

Prevalence of Shoulder Pain Among Competitive Swimmers Using the Swimmer's Functional Pain Scale (SFPS)

Sejal Urkude¹; Dr. Kanvi Jagani²

²Research Guide

¹Bachelor of Physiotherapy Student Smt. Radhikatai Pandav College of Physiotherapy, Nagpur, Maharashtra, India

²MPT Paediatrics Professor, Smt. Radhikatai Pandav College of Physiotherapy, Nagpur, Maharashtra, India

Publication Date: 2026/09/09

Abstract:

➤ *Background:*

Shoulder pain is one of the most common musculoskeletal problems among competitive swimmers, primarily due to the repetitive overhead movements involved in swimming. Repeated loading, high training volume, muscle imbalance, poor technique, and inadequate recovery may contribute to shoulder pain and overuse injuries. Pain can affect shoulder function, stroke efficiency, training capacity, and overall athletic performance. Therefore, early identification of shoulder pain and appropriate preventive strategies are important for maintaining shoulder health and optimizing swimming performance.

➤ *Aim:*

To find out the prevalence of shoulder pain in professional swimmers using Swimmers Functional Pain Scale (SFPS).

➤ *Objective:*

To determine the prevalence of shoulder pain in professional swimmers using Swimmers Functional Pain Scale (SFPS).

➤ *Materials and Methodology:*

- Study Design: Prevalence Study
- Study Setting: Nagpur city, Local area swimming pool
- Duration of Study: 6 Months
- Study Population: Young Professional swimmers aged 12 to 18 years, actively training and competing.
- Sampling Method: A convenient sampling
- Sample Size: Required sample size is 57.
- Sample Size Estimation Formula

Where,

$$n = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

✓ P: Expected proportion

✓ D: Absolute precision

✓ 1- α /2: Desired Confidence level

➤ **Results:**

The study included 57 male competitive swimmers aged 12–18 years, with a mean age of 15.08 ± 1.97 years. Shoulder pain was reported by 52 (91.23%) swimmers, while 5 (8.77%) reported no pain. The mean Modified SFPS score was 4.26 ± 3.14 . A statistically significant moderate positive correlation was found between age and Modified SFPS score ($r = 0.520$, $p < 0.001$).

➤ **Conclusion:**

The study found a high prevalence of shoulder pain among young competitive swimmers, with a considerable proportion experiencing higher Modified SFPS scores. Older swimmers tended to report higher SFPS scores. These findings highlight the importance of regular shoulder screening, appropriate training-load management, adequate recovery, and preventive physiotherapy interventions to reduce shoulder-related problems and maintain swimming Performance.

Keywords: Shoulder Pain, Swimmers, SFPS, Competitive Swimming, Adolescent Swimmers, Etc.

How to Cite: Sejal Urkude; Dr. Kanvi Jagani (2026) Prevalence of Shoulder Pain Among Competitive Swimmers Using the Swimmer's Functional Pain Scale (SFPS). *International Journal of Innovative Science and Research Technology*, 11(8), 3176-3186. <https://doi.org/10.38124/ijisrt/26aug1517>

I. INTRODUCTION

Shoulder injuries are among the most common musculoskeletal problems observed in athletes, particularly those involved in overhead sports like swimming. The repetitive overhead motion in swimming leads to structural and functional adaptations in the shoulder joint, which, if imbalanced, may predispose athletes to pain and injury.¹ The prevalence of shoulder injuries among competitive swimmers has been reported to range widely, reflecting differences in training intensity, stroke mechanics, and age groups.²

Biomechanical changes accompany painful shoulders in swimmers. During hand entry, there is a decrease in activity of the anterior and middle deltoids, upper trapezius, and rhomboids, while at hand exit there is reduced activity in both heads of the deltoid. This alteration is associated with the characteristic dropped elbow position during recovery, a hallmark sign of shoulder injury. Such changes can lead to asymmetric pull, difficulties in maintaining lane position, and compensations that affect overall performance.^{3,13}

Shoulder pain in swimmers is multifactorial in origin. It can result from overuse, muscle imbalance, poor technique, or a combination of these factors.⁴ Studies have indicated that the incidence of shoulder pain increases with training volume and intensity, suggesting that both biomechanical and physiological stress contribute to injury risk.⁵ Swimmers often report pain during or after practice, which can limit performance and training capacity, potentially affecting long-term career progression.⁶

Several risk factors have been identified for shoulder injuries in swimmers. These include inadequate warm-up, previous shoulder injuries, poor scapular stability, and imbalanced strength between internal and external rotators of the shoulder.^{7,12} Moreover, structural changes such as labral tears, rotator cuff tendinopathy, and subacromial impingement are frequently reported in swimmers presenting with shoulder pain.⁸

The functional impact of shoulder injuries in swimmers is significant. Pain can reduce stroke efficiency, limit range

of motion, and affect training load tolerance. Consequently, athletes may experience both physical and psychological challenges that interfere with their performance.^{9,12} Research has emphasized the importance of preventive strategies, including strength training, technique modification, and proper load management, to reduce the incidence of shoulder pain in swimmers.¹⁰

Additionally, recent studies have shown that biomechanical alterations due to painful shoulders, such as changes in muscle activation patterns during swimming, can further compromise performance and increase the risk of secondary injuries.¹³

Given the high prevalence and multifactorial nature of shoulder injuries in swimmers, further research is essential to identify effective assessment, prevention, and rehabilitation strategies. Understanding the epidemiology, biomechanics, and risk factors of shoulder pain can guide physiotherapists, coaches, and athletes in implementing evidence-based interventions to maintain shoulder health and optimize swimming performance.¹¹

➤ **Aim**

To find out the prevalence of shoulder pain in professional swimmers using Swimmers Functional Pain Scale (SFPS).

➤ **Objective**

To determine the prevalence of shoulder pain in professional swimmers using Swimmers Functional Pain Scale (SFPS).

