Prevalence of Musculoskeletal Injuries Among Taekwondo Players in Gangtok: A Cross-Sectional Study

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ABSTRACT

Background: Taekwondo is a traditional martial art, renowned for its focus on energetic kicking, blocks, and stances resulting in higher risk of musculoskeletal injuries that can vary depending on various factors. Ensuring the access to qualified physiotherapy professionals can facilitate early detection and effective management of such injuries prompting timely recovery and minimizing long term implications on the players are crucial in the field of sports. This study aimed to determine the prevalence and types of musculoskeletal injuries among Taekwondo players in East Sikkim, Gangtok.

Methods: A cross-sectional study was conducted using a questionnaire on an interview basis. The questionnaire was adopted and validated from previous studies, gathered information through purposive sampling on the injury history and type in Taekwondo players who were registered under Taekwondo Association.

Results: 66 Taekwondo players participated in this study. A high prevalence of injuries was found among players with (78.8%) reporting to sustain at least one musculoskeletal injury, mainly located in the ankle (63.6%) followed by knee (54.5%) and neck and shoulder (8%). Color belt holders (white, green, yellow, and brown) constituted the majority of the participants (60.6%) compared to black belt holders (39.4%). Most participants identified as professional Taekwondo players (62.1%), followed by amateurs (19.7%) and semi-professionals (18.2%). Sparring players were more prevalent than poomsae players (45.5% vs. 7.5%). On average, participants reported a training duration of over two years (63.6%), with the majority training 3-5 days per week (43.9%), and almost half (48.5%) trained for 1-2 hours per session.

The most prevalent type of injury reported by players was ankle sprains (63.6%), while fracture and dislocations were the least reported 1.5% and 0% respectively. The most commonly affected body sites by the injuries were the ankle (63.6%), followed by knee (54.5%), and thigh (3%), while the groin exhibited the minimum occurrence of injury (1.5%) among the players.

Conclusion: Based on the results of this study, prevalence of musculoskeletal injuries among the Taekwondo players in Gangtok, East Sikkim was found to be 78.8%. Taekwondo players are highly prone to various musculoskeletal injuries, with sprains, contusions, and fractures being the most common. Common injury sites include the ankle, knee, leg, and forearm. Risk factors for these injuries include age, belt color, level of skill, the duration and number of training sessions per day.

Keywords: musculoskeletal, injury rate, Taekwondo, players, Gangtok, martial arts, prevalence, recurrence.

Introduction

Taekwondo is a well-known traditional martial art oriented in Korea and has been a part of the Olympic Games since its inclusion in the Sydney Olympics in 2000. The term "Taekwondo means the way of kicking and punching, reflecting its origins as a form of military training. The word 'Tae' means foot, 'Kwon' signifies hand, and 'Do' stands for the art. This dynamic and fast-paced sport demands significant explosive power to deliver kicks, adhering to the rules of the discipline (1). Over the last fifty years, taekwondo has evolved into one of the most popular martial arts in the world, boasting approximately 80 million practitioners in 206 different countries (1–4).

Taekwondo is classified into three main types: sparring (Kyorugi), poomsae, and demonstration. In sparring, victory is determined by the number of successful strikes between competitors, which involves a high risk of injury from external impacts and complex movements. Injuries can also occur from internal force imbalances, even without direct contact (3). In female martial arts athletes, inadequate muscle force in the hip joints and imbalances in muscle strength around the ankle joints were identified as significant internal factors contributing to injury incidence (5).

Poomsae involves a series of techniques designed to simulate both offensive and defensive scenarios against an imaginary opponent. Success in poomsae is assessed based on the accuracy, skillfulness, and power displayed in each movement. Despite the absence of actual combat, injuries can occur due to the precision required in executing movements and kicks. Demonstrations encompass all aspects of Taekwondo, including fundamental techniques, sparring, poomsae, self-defense, and breaking. Athletes performing in demonstrations execute high-intensity maneuvers such as kicks, turning kicks, jumping, and landing, which increases their susceptibility to injuries (3).

