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Psychological Factors, Sleep Quality, and Injury Prevalence among Iranian Taekwondo Athletes (November–December 2023): A Cross-Sectional Study

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ABSTRACT

Background: This study investigated the prevalence of injuries among Taekwondo athletes, with specific emphasis on psychological attributes, namely competitive anger and aggression, as well as sleep quality. Although these factors are recognized contributors to sports-related injury risk, their association with Taekwondo-specific injuries remains insufficiently explored. The research aimed to identify injury patterns and evaluate the relationships between these psychological constructs, sleep quality, and injury incidence to guide targeted prevention and management approaches.

Methods: A cross-sectional survey was administered in Tehran between November and December 2023 to 201 Iranian Taekwondo practitioners. Participants completed a validated Farsi-language online questionnaire capturing demographic information, training characteristics, scores on the 12-item Competitive Aggressiveness and Anger Scale (CAAS), the 19-item Pittsburgh Sleep Quality Index (PSQI), and self-reported musculoskeletal injuries over the preceding six months. Data analyses employed descriptive statistics and multivariable logistic regression to determine independent predictors of injury.

Results: Among respondents, 118 athletes (58.7%) reported at least one injury, most commonly involving the ankle (20.6%) and foot/toe (17.6%). Adjusted regression analyses revealed that each one-point increase in CAAS score was associated with greater injury risk (OR = 1.23; 95% CI 1.11–1.36; $p < 0.001$), as was each one-point increase in PSQI score (OR = 1.12; 95% CI 1.05–1.38; $p = 0.006$). Training more than three sessions per week (OR = 4.01; 95% CI 1.93–8.33; $p < 0.001$) and session durations exceeding 60 minutes (OR = 2.27; 95% CI 1.07–4.84; $p = 0.032$) were also independent predictors.

Conclusion: The findings underscore the need to systematically assess competitive aggressiveness, anger, sleep quality, and training load when formulating injury prevention and management strategies for Taekwondo athletes.

Keywords: Athletic injuries; Aggression; Anger; Sleep quality; Risk factors

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Introduction

Taekwondo, an ancient Korean martial art, is trained by practitioners in more than 206 nations globally. It holds significant educational and physical benefits (1). Taekwondo has evolved into a global sport, celebrated for its diverse kicks and potent attacking techniques (2). It emphasizes dynamic movements, requiring agility, speed, flexibility, and endurance for effective execution (3). While taekwondo offers numerous physical benefits across all age groups, its intense, full-contact nature also poses injury risks. Engaging in sports is generally seen as beneficial, but it always carries a potential risk of injury (3, 4). The contentious nature of martial arts has sparked ongoing inquiries into their impact on players' behavior (5). Central to these inquiries are concerns about the potential influence of martial arts on aggression levels. Questions such as "Does exercise amplify or reduce aggression?" and "Which forms of exercise foster negative versus positive effects on aggression?" are commonly raised (5, 6). The connection between anger, violence, and sports injuries warrants examination (7). While prior research has yet to offer conclusive insights, the relationship between aggression, particularly in martial arts, and sports injuries remains a debated topic (8). Aggression, characterized as intentional and forceful actions, can manifest verbally or physically and serves as the behavioral expression of emotions like anger, rage, or hostility (9). While sports participation offers numerous benefits, championship events frequently witness heightened levels of aggression (10). The rise in aggression within sports is increasingly worrying for sports philosophers, coaches, and psychologists (11). This tendency risks undermining and devaluing sports, as evidenced by the violence observed on playing fields and in stadiums (12-14). The likelihood of injuries related to Taekwondo is also heightened by aggression (15). It is crucial to managing the tendency towards aggressive behavior in combat sports, including taekwondo (16). Athletes possess significant skills and strengths that, if misused outside the sport, could result in conflicts. This point has been debated and emphasized (5, 17, 18). Understanding the causes of sports injuries is essential for effective injury prevention (19). Identifying these causes forms the basis for developing and implementing successful injury prevention strategies (20). Risk factors can be divided into two main categories: external factors, which encompass the nature of the exercise and environmental conditions, and internal factors, including both physiological and psychological aspects (21, 22). While many studies have explored the impact of physical and biomechanical factors on athlete injuries, the relationship between martial artists' psychological characteristics and their injury rates remains less investigated (23-25). Recognizing the psychological factors that contribute to sports injuries can be crucial in developing effective injury prevention strategies (21, 26). There is an evident scarcity of research in the realm of taekwondo, with the subject of aggression seldom being the focus of recent studies (27). Without a doubt, there is a pressing need for exhaustive research to uncover and aptly tackle these facets.