➤ **Need for the Study**

Shoulder pain is common musculoskeletal condition among swimmers due to the high physical demands of intensive training. Training components such as resistance training, endurance training, power training and prolonged repetitive shoulder activity further increase the load of shoulder complex increasing the risk of pain and dysfunction. Therefore, it is important to determine the prevalence of shoulder pain in this population.

II. REVIEW OF LITERATURE

- *De Almeida MO, Hespanhol LC, Lopes AD. PREVALENCE OF MUSCULOSKELETAL PAIN AMONG SWIMMERS IN AN ELITE NATIONAL TOURNAMENT. Int J Sports Phys Ther. 2015 Dec;10(7):1026-34.*

This study investigated the prevalence and distribution of musculoskeletal pain among elite swimmers during a national-level competition. Using questionnaires and physical assessments, the authors found that shoulder pain was the most commonly reported musculoskeletal complaint, followed by pain in the lower back and knees. The study attributed the high prevalence of shoulder pain to repetitive overhead movements, high training volumes, and insufficient recovery periods. The authors emphasized the importance of preventive strategies, including proper technique training, strength and conditioning programs, and early intervention to reduce pain and maintain performance in competitive swimmers.

- *Virag B, Hibberd EE, Oyama S, Padua DA, Myers JB. Prevalence of freestyle biomechanical errors in elite competitive swimmers. Sports Health. 2014 May;6(3):218-24.*

The study aimed to identify the frequency of biomechanical errors in elite freestyle swimmers and their possible relation to shoulder injuries. The authors analysed common stroke errors such as dropped elbow, wide hand entry, and crossover, which may alter shoulder mechanics and increase injury risk. Findings revealed a high prevalence of biomechanical faults even among elite swimmers, indicating that improper technique is not only common but also a potential contributor to overuse injuries. The study highlighted the importance of early detection and correction of stroke errors to reduce shoulder injury risk and improve swimming performance.

- *Harafsheh, I. and Abu-Eid, F. (2016) The Most Common Athletic Injuries among Swimmers: The Case for University Students in Jordan. Advances in Physical Education, 6, 52-58.*

The study explored the prevalence and types of athletic injuries among university-level swimmers in Jordan. Data were collected using questionnaires and interviews to identify injury patterns related to training and competition. Results showed that shoulder injuries were the most common, followed by knee and back injuries, largely attributed to repetitive movements and overuse. The authors emphasized the need for preventive strategies such as technique correction, strength training, and proper warm-up routines to minimize injury risk among student swimmers.

- *Tessaro M, Granzotto G, Poser A, Plebani G, Rossi A. SHOULDER PAIN IN COMPETITIVE TEENAGE SWIMMERS AND IT'S PREVENTION: A RETROSPECTIVE EPIDEMIOLOGICAL CROSS SECTIONAL STUDY OF PREVALENCE. Int J Sports Phys Ther. 2017 Oct;12(5):798-811.*

The study investigated the prevalence of shoulder pain in adolescent competitive swimmers and examined potential

preventive strategies. Using retrospective data from teenage swimmers, the researchers identified a high occurrence of shoulder pain, strongly linked to overuse, poor technique, and high training volume. The study also emphasized the importance of preventive measures, including regular screening, strength and flexibility training, and early intervention programs to reduce the risk of chronic shoulder injuries in young swimmers.

- *Ostrander T, DeGrauw C, Howarth SJ, Hogg-Johnson S. Prevalence of shoulder problems in youth swimmers in Ontario. J Can Chiropr Assoc. 2022 Dec;66(3):244-252.*

This study aimed to determine the prevalence and characteristics of shoulder problems among youth swimmers in Ontario. Data were collected through surveys and physical assessments, focusing on pain, functional limitations, and training habits. Results indicated that a significant proportion of young swimmers experienced shoulder issues, with symptoms often associated with high training volumes, repetitive overhead movements, and insufficient rest periods. The authors highlighted the importance of monitoring training load, implementing targeted strengthening exercises, and promoting early intervention strategies to prevent long-term shoulder injuries in youth athletes.

- *Feijen S, Tate A, Kuppens K, Claes A, Struyf F. Swim-Training Volume and Shoulder Pain Across the Life Span of the Competitive Swimmer: A Systematic Review. J Athl Train. 2020 Jan;55(1):32-41.*

This systematic review analysed the relationship between swim-training volume and shoulder pain in competitive swimmers of all ages. By synthesizing evidence from multiple studies, the authors found a strong correlation between high training volumes and increased prevalence of shoulder pain, particularly in adolescent and adult swimmers. The review emphasized that overuse, inadequate recovery, and improper technique are major contributors to shoulder injuries. Recommendations included monitoring training load, implementing strength and conditioning programs, and early detection of shoulder symptoms to reduce injury risk across a swimmer's career.

- *Yoma M, Herrington L, Mackenzie TA, Almond TA. Training Intensity and Shoulder Musculoskeletal Physical Quality Responses in Competitive Swimmers. J Athl Train. 2021 Jan 1;56(1):54-63.*

The study examined how varying training intensities affect the musculoskeletal properties of the shoulder in competitive swimmers. Using physical assessments and monitoring training loads, the authors found that high-intensity training was associated with increased muscle fatigue, decreased shoulder strength, and higher susceptibility to overuse injuries. Moderate and well-structured training loads were shown to maintain musculoskeletal integrity and reduce the risk of shoulder pain. The study highlighted the importance of individualized training intensity, progressive overload, and preventive conditioning to optimize performance while minimizing shoulder injury risk.

- Harrington S, Meisel C, Tate A. *A cross-sectional study examining shoulder pain and disability in Division I female swimmers. J Sport Rehabil. 2014 Feb;23(1):65-75.*

This study investigated the prevalence of shoulder pain and its impact on functional ability in elite female collegiate swimmers. Using questionnaires and physical assessments, the researchers found that a high proportion of swimmers experienced shoulder pain, which was associated with reduced range of motion, decreased strength, and functional limitations during training and competition. The study emphasized that shoulder injuries in female swimmers are influenced by repetitive overhead movements, training volume, and inadequate preventive measures. Recommendations included targeted strength training, technique correction, and early intervention reduce pain and improve shoulder function.

