knee $p = 0.371$; rhomboid $p = 1.000$; biceps $p = 0.109$; trapezius $p = 0.248$; and pectoralis $p = 0.527$).

Table 1. Distribution of the body parts of the 53 athletes who presented pain complaint, with p values concerning the shoulder region which was the most reported.

Areas	n	%	p-value	Areas	n	%	p-value
Shoulder	21	39.60%		Ankle	3	5.70%	<0.001*
Thigh	12	22.60%	0.059	C. escapular	2	3.80%	<0.001*
Knee	11	20.80%	0.034*	L. dorsi	2	3.80%	<0.001*
Low back	9	17.00%	0.010*	Leg	2	3.80%	<0.001*
Rhomboid	8	15.10%	0.005*	Crotch	1	1.90%	<0.001*
Biceps	7	13.20%	0.002*	Hand	1	1.90%	<0.001*
Trapezius	6	11.30%	<0.001*	M. superior	1	1.90%	<0.001*
Pectoralis	5	9.40%	<0.001*	Calf	1	1.90%	<0.001*
Elbow	4	7.50%	<0.001*	Foot	1	1.90%	<0.001*
Triceps	4	7.50%	<0.001*	Neck	1	1.90%	<0.001*
Abdomen	3	5.70%	<0.001*	Wrist	3	5.70%	<0.001*
Shin	3	5.70%	<0.001*				

Two-way equality test.
* $p < 0.05$ values considered significant.

Table 2. Comparison of the pain complaint according to the style practiced by the 71 athletes.

Style	No		Yes		p-value
	n	%	n	%	
Butterfly	4	22.2%	14	77.8%	< 0.001*
Backstroke	9	50.0%	9	50.0%	1.000
Freestyle	14	28.6%	35	71.4%	< 0.001*
Medley	0	0.0%	14	100%	< 0.001*
Breaststroke	5	20.8%	19	79.2%	< 0.001*

Two-way proportion test.

* p < 0.05 values considered significant.

Table 3. Characterization of the 71 athletes by age group.

		11-12	13-14	15-16	17-18/Masters
Athletes	# athletes	19	28	14	10
Sex	Female	5	15	7	3
	Male	14	13	7	7
Age (years)	Minimum-maximum	10 - 12	12 - 14	14 - 16	17 - 23
	Mean ± SD	11.2 ± 0.8	13.1 ± 0.6	15.0 ± 0.7	19.5 ± 1.8
Specialty	Distance	0	8	2	1
	Middle-distance	6	10	6	5
	Sprinter	13	10	6	4
Level	Regional	4	8	0	0
	State	15	13	3	0
	National	0	7	10	8
Style	International	0	0	1	2
	Butterfly	6	8	4	1
	Backstroke	9	3	4	2
	Breaststroke	7	7	5	5
	Freestyle	15	21	8	5
T Practice	Medley	0	8	3	3
	Mean/years	4.5	6.3	6.7	12.6
Frequency	Weekly	5x	5x	6x	6x

Subtitles: SD = standard deviation – T Practice = practice time.

Table 4. Areas with pain complaint according to age group, specialty and level.

		Pain		p-value
		n	%	
Age group	11-12	11	57.9%	0.330
	13-14	20	71.4%	0.001*
	15-16	14	100.0%	<0.001*
	17-18/Masters	8	80.0%	0.007*
Specialty	Distance	9	81.8%	0.003*
	Middle-distance	20	74.1%	<0.001*
	Spreinter	24	72.7%	<0.001*
Level	Regional	6	50.0%	1.000
	State	24	77.4%	<0.001*
	National	20	80.0%	<0.001*
	International	3	100%	0.014*

Two-way equality test.

* p < 0.05 value considered significant.

DISCUSSION

The injuries consequent to sports modality are frequent and generate constant concern in the athletes', trainers', and sports managers' lives, since besides the physical and psychological damage to the athlete, can also lead to financial problem to the club⁷.

Thus, there is need of research which studies the prevalence of injuries in different sports, especially in swimming, since

Table 5. Distribution of the moment at which there was worsening of the pain and what was done to obtain relief.