Optimal sleep quality is vital for recovery and musculoskeletal health, both of which are crucial for enhanced performance. Conversely, poor sleep quality can impede musculoskeletal recovery, reaction time, mood, cognitive functions, and increase the risk of injury (28, 29). To the authors' knowledge, no study has yet examined how anger and sleep quality jointly influence injury risk in Iranian Taekwondo practitioners (29-32). Therefore, the authors conducted a cross-sectional analytical survey in Tehran, Iran, between November and December 2023. The target population comprised male and female Taekwondo athletes aged 18–40 with at least nine months of continuous training (≥2 sessions per week), recruited via university sports departments, clubs, and social media. The researchers selected this cohort because Taekwondo is one of Iran's most popular martial arts, yet data on its psychological and sleep-related risk factors remain scarce. The aim was to explore the correlation between self-reported injuries over the

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previous six months and (1) competitive anger, (2) sleep quality, (3) personal characteristics (e.g., age, BMI), and (4) training parameters (e.g., history, frequency, duration). It was hypothesized that higher anger scores and poorer sleep quality would be associated with increased injury prevalence in this population.

Methods

Study design

This cross-sectional analytical survey was conducted in Tehran, Iran, between November 1 and December 31, 2023. The authors targeted Taekwondo athletes training at university sports departments, private clubs, and community clubs to capture a representative snapshot of practitioners during this specific six-week period.

Sample size determination

The minimum required sample size was calculated using the formula for prevalence studies:

$$n=\frac{Z^2\times P(1-P)}{d^2}$$

Where

- Z = 1.96 (for 95% confidence interval)
- p = anticipated injury prevalence (0.50)
- d= desired margin of error (0.07)

This yields:

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.07)^2} = \frac{3.84 \times 0.25}{0.0049} \approx 196$$

Allowing for up to 10% non-response, the authors aimed to recruit at least 216 participants. Ultimately, 201 eligible athletes completed the survey.

Sampling method

Participants were enrolled via a multi-stage, non-probability convenience sampling approach:

Stage 1: Invitations posted on official university sports department notice boards and messages sent to club managers.

Stage 2: Digital invitations distributed through WhatsApp, Telegram, and Instagram Taekwondo groups.

Stage 3: Snowball referrals, each respondent was encouraged to forward the survey link to fellow practitioners.

Inclusion and exclusion criteria

The authors included athletes aged 18–40, with a minimum of nine months' training and a frequency of two or more sessions per week, who provided informed consent. Anyone with chronic musculoskeletal or systemic disorders, current injuries requiring over seven days of medical leave, or incomplete and inconsistent questionnaire responses was excluded. This recruitment and screening process ensured a robust sample for examining injury prevalence and its associations with psychological anger and sleep quality among Iranian Taekwondo practitioners.

Participation

The research involved 201 Iranian taekwondo players, comprising 124 males and 77 females, with ages ranging from 18 to 40 (average age 21±4.7). A Taekwondo player is defined as an individual who wears a Taekwondo uniform and engages in exercises involving punching and kicking techniques (33).

Data collection

A survey was crafted in Farsi utilizing Google Forms, and a digital hyperlink to the online survey was established. This link was shared with Taekwondo players through various online communication platforms such as WhatsApp, Telegram, and Instagram. The questionnaire consisted of two main sections. The first section gathered information on personal characteristics (e.g., age, weight, height) and training details (e.g., training history, duration, frequency, presence of a coach, training program, warm-up, and cool-down practices). 2. The second section focused on documenting any injuries experienced by the athletes in the past six months. This section included a diagram of the human body, divided into 84 numbered points representing various upper and lower body areas. Athletes were asked to indicate any points or areas where they had felt pain, discomfort, or new musculoskeletal issues during training. For this study, a Taekwondo injury was defined as any physical harm sustained during practice or competition, whether or not it required medical treatment, that caused the athlete to miss a

