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Swimmers shoulder among university students, prevalence and risk factors: A cross sectional study

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Abstract

The main symptom of swimmer's shoulder is pain in the shoulder area during or after swimming. Clarifying the differences between swimmers with and without shoulder pain could serve as a basis for developing a program to prevent shoulder injury that may lead to pain and dysfunction.

Purpose: To find out the risk factors for swimmer's shoulder syndrome among passing students, and the relationship between shoulder pain and swimmers.

Methodology: Cross sectional/observational study, between student swimmers at An-Najah National University, the sample size was 61. Then we distributed questionnaires (swimmers shoulder questionnaire and pain assessment), and data will be collected and analysed using individual ratio and logistic regression. Between July 2023 and August 2023.

Result: The number of participants with shoulder pain was 31 and 30 had no shoulder pain. It was found that 50.8% of the participants had shoulder pain associated with swimming. More than half of the participants (54.8%) reported that the intensity of the pain was moderate for them. 32.9% indicate that there is a moderate positive relationship between the number of weekly training sessions and the probability of swimmer's shoulder experience, and 46.7% indicate that there is a stronger positive relationship between the number of meters swam per session and the risk of swimmers shoulder. 31.1% of the participants indicated that the university swim team set aside time for shoulder strengthening exercises during the workout and 68.9% of swimmers who do not participate in shoulder stretches before swimming are more likely to develop swimmer's shoulder compared to those who practice shoulder stretches.

Conclusion: This study showed that students who swimming at An-Najah University have risk factors for developing swimmer's shoulder syndrome. So the effected students should have more knowledge about swimmer's shoulder syndrome, the rest of students should know how to prevent themselves from the syndrome.

Keywords: Shoulder pain, swimmer's shoulder, athletes, swimming

1. Introduction

Swimming is a popular sport recreational and competitive sport among all generations, making it an excellent choice for many teenagers seeking to engage in athletics. However, in competition swimming, the freestyle, butterfly, backstroke, and breaststroke are all of the recognized strokes. Swimmers spend most of their training time swimming freestyle, regardless of the stroke they use in competition. Because of the extremely repetitive motion that occur in the normal swimming stroke, swimmers are more at risk for musculoskeletal injuries to the upper limb, shoulder mostly ^[1].

Shoulder pain is the most common symptom that affects swimmers, with a prevalence between 40 to 91%, as shown in the study published by A 5-year survey from the National Collegiate Athletic Association (NCAA) in 1974, and it called "swimmer's shoulder" syndrome. The fact that the upper limbs produce 90% of the propelling forces while swimming, due to the nature of their activity, which requires regular, vigorous shoulder motions, swimmers are especially vulnerable to this illness ^[2].

Kennedy and Hawkins first identified this condition in 1974, which is characterized by pain after swimming activities. Pain during and after training may develop, finally, the pain affects the progress of the athlete ^[3].

Swimmers shoulder, which includes a range of shoulder disorders, such as bursitis, rotator cuff tendinitis, and partial tears leading up to full-thickness tear of the rotator cuff, and other related conditions. It stands as the primary cause of shoulder pain worldwide and a significant factor contributing to disability [4].

This condition occurs when the tendons and bursa (fluid-filled sacs that provide cushioning) in the shoulder become compressed and irritated between the bones of the shoulder joint, particularly the humerus (upper arm bone) and the acromion (A bony process of the shoulder blade). This compression can lead to pain, inflammation, and limited range of motion in the shoulder [5].

According to data from recent studies, the prevalence of shoulder pain among swimmers has grown from 3% in a 1974 research to 91% today. There is a significant difference between the two statistics, because of the various inclusion and exclusion criteria used [6].

According to study published during 2015–2016 in the United States, 5 million high school swimmers competed on teams, while 336 000 participated on club teams. Compared to this, just 22000 swimmers from the National Collegiate Athletic Association were registered in leagues [7].

In competitive swimming, prescribed significant quantities of low-intensity swimming exercise to improve performance. Competitive swimming has become almost a year-round, intense activity as a result of these tough and time-consuming training programs, with athletes at young ages concentrate only on swimming [8-9].