In a recently conducted epidemiological study (2021) among junior Taekwondo athletes, it was found that 7.5 out of every 100 athletes sustained new or recurring injuries (5). A 2020 nationwide study in Portugal found that Taekwondo training resulted in 2.15 injuries per 1,000 hours of taekwondo practice (6). A previous study carried out in Pune, Maharashtra, revealed that 48% of athletes suffered musculoskeletal injuries during training. These injuries were

predominantly present in the lower limbs viz. knee (54.16%), followed by the foot and ankle (50%), then the upper limbs especially the shoulder (39.58%) (2).

Between 1998 and 2023, modifications to scoring rules in competitions altered how points were awarded for full-contact kicks to the body and head, and punches to the body. In 2009, electronic scoring became the norm for World Taekwondo Federation (WTF) sanctioned events, where kicks must surpass a predefined threshold to register points. The WTF established specific scoring criteria for kicks based on weight classes for both male and female players (7). Matches consist of three rounds, each lasting two minutes, requiring athletes to exert high intensity and demonstrate endurance. Taekwondo practitioners typically train four to six times a week and must exhibit skills to advance in rank. Athletes who have accumulated more years of tournament experience, combined with frequent and prolonged training sessions, are at higher risk of injuries. Educating athletes and trainers about these risks can enable them to implement strategies to adjust training and tournament schedules, aiming to reduce the incidence of injuries (8)

Male athletes have reported higher injury rates than females, with the most common injuries attributed to athlete-to-athlete contact during competitions (5). Kazemi and Pieter (2004) also observed elevated injury frequencies among male black belt players. The higher injury rates in males may be due to the direct impact with greater force generation and aggression (9).

Taekwondo provides health benefits and promotes mental well-being for all ages, but it also carries injury risks due to intense full-contact sparring, which can affect long-term participation. Research shows some martial arts injuries are preventable and pose significant health concerns. Analyzing the specific types and locations of injuries sustained during taekwondo practice is important for effectively managing injuries and preventing unnecessary harm to participants (10).

Over time, sparring rules have undergone significant revisions aimed at reducing injury rates. Martial arts practitioners are required to wear protective gear, including gloves, foot guards, and helmets, to enhance safety during both training sessions and competitions (11). Despite the widespread use of protective equipment and the implementation of stricter competition rules, injuries persist as the primary health issue among practitioners of Taekwondo (12).

Taekwondo demonstrates higher competition injury rates in comparison to other full-contact and collision sports like American football and wrestling. It was also discovered that taekwondo had the highest injury risk among all Olympic sports during the 2012 Games. Across all taekwondo involvement levels, prior research has shown that injuries primarily occur in the lower limbs (13,14). The most frequent mechanism of the injury is receiving blows from the opponent. (15). These injuries represent a notable public health concern in Western countries, where 40% of adolescent medical visits are attributed to Taekwondo injuries. Each year, 8% of young individuals cease their recreational activities due to these injuries, resulting in considerable financial implications (14).

This emphasizes the importance of developing strategies to effectively reduce the number and severity of injuries associated with taekwondo (16). According to earlier research, targeted areas for preventive measures include the head, neck, and lower limbs (17).

The previous study found that a significant portion of athletes experienced injuries during competition: 27% suffered one injury, 42% had two injuries, and 30% had three or more, with some athletes experiencing up to six injuries. About 35% of these injuries affected the athletes' performance during competition. The study also found that athletes' chances of winning a gold decreased by 88% for every additional injury they received during a game. Given the intensity of competition and the format requiring athletes to compete in multiple matches in a day, there is limited time for recovery even from minor injuries. This emphasizes how crucial it is to include preventive measures like taping, and the usage of protective gear in the rules and regulations of the competition. Immediate and proper care by qualified healthcare professionals is also crucial for managing injuries effectively in taekwondo competitions (9).

To our understanding, there is currently no existing literature on Taekwondo injuries in Gangtok, East Sikkim. Therefore, this study aimed to assess the rate, types, locations on the body, and risk factors associated with musculoskeletal injuries among Taekwondo players in Gangtok. This will help instructors and athletes recognize injury risks associated with each event and develop customized training plans or preventive strategies for both injury prevention and rehabilitation.

