

## RESEARCH ARTICLE

# Prevalence of golf-related injuries among recreational golfers in Malaysia

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## Abstract:

Golf is a non-contact sport that requires a complex movement involving the entire body to execute an efficient swing. As the movement is repeatedly made, it increases the pressure on the body structures such as muscles, joints, nerves, and tendons. Consequently, this will increase the risk of injuries during golf games. This study aimed to determine the prevalence and anatomical distribution of injury among recreational golfers. Several golf clubs in Selangor, Malaysia, were chosen as study settings due to their popularity among golfers in Malaysia. An online retrospective cross-sectional study design was used. Data were analyzed by using SPSS 22.0 and descriptively described. A total of 372 recreational golfers participated in the survey. Statistically, 98.9% of the respondents were male, with 87.4% being 40 years and above. Meanwhile, for Body Mass Index (BMI), 60.0% were overweight and obese. The prevalence of golf-related injuries was 51.1%, with 80.5% of injuries sustained during playing at the golf course. Anatomically, it was the upper extremities that comprised 53.3% of the total injury. The type of injuries in the upper extremity included shoulder muscle strain (77%), golfer's elbow (63%), wrist sprain (57%), and shoulder sprain (51%). Significantly, there is an association between golfing frequency and golf-related injuries ( $p < 0.05$ ). In conclusion, there was a significantly higher prevalence of injuries among golfers. Further study is warranted to establish the effect of injury on golfers' performance and quality of life.

**Keywords:** Recreational, golfers, prevalence, anatomical distribution, risk factors

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## 1. INTRODUCTION

Golf is a non-contact sport that incorporates physical, and psychological benefits for one's health. It is a well-known sport globally, especially in the United States, European countries, and Asia, such as Japan, South Korea, China, and Thailand (Edwards, Dickin & Wang, 2020). Several factors that may increase the risk of injury are frequency of golfing, age, body mass index (BMI), warm-up habits, incorrect technique, inappropriate equipment, and intensity of training and driving distance (Gosheger et.al, 2003; Javed et.al, 2015; Jeong, Lee & Cho, 2013; McHardy, Pollard & Luo, 2006; Tucker, 2016). Injuries to the body structures can cause a significant impact on a golfer, thus reducing golf performance.

Commonly, golf-related injuries sustained among recreational golfers are the lower back, elbow, wrist, hand, and shoulder, whereas head, lumbar spine, wrist, and hand injuries are common among professional golfers (Cabri, et.al, 2009). For instance, injuries to the lower back may occur during the golf swing. The power of trunk rotation is increased to produce a higher speed for the club head to hit the golf ball (Cole & Grimshaw, 2016). Therefore, excessive repetition of the lower back rotation may increase the risk of injuries to the lower back (Smith, et.al, 2018).

A systematic review shows the incidence of golf-related injuries where the professional golfer has a higher incidence of injuries between 31.0% and 90.0%, whereas recreational

golfers are between 15.8% and 40.9% (Murray, et.al, 2017). So far, in Malaysia, the only study conducted was among professional golfers during the Asian Games in 2014 (Hamid, et.al, 2016). This study aims to determine the prevalence, anatomical distribution, and risk factors of golf-related injuries among recreational golfers in Malaysia. Also, the study aimed to determine the relationship between age, lack of warm-up, and frequency of golfing with golf-related injuries.

## 2. METHODS AND MATERIALS

This was an online retrospective cross-sectional study among recreational golfers in Malaysia. It was a self-administered questionnaire using an online survey. The link to the survey was distributed to potential respondents' emails with the aid of the respective golf clubs. Participants who agreed to participate in the study can access the questionnaire through the link given. The participant's information sheet was also attached to the questionnaire to explain the purpose of the study. Research ethics approval has been obtained from UiTM's Research Ethics Committee (Ref: REC/10/2020 (UG/MR/204, dated 13 October 2020).

