

Prevalence of Subacromial Impingement Among Egyptian Swimmers: A Cross Sectional Survey Study

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ABSTRACT

Background: Shoulder injuries is one of the serious injuries facing swimmers, subacromial impingement on the top of these limiting, career threatening injuries and to know how to solve this problem we should have information about the rate of incidence to make maximum benefit to the community of swimming in Egypt. A lot of studies available about the management of subacromial impingement from the surgical, pharmacological and physiotherapy approaches but it was difficult to find any studies investigated the injury rate in Egypt.

Objective: This study aimed to investigate the prevalence in different ages and sex among Egyptian swimmers via clinical testing and to investigate the association of some intrinsic predisposing factors with the incidence of subacromial impingement syndrome (SAIS) in Egyptian competitive swimmers.

Individuals and Methods: A cross-sectional survey study with 405 swimmers who had body mass index from 18.5 – 24.9 kg/m². Their ages ranged from 12 to 25 years old. They were divided into 5 subgroups for each gender, all swimmers were assessed by measuring external/internal shoulder rotation ratio, Lift-off test, Hawkins-Kennedy Test, Neers test and modified DASH Questionnaire. **Results:** The prevalence of subacromial impingement among Egyptian swimmers were 37.3%. It was present in 80 (38.6%) of female individuals and in 71 (35.9%) of male patients. 28 (35.9%) of individuals had subacromial impingement with 12-13 years old, 26 (32.5%) of individuals with 14-15 years old, 37 (44.6%) of individuals with 16-17 years old, 28 (35%) of individuals with 18-19 years old and in 32 (38.1%) of individuals with 20-25 years old. There was no significant correlation between subacromial impingement and age or sex ($p = 0.56$). **Conclusion:** This study suggested that there is a prevalence of subacromial impingement among Egyptian swimmers with no significant association between age or sex.

Keywords: Prevalence, Subacromial impingement, Swimmer's shoulder, Egypt.

INTRODUCTION

Egyptian swimmers have achieved a lot and contributed to the swimming sport along the history. It is worthy to mention just a few of remarkable champions like Abdellatif abuheif and, Abla Khairy, these are the old champions but when we talk about the recent young champions Marwan Elkamash and Farida Osman the Golden fish would be on the top of the list [1]. Epidemiological studies and investigators of researchers found that the most common complaint in swimmers was the shoulder pain with prevalence rate of 40 % to 91 % [2,3]. Other studies revealed that with a rate of 10 - 31%, shoulder pain forces professional swimmers to stop training for some time. A significant number of swimmers are suffering from chronic shoulder injuries. These injuries are sometimes career-threatening or even lead to an end of their career [4].

Sub-acromial impingement syndrome (SAIS) is one of the most prevalent disorders affecting the shoulder, representing for 44–65% of all complaints of shoulder pain throughout a physician visit [5,6].

The subacromial impingement is firstly described as the term “swimmer’s shoulder” in swimmers by Kennedy and Hawkins. Mainly, swimmer's shoulder in denoted to the impingement of supraspinatus tendon as well as long head of biceps tendon that occur below the coracoacromial arch [7]. The prevalence of shoulder pain in swimmers in Egypt is not well studied, but it is commonly experienced. Till now, no research has been published in Egypt on the prevalence, assessment, and predisposing factors of SASI in competitive swimmers. Swimmers, coaches, as well as swimming organizations

must be aware of the high prevalence of shoulder pain together with impingement syndrome in order to take preventative measures, to build up prevention programs, rehabilitation strategies and early screening to limit the widespread of this injury.

This study attempts to investigate the prevalence in different ages and sex among Egyptian swimmers via clinical testing and to investigate the association of some intrinsic predisposing factors with the incidence of SAIS in Egyptian competitive swimmers. The findings can be utilized to adjust training programs, support safety instructions including immediate as well as suitable treatment of shoulder pain, and help in the development of suitable educational as well as health policies to aid in prevention of overuse shoulder injuries in swimmers.

INDIVIDUALS AND METHODS

A cross sectional study was carried-out and designed to examine and make comparison between the prevalence of sub-acromial impingement among different ages in Egyptian swimmers at Cairo. The study was conducted at 15 clubs in Cairo from March 2022 to October 2022.

