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Knowledge and awareness of shoulder injuries associated with resistance training among athletes in Riyadh, Saudi Arabia 2021

Abdulrahman M Al Qahtani[1], **Sultan M Al Dajani**[1], **Abdulwahab N Al Adhyani**[1], **Abdulaziz Abuabat**[1], **Mofeed H Alhashim**[2]

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Author Affiliation:
[1]General Practitioner, Ministry of Health, Riyadh Saudi Arabia
[2]Assistant Consultant, Department of Orthopedic, King Saud Medical City, Riyadh Saudi Arabia

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ABSTRACT

Background: Sport and exercise have become an important part of our daily life to promote and enhance our quality of life. However, injuries might occur in some cases due to multiple factors such as improper techniques, overexertion, inadequate preparation, and other factors. In this study we aim to determine the level of knowledge about shoulder injuries associated with resistance training among athletes in Saudi Arabia. *Methodology:* An electronic observational-descriptive cross-sectional study has been conducted on all members older than 18 years old inside and outside gym trainees asking them about shoulder injuries, sample size is 314 based on census taken by General Authority for Statistics. Significance was considered if P-Value ≤ 0.05. *Result:* The training place showed a statistically significant association with shoulder injury. Respondents who trained in the gym were more prevalent among those with injuries (46.6%) than those without (34.1%), and the association was statistically significant (P = 0.036). The duration of practicing sports was lower in respondents with shoulder injuries (P = 0.008). The prevalence of respondents who did not warm up was lower in respondents with injuries (11.7%) than those without (24.6%), and the association was statistically significant (P = 0.011). Powerlifting (P = 0.016) and bodybuilding (P = 0.008) were associated with more shoulder injuries. *Conclusion:* Resistance training such as weight lifting showed a direct impact on shoulder injuries, particularly at gym. The risk of shoulder injuries increases with short period of resistance exercising.

Keywords: Shoulder, Injury, Exercise, Awareness, Riyadh, Saudi Arabia

1. INTRODUCTION

Resistance training is a one type of many training programs between athletes and the general population's of both genders. Resistance training is defined as

any exercise that causes the muscles to contract against any external resistance, which can be using weights or the body's weight to promote muscular growth and fitness. There are several types of resistance training, such as Olympic lifting, powerlifting, and weightlifting (Westcott, 2012). Multiple studies have showed that regular resistance training can increase muscle mass, increase resting metabolic rate, and reduce body fat (Strasser and Schobersberger, 2011; Westcott, 2012; Westcott et al., 2009). As a result, it gives many health benefits, such as improving cardiovascular status, increasing bone mineral density, and enhancing mental health (Going and Laudermilk, 2009; Strasser and Schobersberger, 2011; Westcott, 2012; Westcott et al., 2009; Azeem, 2020). However, improper training often leads to musculoskeletal injuries, which an orthopedist will evaluate. Being aware with injury patterns occur in resistance training will benefit and minimize the incidence of injuries for professional athletes and assist general physicians and sport medicine specialists caring for the general population.

In many countries worldwide, resistance training has been popular among athletes (Humphries et al., 2018; Vingren et al., 2013). However, contrary to popular belief, resistance training is not exclusive to aesthetics or fitness training; it can also be used to rehabilitate injuries (Kristensen and Franklyn-Miller, 2012). Since it is a common practice, it is critical to raise awareness of the possible and preventable dangers to promote safe practices. The shoulder joint has been described in the literature as one of the more commonly susceptible joints to be injured in resistance training (Dunn et al., 2014; Harvie et al., 2004; Luime et al., 2004; Peter Magnusson et al., 2007; Picavet and Schouten, n.d.; Pribicevic, 2012). According to population surveys, shoulder pain affects 18-26% of adults at any point in time (Linaker and Walker-Bone, 2015). The shoulder consists of three prominent bones: the humerus, the scapula, and the clavicle. The humerus is placed centrally on the glenoid cavity, which is kept in place by several muscles and tendons, so any injuries: sprains and strains, dislocation, rotator cuff tear can happen according to its anatomy.

Up to date, there have been no studies in our region that have identified demographic or training variables that might lead to a shoulder injury for those who participate in resistance training. However, shoulder injuries often occur during such training, which a proper technique and supervision can minimize the incidence of injury. In addition, a significant relation between coaching supervision and the injury percentage of resistance training was found, but this was not specific to the shoulder. Therefore, this study aimed to determine the level of knowledge about shoulder injuries associated with resistance training among athletes in Saudi Arabia. Up to our knowledge, there is a need in the literature to raise awareness about such injuries and their associated risk factors to promote safe practices.