- Dischler JD, Baumer TG, Finkelstein E, Siegal DS, Bey MJ. *Association Between Years of Competition and Shoulder Function in Collegiate Swimmers. Sports Health. 2018 Mar/Apr;10(2):113-118.*

The study examined the relationship between the duration of competitive swimming and shoulder function in collegiate athletes. Through physical assessments and functional tests, the authors found that swimmers with more years of competitive experience exhibited higher rates of shoulder pain, reduced strength, and limited range of motion compared to less-experienced swimmers. The findings suggested that cumulative training load and repetitive overhead activity contribute significantly to shoulder dysfunction. The study highlighted the need for long-term preventive strategies, including targeted strengthening, load management, and monitoring of shoulder health throughout a swimmer's career.

- Suzuki Y, Maeda N, Sasada J, Kaneda K, Shirakawa T, Urabe Y. *Ultrasonographic Evaluation of the Shoulders and Its Associations with Shoulder Pain, Age, and Swim Training in Masters Swimmers. Medicina (Kaunas). 2020 Dec 31;57(1):29.*

This study used ultrasonography to assess structural changes in the shoulders of master's swimmers and investigated their associations with shoulder pain, age, and training history. The authors found that degenerative changes, tendon thickening, and subacromial abnormalities were common, particularly in older swimmers and those with extensive training histories. Shoulder pain correlated strongly with these structural changes, emphasizing the impact of long-term repetitive swimming on musculoskeletal health. The study recommended regular imaging assessments, tailored training modifications, and preventive conditioning to manage and reduce shoulder pain in master's swimmers.

- Thomas SJ, Blubello A, Peterson A, Blum D, Sarver JJ, Cobb J, Tate AR. *Altered Functional and Structural Measures in Masters Swimmers With Shoulder Pain and Disability. J Athl Train. 2021 Dec;56(12):1313-1320.*

This study investigated the functional and structural characteristics of the shoulders in master's swimmers experiencing pain and disability. Using a combination of physical assessments, strength testing, and imaging, the

authors identified significant alterations in shoulder mobility, muscle strength, and tendon structure among affected swimmers. The findings indicated that chronic repetitive swimming can lead to both functional impairment and structural changes, which are closely associated with pain and reduced performance. The study emphasized the importance of preventive exercises, monitoring training load, and early intervention to mitigate shoulder dysfunction in adult competitive swimmers.

- Heinlein SA, Cosgarea AJ. *Biomechanical Considerations in the Competitive Swimmer's Shoulder. Sports Health. 2010 Nov;2(6):519-25.*

This study examined the biomechanical factors contributing to shoulder injuries in competitive swimmers. The authors highlighted how repetitive overhead movements, stroke technique errors, and high training volumes place excessive stress on the glenohumeral joint and surrounding musculature. Common issues identified included impingement, rotator cuff tendinopathy, and muscular imbalances. The study emphasized the importance of stroke analysis, proper technique, and targeted strength and flexibility training to prevent shoulder injuries. By addressing biomechanical risk factors, coaches and clinicians can reduce the incidence of overuse injuries and improve performance in competitive swimmers.

- Belilos E, Jow S, Maxwell M. *Descriptive Epidemiology of High School Swimming and Diving Injuries. Clin J Sport Med. 2023 Jul 1;33(4):428-434.*

This study analysed injury patterns among high school swimmers and divers, focusing on prevalence, type, and anatomical location of injuries. Data collected from injury reports showed that shoulder injuries were the most frequent in swimmers, primarily due to overuse and repetitive overhead motions. The authors also highlighted that inadequate conditioning, technique errors, and high training loads contributed significantly to injury risk. The study emphasized the need for preventive strategies, including structured strength programs, proper technique training, and monitoring of training intensity to reduce shoulder injury incidence among adolescent swimmers.

III. MATERIALS & METHODOLOGY

- Study Design: Prevalence Study
- Study Setting: Nagpur city, Local area swimming pool
- Duration of Study: 6 Months
- Study Population: Young Professional swimmers aged 12 to 18 years, actively training and competing.
- Sample Size: Required sample size is 57.

• Sample Size Estimation:

It is estimated based on prevalence of shoulder pain among young professional swimmers using Swimmers Functional Pain Scale (SFPS). reported in published article (Reference : Prevalence of Shoulder and Elbow Overuse Injuries Among Competitive Overhead Youth Athletes in Singapore Rachel Lau,* BSc, and Swarup Mukherjee,*† MD, PhD) with following assumptions.

- ✓ prevalence of shoulder pain among young professional swimmers = 31.3 %
- ✓ Absolute precision = 12 %
- ✓ Desired confidence level (1- α)% = 95

• *Sample Size Estimation Formula*

$$n = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}$$

➤ *Method of Selection of Study Subject*

Table 1 Method of Selection of Study Subject

INCLUSION CRITERIA	EXCLUSION CRITERIA
1. Male swimmers are eligible to participate.	1. Inactively training and competing freestyle swimmers.
2. Age 12 to 18 years.	2. Neurological conditions / Neuromuscular conditions eg. Stroke, Myasthenia Gravis, Multiple Sclerosis etc.
3. Actively training and competing freestyle swimmers.	3. Duration of practice: < 5 days/week.
4. Duration of practice: 5-6 days/week.	4. Person who is not willing to participate.
5. Years of experience in swimming: >3 years.	5. Years of experience in swimming: < 3 years.