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full warm-up, skip one or more sparring sessions, cut practice short, or seek outside medical attention (34, 35). The online questionnaire also included the following instruments:

Competitive aggressiveness and anger

To evaluate the levels of anger and aggression among the participants, the Competitive Aggression and Anger Scale (CAAS), developed by Maxwell and Morris in 2007, was employed (36). They validated its reliability and validity, reporting a retest reliability of 0.77 and an internal consistency of 0.78 (36). The scale consists of 12 items, divided into two six-item factors: anger and aggression. Higher scores indicate increased levels of anger and aggression (36). The validity and reliability of this survey have been established in Persian. Fathi Rezaei et al. verified that both factors, along with their respective six items, were adequately validated within this scale. Intragroup correlations showed satisfactory temporal reliability for the scale, with anger at 0.90, aggression at 0.84, and the overall scale at 0.91. Therefore, the translated scale for aggressiveness and competitive anger exhibits acceptable validity and reliability (37).

Sleep quality

The quality of sleep was assessed using the "Pittsburgh Sleep Quality Index" (PSQI), a well-established and reliable questionnaire (38). The PSQI is composed of a total of 19 questions, such as "In the past month, how often have you experienced difficulty sleeping because you wake up in the middle of the night or early morning?" These questions cover seven areas of sleep, including quality of sleep, length of sleep, time taken to fall asleep, sleep efficiency, sleep disruptions, use of sleep aids, and daytime impairment. The questionnaire produces a composite score that reflects both sleep quality and quantity, ranging from 0 to 21, with higher scores indicating poorer quality of sleep. According to Farrahi et al. (2012), the Persian version of the PSQI has shown satisfactory validity and reliability, with a Cronbach's alpha of 0.78 (39).

Data analysis

Data were analyzed using IBM SPSS Statistics version 27. Quantitative variables were expressed as means and standard deviations, while categorical variables were presented as frequencies and percentages. Since none of the quantitative variables followed a normal distribution, non-parametric tests, Mann–Whitney U for continuous data and Chi-square for categorical data, were employed to compare athletes with and without injury. To adjust for multiple bivariate comparisons (n = 12), a Bonferroni correction was applied by dividing the nominal $\alpha = 0.05$ by 12, yielding an adjusted significance threshold of $p < 0.00$; only p-values below this cutoff were regarded as statistically significant in these tests. Variables with $p < 0.20$ in the bivariate analyses were then entered into the multivariable logistic regression model using backward elimination, retaining factors with $p < 0.05$ (40). Multicollinearity was assessed via variance inflation factors (all VIF < 3) (41), and results are reported as odds ratios (OR) with 95% confidence intervals.

Bias Mitigation

To minimize potential biases, the authors embedded validation questions, such as repeating key items to flag inconsistent responses, asked participants to corroborate self-reported injuries with their personal training logs or medical records when possible, and provided standardized instructions at the beginning of the survey to promote honest, accurate recall. These bias-reduction tactics, together with richer participant profiling, comprehensive survey metrics, a clearer injury definition, and a robust statistical analysis plan, substantially enhance the methodological rigor of the study.

Results

Taekwondo players responses and characteristics

Out of the 210 Taekwondo players surveyed, 9 were excluded due to providing incorrect or incomplete data that failed to satisfy the eligibility criteria. Table 1 presents the characteristics of the Taekwondo players, divided into two groups based on their injury history. Among the Taekwondo players surveyed, 61% (124) were male. Those who

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reported experiencing an injury exhibited notably higher levels of aggressiveness and anger towards competition and scored lower on sleep quality (indicating poorer sleep quality). Specifically, 46.8% of Taekwondo players had more than 5 years of training experience, 67.2% engaged in up to 3 training sessions per week, and 76.6% practiced for more than 60 minutes per session. Approximately 90.5% of Taekwondo players had a BMI within the healthy range (18 < BMI < 25). Moreover, 98% had a coach assisting them, and 91% of the Taekwondo players performed warm-up exercises before training, while 84.6% engaged in cool-down exercises at the end of their sessions.

Taekwondo injuries and location

Out of the 201 Taekwondo players surveyed, 118 (58.7%) reported experiencing at least one or multiple injuries within the last six months. In terms of gender distribution, 76 (64.4%) males and 42 (35.6%) females reported at least one injury. The ankle was the most commonly reported injury location, accounting for 20.6 % of all injuries, followed by the foot/toe, which accounted for 17.6% of reported injuries. Table 3 presents a detailed breakdown of injury locations by gender.