INDIVIDUALS

A sample size for a population of 30000 were taken for this study out of 55000 swimmers registered in the Egyptian swimming federation according to year 2021. With predictable prevalence 35% as well as precision 5% with 95% confidence interval, the minimal essential sample size was 350 based on the formula: $n = \frac{NZ^2 P(1-P)}{d^2 (N-1) + Z^2 P(1-P)}$

where: n = sample size with limited patient correction. N = population size. Z = Z statistic for a level of

confidence. P = expected prevalence or proportion. d = precision [8].

Their age ranged from 12 – 25 as revealed in the subgroups. This study was carried out on swimmers from 15 clubs (Al-Ahly, Heliopolis, Shooting, El Shams, Al-zohour, platinum, El-Nasr, Cairo, Al-Maadi, Tala'ea Elgeish, Ittihad el shorta, El- Rowad, Wadi-Degla, Shooting, El Ghaba and El Geziera Sporting Clubs) and was conducted as one shot. They were divided into two groups according to their gender and each group was divided into 5 subgroups according to their age.

- **Group A (Males):** (I) From 12 to less than 14 years. (II) From 14 to less than 16 years. (III) From 16 to less than 18 years. (IV) From 18 to less than 20 years. (V) From 20 to 25 years.
- **Group B (Females):** (I) From 12 to less than 14 years. (II) From 14 to less than 16 years. (III) From 16 to less than 18 years. (IV) From 18 to less than 20 years. (V) From 20 to 25 years.

Instrumentation for evaluation and assessment procedures:

There was a scale, one instrument, a questionnaire and three special tests were used in this study, Digital weighing and height scale, Manual muscle tester (Lafayette Instrument), Modified DASH questionnaire, Lift-off test, Neers test and Hawkins and Kennedy test.

Digital weighing and height scale

It was used to measure weight (kg) and height of swimmers in cm to calculate BMI. Swimmers were weighed wearing light clothes, bare feet with socks while fasting and the bladder was empty. Also, participants stand bare feet that kept together with head in vertical position [9]. Then calculated as weight (kg) / height (m)².

Manual muscle tester (Lafayette Instrument)

The manual muscle tester (MMT) (Model: 01163, Manufacturing: Lafayette Apparatus Company, Sagamore Pkwy, IN, USA) was utilized to evaluate the shoulder rotation strength ratio (external/ internal rotation ratio).

This instrument is valid and reliable [10]. Testing was performed with the participants standing. Participants were requested to brace themselves by putting their feet shoulder width apart as well as flexing their knees to prevent losing balance throughout testing [11], we can also perform the test also from sitting position [12].

The modified QuickDASH (Disabilities of the Arm, Shoulder, and Hand):

The QuickDASH is scored in two parts: the disability/symptom part (eleven items, with scoring 1-5) as well as the additional high-performance sport/music or job modules (4 items, with scoring 1-5). This value is then converted to a score of one hundred by subtracting 1 as well as multiplying by 25. $Score = (sum\ of\ n\ responses / n) - 1 \times 25$ whereas n is equal to the total amount of finished responses [13].

Lift-off test (LOT) or Gerber's test

The test is recognized as lift-off test (LOT) or Gerber's lift-off test. Gerber and Krushell were the first to describe it at 1991 [14]. It is used as a development simple clinical maneuver, which can be reliable for diagnosis or clinical exclusion for subscapularis tendon rupture. The Subscapularis is one of the rotator cuff muscles that provides stability as well as strength to the shoulder joint when in motion. If the patient is unable to resist, raise the hand off the back, or substitute by extending his or her elbow and shoulder, the test is regarded as positive [15].

Neer's test:

The Neer's test is a common and very important test in the examination of the subacromial impingement of shoulder. It has been described as the most reliable test. Neer's test is carried out from a standing position, with the patient's arm passively lifted in the plane of the scapula whilst limiting scapula rotation. A positive response for SAIS was the recurrence of pain at the anterior border of the acromion/lateral deltoid [16]. It can also be performed from sitting position [17].

Hawkins-Kennedy test

It is one of the most important tests for the subacromial impingement. From a standing position with the elbow flexed to 90 degrees, the patient's shoulder was passively lifted to 90 degrees in the sagittal plane after which it was aggressively rotated medially. Pain was confirmed a positive test result [18].