The inclusion criteria of the respondents for this study were recreational golfers aged 18 years and above who played golf as a hobby or for recreational purposes. Professional golfers, participants who are not active in golf for more than 2 years and experienced injuries not caused by golf were excluded. The questionnaire from a previous study among recreational golfers was chosen as a research instrument. The questionnaire is divided into 3 sections, which are background information (Part A), injury information (Part B), and demographic data (Part C).

Data were analysed by using the Statistical Package for the Social Sciences (SPSS) version 20.0 and statistically described. The relationship between the age, frequency of golfing, warm-up, and perceived knowledge of the prevention of golf-related injuries were analysed by using Pearson Chi-square. A p-value less than 0.05 ( $p \leq 0.05$ ) indicates statistical significance.

## 3. RESULTS

### Demographic characteristics

A total of 372 respondents have completed the study. The majority (98.9%) of the participants were male and almost two-thirds (64.8%) of the participants were aged 50 years and above (Table 1). The Body Mass Index (BMI) of the respondents was 3.8% underweight, 36.3% normal weight, 42.5% overweight, and 17.5% obese.

Almost two-thirds (61.3%) of the respondents were holding a handicap of between 11 and 20 followed by 21 to 30 (26.1%), 31 to 40 (0.5%).

Table 1: The demographic characteristics of the participants.

Demographic characteristics	N	%
<b>Gender</b>		
Female	4	1.1
Male	368	98.9
<b>Age (in years)</b>		
Below 30	11	3.0
31 to 40	36	9.7
41 to 50	84	22.6
51 to 60	138	37.1
60 or above	103	27.7
<b>BMI (kg/m<sup>2</sup>)</b>		
Below 18.5	14	3.8
18.5 to 24.9	135	36.3
25 to 29.9	158	42.5
30 or greater	65	17.5
<b>Handicap</b>		
Below 10	25	6.7
11 to 20	228	61.3
21 to 30	97	26.1
31 to 40	2	0.5
Unknown handicap	20	5.4

### The golf-related injuries

Slightly more than half (51.1%) of the participants reportedly ever experienced golf-related injuries in the past year. (Table 2).

Table 2: Experience golf-related injury.

Suffer Golf-Related Injuries	N	%
Yes	190	51.1
No	182	48.9
Total	372	100

The type of injuries based on the anatomical region (Table 3) is the upper extremity including, shoulder muscles strain (13.1%), golfer's elbow (10.7%), wrist sprain (9.7%), and shoulder sprain (8.7%). The second most anatomical region was the lower extremity, with 23.34% of injuries reported, of which the most common injury was ankle sprain (6.5%) and knee sprain (7.7%). Lower back strain (16.5%) was the most common type of injury experienced by the respondent. Lastly, the head region was the least region of injuries which include head and eye contusions.

Table 3: Type of injuries sustained.

Type of Injuries	N	(%)
Head Contusion	1	0.2
Eye Contusion	3	0.5
Shoulder Sprain	51	8.7
Shoulder Dislocate	3	0.5
Shoulder Muscles Strain	77	13.1
Elbow Contusion	16	2.7
Golfer's Elbow	63	10.7
Forearm Muscles Strain	30	5.1
Wrist Sprain	57	9.7
Wrist Dislocated	1	0.2
Wrist Chronic Pain	11	1.9
Lower Back Strain	97	16.5
Lower Back Vertebral Subluxation	10	1.7
Lower Back Chronic Pain	18	3.1
Abdomen Muscles Strain	6	1.0
Knee Sprain	45	7.7
ACL &PCL	8	1.4
Meniscus Tear	3	0.5
Ankle Sprain	38	6.5
Ankle Heel Tear	4	0.7
Plantar Fasciitis	6	1.0
Quadriceps Strain	2	0.3
Hamstring Strain	13	2.2
Calf Strain	13	2.2
Others	11	1.9
<b>Total</b>	<b>190</b>	<b>100</b>

Table 4 presents the perceived factors of golf-related injuries. Based on the results obtained, 23.8% believed that the factors of golf-related injuries were not enough warm-up, overuse of a specific body part (19.7%), inappropriate swing technique (19.1%), and tiredness (12.9%). Meanwhile, only a few respondents found that others' negligence (4.3%), venue (2.0%), and improper equipment (0.8%) were the factors of golf-related injuries

Table 4: The perceived factors of golf-related injuries.