➤ *Materials Used*

• *Tools and Scales*

- ✓ Consent form

➤ *Methods of Measurements*

- ✓ Swimmers functional pain scale
- ✓ Pen
- ✓ Paper

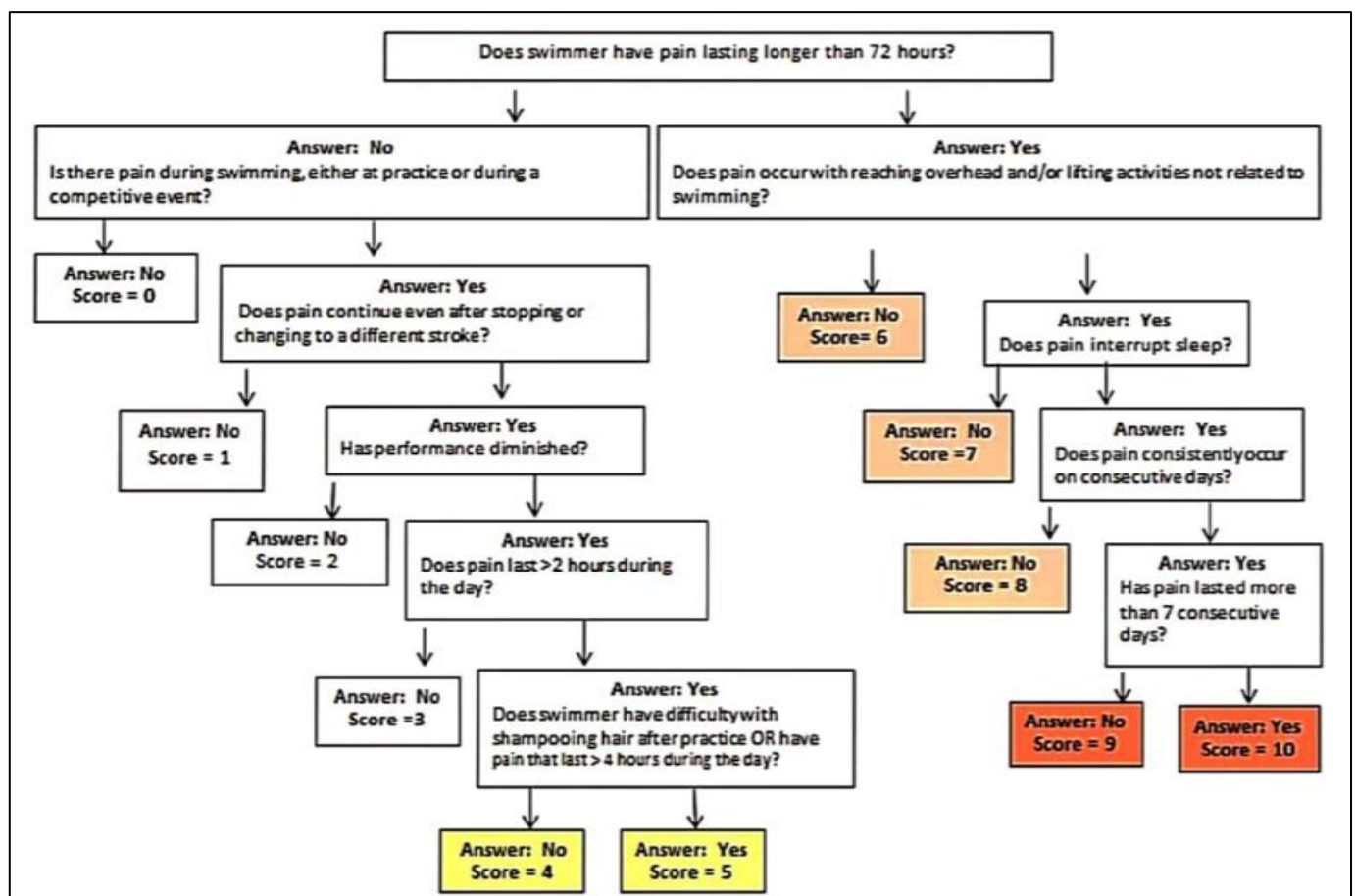


Fig 1 Methods of Measurements

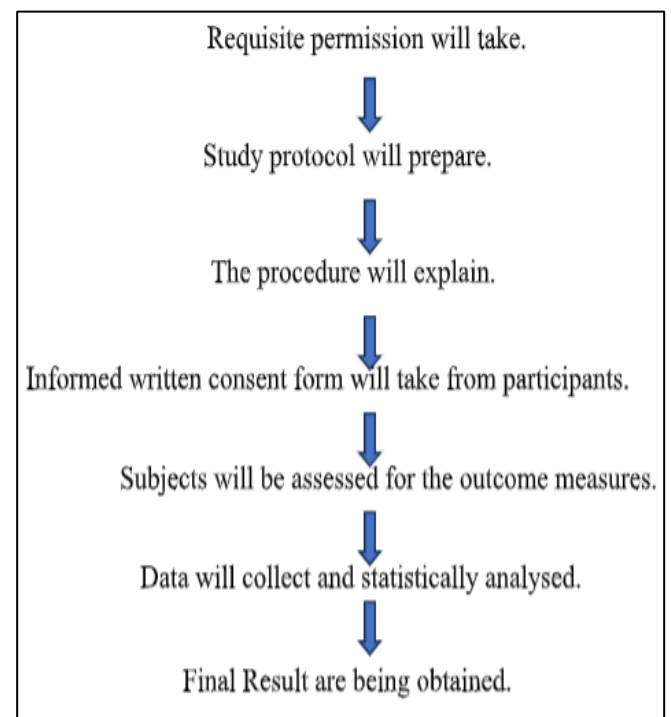
➤ *SFPS Interpretation*

Table 2 SFPS Interpretation

Score	Interpretation	Functional implication for the swimmer
0	No pain	The swimmer reports no shoulder pain and is able to perform swimming and routine activities without pain-related limitation.
1-3	White zone – Minimal pain / No significant functional limitation	Mild symptoms may be present, but the swimmer is generally able to continue swimming without significant reduction in performance or daily functional activities.
4-5	Yellow zone – Pain affecting performance	Shoulder pain is more noticeable and may begin to affect swimming performance. Training may require modification, with attention to swimming technique and symptoms.
6-8	Orange zone – Significant pain / Rehabilitation indicated	Pain is associated with functional difficulty and may substantially affect swimming or shoulder activities. Training should be reduced or modified, and rehabilitation/clinical assessment is indicated.
9-10	Red zone – Severe pain / Referral indicated	Pain substantially interferes with swimming and shoulder function. The swimmer may be unable to perform swimming activities effectively and should be referred for assessment by an appropriate healthcare professional.