Ethical consent: All swimmers were offered a detailed description of procedures, purpose of the study and they signed informed consent, which includes their agreement to participate in the study. The study was conducted out in line with the Helsinki Declaration. This study protocol has been approved by The Faculty of Physical Therapy's Research Ethics Committee (NO: P.T.REC/012/003618) as well as submitted at the National Library of Medicine in the United States. (ClinicalTrials.gov Identifier: NCT05548816).

Statistical analysis

The statistical package for social studies (SPSS) edition 25 for Windows was utilized to carry out all statistical analyses. In revealing the patients' demographic as well as collected data, descriptive statistics such as mean, standard deviation, frequencies, percentages, as well as confidence intervals (CI) were used. The mean and standard deviation were used for summarizing quantitative variables, whereas frequencies in addition to percentage were used for summarizing categorical variables. The association between sex and age with subacromial impingement were examined by chi-square. Comparison of external and internal rotators strength and external/internal rotators ratio among individuals with and without subacromial impingement was conducted by unpaired t test. The level of significance was established at $p \leq 0.05$ for all statistical tests.

RESULTS

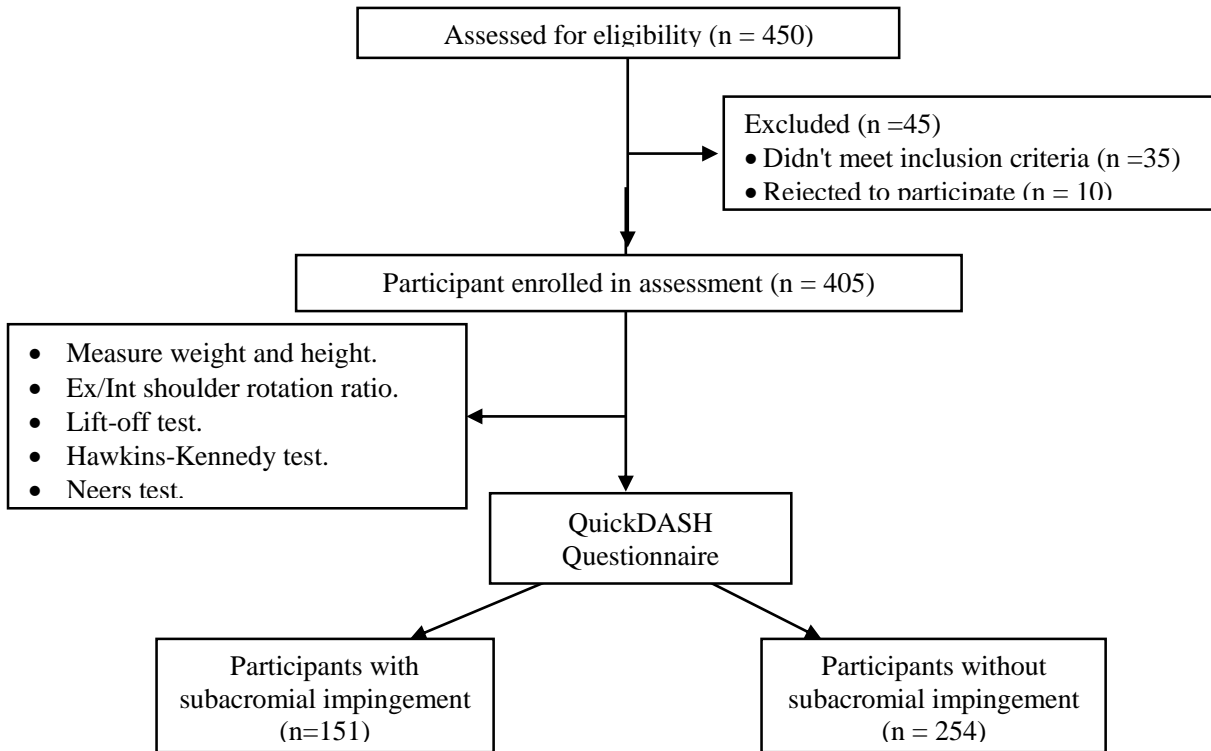


Figure (1): Flowchart of the study.