Methodology

Participants

A cross-sectional study involved 66 participants who were recruited with the permission of the President of the Sikkim Amateur Taekwondo Association (SATA). Players were selected from four Taekwondo clubs in Gangtok, all registered under SATA. The sampling method utilized was purposive sampling, employing a questionnaire administered after proper consent through interviews. This questionnaire was validated and adapted from various previous studies (Chudolinski et al., 2009; Ghagare & Pingale, 2017; Jabbar et al., 2021) .

Eligibility criteria

All Taekwondo practitioners in Gangtok, irrespective of age or gender, were eligible for inclusion in the study. Exclusions comprised individuals not registered with any clubs, those with a history of musculoskeletal injuries unrelated to Taekwondo activities, or those unwilling to participate or provide consent.

Research Tools

The questionnaire consisted of three sections. Section A focused on demographic information of the subjects, including club name, state & city, gender, and age group. It also covered training habits such as stretching, warm-up, cool-down, use of headgear and vest, and full gear. Additionally, it assessed the skill level (amateur, semi-professional, and professional), type of player (Poomsae, sparring, or both), frequency of practice per week, sessions of training per day, duration of training per session, and experience in Taekwondo. Section B focused on injury characteristics, including the type of injury, injury location, number of injuries sustained, and recurrence of injuries. Section C addressed methods for managing injuries, such as abstaining from training, utilizing over-the-counter medication, or seeking professional treatment.

Data Collection and Statistical Analysis

Participants were provided with an information sheet outlining the study's objectives, ensuring confidentiality, and detailing the study's setting. Additionally, a consent form was distributed alongside the information sheet, and data collection was conducted through questionnaire-based interviews. The study proposal underwent review and approval by the

Institutional Review Committee (IRC) and the Institutional Ethics Committee (IEC) at SMIMS. Data collection spanned eight months, from July 2023 to March 2024.

Data was analyzed using SPSS version 27. Descriptive statistics were used to summarize the demographic characteristics of the participants. The Chi-squared test was employed to assess associations between participant characteristics and musculoskeletal injuries, as well as associations between participant characteristics and the occurrence of single or multiple musculoskeletal injuries among Taekwondo players.

Results

A total of 66 Taekwondo players took part in the study, with the highest proportion falling in the age group below 15 years (39.4%), while the lowest percentage was in the 35-39 age group (1.5%). Male participants outnumbered females by (8%). Color belt holders (white, green, yellow, and brown) constituted the majority of the participants (60.6%) compared to black belt holders (39.4%). Most participants identified as professional Taekwondo players (62.1%), followed by amateurs (19.7%) and semi-professionals (18.2%). Sparring players were more prevalent than poomsae players (45.5% vs. 7.5%). On average, participants reported a training duration of over two years (63.6%), with the majority training 3-5 days per week (43.9%), and almost half (48.5%) trained for 1-2 hours per session (Table 1).

The training habits of the participants are outlined in Table 2, utilizing a 5-point Likert scale ranging from "never" to "always." The majority of participants reported "always" practicing stretching (47.9%), warming up exercises (80.3%), cool-down routines (77.3%) and only head gear and vest (40.9%) at training. However, full gear training was reported as "sometimes" by the majority (51.5%) of participants only during competition.

Table 3 depicts 78.8% participants, had experienced musculoskeletal injuries and among them 24.2% had encountered injury at least once since they started playing, while 54.6% had suffered from multiple musculoskeletal injuries.The most prevalent type of injury reported by players was ankle sprains (63.6%), while fracture and dislocations were the least reported 1.5% and 0% respectively. The most commonly affected body sites by the injuries were the ankle (63.6%), followed by knee (54.5%), and thigh (3%), while the groin exhibited the minimum occurrence of injury (1.5%) among the players.

Figure 1, illustrates that defensive and offensive kicking collectively contributed to the most of injuries compared to punching.

Table 4 highlights that 50% of players in the age group below 15 years experienced musculoskeletal injuries, while the least injury rate was observed among those aged 35-39 years (2%). Age showed statistically significant association with training-related injuries ($p<0.001$).