➤ *General Procedure*

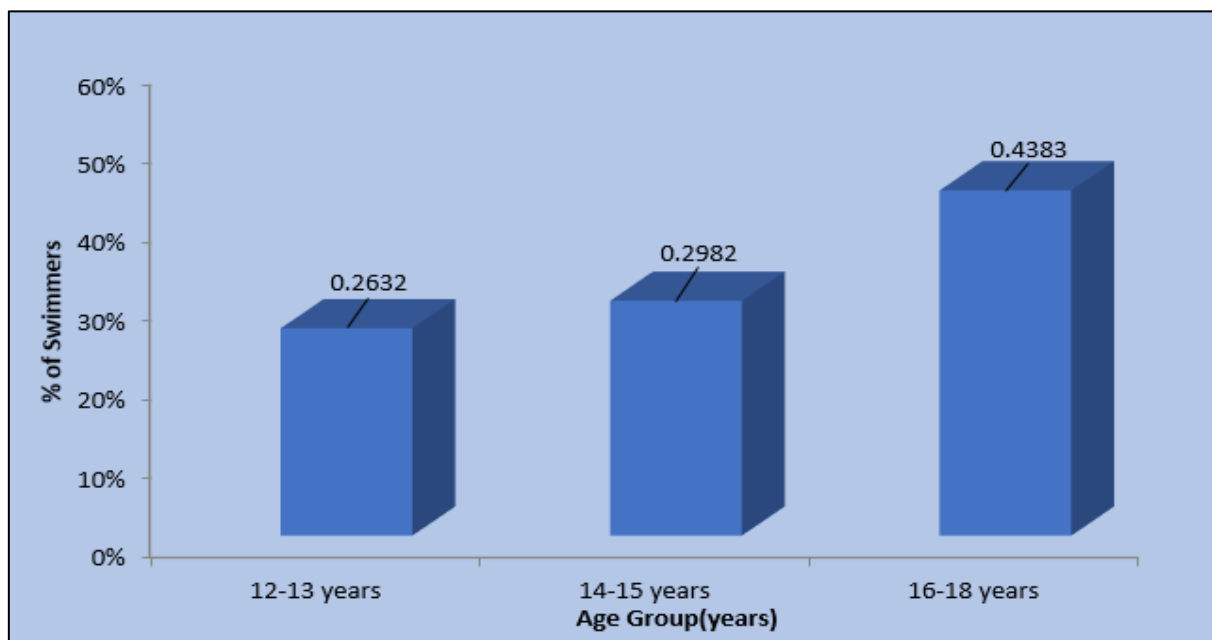
- The approval of the study is obtained from the ethical committee (see Annexure I), after which permission is obtained from the owner of the swimming pool.
- Once the approval is obtained, there is an informal interaction with the swimmers.
- Then they are provided with the information sheet with regards to the nature of the study.
- After explaining the nature of the study to the swimmer's, written consent is obtained from the subjects (see Annexure II).
- Subjects were selected based on fulfilment of inclusion criteria.
- Later, the questionnaire is handed to the subjects, and they are asked to fill it out and return it according to the given instructions.
- Upon completion of making the responses, the questionnaire is taken back and is later interpreted.

• *Flow Chart for General Procedure*

IV. RESULTS & TABLES

Table 3 Distribution of Swimmers According to Their Age in Years

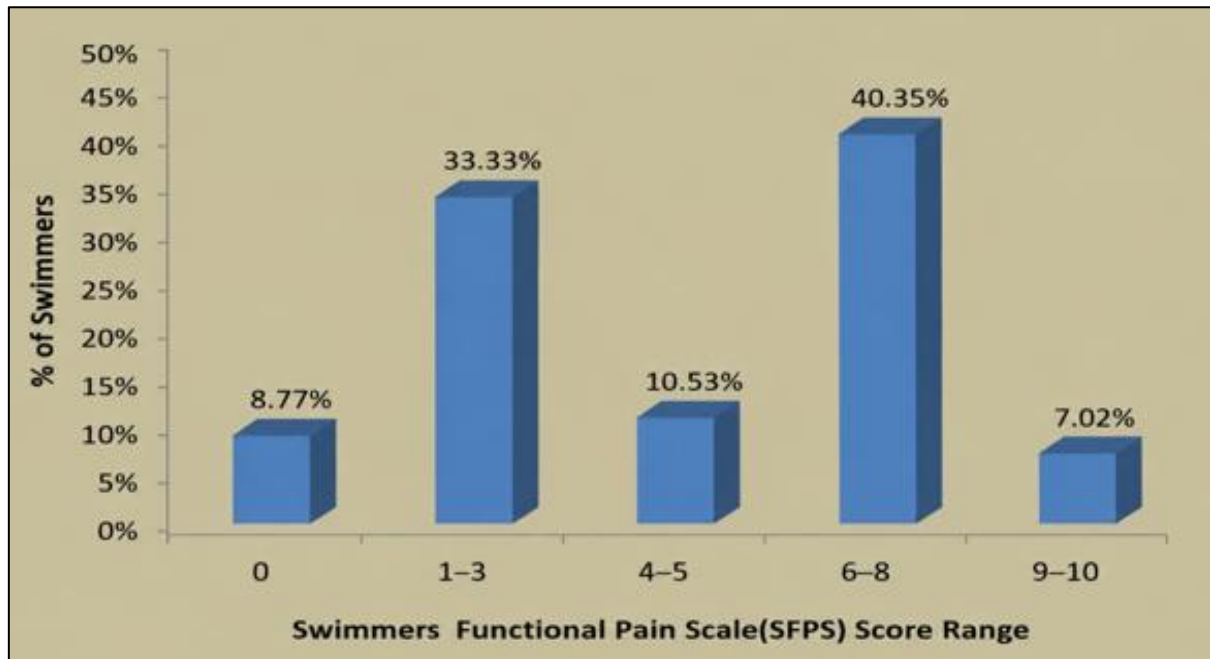
Age Group(yrs)	No of Swimmers	Percentage
12-13 years	15	26.32
14-15 years	17	29.82
16-18 years	25	43.83
Total	57	100
Mean±SD	15.08±1.97(12-18 years)	