When does pain gets worse?	n	%	p-value
Ater training	20	37.7%	
Training	17	32.1%	0.541
Do strength	17	32.1%	0.541
Physical training	13	24.5%	0.142
Do not know	7	13.2%	0.004*
Competing	1	1.9%	< 0.001*
Two training sets	1	1.9%	< 0.001*
What do you do to obtain relief?			
M/P guidance	18	34.0%	
Ice	16	30.2%	0.677
Nothing	15	28.3%	0.529
Rest	9	17.0%	0.045*
Medication	4	7.5%	< 0.001*
Other	3	5.7%	< 0.001*

Two-way equality test.

*p < 0.05 value considered significant.

Table 6. Distribution of the athletes who underwent treatment, which kind and if there was improvement.

Did you take treatment?	n	%	p-value
Yes	25	47,2%	0,560
No	28	52,8%	
Which treatment?			
Medication	2	8%	< 0,001*
Conservative (physiotherapy)	25	100%	
Was there improvement?			
Yes	29	54,7%	0,244
No	23	43,4%	

(Two-way equality test.* p < 0.05 values considered significant).

it is one of the sports hits over the last years. Therefore, this study verified the prevalence of pain and its correlation with the main style and the time of practice of the swimmers from São Caetano do Sul.

71 athletes aged between 10 and 23 years participated in this investigation. The majority was male, from the 11-12, 13-14, 15-16 and 17-18/masters categories, where fewer pain complaints were found in the lower categories, probably due to lower training volume, which is performed in a more playful manner and aiming the technique learning. According to Richardson et al.⁸ and Richardson⁹, the child up to 12 years old should not participate in specific sports activities and competitions, for not being sufficiently mature to understand and assimilate everything which is involved in the competitive process.

Different authors: Borges¹⁰, Léglise¹¹, Malina and Bouchard¹² and Rodrigues and Barbanti¹³ did not establish specific ages; however, they warned that competitions and training of youngsters should not be measured considering only chronological age, but also physical, emotional and maturational characteristics so that sports practice is enjoyable, natural and does not become an obligation, but rather a favorable aspect to their development.

Due to the low and high categories prerogative, the questionnaire was applied in a group, according to the category to facilitate the athletes' understanding, being it composed of simple and objective questions, especially concerning pain. The application lasted approximately 15 minutes and the doubts found were about the circling of the pain site, probably due to little anatomic knowledge, despite the figure attached to the

questionnaire, whose aim was exactly to help understanding.

According to the information collected, the high pain level reported (74.6%) is probably consequence of the time this research was conducted, at the training climax, a period in which the athlete is more prone to pain complaints, which always present physical and psychological implications, added to the higher performance increasing training volume¹⁴.

In the research by Aguiar¹⁵ in a club from São Paulo, with application of a questionnaire to the swimming trainer, information about the athletes' training, such as time of practice, swimming style, kind of event swum in the competitions, level of competition and training volume in and out the pool, besides information collected in the medical records of the athletes was collected. Data of 63 swimmers were assessed and 83 injuries were found. The upper extremities were the most frequently reported, with stress on the shoulder with tendinitis and bursitis.

In the study by Mello et al.⁶ on sports injuries performed with swimmers of different clubs from São Paulo, a questionnaire with more specific questions on the kind of injury found was also individually applied in 215 athletes during the competitions. The results pointed out high rate of injuries, where the shoulder was again the region most mentioned with 38.6% of athletes injured.

The swimming injuries were firstly described by Councilman⁵ who verified the prevalence of injuries in competitive swimmers and identified higher rate in the shoulder (37%), knee (28%), foot and ankle (19%). In the present study, the prevalence of pain was mainly in the shoulder (39.6%), thigh (22.6%), knee (20.8%), foot (1.9%) and ankle regions (1.9%) showing that the percentage of pain on the foot and ankle decreased as compared to the one in that time, probably due to technical improvement of the leg stroke during swimming styles. According to Wolf et al.¹⁶, when assessing athletes in a university in the USA, 37% of these students were injured, and the part mostly reported was the shoulder (31%), followed by the neck (23.7%) and back (19.8%).