However, the gender of participants did not exhibit a statistically significant association with injury rates ($p=0.153$). Interestingly, a higher proportion of black belt participants suffered injuries (80.8%) compared to color belt participants (77.5%). However, the color of the belt did not demonstrate a statistically significant association with injuries related to training ($p=0.751$). Regarding training sessions, participants who trained more than three sessions per day experienced a higher rate of injuries (100%) compared to those who trained one, two, or three sessions per day. This association was statistically significant ($p<0.01$). However, factors such as gender, belt color, level of skill, player type, training frequency per week, duration and experience did not show statistically significant associations with injuries ($p>0.05$).

Table 5 showed the statistically significant characteristics of participants in relation with the number of injuries (single, multiple, or none) were identified as belt color ($p =0.05$), with 35.6% of black belt participants experiencing single injuries and 57.7% experiencing multiple injuries, compared to 17.5% single and 52.5% multiple injuries among color belt participants. Additionally, the level of skill, number of sessions per day and duration of each sessions showed significant associations with the number of injuries ($p<0.05$). However, factors such as age, gender, player type, frequency of training per week, and experience were not found to be associated with the number of injuries.

Almost half of the participants have suffered from recurrence of musculoskeletal injuries (40.9%). The methods the participants used to manage the injuries were being absent from training or competition for 0-2 weeks (43.9%) whereas some players underwent physiotherapy treatment (24.6%), the remaining majority of participants (71.2%) took no treatment. Medications were sought by 71.2% who used painkillers and 3% took no medication as depicted in Table 6.

Table 1: Demographic characteristics of the participants.

Characteristics	(n=66)
Age (in years)	
< 15	26 (39.4)
15-19	10 (15.2)
20-24	13 (19.7)
25-29	8 (12.1)
30-34	6 (9.1)
35-39	1 (1.5)
≥40	2 (3)
Gender	
Female	30 (45.5)
Male	36 (54.5)
Belt color	
Color belt	40 (60.6)
Black belt	26 (39.4)
Level of Skill	
Amateur	13 (19.7)
Semi-professional	12 (18.2)
Professional	41 (62.1)
Player type	
Poomsae	5 (7.5)
Sparring	30 (45.5)
Both	31 (47)
Training Frequency per week	
1-2	6 (9.1)
3-5	29 (43.9)
>5	31 (47)
No. of Sessions per day	
One	29 (44)
Two	22 (33.3)
Three	14 (21.2)
>Three	1 (1.5)
Duration of each session	
<1 hour	3 (4.5)
1-2 hour	32 (48.5)
>2 hours	31 (47)
Years of experience	
<1 year	9 (13.6)
1-2 year	15 (22.8)
>2 years	42 (63.6)
Note: All values are represented in frequency and percentage	

Table 2: Training habits of the participants.					
Exercise	**Never**	**Occasionally**	**Sometimes**	**Often**	**Always**
Stretching	1 (1.5)	5 (7.6)	23 (34.8)	6 (9.1)	31 (47.9)
Warm-up	-	2 (3)	8 (12.1)	3 (4.5)	53 (80.3)
Cool-down	-	1 (1.5)	6 (9.1)	8 (1.8)	51 (77.3)
Only head gear and vest	3 (4.5)	1 (1.5)	23 (34.8)	12 (18.2)	27 (40.9)
Full gear	4 (6.1)	10 (15.2)	34 (51.5)	6 (9.1)	12 (18.2)
Note: All values are in n (%) i.e., no. of participants (percentage); Total no. of participants in the study is n=66.					

Table 3: Taekwondo related injuries in the participants.	
Characteristics	**(n=66)**
Injury	
No	14 (21.2)
Yes	52 (78.8)
Number of injuries	
No injury	14 (21.2)
Single	16 (24.2)
Multiple	36 (54.6)
Type of injuries	
Knee sprain	36 (54.5)
Ankle sprain	42 (63.6)
Tear (Groin)	1 (1.5)
Fracture	1 (1.5)
Dislocation	-
Contusion (Head, Thigh, Foot)	1 (1.5), 2 (3), 1 (1.5)
Others	8 (12.2)
Note: All values are in n (%) i.e., no. of participants (percentage).	