Continuous data are presented as means and standard deviations, analyzed using the Mann-Whitney test. All categorical data are shown as counts of Taekwondo players and percentages, analyzed using the Chi-square test. Statistically significant differences between those with and without a history of injury are indicated by bolded p-values.

Table 1. Characteristics of Taekwondo players, comparing those with a history of injuries to those without

Variable		Total Taekwondo players	Taekwondo players with injury history	Taekwondo players without injury history	P-value
Sex	Female, n (%)	77 (38.3)	42 (35.6)	35 (42.2)	
	Male, n (%)	124 (61.7)	76 (64.4)	48 (57.8)	0.345
Total, n (%)		201	118 (58.7)	83 (41.3)	
Age (years)		21 (4.7)	21 (4.5)	20 (4.9)	0.086
Competitive aggressiveness and anger		24 (5.5)	24.6 (3.6)	22.2 (3.3)	0.000
Sleep quality		10.5 (4.9)	10.8 (4.8)	9.7 (4.7)	0.003
Practice experience (years)		5.6 (4.5)	6 (4.9)	5 (5)	0.020
Up to 2, n (%)		57 (28.3)	26 (22.1)	31 (37.3)	
Between 2 & 5, n (%)		50 (24.9)	30 (25.4)	20 (24.1)	0.047
Over 5, n (%)		94 (46.8)	62 (52.5)	32 (38.6)	
Practice sessions (No/week)		3 (1)	4 (1)	3 (1)	0.000
Up to 3, n (%)		135 (67.2)	65 (55.1)	70 (84.3)	0.000
Over 3, n (%)		66 (32.8)	53 (44.9)	13 (15.7)	
Practice duration (min/session)		94 (26)	98 (27)	88 (23)	0.014
Up to 60, n (%)		47 (23.4)	23 (23.7)	24 (28.9)	0.120
Over 60, n (%)		154 (76.6)	95 (76.3)	59 (71.1)	
Practice time					
Morning		0 (0)	0 (0)	0 (0)	0.868
Afternoon		110 (54.7)	64 (54.2)	46 (55.4)	
Night		91 (45.3)	54 (45.8)	37 (44.6)	
BMI (kg/m2)		21 (3)	22 (2)	21 (3)	0.022
Normal, n (%)		182 (90.5)	102 (86.4)	80 (96.4)	
Overweight, n (%)		6 (3)	6 (5.1)	0 (0)	0.038
Obese, n (%)		13 (6.5)	10 (8.5)	3 (3.6)	
Having a coach	No, n (%)	12 (6)	9 (7.6)	3 (3.6)	0.237
	Yes, n (%)	189 (94)	109 (92.4)	80 (96.4)	
Warm-up	Yes, n (%)	183 (91)	109 (92.4)	74 (89.2)	0.432
	No, n (%)	18 (9)	9 (7.6)	9 (10.8)	
Cool-down	Yes, n (%)	170 (84.6)	101 (85.6)	69 (83.1)	0.634
	No, n (%)	31 (15.4)	17 (14.4)	14 (16.9)	

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Taekwondo injuries and associated factors

Table 4 presents the outcomes of univariate logistic regression analysis comparing Taekwondo players with and without a history of injury. Factors such as elevated levels of aggressiveness and anger during competitive Taekwondo sessions and scoring lower on sleep quality, training more than 3 times a week, and training sessions lasting over 60 minutes were significantly associated with Taekwondo injuries ($p < 0.05$). Table 5 displays the outcomes of the multivariable logistic regression analysis examining the risk factors linked to the site of injury. Factors significantly associated with Taekwondo injuries included competitive aggressiveness and anger (odds ratio [OR]: 1.23, 95% confidence interval [CI]: 1.11-1.36), sleep quality (OR: 1.12, 95% CI: 1.05-1.38) training more than 3 times a week (OR: 4.01, 95% CI: 1.93-8.33), and training sessions lasting over 60 minutes (OR: 2.27, 95% CI: 1.07-4.84). The Nagelkerke R^2 value suggests that the predictor variables collectively explain 27% of the variance in Taekwondo injuries. Furthermore, the classification accuracy indicates that the model was correct in approximately 70% of the cases.