Graph 1 Distribution of Swimmers According to Their Age in Years

Table 4 Distribution of Swimmers according to their Swimmers Functional Pain Scale (SFPS) Score

SFPS Zone	Score Range	No. of Swimmers	Percentage(%)
No Pain	0	5	8.77
White Zone	1–3	19	33.33
Yellow Zone	4–5	6	10.53
Orange Zone	6–8	23	40.35
Red Zone	9–10	4	7.02
Total	0–10	57	100
Mean ± SD		4.26 ± 3.14 (0–10)	

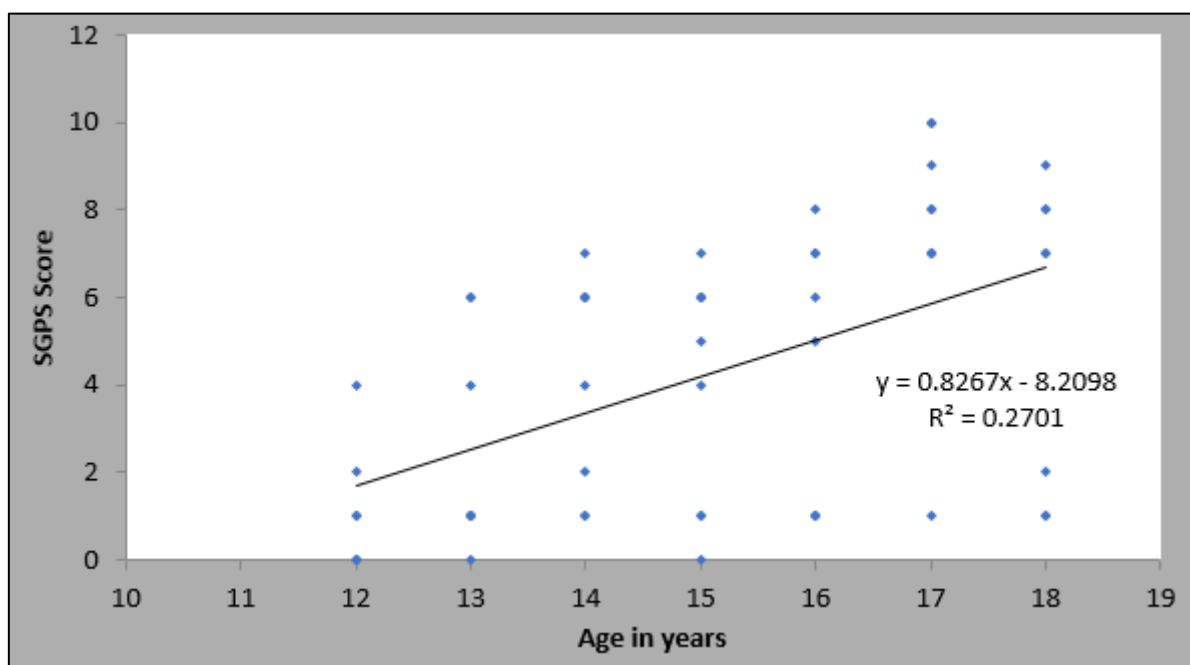


Graph 2 Distribution of Swimmers According to their Swimmers Functional Pain Scale (SFPS) Score

Table 5 Correlation between Swimmers Functional Pain Scale (SFPS) Score and age in years of swimmers

	Mean	Std. Deviation	N	Correlation 'r'
Age in years	15.08	1.97	57	0.520
SFPS Score	4.26	3.14	57	P<0.001, S

By using Pearson's Correlation Coefficient significant positive correlation was found between age and SFPS score ($r = 0.520$, $p < 0.001$), indicating that higher age was associated with higher SFPS scores among the swimmers.



Graph 3 Correlation between Modified Swimmer's Functional Pain Scale (Modified SFPS) Score and Age of Swimmers

Statistical analysis was done by using descriptive and inferential statistical using Pearson's Correlation Coefficient and software used in the analysis was SPSS 27.0 version and $p < 0.05$ is considered as level of significance.

V. DISCUSSIONS

The present study was conducted to determine the prevalence of shoulder pain among young competitive swimmers using the Modified Swimmer's Functional Pain

Scale (Modified SFPS). A total of 57 male swimmers aged 12–18 years participated in the study. The collected data were analyzed statistically to determine the prevalence of shoulder pain and to evaluate the relationship between age and Modified SFPS score.

The present study included swimmers belonging to three different age groups. The mean age of the participants was 15.08 ± 1.97 years, with the majority of swimmers (43.83%) belonging to the 16–18 years age group, followed by 29.82% in the 14–15 years age group and 26.32% in the 12–13 years age group. This indicates that most of the participants were older adolescent swimmers who may undergo greater training volume and competitive exposure. Increased years of swimming practice and repetitive overhead activity may contribute to a higher occurrence of shoulder pain in this age group.

As per the inclusion criteria, all participants were male swimmers (100%). Therefore, the findings of the present study specifically represent the prevalence of shoulder pain among young male swimmers and may not be directly generalized to female swimmers.

The major finding of the present study was the high prevalence of shoulder pain among the participants. Out of 57 swimmers, 52 (91.23%) reported shoulder pain, whereas only 5 (8.77%) reported no pain. Among the participants, 19 swimmers (33.33%) had scores within the White zone (1–3), 6 swimmers (10.53%) were within the Yellow zone (4–5), 23 swimmers (40.35%) were within the Orange zone (6–8), and 4 swimmers (7.02%) were within the Red zone (9–10). The highest proportion of swimmers was observed in the Orange zone. The mean Modified SFPS score was 4.26 ± 3.14 , indicating the presence of a considerable level of shoulder pain and functional symptoms among the participating swimmers.