Demographic characteristics: 405 Egyptian swimmers were recruited in this study. The mean \pm SD age of individuals was 16.85 ± 3.43 years with minimal of 12 years and maximal of 25 years. 78 (19.3%) individuals were 12-13 years old, 80 (19.8%) were 14-15 years, 83 (20.5%) were 16-17 years, 80 (19.8%) were 18-19 years and 84 (20.7%) were 20-25 years old. The sex distribution of individuals revealed that there was 207 (51.1%) females and 198 (48.9%) males (Table 1).

Table (1): General characteristics of the patients

	$\bar{X} \pm SD$	Minimum	Max
Age (years)	16.85 ± 3.43	12	25
		N (%)	
Age groups			
12-13 years	12.47 ± 0.50	78 (19.3%)	
14-15 years	14.45 ± 0.51	80 (19.8%)	
16-17 years	16.46 ± 0.50	83 (20.5%)	
18-19 years	18.43 ± 0.49	80 (19.8%)	
20-25 years	22.11 ± 1.59	84 (20.7%)	
Sex distribution			
Females		207 (51.1%)	
Males		198 (48.9 %)	

External and internal rotators strength and external/internal rotators ratio of the patients:

The mean of external rotators strength of the individuals was 7.73 ± 2.09 kg with minimal of 2 kg and maximal of 12 kg. The mean of internal rotators strength of the individuals was 9.97 ± 1.99 kg with minimal of 5 kg and maximal of 13.2 kg. The mean of external/internal rotators ratio of the individuals was 0.76 ± 0.08 kg with minimal of 0.4 and maximal of 1.2 (table 2).

Table (2): External and internal rotators strength and external/internal rotators ratio of the patients

Strength (kg)	$\bar{X} \pm SD$	Minimum	Max
External rotators	7.73 ± 2.09	2	12
Internal rotators	9.97 ± 1.99	5	13.2
External/internal rotators ratio	0.76 ± 0.08	0.4	1.2

Modified Quick Dash Questionnaire Score of the patients: The mean of quick DASH of the individuals was 37.48 ± 14.15 with minimum of 5 and maximum of 75. (Table 3).

Table (3): Quick DASH of the patients

	$\bar{X} \pm SD$	Minimum	Maximum
Quick DASH	37.48 ± 14.15	5	75

Prevalence of subacromial impingement in Egyptian swimmers: The prevalence of subacromial impingement among Egyptian swimmers was 37.3% with 95% CI of 32.71- 42.09% (table 4).

Table (4): Prevalence of subacromial impingement of the patients

	Prevalence (%)	95% CI
Subacromial impingement	151 (37.3%)	32.71-42.09%

CI: Confidence interval

Association between subacromial impingement and sex: Subacromial impingement was present in 80 (38.6%) of female individuals and in 71 (35.9%) of male patients. There was no substantial correlation between subacromial impingement and sex ($p = 0.56$). (Table 5)

Table (5): The prevalence of subacromial impingement with sex

Sex	Prevalence of subacromial impingement		χ^2 value	p-value	Sig
	Positive	Negative			
Females	80 (38.6%)	127 (61.4%)	0.33	0.56	NS
Males	71 (35.9%)	127 (64.1%)			

χ^2 : Chi-squared test, p value: Probability value, NS: Non significant

Association between subacromial impingement and age: Subacromial impingement was present in 28 (35.9%) of individuals with 12-13 years old, in 26 (32.5%) of individuals with 14-15 years old, in 37 (44.6%) of individuals with 16-17 years old, in 28 (35%) of individuals with 18-19 years old and in 32 (38.1%) of individuals with 20-25 years old. There was substantial correlation between subacromial impingement and age ($p = 0.56$) (Figure 2).