Perceived factors	N	%
<b>Internal Factors</b>		
Not Enough Warm-up	116	23.8
Poor body position	75	15.4
Overuse of a specific body part	96	19.7
Tiredness	63	12.9
<b>External Factors</b>		
Inappropriate swing techniques	93	19.1
Venue	10	2.0
Other's negligence	21	4.3
Improper equipment	4	0.8
Others	10	2.0

**The relationship between age, lack of warm-up, and frequency of golfing with golf-related injuries.**

From the results in Table 5, the frequency of golfing is statistically significant with golf-related injuries (p=0.05). In addition, there is a statistically significant between perceived knowledge of injury prevention with the frequency of golf-related injuries (p=0.00). The results showed that, out of 190 respondents who experienced injury, 130 respondents perceived that they do not know about the prevention of golf injury.

Meanwhile, the age of the participants shows that it is not statistically significant with the frequency of golf-related injuries (p=0.813). Also, there was not statistically significant between the warm-up activities before the golf game with golf-related injuries.

Table 5: The relationship between warming-up, age, frequency of golfing, and perceived knowledge prevention with the frequency of golf-related injuries.

	Had suffered injuries (n= 190) N (%)	Not suffer injuries (n= 182) N (%)	Statistic (df)	P-value
<b>Age</b>				
Below 50	68(51.9)	63(48.1)	0.056(1)	0.813
Above 50	122(50.6)	119(49.4)		
<b>Warm-up</b>				
Yes	172(50.9)	166(49.1)	0.052(1)	0.819
No	18(52.9)	16(47.1)		
<b>Frequency of golfing</b>				
Less than 7 hours	84(45.9)	99(54.1)	3.858(1)	0.050
More than 7 hours	106(56.1)	83(43.9)		
<b>Perceived Knowledge of Golf Injury Prevention</b>				
Yes	60(38.7)	95(61.3)	16.259(1)	0.000
No	130(59.9)	87(40.1)		

#### 4. DISCUSSION

Golf is a sport being participated in by all regardless of any background, yet participation among men is higher among men (Lee, et.al, 2013). This is consistent with the findings of this study, which found that male respondents were more dominant than females, implying a higher prevalence of injuries among male golfers. Golfers, unlike football and rugby players, are more likely to continue playing from middle age to old age (Murray, et.al, 2017). It was found that there is a higher number of golf-related injuries among golfers aged above the fifties. However, this study found that there is statistical insignificance between age and frequency of golf-related injuries. Meanwhile, in a previous study, the age group, particularly among older golfers, is one of the injury risks factors (McHardy, Pollard & Luo, 2007).

The upper extremities were reported as the main anatomical injuries followed by the lower extremities. The shoulder and lower back showed the two highest injured parts of the body. The findings of the previous study also found that the upper extremities were the highest anatomical region reported, followed by the trunk, lower extremities, and the head region (Timothy, 2012).