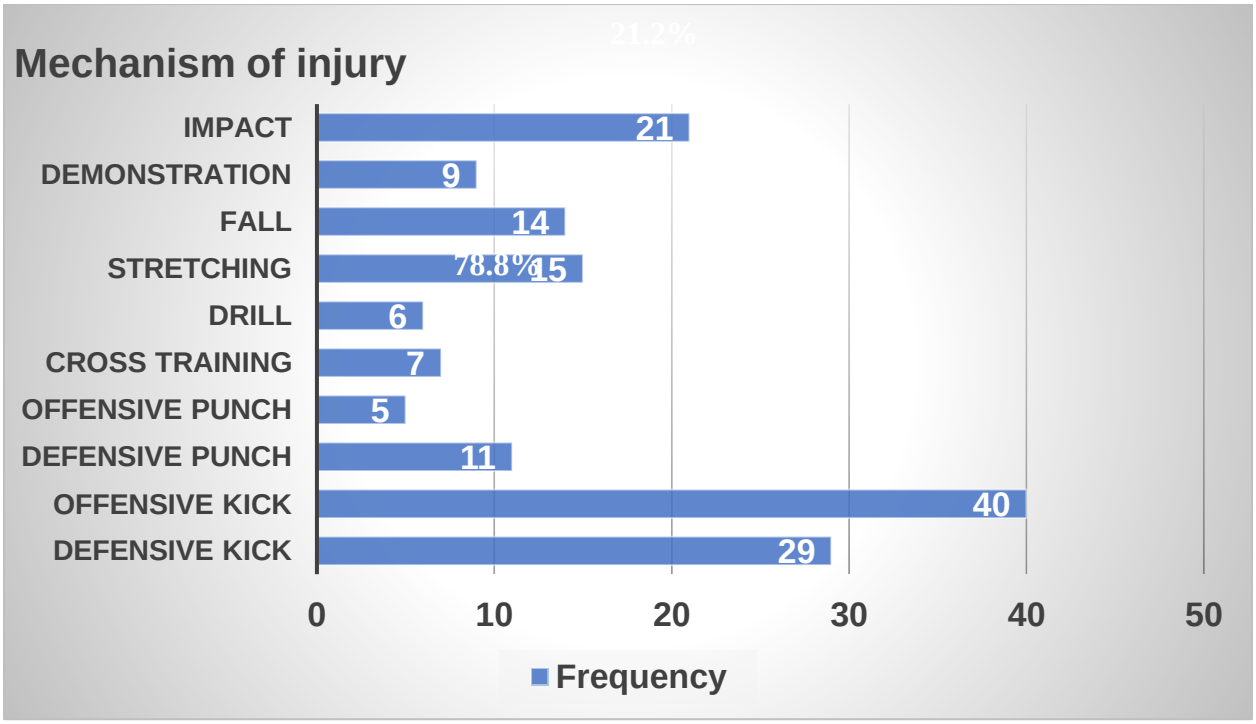

Figure 1: Mechanism of injury

Table 4: Association between Taekwondo related musculoskeletal injuries and characteristics of the participants.			
Characteristics	**Taekwondo related musculoskeletal injuries**		**p value**
	Yes	**No**	

Age (in years)			
<15	26 (50)	-	
15-19	4 (7.7)	6 (42.9)	
20-24	8 (15.4)	5 (35.7)	
25-29	5 (9.6)	3 (21.4)	0.001*
30-34	6 (11.5)	-	
35-39	1 (2)	-	
>40	2 (3.8)	-	
Gender			
Female	26 (86.7)	4 (13.3)	0.153
Male	26 (72.2)	10 (27.8)	
Belt color			
Color belt	31 (77.5)	9 (22.5)	0.751
Black belt	21 (80.8)	5 (19.2)	
Level of skill			
Amateur	12 (92.3)	1 (7.7)	
Semi-professional	9 (75)	3 (25)	0.412
Professional	31 (75.6)	10 (24.4)	
Player type			
Poomsae	5 (100)	-	
Sparring	21 (70)	9 (30)	0.201
Both	26 (78.8)	5 (21.2)	
Frequency of training per week			
1-2 days	4 (66.7)	2 (33.3)	
3-5 days	23 (79.3)	6 (20.7)	0.742
>5 days	25 (80.6)	6 (19.4)	