The review by Polard and Fernandes¹⁷ confirmed that the main injuries in swimmers were on the shoulder, neck and back regions and the investigations performed outside the pool are the ones which contribute the most to the injuries. Aguiar¹⁵ also observed that the majority of injuries were physical, which placed swimmers away from training for a period of time. The resting time and reduced training are necessary for recovery, but all effort should be made to keep the swimmer "in water", avoiding hence deconditioning and competitive disadvantage.

According to Aguiar¹⁵, distance swimmers present double of injuries than sprinters, as observed in the present study, where pain prevalence was higher in the distance and higher level swimmers showing that the higher the training load and the aim of the athlete, the higher the chances to present pain episodes.

Such situation agrees with studies by several authors¹⁸⁻²¹, who described that competitive swimmers usually perform high mileage volume training and with excessive and repetitive arm and leg stroke movements, had mean participation of 10 annual competitions and among them, one or two main events. These remarkable figures of repetitive movements added to the years of training predispose the athletes to sports injuries. Such findings agree with this investigation, which verified high frequency of

pain episodes, which probably occurred due to overtraining.

Additionally, concerning the time of practice, it was observed that the athletes with pain presented longer sports time than those who did not complain; however, this difference was not considered significant. Likewise, Aguiar¹⁵ pointed out the correlation between anthropometric features and training, years of sports practice and age of the participants with injury onset. Regarding backstroke and distance swimmers, the occurrence of injuries was higher to the ones with longer time of practice.

Comparing pain distribution according to the style swum, it can be observed that the backstroke swimmers are the only ones who did not present significant pain, while *medley* swimmers are the ones who present the most pain complaints, since this modality is the combination of the four styles, working with many muscular groups²².

Concerning the *medley*, the style with the highest pain incidence in this study (100%), this modality is composed of the four styles, which biomechanically differ by the arm and leg stroke technique. According to Troup²³, the freestyle and the backstroke present special trunk swing and alternated movement of upper extremities (UE), mainly by the participation of the glenohumeral articulation. In the butterfly style, there is no trunk swing, but the arm and leg gesture is similar. The movements of the upper extremities (EU) and lower extremities (LE) are simultaneously performed, with one arm stroke cycle for two leg stroke cycles, known as the dolphin kick²⁴. The biomechanics of the breaststroke style is different from the others, since the EU activity is highlighted which simultaneously start leg stroke with maximal flexion of hip and knee articulations, ankle dorsiflexion, ending with extension and adduction of the mentioned joints, such as in Rodeo²⁰. Thus, the recruiting of many muscular groups combined with the movements repetition may lead to overload of the musculoskeletal system and generate hence pain episodes.

Nevertheless, despite all the benefits associated with the sports practice, sports engagement also brings the risk of injury, either in competitive or recreational level, as referred by Olsen et al.²⁵. It is one of the greatest causes of injuries, in comparison with aviation accidents, home accidents, leisure accidents, work accidents or violence, added to the fact that sports injuries may result in pain, which lead to time away from competitions or work and add up to medical costs. If for the ones who live on sports as an amateur, injuries may bring small alterations to their daily routine without compromising of all their activities of daily living, to the ones who live on sports professionally, their career may be compromised²⁶.

Physiotherapy may use prevention as a rule and not exception, helping the athletes maintain their professional careers, besides better performance in training and consequently in competitions²⁷.

In the study performed, it was observed that out of the 74.6% who presented pain complaint, 52.8% did not take treatment, and out of the 47.2% who did, 54.7% presented improvement, evidencing the need for better guidance concerning the importance of possible treatments which may be searched or used, agreeing on the study by Cunha et al.²⁸, who reported the onset of injuries consequent of sports practice for lack of guidance, by

overload during trainings, biomechanical errors of the sportive gesture or by negligence from the side of the athlete in performing joint warm-up and stretching, not giving proper attention to these procedures.