2. METHOD AND THE STUDY DESIGN

An observational descriptive cross-sectional study has been conducted through an electronic online-based questionnaire. Data was collected between the periods of 15th September 2020 until January 2021. The study included all patients who are older than 18 years old who have concerns about the presence or absence of shoulder injuries, whether active or past injury and does the participant trainer or not. Questionnaire was conducted on trainers in any gym, or who are doing any type of resistance exercises at home, both male and female across several gyms in Saudi Arabia. Participating in the study is voluntary, patients who are unwilling to complete the questionnaire and patients who are less than 18 years old will be excluded. The sample size is 314 participants based on (census taken by General Authority for Statistics) statistician recommendation by reviewing the literature. A purposive sample will be drawn from general population to do comparison. Our inclusion criteria: 1) trainee who is in a gym or trained at home, 2) aged more than 18 years, 3) the study participants should history with upper limb injury. The questionnaire has been distributed throughout active social media platforms or online groups. All participants were assured about anonymity and confidentiality, keeping participant privacy. The demographics of the patients have been obtained. Ethical approval obtained and approved from Al Maarefa University local research and ethical committee board numbered (1/211). The questionnaire has been discussed with two orthopedic consultants and an epidemiologist to validate the questionnaire.

Statistical analysis

Hypothesis testing was performed at 5% level of significance Using R v 3.6.3. The mean ± standard deviation was used to summarize the distribution of continuous variables. Chi-square test was used to assess the association between categorical variables.

3. RESULTS

The study questionnaire was completed by 314 respondents. Sociodemographic characteristics for the respondents are shown in Table 1. Males and females were approximately equal (53.5% males and 46.5% females). Respondents aged 18 – 29 years represented majority of study sample (58%), while respondents aged 30 – 39 years old represented one-quarter. Three-quarters of

the respondents completed university education (73.6%), and 14.6% completed only high school. Most of the respondents were Saudi (90.8%), 13.4% reported comorbidities, and 17.8% reported smoking. Approximate sleeping hours varied between respondents, with 75% sleeping 6 – 8 hours. The average body mass index was 26.3 ± 5.13 Kg/m^2. Only 48.1% of the respondents had a normal BMI (< 25 Kg/m^2). Overweight and obese respondents represented 30.9% and 21% of the study respondents, respectively.

Table 1 Sociodemographic characteristics of the study respondents

	N=314
Gender:	
Female	146 (46.5%)
Male	168 (53.5%)
Age:	
18-29	182 (58.0%)
30-39	76 (24.2%)
40-49	40 (12.7%)
50-59	16 (5.10%)
BMI (Kg/m2)	26.3 (5.18)
BMI category:	
Normal	151 (48.1%)
Overweight	97 (30.9%)
Obese	66 (21.0%)
Highest education level:	
High school	46 (14.6%)
Bachelor	231 (73.6%)
Post-graduate degree	37 (11.8%)
Nationality:	
Saudi	285 (90.8%)
Non-Saudi	29 (9.24%)
Comorbidities:	
No	272 (86.6%)
Yes	42 (13.4%)
Smoker:	
No	258 (82.2%)
Yes	56 (17.8%)
Approximate sleeping hours:	
< 5	7 (2.23%)
5	48 (15.3%)
6	76 (24.2%)
7	84 (26.8%)
8	76 (24.2%)
9	23 (7.32%)
Counts are percentages were used to summarize categorical variables, and the mean ± standard deviation was used for continuous variables	

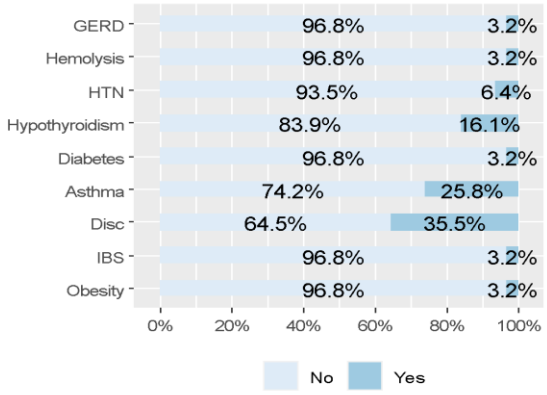

Figure 1 Comorbidities of the included respondents (n = 31)