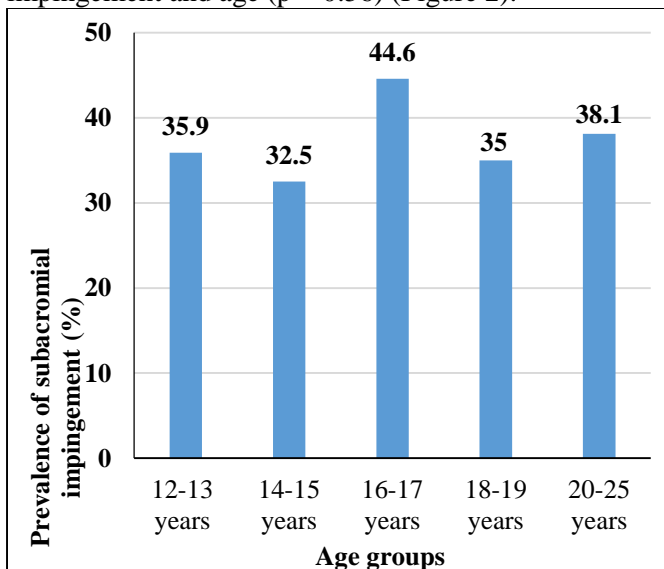


Figure (2): The prevalence of subacromial impingement with age

Comparison of external and internal rotators strength and external/internal rotators ratio among individuals with and without subacromial impingement:

The mean of external rotators strength of individuals with subacromial impingement was 7.77 ± 2.00 kg and that of individuals without subacromial impingement was 7.71 ± 2.14 kg. There was no substantial difference in external rotators strength between individuals with and without subacromial impingement ($p = 0.78$). The mean of internal rotators strength of individuals with subacromial impingement was 10.02 ± 1.89 kg and that of individuals without subacromial impingement was 9.93 ± 2.04 kg. There was no substantial difference in internal rotators strength between individuals with and without subacromial impingement ($p = 0.66$). The mean of external/internal rotators ratio of individuals with subacromial impingement was 0.76 ± 0.08 and that of individuals without subacromial impingement was 0.77 ± 0.09 . There was no substantial difference in external/internal rotators ratio between individuals with and without subacromial impingement ($p = 0.93$) (Figure 3).

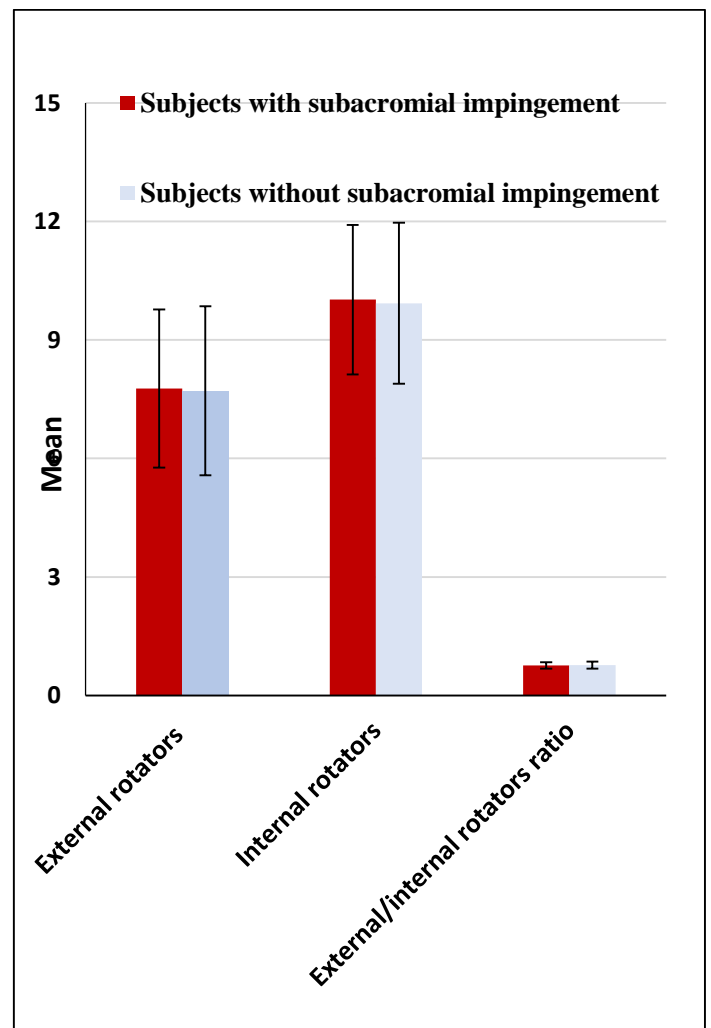


Figure (3): Mean external and internal rotators strength and external/internal rotators ratio of individuals with and without subacromial impingement

DISCUSSION

According to **Haldorsen et al.** [24] the usage of modified DASH questionnaire demonstrated excellent test reliability that showed the variation in disability of the swimmers with shoulder pain. The score system varied from 0-100, a higher score refers a greater disability therefore, the study was indicated as a strength. Moreover, **Haldorsen et al.** [24] showed that the DASH is a valid assessment of physical impairment and symptoms in individuals with SAIS.