The high prevalence of shoulder pain observed in this study may be explained by the repetitive overhead nature of swimming. During freestyle swimming, the shoulder repeatedly performs flexion, abduction, internal rotation, and external rotation throughout every stroke cycle. Continuous repetition of these movements places substantial stress on the rotator cuff muscles, glenohumeral joint, long head of the biceps tendon, and scapular stabilizing muscles. Repetitive mechanical loading, muscle fatigue, inadequate recovery, improper swimming technique, and excessive training volume may lead to cumulative microtrauma and overuse symptoms affecting the shoulder complex, commonly associated with swimmer's shoulder.

Another important finding of the present study was the statistically significant moderate positive correlation between age and Modified SFPS score ($r = 0.520$, $p < 0.001$). This finding indicates that older swimmers tended to have higher Modified SFPS scores within the studied age range. Older swimmers may generally be exposed to more years of competitive training, longer practice sessions, higher training intensity, and repeated overhead movements, which may increase cumulative stress on the shoulder complex. These

factors may contribute to the higher SFPS scores observed among older swimmers. However, as the present study was cross-sectional in nature, this association does not establish that increasing age directly causes an increase in shoulder pain.

The findings of the present study are consistent with previous research reporting that shoulder pain is one of the common musculoskeletal complaints among competitive swimmers. Previous studies have suggested that repetitive overhead movements, excessive training load, inadequate recovery, poor stroke mechanics, scapular dysfunction, rotator cuff weakness, and muscular imbalance may contribute to shoulder pain in swimmers. The high prevalence observed in the present study supports these findings and further highlights the burden of shoulder symptoms among young competitive swimmers.

The findings of this study have important clinical implications for physiotherapists, coaches, and sports medicine professionals. Early identification of shoulder symptoms through regular screening using the Modified Swimmer's Functional Pain Scale may help detect symptoms before they progress into more serious overuse problems. Preventive strategies, including rotator cuff and scapular stabilizer strengthening, flexibility exercises, correction of swimming technique, structured warm-up and cool-down programmes, appropriate workload management, and adequate recovery, should be incorporated into regular training programmes to reduce the risk of shoulder pain.

Overall, the findings of the present study demonstrate that shoulder pain was highly prevalent among the young competitive swimmers studied, with 91.23% reporting a Modified SFPS score greater than zero. A considerable proportion of swimmers were classified within the Orange and Red zones, indicating clinically relevant shoulder-related symptoms. The significant positive correlation between age and Modified SFPS score suggests that older swimmers tended to report higher SFPS scores. These findings emphasize the importance of preventive physiotherapy interventions, early assessment, regular screening, and appropriate training modifications to reduce shoulder symptoms, maintain functional performance, and promote the long-term musculoskeletal health of young competitive swimmers.

VI. CONCLUSION

The present study was conducted to determine the prevalence of shoulder pain among young competitive swimmers using the Modified Swimmer's Functional Pain Scale (Modified SFPS). The findings revealed a high prevalence of shoulder pain, with 52 out of 57 swimmers (91.23%) reporting a Modified SFPS score greater than zero, while 5 swimmers (8.77%) reported no shoulder pain. Among the participants, 19 (33.33%) were classified within the White zone, 6 (10.53%) within the Yellow zone, 23 (40.35%) within the Orange zone, and 4 (7.02%) within the Red zone.

The study also demonstrated a statistically significant moderate positive correlation between age and Modified SFPS score ($r = 0.520$, $p < 0.001$), indicating that older swimmers tended to report higher SFPS scores. This association may be related to greater cumulative exposure to competitive swimming, repetitive overhead movements, increased training demands, and prolonged loading of the shoulder complex.

The findings emphasize that shoulder pain is a common musculoskeletal problem among young competitive swimmers. Regular screening, appropriate training-load management, adequate recovery, strengthening of the rotator cuff and scapular stabilizers, flexibility exercises, and correction of swimming technique may help in the early identification and prevention of shoulder-related problems.

Overall, the study concludes that shoulder pain is highly prevalent among young competitive swimmers, with a considerable proportion of swimmers experiencing symptoms within the higher SFPS zones. Early assessment and preventive physiotherapy interventions may help maintain shoulder function, reduce the risk of overuse problems, and support long-term athletic performance.

RECOMMENDATIONS

Shoulder Strengthening Programme: Rotator cuff and scapular stabilizer strengthening exercises should be incorporated into regular training programmes to improve shoulder strength, stability, and control and to support the demands of repetitive swimming activity.

Flexibility and Mobility Training: Regular stretching and mobility exercises for the shoulder, chest, and upper back should be included to maintain adequate range of motion and reduce restrictions that may contribute to altered shoulder mechanics.

Swimming Technique Correction: Coaches should emphasize proper swimming technique, particularly freestyle stroke mechanics, to minimize unnecessary stress on the shoulder and reduce excessive repetitive loading.

Training Load Management: Training intensity, duration, and frequency should be monitored according to the swimmer's age, training level, and physical capacity. Adequate rest and recovery should be incorporated to minimize the effects of cumulative shoulder loading.

Appropriate Warm-up and Cool-down: Swimmers should perform appropriate warm-up activities before training and cool-down exercises after training, with emphasis on preparing the shoulder complex for activity and promoting recovery.

Regular Shoulder Screening: Regular screening using the Modified Swimmer's Functional Pain Scale may help identify shoulder symptoms at an early stage, particularly in swimmers reporting higher scores or those experiencing persistent symptoms.

Early Physiotherapy Intervention: Swimmers experiencing persistent or increasing shoulder pain should undergo early physiotherapy assessment to identify contributing factors and initiate appropriate management before symptoms interfere significantly with training and performance.

Education and Awareness: Swimmers, coaches, and parents should be educated regarding early signs and symptoms of shoulder problems, the importance of reporting pain, appropriate training-load management, recovery, and injury-prevention strategies.