Swimmers are regularly practice 5 to 7 days a week, and even twice daily, throughout their 10- to 15-year swimming careers, this prolonged exposure to swimming linked to overtraining increase the danger of and soft tissue damage, fatigue, and discontent [8-9].

2. Materials and Methods

Cross-sectional search included non-probability convenience sampling method, with 61 participants that matched our inclusion criteria. The major criteria for inclusion and exclusion were at first should be a student at An-Najah National University, age between 18-24 years, male or female, all of the participants don't suffer from any shoulder injury and all of the participants swimming training period shouldn't be less than one month.

2.1 Research setting

Our study was conducted on swimming students at An-Najah National University in Nablus, Palestine.

2.2 Research instrumentation: Regarding to our research instrument multiple questionnaire has been used: "Swimming Shoulder Pain and Injury Questionnaire", "Shoulder Pain Questionnaire", " Pain assessment questionnaire "included risk factor that mentioned in chapter 2 "risk factor for swimmers shoulder" Pain is a patient-specific experience that requires ongoing assessment and evaluation, both by patients and their providers. This questionnaire will help assess, persistent baseline and breakthrough pain.

2.3 Data collection procedure: As a group of four students, we submitted the IRP to the university and it was approved, then we published an announcement that we will conduct this research in NNU at a specific hour for those who have the opportunity to participate, we met the swimmers and explained to them the purpose of the study and asked them for

permission to collect the survey data. The questionnaire will include inquiries about risk factors associated with swimmers' shoulders, including age, meters per day, and number of workouts.

2.4 Pilot study: To assess the clarity and understanding of the questionnaire among swimmers, a pilot study was conducted with a sample of 5 participants. The results of the pilot study indicated that there were no complications in terms of language, time spent by the swimmers, or understanding of the questionnaire.

2.5 Research design: An observational cross-sectional study. This type of study design allows researchers to examine the prevalence of a phenomenon or the association between variables at a single point in time. Which helps us to know the prevalence and risk factors that increase the possibility of developing shoulder pain among competitive swimmers at An-Najah National University.

2.6 Statistical analysis: SPSS was used to analyse risk factors for swimmer's shoulder injury and their association with swimmer's shoulder injury. The data collected for the study were entered into the Statistical Package for the Social Sciences (SPSS), specifically version 26.0. SPSS descriptive statistics were calculated for variables measured using descriptive statistics, and for categorical variables frequencies (Number of occurrences for each category) and percentages (Relative proportions) were calculated. Since the collected data included categorical variables with "yes/no" answers, a chi-square analysis was performed. The level of statistical significance was set at $p < 0.05$

3. Results

3.1 Sample characteristics: This section described the demographic data using frequency and percentage. 61 questionnaires were distributed, and 61 participants responded to the survey. After applied the inclusion criteria, the sample was consist of 61 participants. Table 1 represents the main characteristics of these participants: Based on gender, age, BMI, field of study, and year of study. The largest represented fields of study are "Sport," and the majority of participants were in their 3rd year of study.

Table 1: Summarize the Characteristics of the Sample

Demographics characteristics	Number	Percentage
Gender		
Male	37	60.7
Female	24	39.3
Age (mean \pm sd) yrs	(21.03 \pm 2.08)	
BMI (mean \pm sd)	(23.80 \pm 3.93)	
Filed of study		
Accounting	3	4.9
ART	4	6.6
Computer science	7	11.5
Engineering	4	6.6
IT	2	3.3
Laboratory	2	3.3
physical therapy	1	1.6
Sport	38	62.3
Year of study		
1 st	2	3.3
2 nd	9	14.8
3 rd	26	42.6
4 th	20	32.8
5 th	4	6.6

Section 1: Number weekly training and Meters per Swim
 Most participants trained four times a week (27.9%), significant percentages trained one (34.4%). The range of daily training distance varied: 11.5% swam over 200 meters, 21.3% swam 101-150 meters, 23.0% swam 11-30 meters, and other ranges included 1-10, 31-100, and 151-200 meters.