No. of Sessions per day			
One	27 (93.1)	2 (6.9)	
Two	17 (77.3)	5 (22.7)	
Three	7 (50)	7 (50)	0.013*
>Three	1 (100)	-	
Duration of each session			
<1 hour	3 (100)	-	
1-2 hour	26 (81.3)	6 (18.7)	0.518
>2 hours	23 (74.2)	8 (25.8)	
Experience			
< 1 year	7 (77.8)	2 (22.2)	
1-2 year	13 (86.7)	2 (13.3)	0.693
>2 years	32 (76.2)	10 (23.8)	

Note: All values are in n (%) i.e., no. of participants (percentage); Total no. of participants in the study is n=66. Chi-square test, level of significance ≤0.05.

Table 5: Association between number of Taekwondo related musculoskeletal injuries and the characteristics of the participants.

Characteristics	Single	Multiple	No injury	p value
Age (in years)				
<15	5 (19.2)	13 (50)	8 (30.8)	
15-19	4 (40)	5 (50)	1 (10)	
20-24	2 (15.4)	8 (61.5)	3 (23.1)	
25-29	2 (25)	5 (62.5)	1 (12.5)	0.580
30-34	2 (33.3)	4 (66.7)	-	
35-39	-	-	1 (100)	
>40	1 (50)	1 (50)	-	
Gender				
Female	6 (33.3)	22 (20)	8 (46.7)	0.281
Male	14 (16.7)	10 (61.1)	6 (22.2)	

Belt color				
Color belt	7 (17.5)	21 (52.5)	2 (30)	0.058*
Black belt	9 (34.6)	15 (57.7)	12 (7.7)	
Level of skill				
Amateur	5 (38.4)	2 (15.4)	6 (46.2)	
Semi-professional	1 (8.3)	7 (58.3)	4 (33.4)	0.007*
Professional	10 (24.4)	27 (65.8)	4 (9.8)	
Player type				
Poomsae	3 (60)	1 (20)	1 (20)	
Sparring	5 (16.7)	21 (70)	4 (13.3)	0.089
Both	8 (25.8)	14 (45.2)	9 (29)	
Frequency of training per week				
1-2 days	1 (16.7)	4 (66.6)	1 (16.7)	
3-5 days	5 (17.2)	5 (55.2)	8 (27.6)	0.600
>5 days	10 (32.3)	16 (51.6)	5 (16.1)	
No. of Sessions per day				
One	9 (31)	11 (38)	9 (31)	
Two	1 (4.6)	18 (81.8)	3 (13.6)	
Three	5 (35.7)	7 (50)	2 (14.3)	0.023*
>Three	1 (100)	-	-	
Duration of each session				
<1 hour	2 (66.7)	-	1 (33.3)	
1-2 hour	5 (15.6)	17 (53.1)	10 (31.3)	0.059*
>2 hours	9 (29)	19 (61.3)	3 (9.7)	
Experience				
< 1 year	2 (22.2)	4 (44.5)	3 (33.3)	
1-2 year	3 (20)	6 (40)	6 (40)	0.185
>2 years	11 (26.2)	26 (61.9)	5 (11.9)	

Note: All values are in n (%) i.e., no. of participants (percentage); Total no. of participants in the study is n=66

Chi-square test, level of significance ≤0.05.

Table 6: Methods to manage the consequences of the injury	
Methods	**(n=66)**
Recurrence of injury	
Yes	27 (40.9)
No	39 (59.1)
Absent due to injury	
0-2 week	37 (43.9)
3-4week	11 (16.7)
1-3months	9 (13.6)
3-6 months	2 (3)
6-12months	1 (1.5)
>12 months	2 (3)
Medicine	
Pain killer	47 (71.2)
Relaxant	13 (19.7)
Other	4 (6.1)
No	2 (3)
Treatment	
Physiotherapy	16 (24.6)
TCM	-
Medical doctor	2 (3.1)
PT + medical doctor	4 (6.1)
No treatment	43 (71.2)
Note: All values are in n (%) i.e., no. of participants (percentage).	