Age-specific Monitoring: Since the present study demonstrated a significant positive correlation between age and Modified SFPS score, older adolescent swimmers may benefit from more regular monitoring of shoulder symptoms and training exposure.

Future Research: Further research should include larger and more diverse samples, including female swimmers and swimmers from different age groups and swimming strokes. Longitudinal studies should also be conducted to investigate changes in shoulder pain over time and to identify specific training-related and biomechanical risk factors.

FUTURE SCOPE OF STUDY

The present study was conducted among professional male swimmers using the Swimmer's Functional Pain Scale (SFPS). Further research can be carried out with a larger sample size to improve the generalizability of the findings. Similar studies should also be conducted among professional female swimmers to determine the prevalence of shoulder pain and compare the findings with male swimmers, as differences in anatomy, muscle strength, hormonal influences, and training patterns may affect the occurrence of shoulder pain.

Future studies may compare swimmers of different swimming strokes, such as freestyle, butterfly, backstroke, and breaststroke, to identify stroke-specific risk factors for shoulder pain. Longitudinal studies are also recommended to evaluate the progression of shoulder pain over time and to assess the effectiveness of preventive physiotherapy interventions, rehabilitation programmes, and injury prevention strategies.

REFERENCES

- [1]. De Almeida MO, Hespanhol LC, Lopes AD. PREVALENCE OF MUSCULOSKELETAL PAIN AMONG SWIMMERS IN AN ELITE NATIONAL TOURNAMENT. *Int J Sports Phys Ther*. 2015 Dec;10(7):1026-34. PMID: 26676276; PMCID: PMC4675188.
- [2]. Virag B, Hibberd EE, Oyama S, Padua DA, Myers JB. Prevalence of freestyle biomechanical errors in elite competitive swimmers. *Sports Health*. 2014 May;6(3):218-24. doi: 10.1177/1941738114527056. PMID: 24790691; PMCID: PMC4000476.

- [3]. Harafsheh, I. and Abu-Eid, F. (2016) The Most Common Athletic Injuries among Swimmers: The Case for University Students in Jordan. *Advances in Physical Education*, 6, 52-58. doi: 10.4236/ape.2016.62006.
- [4]. Tessaro M, Granzotto G, Poser A, Plebani G, Rossi A. SHOULDER PAIN IN COMPETITIVE TEENAGE SWIMMERS AND IT'S PREVENTION: A RETROSPECTIVE EPIDEMIOLOGICAL CROSS SECTIONAL STUDY OF PREVALENCE. *Int J Sports Phys Ther*. 2017 Oct;12(5):798-811. PMID: 29181257; PMCID: PMC5685406.
- [5]. Ostrander T, DeGraauw C, Howarth SJ, Hogg-Johnson S. Prevalence of shoulder problems in youth swimmers in Ontario. *J Can Chiropr Assoc*. 2022 Dec;66(3):244-252. PMID: 36818360; PMCID: PMC9914825.
- [6]. Feijen S, Tate A, Kuppens K, Claes A, Struyf F. Swim-Training Volume and Shoulder Pain Across the Life Span of the Competitive Swimmer: A Systematic Review. *J Athl Train*. 2020 Jan;55(1):32-41. doi: 10.4085/1062-6050-439-18. PMID: 31935141; PMCID: PMC6961642.
- [7]. Yoma M, Herrington L, Mackenzie TA, Almond TA. Training Intensity and Shoulder Musculoskeletal Physical Quality Responses in Competitive Swimmers. *J Athl Train*. 2021 Jan 1;56(1):54-63. doi: 10.4085/1062-6050-0357.19. PMID: 33176360; PMCID: PMC7863595.
- [8]. Harrington S, Meisel C, Tate A. A cross-sectional study examining shoulder pain and disability in Division I female swimmers. *J Sport Rehabil*. 2014 Feb;23(1):65-75. doi: 10.1123/jsr.2012-0123. Epub 2013 Aug 12. PMID: 23945068; PMCID: PMC4146617.
- [9]. Dischler JD, Baumer TG, Finkelstein E, Siegal DS, Bey MJ. Association Between Years of Competition and Shoulder Function in Collegiate Swimmers. *Sports Health*. 2018 Mar/Apr;10(2):113-118. doi: 10.1177/1941738117726771. Epub 2017 Aug 22. PMID: 28829699; PMCID: PMC5857725.
- [10]. Suzuki Y, Maeda N, Sasadai J, Kaneda K, Shirakawa T, Urabe Y. Ultrasonographic Evaluation of the Shoulders and Its Associations with Shoulder Pain, Age, and Swim Training in Masters Swimmers. *Medicina (Kaunas)*. 2020 Dec 31;57(1):29. doi: 10.3390/medicina57010029. PMID: 33396219; PMCID: PMC7824457
- [11]. Thomas SJ, Blubello A, Peterson A, Blum D, Sarver JJ, Cobb J, Tate AR. Altered Functional and Structural Measures in Masters Swimmers With Shoulder Pain and Disability. *J Athl Train*. 2021 Dec;56(12):1313-1320. doi: 10.4085/1062-6050-0067.21. Epub 2021 Apr 13. PMID: 33848358; PMCID: PMC8675314.
- [12]. Heinlein SA, Cosgarea AJ. Biomechanical Considerations in the Competitive Swimmer's Shoulder. *Sports Health*. 2010 Nov;2(6):519-25. doi: 10.1177/1941738110377611. PMID: 23015983; PMCID: PMC3438875.
- [13]. Belilos E, Jow S, Maxwell M. Descriptive Epidemiology of High School Swimming and Diving Injuries. *Clin J Sport Med*. 2023 Jul 1;33(4):428-434. doi: 10.1097/JSM.0000000000001121. Epub 2023 Jan 27. PMID: 36715985; PMCID: PMC10372189.
- [14]. Drake SM, Krabak B, Edelman GT, Pounders E, Robinson S, Wixson B. Development and validation of a swimmer's functional pain scale. *J Swim Res*. 2015 Mar 1;23:21-32.