Section 2: Swimming and physiotherapy incidence.
 The participants were asked if they were taking physical therapy sessions or not, and the number of sessions they took. The percentage was 8.2%. They underwent physical therapy with a number of sessions from 6-20 sessions during their

training.

Section 3: Stretching and Strengthening.
 Roughly half of respondents did stretching before training (50.8%). where their frequency varied was: (51.6% stretched once / 32.3% stretched twice / 9.7% stretched three times / 6.5% stretched more than three times).
 The percentage of participants who used a resistance band for stretching was 23.0%, and 59.0% included weight training in their exercises. The types of weights used included free weights (69.0%) and weight machines (31.0%).

Table 2: More expected to swimmer shoulder and less expected to have swimmer shoulder

Risk factor	More expected to swimmer shoulder (n=31) n (%)	Less expected to have swimmer shoulder (n=30) n (%)	X ²	P-value
Coach instructions for stretching				
Yes	6(31.6)	13(68.4)	0.043	0.049
No	25(59.5)	17(40.5)		
Gender				
Male	17(45.9)	20(54.1)	3.44	0.434
Female	14(58.3)	10(41.7)		
BMI				
Non normal weight	20(52.6)	18(47.4)		
Normal weight	11(47.8)	12(52.2)	0.716	0.795
Age at first swim				
<18 years	16(43.2)	21(56.8)		
>= 18 years	15(62.5)	9(37.5)	0.142	0.192
Do stretching before training				
No	18(60)	12(40)		
Yes	13(41.9)	18(58.1)	0.158	0.204
used weight training in your workouts				
No	15(60)	10(40)		
Yes	16(44.4)	20(55.6)	0.232	0.300
Number of weekly training (r,p-value)			(0.329; 0.010)	
How many meters per day do you swim during training? (r,p-value)			(0.467; 0.000)	
How many months will you practice this year?			(0.159; 0.200)	

3.2 Risk factors profile

3.2.1 Positive risk factors that affect swimmer’s shoulder:
Number of weekly training sessions: There is a correlation of 32.9% indicating a positive relationship between the number of weekly training sessions and the likelihood of swimmers sustaining a swimmer's shoulder injury. This indicates that as the number of training sessions per week increases, the risk of swimmer’s shoulder also tends to increase.

Number of meters per swim: There is a relationship of 46.7% indicating a stronger positive relationship between the number of meters swam in each session and the risk of swimmers' shoulder injury. This indicates that swimmers who cover a greater distance per swim are more likely to injure swimmer's shoulder.

Trainer Instructions for Stretching Exercises: Swimmers who do not perform shoulder extension exercises are more likely to injure swimmer's shoulder than those who do shoulder extension exercises.

3.2.2 Adverse risk factors that do not affect swimmers' shoulder

Gender: The absence of a relationship between sex and swimmers shoulder indicates that the incidence of swimmer’s shoulder is not affected by sex.

BMI (Body Mass Index): No relationship between BMI and swimmer's shoulder

Section 4: Swimmers and shoulder pain

The percentage of participants suffering from shoulder pain due to swimming was 50.8%. Half of the participants (51.6%) experienced two episodes of pain, and 29% felt pain during the night. Another 25% said the pain lasted more than 30 minutes. When asked how long pain meditation took, nearly half (48.4%) said 30 minutes.

4. Discussion

This section will discuss the results of our study and compare them with other studies that were related to swimmers' shoulder. The goal is to study the risk factors for swimmer's shoulder syndrome among success students, and the relationship between shoulder pain and swimmers. Then we can determine whether the symptoms are the result of too repetitive movement or not warming up adequately before training. As a result of our study, the prevalence of participants’ injury to swimmers’ shoulder in general was 50.8%, among 14 females the percentage was 45.9%, and among 17 males it was 58.3%, which confirms the importance of This is the case among the swimming community. The relationship between various risk factors and the incidence of swimmer’s shoulder in swimmers, including:

1. Pain Prevalence: The prevalence of swimmer’s shoulder was moderate among swimmers, with 50.8% of the participating athletes reporting at least one painful event during the period preceding the collection of data. Besides, in recent studies such as (Tessaro *et al* 2017) found a similar result and it was consistent with our research, according to this study, shoulder pain prevalence over the previous 12 months from the completion of the survey was 51%. This value is greater than the results of the other international studies published between (1998 - 2016) where prevalence was ranged between 18% to 38% [9, 10, 11, 12].