In swimming, the combination of local strength resistance with flexibility and proprioception significantly contributes to the swimmer's physical conditioning improvement, since flexibility is responsible for voluntary performance of maximal range of motion by one or more joints, within the morphological limits, with no risk of injuries. Stretching results in promotion of posture reestablishment, muscular improvement in the search for athletic performance, muscular tendon injuries prevention as well as improvement in coordination, avoiding additional efforts²⁹.

Thus, sports become an example of physical performance improvement of the individual through techniques and muscular exercises, which becomes more efficient when warm-up and stretching are performed before training and competitions, since this combination may avoid injuries³⁰.

The basic principle of prevention is the application of common sense. Therefore, it is extremely important that competitive and even recreational athletes, not only swimming but all sports, become aware of that good performance implies suitable preparation²⁸.

The present study on pain prevalence was conducted only in swimmers from São Caetano do Sul, and hence, further studies which broaden the research field to other regions beyond southern Brazil, but in other regions where culture and climate

may influence on the indices of injuries and sports performance of the athletes.

The findings here of high pain prevalence justify the need of implementation of physiotherapeutic programs for the athletes starting at the lower categories, to create awareness on the behavior and attitude of the athletes concerning body care, avoiding hence limitation on the sports career.

It is concluded that in the studied population there was high prevalence of moderate pain (74.6%), with the shoulder and thigh regions being the most reported. It was identified that pain correlated with almost all the practiced styles, except for the backstroke; however, there was no correlation with time of sports practice.

Having the results here as grounding, further research is suggested both with a bigger sample and also investigating other cities and regions, with the aim to obtain broader results of pain prevalence in swimming athletes, since this sport is going through a moment of great success in the national and international sports scenario.

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Appendix 1. Questionnaire designed by the researchers to assess the swimmers.

1. Name : _____
 Telephone number: _____ Age group: _____
 Email: _____
 Sex: ()F ()M Age: _____

2. What style are you specialist in?
 () Freestyle () Butterfly () Backstroke () Breaststroke () Medley

3. You are a:
 () Sprinter () Middle-distance swimmer () Distance swimmer

4. Which distance do you swim?
 () 50 meters () 100 meters () 200 meters () 400 meters
 () 800 meters () 1500 meters

5. Which kind of championships do you participate in?
 () Regional Championships () State Championships
 () National Championships () International Championships

6. Weekly training volume is: _____ times

7. Weekly training mileage is : _____ meters

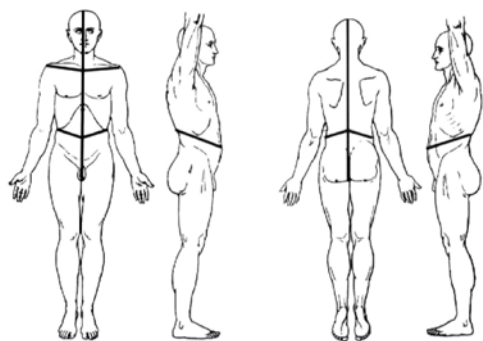
8. Daily training time is : _____ hours

9. You have practiced swimming for _____ years

10. Do you feel pain in any body part ?
 () Yes () No

11. Can you correlate this pain with any style?
 () No () Yes - Which one? _____

12. Circle the areas where you feel pain:



13. From 0 to 10 how strong is your pain ? (10 is unbearable pain and 0 is painless). Circle the corresponding number.
 0 1 2 3 4 5 6 7 8 9 10

14. When do you perceive the pain gets worse?
 () When training
 () When there are 2 training periods a day
 () During physical part or weight training
 () After training
 () When perform any strength (activities which require more overload)
 () When competing
 () I cannot tell

15. What do you do to relieve this pain?
 () Search for medical or physiotherapeutic guidance
 () Self-medicate
 () Rest until pain is gone
 () Apply ice
 () Do not do anything
 () Other: _____

16. Have you undergone treatment?
 () Yes () No

17. If yes, which treatment?
 () Medication
 () Conservative (Physiotherapy)
 () Other: _____

18. If have used physiotherapy, what kind of treatment was performed?
 () Machines () Manual devices () Exercises
 () Acupuncture () Other _____

19. Did you improve ?
 () Yes () No