A study carried-out by **Bansal et al.** [19] where they used testing of mechanical impingement carried-out based on Hawkins, Abrahams (1992) and Neer (1972), recorded findings from 161 male swimmers where the rate of affliction with shoulder impingement syndrome was 17% as a whole. In our study on 198 males the subacromial impingement rate of incidence was 35.9%. Despite that they used some of tests that performed in our study like Hawkins Kennedy test and Neer's test, their results were different. The difference in the results might be including additional different testing and approach like Yergason's test in addition to Speed's test to rule out bicipital tendinitis, on the other hand we used lift-off test as it has a great reliability in ruling in subacromial impingement and subscapularis integrity. Also, it can be because of race as that study was conducted on Indians, while our study on Egyptians, which might affect the probability of getting injured.

Another study **Laudner and Stips** [20] examined the incidence of shoulder pathology in collegiate overhead athletes in five different sports including swimming. The most prevalent shoulder injuries for each particular activity were SAIS and rotator cuff (RTC) tendinitis, accounting for 27% and 24% of the overall shoulder injuries respectively. Our study was conducted on 206 female swimmers the incidence of subacromial impingement was 38.6%, which is different from **Laudner and Stips** [20] result that performed on 32 female swimmers with incidence of Subacromial impingement by 25 % of the total number.

The difference between the results of the two studies might be due to multiple factors like hormonal imbalances, training loads, training volume. The coaches are not certified enough to know the difference in training loads between males and females, therefore they used the same training programs for both of them and this might increase the affected number of female swimmers.

The findings of **Troup et al.** [21] showed that the rate of incidence in shoulder pain is higher in males (70%) than in females (65%), while in our study all participant suffered from shoulder pain with different intensities and the rate of subacromial injury was slightly higher in females. In the other hand **Puckree and Thomas** [22] studied swimmers with shoulder pain irrespective of gender or race, for the age bracket of 13-

25 years. A randomized sample involving about 96 athletes were invited to join from 300 registered swimmers, and they found that 71% of the swimmers had shoulder pain 64% out of them are reported with shoulder injury. The most common diagnoses involved tendonitis (35%), muscular imbalance (29%), impingement (19%) and others (17%). Despite that our study use the same age factor as **Puckree and Thomas** [22], our results were higher than 19%. for impingement injuries as it recorded 37.7 %. This research can have further investigation on a long term. From the previous research, the considerable gap lies in the difference between the underlying assumptions used to establish the definition of the painful event and also in the different inclusion and exclusion criteria adopted. A strong consensus is deficient regarding shoulder pain causes in swimmers and the etiology of swimmer's shoulder is considered to be multifactorial.

Furthermore, our findings correspond with those of **Batalha et al.** [23], who stated that swimming propulsion is mostly based on repeated adduction and internal rotation of the shoulders, which often results in muscle imbalances between powerful medial rotators (MR) and comparatively weaker lateral rotators (LR). This leads to higher injury rate because of the repetitive motion as in our study external rotators strength of the individuals was 7.73 ± 2.09 kg. On the other hand, the internal rotators strength of the individuals was 9.97 ± 1.99 kg.

LIMITATION

Although the present study showed objective data with statistical substantial results, there are some limitations. This study can be improved by better sampling assignment. it should be conducted to determine the incidence of subacromial impingements in other clubs and in wider zones. Also, radiological investigations could be used in further researches to confirm the diagnosis.

CONCLUSION

There were no significant statistical differences in prevalence of SAIS among Egyptian swimmers. In conclusion, the study revealed several strengths. It is the first research to investigate the prevalence of subacromial impingement in Egyptian swimmers. Secondly, the results of the study gave us a clear view about the rate of the injuries among swimmers, which may benefit the ministry of youth and sports, swimming federation and physiotherapy community that may be used in further research.

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- **Conflict of interest:** The authors state no conflict of interest.

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