The most common comorbidities reported by the respondents included disc (35.5%), asthma (25.8%), and hypothyroidism (16.1%), as shown in Figure 1. Table 2 shows the diet and exercise pattern of the respondents. Most of the respondents (69.1%) did not follow any specific diet, while 29.9% followed flexible dieting. Only three respondents reported using a keto diet. Approximately majority of the respondents had a sedentary lifestyle, and only 6 (1.91%) did heavy work. The remaining 27.1% and 21.3% work included variable standing and walking without and with physical exertion, respectively. One-third of the respondents have been doing sport for 0 – 6 months, and 40.1% have been doing sport for more than two years. The duration of each session varied from < 30 minutes (22.9%), to > 120 minutes (1.27%). Approximately one-half (46.2%) of the respondents practiced at home and 38.2% practiced in the gym. The remaining 15.6% reported practicing in both places. The training program was self-made, as reported by 72.6% of the respondents, while 16.2% practiced with a personal trainer and 11.1% used apps with built-in training programs. Only 10.5% of the respondents trained multiple times per day with an average of 3.76 ± 1.63 days/week.

Table 2 Diet and exercise pattern of the included respondents

Followed diet:	***N=314***
Flexible dieting (calories counting)	94 (29.9%)
Keto-diet	3 (0.96%)
None	217 (69.1%)
Physical exertion at occupation:	
Heavy work	6 (1.91%)
Varied standing and walking, including physical exertion	67 (21.3%)
Varied standing and walking, without physical exertion	85 (27.1%)
Mainly sedentary	156 (49.7%)
How long have you been doing your sport for?:	
0 - 6 months	119 (37.9%)
1 - 2 years	48 (15.3%)
6 - 12 months	21 (6.69%)
More than two years	126 (40.1%)
Duration of each training sessions:	
< 30 minutes	72 (22.9%)
> 120 minutes	4 (1.27%)
30 - 60 minutes	142 (45.2%)
60 - 90 minutes	73 (23.2%)
90 - 120 minutes	23 (7.32%)
Training place:	
Gym	120 (38.2%)
Home	145 (46.2%)
Both	49 (15.6%)

Training program:	
Program I made myself	228 (72.6%)
Using apps with a built-in training program	35 (11.1%)
With a personal trainer	51 (16.2%)
Average training days/week	3.76 (1.63)
Average rest days/week	2.92 (1.51)
Multiple trainings per day:	
No	281 (89.5%)
Yes	33 (10.5%)
The gym provides a beginner's program	
No	199 (63.4%)
Yes	115 (36.6%)
Counts are percentages were used to summarize the variables	