2. Gender and Swimmers Shoulder

There no significant relationship between gender and swimmers shoulder however, in recent studies such as (Tessaro *et al.* 2017) Whereas, the study found that there is relationship between correlation between shoulder pain and sex was found to be statistically significant for females ($p = 0.048$) [33]. The reason for the difference in the results may be the absence of a large sample size in our study, as the number of participants was 61 compared to the Tessaro *et al* study sample size was 274, and also our inability to make the sample equal in number between males and females [13].

3. Number of Weekly Training

The relationship was positive and moderate between the number of weekly training sessions and the probability of injury to the swimmer’s shoulder by 32.9%, besides, in recent studies such as (Feijen *et al.* 2020) found that adolescent developing athletes who swam more than 15 hours or 35 km per week were at a higher risk of developing shoulder pain [14].

4. Number of Meters per Swim

The relationship was positive and stronger between the number of meters per swim and the probability of injury to the swimmer’s shoulder by 46.7%, besides, in studies such as (Tate *et al.* 2012) [14] found that swimmers averaged more than 15 hours per week of swimming, and some swimmers reported swimming 10 000 m or more daily. Sein *et al.* also found that athletes who swam more than 15 hours per week were twice as likely to have pain in shoulder as those who trained less [15].

5. Stretching and Strengthening

The relationship not significant between stretching and strengthening before training, as we can see in the table there was more people who did not practice stretching or strengthening exercises there are more experienced pain and expected to have swimmers shoulder. (Beach *et al.* 1992) [16] is consistent with our research, this study investigated the relationship between strength and stretch ratios and shoulder pain and found is a relationship between swimmers’ shoulder and participants who practice stretching exercises before swimming with instructions from the coach. The results demonstrated that no significant correlation ($p > 0.001$) existed between shoulder stretch and strength ratios, and shoulder pain in competitive swimmers [16].

6. Swimmers shoulder and Physical therapy

The percentage was 8.2% underwent physical therapy to relieve symptoms of shoulder pain, and the percentage of participants who underwent physical therapy underwent either 6 or 20 sessions during their training period. Physiotherapy has positive effects on reducing the incidence of shoulder

pain, the management of shoulder pain, and improving shoulder musculoskeletal risk factors in competitive swimmers [17].

4. Strengths and Limitations

We obtained an Arabic version of our questionnaire which was easy for participants to read and understand. Our research was the first of its kind to study the prevalence of swimmer’s shoulder at An-Najah National University. The first is that the sample size was considered small and insufficient for such research. The other restriction relates to the gender of the participant. We were unable to make the sample equal between males and females.