Discussion

The study aimed to investigate the prevalence and types of musculoskeletal injuries among Taekwondo players in Gangtok, East Sikkim, while also identifying associated factors for these

injuries. A total of 66 Taekwondo players from four different clubs in Gangtok participated in the study. The findings revealed that a majority of the players experienced musculoskeletal injuries as a result of their Taekwondo practice, with many reporting multiple occurrences of such injuries.

Our study supports the recently conducted similar study done by Jabbar et al. in Malaysia which reported the higher prevalence of musculoskeletal injury (61%) among Taekwondo players (1). The most prevalent types of musculoskeletal injuries among Taekwondo players were identified as sprains, followed by contusions and strain (14). Notably, ankle sprains emerged as the most common type of sprain among all reported locations of sprains. These results are similar to a study conducted a few years ago that concluded sprain as the most common episode in taekwondo players (1,20). These findings can be explained by the greatest numbers of offensive and defensive techniques associated with the game that are the main cause of this injury type. Furthermore, the strain (tears in the muscles) could happen as the result of kicking actions above the waist or above the opponent's head to obtain the highest scores in taekwondo (6).

The emphasis on footwork is crucial in Taekwondo due to its significant role in the sport. It is recommended that players prioritize practicing footwork techniques diligently to enhance their performance in tournaments. Given the fast-paced and demanding nature of Taekwondo, improving strength, endurance, and postural stability under stress is also highly recommended for injury prevention and overall skill enhancement (20).

According to our study data, the offensive kick was the more prevalent cause of injury (n=40), followed by defensive kick (n=29) and direct impact with another athlete (n=2). This finding is consistent with the result of nationwide study done in Portugal by a researcher. As the Taekwondo emphasizes more on lower extremity mainly kicks, unlike Karate that emphasizes on upper extremities. There are different kicking techniques and the types of kicks; roundhouse kick, axe kick, back kick, swing kick and tornado kick while for the hand techniques, only punches are used. Usually, high force exerted on lower extremities while performing the kicks especially the tornado kick (360 turning kick) lead to a high chance of injury during the demonstration (6). Due to the high acceleration and great power, the impact of soft tissues (muscles) with harder regions (bones and joints) can injure those who receive the blow(14)

Table 1 illustrates that the majority of Taekwondo practitioners are in the age groups below 15 and 20-24, with the lowest representation in the 35-39 age group. However, Table 4 indicates that the highest injury rates were observed in the age group below 15, followed by the 20-24, 30-34, and 25-29 age groups, while the numbers were notably smaller in the 35-39 and over 40 age groups. Despite the smaller representation, older players demonstrated a higher tendency to sustain injuries compared to younger counterparts while receiving a punch, possibly due to a reduced confidence in ability to perform a kick with increased age (21).

The majority of Taekwondo players involved in this study were males, and they exhibited a higher susceptibility to injuries compared to females (Table 4). This heightened vulnerability among male players can be attributed to factors such as increased force generation and aggression during training and competitions (16,21).

A larger proportion of participants in the study were color belt Taekwondo players compared to black belt holders. Interestingly, Table 4 highlights that black belt players reported a significantly higher rate of injuries than color belt holders. Black belt players experienced significantly more multiple injuries compared to color belt holders (Table 5). A Taekwondo player requires two to three years to become 1st Poom or 1st Dan black belt holder. Therefore, a black belt holder normally spends more years of training in Taekwondo as compared to color belt holder and more involvement in the tournaments and also due to the complex and powerful techniques they use, which carry a higher risk of injury (1). This statement is supported by the study done by M Kazemi et al. who also reports a similar finding in their research (2009) (21).

In this study, the data indicates that professional Taekwondo players experienced a significantly higher rate of injuries compared to amateur and semi-professional players that correlates with the study done by Ji Min Joon et al. (2016). This difference in injury rates may be attributed to the varying skill levels and training intensities among these player categories. Amateur players, who may be relatively new to Taekwondo, might suffer injuries due to a lack of defensive skills and control during training and competitions. On the other hand, semi-professional and professional players, with more advanced skills and experience, may sustain injuries while attempting advanced or complex techniques during intense training sessions or competitive matches. These players may push themselves to execute fancy or challenging techniques with increased speed and power, thereby increasing their risk of injury (10). The finding that

professional Taekwondo players are at a higher risk of injury compared to amateur and semi-professional players aligns with the results of another study. This consistency in findings suggests that the elevated risk of injury among professional players may be a common trend across various Taekwondo contexts (19).