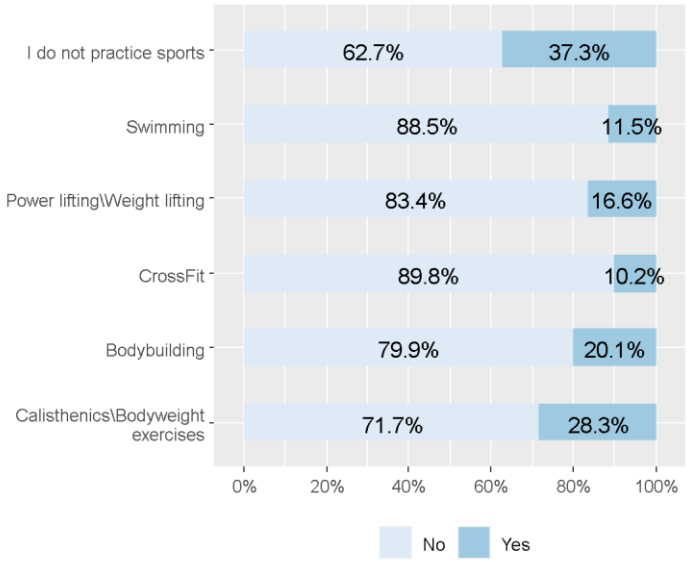

Figure 2 Sports practiced at the gym

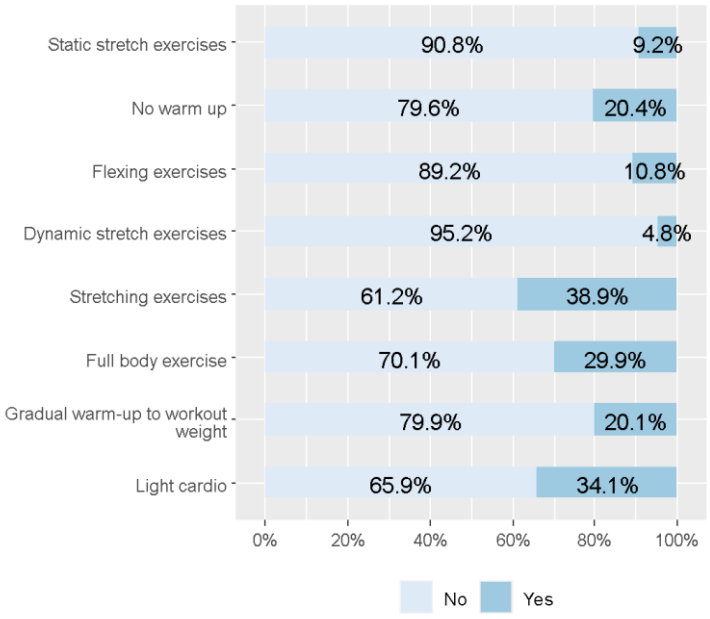

Figure 3 Warm-up exercises reported by the respondents

Figure 2 depicts the percentage of respondents who practiced the different types of sport at the gym. Approximately one-third of the respondents did not practice sports (37.3%). Practiced sports included bodyweight exercises (28.3%), body building (20.1%), and powerlifting (16.6%). Swimming and Cross Fit were practiced by 11.5% and 10.2% of the respondents, respectively.

Stretching exercises (38.9%) and light cardio (34.1%) were commonly reported warm-up exercises. Other warm-up exercises included full-body exercises (29.9%) and gradual warm-up to workout weight (20.1%). Only 20.4% of the respondents reported no warm-up exercises. The results illustrated in Figure 3.

Table 3 Prevalence of shoulder injuries among the study respondents

	[ALL]	**N**
	N=314	
Current or previous shoulder injury		314
No	211 (67.2%)	
Yes	103 (32.8%)	
Discomfort\pain the injured area before injury:		103
No	61 (59.2%)	
Yes	42 (40.8%)	
Seen a doctor or a physical therapist after the injury		103
No	58 (56.3%)	
Yes	45 (43.7%)	
Reason for not seeing a doctor or a physical therapist after injury:		56
I did not think my injury needs a professional advice	38 (67.9%)	
I've seen a doctor\physical therapist, but nothing changed	5 (8.93%)	
It is costly to see one	13 (23.2%)	
Diagnosis of the injury:		102
Dislocation	8 (7.84%)	
Joint ligament tear	7 (6.86%)	
Muscle tear	6 (5.88%)	
Muscle tendon tear	10 (9.80%)	
No diagnosis	28 (27.5%)	
Not diagnosed yet	31 (30.4%)	
Overuse	10 (9.80%)	
Stress fracture	2 (1.96%)	
Abstained from training due to the injury:		103
No	46 (44.7%)	
Yes	57 (55.3%)	
Injury cause:		100
I don't remember	40 (40.0%)	
Other	14 (14.0%)	
Resistance training	39 (39.0%)	
Running/During cardio workout	7 (7.00%)	
Treatment plan:		81
Pain killers	31 (38.3%)	
Physical therapy exercises	10 (12.3%)	
Rest	34 (42.0%)	

Surgery	6 (7.41%)	
Followed the plan:		99
No	58 (58.6%)	
Yes	41 (41.4%)	
Counts are percentages were used to summarize the variables		

Table 3 summarizes the questionnaire results for shoulder injuries among the study respondents. One-third of the respondents (n = 103, 32.8%) reported current or previous shoulder injury, and 40.8% reported feeling pain or discomfort in the injured area before the injury. Of the 103 respondents who reported injury, only 45 (43.7%) reported seeing a doctor or a physical therapist after injury. The main reason for not doing so was that respondents did not think their injury needed professional advice (n = 38, 67.9%). Other reasons included costs (23.2%) and poor perception regarding the results of these visits (8.93%). Approximately 50% of the injuries were not diagnosed, while muscle tendon tears were diagnosed in 9.8% of the cases. Other causes included overuse (9.8%), joint ligament tear (6.86%), muscle tear (5.88%), and dislocation (7.84%). More than half of the respondents who were injured had to abstain from training (55.3%). The cause of the injury was not remembered by 40% of the respondents, while 39% reported that the injury occurred during resistance training. Eighty-one respondents reported the treatment plan. Rest (42%) and pain killers (38.3%) were the mainstays of treatment, while physical therapy was needed in 12.3% of the cases. Less than one-half (41.4%) of the respondents followed the recommended plan.