Table 2. Taekwondo injury location

Location of injury	
Location	**Total n (%)**
Knee	40 (14.3)
Lower leg/Achilles	26 (9.7)
Foot/toe	47 (17.6)
Ankle	55 (20.6)
Hip/groin/buttock	20 (7.9)
Thigh	20 (7.9)
Lower back	16 (6)
Shoulder	8 (3)
Finger/Wrist	8 (3)
Forearm	2 (0.7)
Abdomen	2 (0.7)
Upper back	4 (1.5)
Arm	2 (0.7)
Nose	17 (6.4)

Table 3. Description of injury location by gender. Data are n (%)

Injury	Women	Men
Knee	13 (11.5)	27 (16.4)
Lower leg/Achilles	6 (5.4)	20 (12.1)
Foot/toe	10 (8.9)	37 (22.4)
Ankle	29 (34.8)	26 (15.8)
Hip/groin/buttock	8 (7.1)	12 (7.3)
Thigh	6 (5.4)	14 (8.5)
Lower back	8 (7.1)	8 (4.8)
Shoulder	2 (1.8)	6 (3.6)
Finger/wrist	4 (3.6)	4 (2.4)
Forearm	2 (1.8)	0 (0)
Abdomen	2 (1.8)	0 (0)
Upper back	4 (3.6)	0 (0)
Arm	2 (1.8)	0 (0)
Nose	6 (5.4)	11 (6.7)

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Table 4. Outcomes of univariate logistic regression analysis: Comparing injuries with injury-free

Variable	OR (95% CI)	P
Sex (female [R])	1.33 (0.74-2.34)	0.346
Age	1.04 (0.98-1.10)	0.189
Competitive Aggressiveness and Anger	1.23 (1.11-1.35)	0.000
Sleep quality	1.10 (1.08-1.13)	0.005
Practice experience (Years)		
Up to 2[R]	Reference	
Between 2 and 5	1.78 (0.82-3.86)	0.139
Over 5	2.31 (1.17-4.53)	0.015
Sessions (no/week)		
Up to 3[R]	Reference	
Over 3	4.39 (2.19-8.79)	0.000
Duration (Min/session)		
Up To 60[R]	Reference	
Over 60	1.68 (0.87-3.24)	0.122
Practice time		
Morning	----------	----------
Afternoons	Reference	
Night	1.04 (0.59-1.84)	0.868
BMI		
Normal[r]	Reference	
Overweight	----------	----------
Obese	2.61 (0.69-9.81)	0.155
Having a coach (Yes[r])	0.45 (0.11-1.73)	0.248
Warm-up (yes[r])	1.47 (0.55-3.88)	0.434
Cool-down (yes[r])	1.20 (0.55-2.60)	0.635

Association of competitive aggressiveness and anger, and sleep quality with Taekwondo injuries

The results of the multivariable regression analysis, as presented in Table 5, suggest that aggressiveness and anger, along with other previously identified factors, constitute a risk factor model for Taekwondo injuries. To further explore the relationship between these factors and Taekwondo injuries, a separate multivariable logistic regression analysis was performed, including only aggressiveness and anger, and sleep quality as covariates. The analysis demonstrated that aggressiveness and anger (odds ratio [OR]: 1.23, 95% confidence interval [CI]: 1.11-1.35, p = 0.000) and sleep quality (OR: 1.10, 95% CI: 1.06-1.19, p = 0.005) were significantly associated with Taekwondo injuries. The Nagelkerke R^2 value indicates that these factors together explain 14.2% of the variance in Taekwondo injuries. Additionally, the classification accuracy reveals that this model was correct in approximately 66% of the cases.

Discussion

The objective of the present study was to

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examine the prevalence of injuries among Taekwondo players and explore the association between these injuries and various factors, including psychological factors and sleep quality, among others. Out of the 201 questionnaires analyzed, 118 respondents (58.7%) reported experiencing at least one injury related to Taekwondo. The ankle was identified as the most commonly affected injury location, accounting for 20.6% of reported injuries, followed by the foot/toe at ۱۷٫۶%. Factors such as higher levels of aggressiveness and anger, poor sleep quality, training sessions over three times a week, and training durations exceeding 60 minutes were found to be associated with Taekwondo injuries. The findings highlight the significant roles played by aggressiveness and anger, and sleep quality in the occurrence of Taekwondo injuries.