It's clear that within Taekwondo, there are two distinct player types: sparring and Poomsae practitioners. Sparring involves combat, emphasizing agility, aggressiveness, fitness, and muscle conditioning. Flexibility is also crucial, as head scores carry more weight than trunk scores according to Taekwondo sparring rules. Conversely, Poomsae focuses on demonstration-style movements, emphasizing pose, flexibility, balance, and muscle conditioning (3). Each player type prioritizes different aspects of training and performance to excel in their respective disciplines.

The study enrolled a larger number of sparring players compared to Poomsae players. Tables 4 and 5 reveal that poomsae players experienced a higher rate of injuries and a significantly elevated incidence of multiple injuries which is contradicting to the study done by Pingale et al. (2017). This result is most likely due to the enrollment of poomsae players who had an injury and possibly felt more motivated to answer the questionnaire (2).

The majority of Taekwondo players in the study practiced more than 5 days a week (47%), with one session per day (44%) lasting 1-2 hours per session (48.5%) (Table 1). Interestingly, participants who practiced more than 5 days per week exhibited the highest rate of injury, with almost half experiencing multiple injuries. This observation may be explained by the notion that increased training frequency allows players to master skills more effectively, but it also raises the likelihood of sustaining injuries due to the heightened intensity and frequency of training sessions.

It has been reported that Taekwondo members who trained three times per day had an increased rate of injury due to fatigue. Accumulation of fatigue can result in overtraining, which has a significant negative impact on performance. When athletes do not receive adequate time to recover between training and competition, fatigue will accumulate, compromise key aspects of performance and result in an increased risk of injury and illness to the athlete (8).

Table 2 indicates that the majority of participants consistently incorporated warming up, cool-down, and stretching into their training routines, whereas the use of gear is only occasional.

Training habit has an impact on the rate of sports injuries among Taekwondo players. Fewer injuries was reported among athletes who warmed up for more than 15 minutes (19).

Among the 52 injured respondents, 40.9% reported a recurrence of injury, underscoring the significance of injury management methods in preventing re-injury. Painkillers, muscle relaxants, emerged as the most commonly used medicines (71.2% and 19.7% respectively) by Taekwondo players in Gangtok. However, few players took physiotherapy treatment (24.6%) and majority of players didn't seek any treatment for their injury (71.2%).

Limitations

This study has several limitations that should be acknowledged. Firstly, the data collection method relied on participant interviews, which could introduce errors associated with recall. Secondly, since all reported injuries were not assessed by healthcare professionals, the reliability of injury classification may be uncertain. Additionally, the sample size was relatively small, limiting the generalizability of the findings. Furthermore, biases may exist due to variations in the number of players across different age groups, belt colors, and skill levels, potentially affecting the significance of results. Finally, the reliability of results could have been enhanced by selecting a specific time frame for injury assessment.

Future recommendations

Future studies can be done with a larger sample size by including all Taekwondo players in Sikkim during championships or competition. Further research can be done targeting only one category of Taekwondo players, either Sparring or Poomsae or Demonstration.

Conclusion

Based on the results of this study, prevalence of musculoskeletal injuries among the Taekwondo players in Gangtok, East Sikkim was found to be 78.8%. Taekwondo players are highly prone to various musculoskeletal injuries, with sprains, contusions, and fractures being the most common. Common injury sites include the ankle, knee, leg, and forearm. Risk factors for

these injuries include age, belt color, level of skill, the duration and number of training sessions per day.

It is imperative to protect Taekwondo players, especially newcomers with limited experience, from musculoskeletal injuries. This can be achieved by raising awareness among players and coaches about the risks associated with these injuries. Encouraging greater caution and mindfulness during training and competitions can help mitigate the occurrence of injuries and ensure the safety and well-being of Taekwondo practitioners.

Preventive strategies such as proper use of protective devices, taping, and modification in the rules and regulation of the sport could be important. In addition, proper and immediate care by qualified health practitioners to prevent injury and its recurrence might also be of utmost importance to the taekwondo players.

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