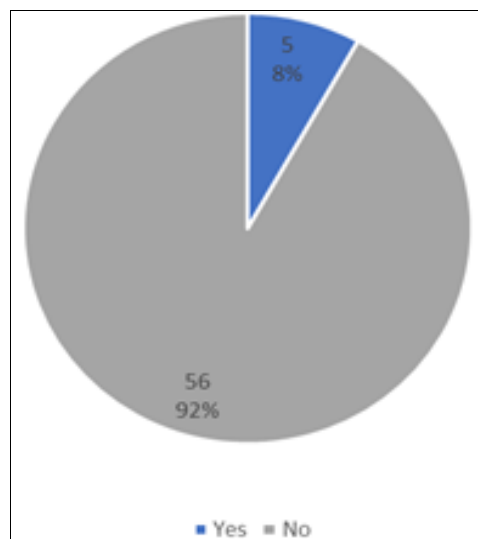


Fig 1: Characteristics of the Sample

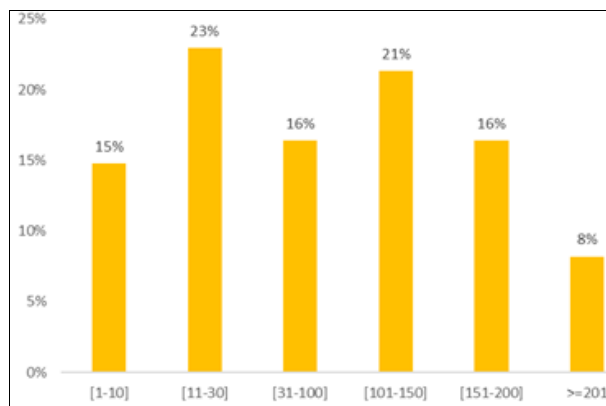


Fig 2: How many meters per day swim during training?

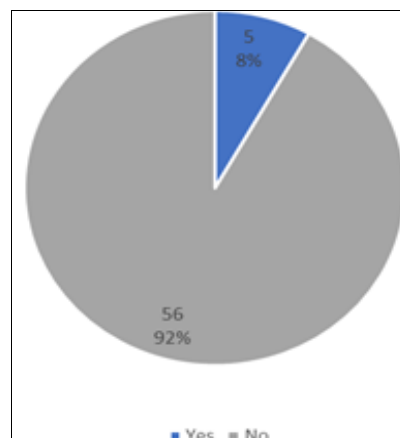


Fig 3: Have you ever had to take physical therapy sessions for shoulder pain?

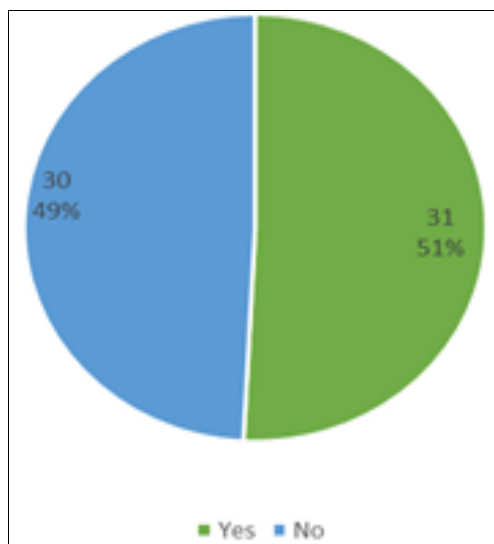


Fig 4: Does the participant do stretch exercises?

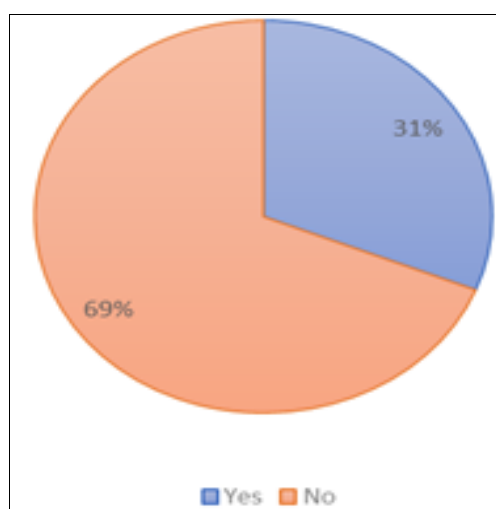


Fig 5: Trainer instructions for shoulder stretching

5. Conclusion

In conclusion, this study showed that students who swimming at An-Najah University have risk factors for developing swimmer's shoulder syndrome, so we accept research hypothesis H1 "There is prevalence of swimmer's shoulder among students at An-Najah National University. And we reject the null hypothesis HO" There is no prevalence of swimmer's shoulder among students at An-Najah National University. So the effected students should have more knowledge about swimmer's shoulder syndrome, On the other hand, the rest of students should know how to prevent themselves from the syndrome.

6. Recommendations

The findings given in this study establish the way for a significant amount of future research. It can develop from cross sectional to experimental research. Then it could have a therapeutic phase in it and could help participants to decrease their pain and symptoms. Also, it can include exercise program so the participants can have self-control their pain. We also recommend future researcher in this subject to increase the population sample so it includes other universities in Palestine. Also, we recommend students to choose the best swimming technique and the appropriate distance.

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