In previous studies, the shoulder, lower back, elbow, and wrist were the commonly affected body parts among both recreational and professional golfers (Hawkes, O'Connor & Campbell, 2013; Jee & Lee, 2013; Joeng, Lee & Cho, 2018). According to previous studies, common shoulder injuries are rotator cuff tears, impingement syndrome, and instability, whereas elbow injuries, include lateral and medial epicondylitis, and wrist injuries include tendinitis, fracture, and carpal tunnel syndrome (Cohn, Lee & Strauss, 2013; Zouzias, et.al, 2018). Shoulder muscle strain, golfer's elbow, and wrist sprains were the common type of injuries reported in this study. This may happen during the golf swing as it required rapid movement of the shoulder with the synchronized effort of the shoulder girdle and rotator cuff muscles to make a successful shot (Lee, et.al, 2017). Consequently, excessive repetitive motion during golf swing will cause micro trauma to the body structures which leads to injury (Cohn, Lee & Strauss, 2013; Zouzias, Hendra & Stodelle, 2018). Therefore, the risk of shoulder injury may be reduced by strengthening the rotator cuff muscles, pectoralis major, and latissimus dorsi, which are the most active during the golf swing (Cohn, Lee & Strauss, 2013).

Improper golf swing techniques, particularly in golfers with muscular imbalances, are the most common causes of lower back injury in recreational golfers. This resulted in improper spinal structure loading and increased stress on the lower back structures during the golf swing. Thus, it will lead to an increase in the risk of lower back injury (Edward, Dickin & Wang, 2020). Therefore, adequate physical preparation is essential to reduce the risk of injury because our bodies can adapt and manage the stress from the golf swing (Edward, Dickin & Wang, 2020).

According to Woo and colleagues (2017), there are several possible causes of golf injuries which are excessive practice, poor golf swing mechanics, inappropriate equipment, and striking another object. The results of this study found that most golfers perceived insufficient warm-up, overuse of a specific body part, and inappropriate swing technique were the factors contributing to golf-related injuries.

However, there is no association between warm-up and the frequency of golf-related injuries in this study. According to a recent systematic review, the golf injury caused by warm-up behaviour is still unknown due to a lack of experimental and longitudinal research to determine the effect of warm-up on the injury (Ehlert & Wilson, 2019). Despite that, warm-up before playing is preferable compared to not warm-up. In addition, a systematic review manifests that neuromuscular warm-up includes stretching, strengthening, and balance exercises that may be effective to reduce the risk of overuse injuries of the lower limb (Herman, et.al, 2012).

Injuries also happen when there is an increase in the frequency of golf. Alike other sports, overuse injuries are one of the common causes of injury which may be associated with muscle imbalance and poor body mechanics (Brandon & Pearce, 2009). Medial epicondylitis is also known as golfer's elbow commonly affects golfers and other sports, such as American football, tennis, and other racquet sports. It is tendinopathy of the flexor and pronator tendon which may occur due to overuse or repetitive movement of wrist flexion and forearm pronation (Amin, Kumar & Schickendantz, 2015).

In the golf swing, there is an increase in force on the body to generate a successful swing to hit the ball at a certain distance and speed. This will result in increased loading and torsional stress on the lumbar spine (Walker, Uribe & Porter, 2019). According to a study, it is estimated that professional golfers experience about 7500N of compression force on the lower back during the downswing phase, which is eight times the average human body weight (Lindsay & Vandervoort, 2004). Health promotion on the prevention to reduce pain on the lower back for golfer such as prevent from excessive playing golf, seek professional golf coach, and improve flexibility and strength of the trunk muscles (Lindsay & Vandervoort, 2004) need to be done.

The limitation of this study was gender inequality and age gap, where there is a higher number of males and a smaller number of golfers aged 40 years and below. Moreover, this study only focused on golf-related injuries among recreational golfers but not professional golfers in Malaysia. Experimental or longitudinal studies need to be done to determine if the lack of warm-up before the golf game and body mechanics contribute to golf-related injury. As golf becomes more popular in Malaysia, promoting the prevention of golf-related injury becomes more relevant in avoiding the risk of injury among golfers.

## 5. CONCLUSION

As in any sport, injury in golf also has an impact on the golf enthusiast. Injury can be avoided with a proper fitness plan that includes exercise, strength training, and flexibility. This will help decrease your chance of injury as injury. Therefore, prevention and education on the golf-related injury for golfers and trainers are required.

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