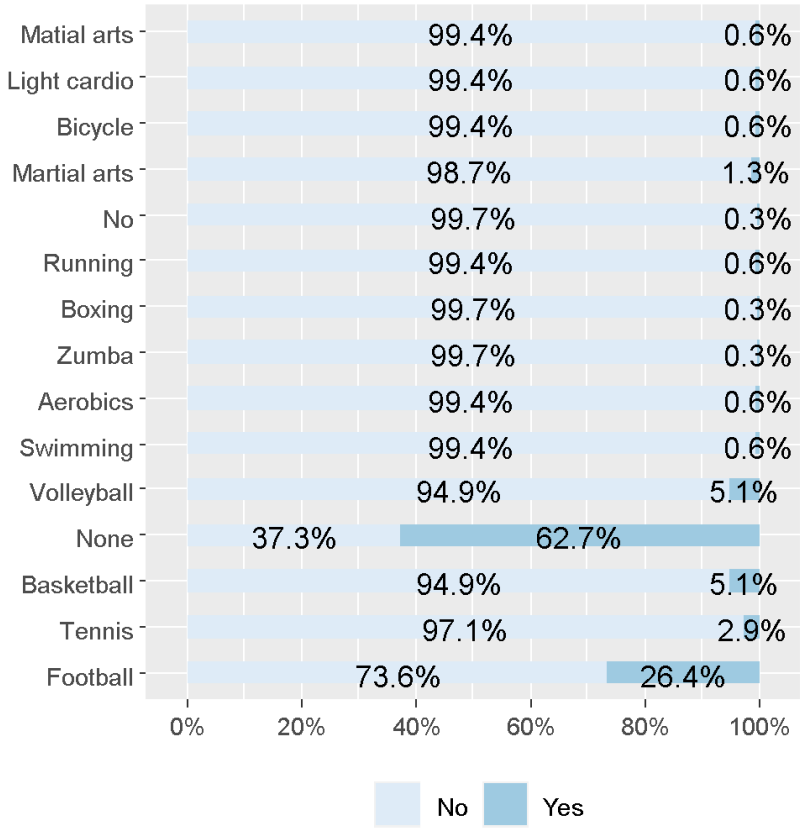

Figure 4 Other practiced sported reported by the respondents

As illustrated in Figure 4, the most reported other sport was football (26.4%), volleyball (5.1%), and basketball (5.1%). Two-thirds of the respondents did not report practicing any other sports (62.7%).

Table 4 Factors for shoulder injuries (n = 311)

	Current or previous shoulder injury		
	No	Yes	P
	N=211	*N=103*	
Age:			0.706
18-29	120 (56.9%)	62 (60.2%)	
30-39	51 (24.2%)	25 (24.3%)	
40-49	30 (14.2%)	10 (9.71%)	
50-59	10 (4.74%)	6 (5.83%)	
BMI category:			0.418
Normal	103 (48.8%)	48 (46.6%)	
Overweight	68 (32.2%)	29 (28.2%)	
Obese	40 (19.0%)	26 (25.2%)	
Training place:			0.036
Gym	72 (34.1%)	48 (46.6%)	
Home	108 (51.2%)	37 (35.9%)	
Both	31 (14.7%)	18 (17.5%)	
Training program:			0.577
Program I made myself	154 (73.0%)	74 (71.8%)	
Using apps with built-in training program	21 (9.95%)	14 (13.6%)	
With a personal trainer	36 (17.1%)	15 (14.6%)	
Duration of each training session:			0.033
< 30 minutes	58 (27.5%)	14 (13.6%)	
> 120 minutes	2 (0.95%)	2 (1.94%)	
30 - 60 minutes	93 (44.1%)	49 (47.6%)	
60 - 90 minutes	46 (21.8%)	27 (26.2%)	
90 - 120 minutes	12 (5.69%)	11 (10.7%)	
Duration of practicing the sport:			0.008
0 - 6 months	91 (43.1%)	28 (27.2%)	
1 - 2 years	34 (16.1%)	14 (13.6%)	
6 - 12 months	15 (7.11%)	6 (5.83%)	
More than 2 years	71 (33.6%)	55 (53.4%)	
Multiple trainings/day:			0.899
No	188 (89.1%)	93 (90.3%)	
Yes	23 (10.9%)	10 (9.71%)	
Warm-up			
Light cardio:	74 (35.1%)	33 (32.0%)	0.685