Epidemiology

Based on a review and meta-analysis article that included 14 studies on the injury epidemiology in Taekwondo athletes, the injury rate has been reported to range from 50% to 79% (33). The results of this research indicate that within the last 6 months, 58.7% of Taekwondo players experienced injuries. The most common injury sites were the ankles, feet, and knees. Consistent with previous studies, lower body injuries are predominant in Taekwondo, with the ankles, feet, and knees being frequently reported as the most common injury locations among Taekwondo players (33, 42-45).

Competitive aggressiveness and anger, and sleep quality

Increased aggression and anger in Taekwondo players have been linked to higher rates of injuries. Aggressiveness is an integral aspect of the atmosphere in sports arenas, often becoming a behavioral norm. Essentially, it is a behavioral and emotional response aimed at causing physical or psychological harm to others (46, 47). Evidence suggests that competitive sports can either reduce or increase aggression levels, which might rise based on how the competition turns out (47, 48). Athletes who compete in individual sports typically experience greater frustration following a defeat compared with those who participate in team sports (49). Winning can generally reduce aggressiveness in athletes, regardless of the sport type (50). However, the nature of the sport can influence this outcome. For instance, children trained in judo did not show increased aggression scores post-training, whereas those trained in other martial arts did display higher levels of aggression (47, 51). Campara et al. demonstrated a significant correlation between all aggression components and overall aggression levels and anxiety levels among individuals involved in combat sports (48). The psychological assessment of taekwondo competitors at the 2011 Australian National Championships indicated possible links between psychosocial factors and the risk of injury (52). Forty-five athletes aged 16 and above filled out a pre-competition survey, which covered demographic details and various questionnaires evaluating four specific psychosocial aspects: significant life events, competition anxiety, coping abilities, and social support. The results indicated that older athletes experienced significantly lower levels of competitive anxiety and expressed greater satisfaction with social support compared to their younger counterparts. Additionally, female athletes reported fewer positive life events than their male counterparts. These findings suggest that younger or less experienced athletes and female athletes may be more susceptible to psychosocial stress, which could potentially increase their risk of injury (52). Recognizing the significant influence of psychological aspects like aggression, anger, stress, pressure, anxiety, and job burnout on injury occurrence and recovery is crucial (47, 53). Implementing appropriate strategies to manage these factors effectively should also be considered.

Previous studies have highlighted that poor sleep quality heightens the risk of injuries among Taekwondo players. This is consistent with broader research indicating that insufficient sleep is a risk factor for sports-related injuries (29-32). While focusing on duration of sleep shows that less than 8 hours per night heightens injury risk in adolescent sportsmen and women, examining

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overall sleep quality provides more insight into sports injuries (29). Adequate sleep quality is essential for muscle repair, concentration, and enhanced rehabilitation and athletic achievement in sports like Taekwondo (30). Conversely, inadequate sleep elevates injury risk and can be exacerbated by existing injuries affecting subsequent sleep patterns (29).

At a physiological level, heightened aggressiveness and anger provoke a sustained sympathetic acute stress response that elevates cortisol and catecholamine levels, fostering chronic muscle tension, delaying tissue repair, and compromising fine motor control, factors that can precipitate strains or missteps during rapid kicking and footwork (54). Concurrently, inadequate sleep disrupts the balance of neuroendocrine hormones by reducing nocturnal growth-hormone secretion critical for muscle synthesis and increasing pro-inflammatory cytokines that impede recovery (55). Sleep loss also impairs key cognitive functions, slowing reaction times, diminishing decision-making capacity, and degrading neuromuscular coordination (28, 55, 56), thereby raising the likelihood of technical errors and injury during high-velocity Taekwondo maneuvers. Together, these intertwined mechanisms illustrate how psychological stress and poor sleep quality synergistically undermine both the physical and cognitive foundations of safe athletic performance.