No warmup:	52(24.6%) (24.6%)	12 (11.7%)	0.011
Stretching exercises:	83 (39.3%)	39 (37.9%)	0.898
Full body exercise:	49 (23.2%)	45 (43.7%)	<0.001
Practiced sport			
Power lifting	27 (12.8%)	25 (24.3%)	0.016
Body building	33 (15.6%)	30 (29.1%)	0.008
Training days/week	3.64 (1.64)	4.00 (1.58)	0.066
Counts and percentages were used to summarize categorical variables, and the mean (SD) was used for continuous variables Statistical analysis was done using Chi-square test of independence			

Results in Table 4 summarize therisk factors of shoulder injuries. Neither age nor BMI was associated with a shoulder injury (P = 0.706 and 0.138, respectively). The training place showed a statistically significant association with a shoulder injury. Respondents who trained in the gym were more prevalent among those with shoulder injuries (46.6%) than those without (34.1%), and the association was statistically significant (P = 0.036). The training program did not show a statistically significant association with shoulder injuries (P = 0.577), while a higher training session duration was more prevalent in respondents with shoulder injuries (P = 0.033). The duration of practicing sports was lower in respondents with shoulder injuries (P = 0.008). The number of exercises per day was not associated with shoulder injuries. The prevalence of respondents who did not warm up was lower in respondents with shoulder injuries (11.7%) than those without (24.6%), and the association was statistically significant (P = 0.011). Powerlifting (P = 0.016) and bodybuilding (P = 0.008) were associated with more shoulder injuries. The average number of training days was not significantly different between groups (P = 0.066).

4. DISCUSSION

In this study, the incidence of shoulder injury during resistance training among athletes was 32.8 percent. There was no significant relationship found between demographics, training program, and the presence of shoulder injury. Participants who had longer training sessions were more prone to have shoulder injury whereas those who had been practicing sports for a long time were less likely to sustain shoulder injury. Moreover, gym training and the type of training, specifically weightlifting, were found to have a significant association with shoulder injuries.

Up to our knowledge, no previous study in the literature examined the association between shoulder injury and resistance training like in this study which showed incidence rate 39 percent. In the contrary, some studies are done showing the prevalence of shoulder injuries in weightlifters with incidence rate around 36 percent and in CrossFit trainers with incidence rate around 23 percent (Calhoon and Fry, 1999; Keogh et al., 2006; Mehrab et al., 2017; Raske and Norlin, 2002; Siewe et al., 2011; Summitt et al., 2016). In this study, participants who sustained shoulder injury usually did not seek professional advice because they did not believe in the need to see a doctor. Nevertheless, half of the athletes who have been seen by a doctor did not follow the management plan. The technique of doing a particular movement in resistant training especially overhead lifting motions need to be done in proper way to prevent shoulder injuries. Since these movements have a high impact on shoulder range of motion and stability, trainers and coaches should be aware of risk factors and should make sure that appropriate range of motion is attained with low resistance before adding external resistance.

Many obstacles were found that should be considered when evaluating the findings. Since we distributed our survey electronically; this generated most certainly sampling bias, with participants who were injured being more likely to complete the survey. Injuries were also self-discovered and reported, which might lead to an inaccuracy in injury severity and diagnosis. Although the data was collected directly from the athletes, leaving some room for personal interpretation, it does not assess severity, diagnosis, or categorization in the same manner as a professional evaluation and diagnostic would. Due to the retrospective nature of the study, there is also a risk of recall bias. The external validity of generalizability was also a limitation of this study. Despite these limitations, our research has paved the way for injury prevention in resistance training. We looked at the rate of shoulder injuries among resistance-training athletes, as well as the risk factors and mechanisms of injury. The next step in

injury prevention is to conduct a prospective study examining injury characteristics and analyzing the profile of beginners versus advanced resistance training athletes to investigate potential causes and mechanism of injury.

5. CONCLUSION

The shoulder injury incidence for athletes participating in resistance training was 32.8%. The most common type of resistance training related with shoulder injury was weightlifting, particularly at the gym. Resistance training for a short period of time was found to be associated to a higher risk of shoulder injury.

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Author Contributions

All authors have contributed equally in this study through writing paper, conducting data, developing methodology and interpreting findings.

Ethical approval

The study was approved by the Medical Ethics Committee of AlMaarefa University (ethical approval code: (1/211).

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Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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