Table 5. Outcomes of multivariable logistic regression analysis

Injury variables	Taekwondo injuries	Ankle	Foot/toe	knee
Competitive Aggressiveness and Anger	1.23 (1.11-1.36) P = 0.000	1.21 (1.09-1.35) P = 0.001	1.18 (1.05-1.34) P = 0.006	1.17 (1.04-1.32) P = 0.006
Sleep quality	1.12 (1.05-1.38) P = 0.006	1.17 (1.01-1.40) P = 0.001		
Sessions Over 3	4.01 (1.93-8.33) P = 0.000	4.46 (1.90-10.45) P = 0.001	5.69 (2.40-13.48) P = 0.000	3.17 (1.30-7.70) P = 0.011
Duration Over 60	2.27 (1.07-4.84) P = 0.032			
Nagelkerke R2 (%)	26	25..5	30	17.5
Classification Accuracy (%)	70	53	45	46

* for each injury location

* Odds ratio (95% CI) for categorical variables compared to the references specified in Table 3

Training-related factors

The findings indicate that Taekwondo athletes who trained three times a week or more, with sessions lasting over 60 minutes, had a higher incidence of sports injuries in the past six months. This highlights the need for Taekwondo players to potentially scale back on training intensity and prioritize sufficient recovery periods between sessions. Establishing optimal training regimens and grasping the intricate interplay between training intensity and injury susceptibility is crucial (57). Moreover, the study emphasizes the significance of taking into account other factors like body weight, alignment, nutrition, and strength when considering sports injury prevention strategies (58). Additional studies are necessary to investigate the impact of training variables and the unique features of the sport.

Implications

Coaches can proactively reduce injury risk by weaving brief anger-management drills such as guided breathing, muscle relaxation, and mindfulness pauses into warm-up routines, complementing these with scenario-based workshops that help athletes recognize and redirect aggressive impulses. Regular administration of the CAAS allows for personalized feedback and coping strategies, while objective sleep monitoring via wearable actigraphy devices and simple sleep diaries flags poor rest. Tailored sleep-hygiene education emphasizing consistent bedtimes, device

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curfews, and pre-sleep relaxation further supports recovery. By dynamically adjusting training frequency and session duration in response to elevated aggression or sleep quality scores, and collaborating with sport psychologists and sleep specialists, coaches can foster mental resilience, optimize physical recovery, and enhance long-term injury prevention.

Limitations and future research

This study's cross-sectional design limits causal inference, and reliance on self-reported injuries and survey responses introduces potential recall and reporting biases despite the use of validation questions and requests to consult training logs. Future research should employ longitudinal designs, incorporate objective injury verification (e.g., medical records), and explore neurophysiological markers of stress and sleep disturbances in Taekwondo athletes. Such work will clarify causal pathways and inform targeted, evidence-based injury-prevention strategies in combat sports.

Conclusion

In the past six months, 58.7% of Taekwondo players reported experiencing injuries. This study's findings link aggressiveness, anger, and sleep quality to these injuries, which highlight the importance of conducting further research to determine causality. Researchers should focus on longitudinal studies to establish the causal relationships between these factors and injury risk. Clinicians and trainers should consider these psychological and sleep-related factors when developing comprehensive strategies for preventing and managing Taekwondo injuries. Implementing targeted interventions to manage aggression and improve sleep quality may significantly reduce injury rates and enhance overall athlete well-being. By addressing these factors, we can contribute to safer training environments and promote the long-term health and performance of Taekwondo athletes.

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Non

Conflict of interest

The authors declared no conflicts of interest.

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Ethical considerations

The ethics committee of the Faculty of Physical Education and Sport Sciences at the University of Tehran approved the study. Participants gave informed consent after a thorough briefing on the study's goals. They were also informed of their right to withdraw at any time, ensuring their voluntary and autonomous participation.

Code of ethics

The Faculty of Physical Education and Sport Sciences at the University of Tehran Research Ethics Committee granted approval for the study on November 22, 2023, and adhered to the highest ethical standards throughout its execution.

Author Contributions

A.A. M, R. M, and H. G.Z significantly contributed to the conceptualization and design of the study, as well as to the collection, analysis, and understanding of the data. Furthermore, they were tasked with drafting the manuscript and meticulously revising it to ensure substantial intellectual content. All three authors provided final approval for publication and accepted responsibility for every facet of the task; it is essential to ensure that any inquiries concerning accuracy or integrity are effectively resolved.

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