ISSN: 2476-5279; International Journal of Musculoskeletal Pain Prevention. 2025;10(1): 1159-1168.

Factors Associated with Amateur Bodybuilders' Injuries: A Cross-Sectional Investigation on Mental Aspect and Sleep Quality

ARTICLEINFO

Article Type
Original Article

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How to cite this article

Maleki AA, Mousavi SH, Karimizadeh Ardakani M. Factors Associated with Amateur Bodybuilders' Injuries: A Cross-Sectional, Investigation on Mental Aspect and Sleep Quality. Int. J. Musculoskelet. Pain. Prev. 2025; 10(1): 1159-1168.

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10.22034/IJMPP.10.1.1159

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Article History
Received: Nov11, 2024
Accepted: Feb15, 2025
E Published: Mar 20, 2025

ABSTRACT

Aims: This study aims to examine the epidemiology of bodybuilding injuries among amateur bodybuilders and explore the association between mental aspects, sleep quality, and other potential factors with such injuries.

Method and Materials We conducted an internet-based survey gathering data from 320 amateur bodybuilders. These data included personal characteristics, practice routines, Mental Aspects (obsessive passion and exercise motivation), sleep quality, and injuries over the preceding six months. The descriptive analysis and logistic regression were applied to analyze the collected data.

Findings: The findings revealed that 170 participants (53.8%) had experienced at least one injury, predominantly affecting the knee and shoulder in 61 participants (19%), and the finger or wrist in 33 participants (13%). Obsessive passion, sleep quality, and being male were significant risk factors for these injuries. Obsessive passion had an Odds Ratio (OR) of 1.65, sleep quality an OR of 1.07, and male sex an OR of 2.11.

Conclusion: The present study revealed the multifactorial nature of bodybuilding injuries, emphasizing the importance of considering mental aspects and sleep quality in injury prevention and management strategies for bodybuilders.

Keywords: Bodybuilding, Injury, Etiology, Epidemiology, Prevention

Introduction

Weight training encompasses various sports such as weightlifting, powerlifting, and bodybuilding, among others. Among these, bodybuilding stands out as one of the most widely practiced sports globally. Its primary goal is to enhance muscle hypertrophy, strength, and endurance, ultimately aiming for increased muscle mass and body symmetry. The ideal physique in bodybuilding is characterized by minimal body fat, emphasizing a lean and sculpted appearance [1]. Weight training, often known as resistance training, involves using various forms of resistance, such as weights or resistance machines, to strengthen muscles and improve physical fitness. It is a popular form of exercise that can benefit people of all ages and fitness levels, contributing to overall health and well-being [2]. Bodybuilding differs from other weightlifting sports in that it is not primarily evaluated based on the amount of weight lifted or the duration of competition. Instead, the assessment is based on the physical appearance of the athlete. Consequently, bodybuilders engage in intense weight training routines aimed at increasing muscle mass, achieving muscular balance (symmetry), and enhancing muscle density [3]. Due to the high-intensity exercises typically undertaken by these athletes during training sessions, the torque exerted on joints, as well as the shear and compressive forces generated, can be substantial. These factors increase the risk of sustaining bodily injuries [2, 4].

Understanding the root causes of sports injuries is essential for effective injury prevention measures. This involves identifying various risk factors associated with sports-related injuries, which can be categorized into external and

[DOI: 10.22034/IJMPP.10.1.1159]

internal factors. External factors include aspects like the type of activity and environmental conditions, while internal factors encompass physiological and psychological elements [5]. To date, numerous studies have investigated the impact of physical and biomechanical factors on athletes' susceptibility to injury. However, there has been relatively less exploration into the correlation between the psychological attributes of athletes and injuries, particularly in the realm of bodybuilding.

Understanding the psychological factors that impact sports injuries can significantly contribute to the development of effective injury prevention strategies [6]. Studies have indicated that psychological and personality factors may elevate the likelihood of sports-related injuries even more than physical and environmental factors. This is because achieving success in sports is not solely contingent upon physical health and fitness but also heavily relies on an individual's mental preparedness and resilience [7]. In a prospective study conducted by Steffen et al., it was demonstrated that stress levels and the perceived team atmosphere regarding skill have a notable correlation with the likelihood of new injuries among female soccer players [8]. Kleinert also observed a correlation between an individual's psychological and personality traits and the likelihood of sustaining injuries. Specifically, Kleinert identified two key factors contributing to injury occurrence: deficiencies in the psycho-physiological process, such as attention deficits and extremes in arousal levels, as well as inadequate decision-making or risk management skills [9]. Mousavi et al. reported the effect of mental aspects and sleep quality on lower limb injuries in recreational runners [10].

The mental aspect, particularly attitudes like passion, has garnered growing interest in sports research, given its potential impact on sports-related injuries [11]. Passion is defined as a strong drive towards an activity that people like [12]. Those with obsessive passion continue their activity regardless of their ability, loading capacity, and sufficient recovery. Bodybuilders with obsessive passion may neglect minor pains and continue training with minor injuries, leading to more severe and difficult-to-treat gradual-onset (overuse) injuries [12]. A compulsive and passionate mindset is noted to have a positive correlation with sports-related injuries [8, 11-13].

Optimal sleep quality plays a crucial role in the recovery process, focusing on musculoskeletal health, both of which are essential for enhanced performance. Conversely, inadequate sleep quality hampers musculoskeletal recovery, reaction time, mood, and cognitive functions, and raises the likelihood of injury [14, 15]. Several studies report that a lack of sleep is associated with an increased risk of sports injuries [15-18]. Although no research has specifically explored this correlation within the bodybuilding community, understanding the prevalence of factors contributing to injuries among bodybuilders can greatly inform the development of more effective prevention and treatment strategies. Exploring the potential link between mental aspects, sleep quality, and injuries among bodybuilders provides valuable insights into the role of these factors in injury occurrence. Therefore, this study aims to investigate the association between injury prevalence among amateur bodybuilders and various factors, including mental aspects, sleep quality, personal characteristics (e.g., age, weight, height), exercise-related factors(e.g., training history, duration, frequency, presence of a coach, training program, warm-up and cool-down practices, participation in other sports) and injury history. Our hypothesis posits that mental aspects and sleep quality are linked to injuries in bodybuilders, with higher levels of obsessive passion and motivation for exercise, coupled with poorer sleep quality, correlating with increased reports of injuries among bodybuilders.

Method and Materials

This study employs a cross-sectional survey methodology to investigate the prevalence of injuries among amateur bodybuilders and identify potential risk factors associated with these injuries. Data were collected through an

[DOI: 10.22034/IJMPP.10.1.1159]

online procedure.

In this study, 320 Iranian amateur bodybuilders, including 187 men and 133 women, aged between 18 and 40 years, with a mean age of 26±6 years, were selected through Morgan's table. Amateur bodybuilders were recruited through various methods, including social media platforms, university sports and health departments, sports clubs, gyms, and sports stores in Iran. An amateur bodybuilder was defined as an individual who had engaged in bodybuilding activities using equipment and following training principles, under the guidance of a trainer or instructional materials such as wall charts, without the aim of competing or preparing for competitions. Additionally, they must train consistently for a minimum of 9 months before completing the questionnaire, with a frequency of at least 2 to 3 times per week [19].

For data collection, a questionnaire was developed in Farsi using Google Forms, and an electronic link to the online questionnaire was generated. This link was then shared with bodybuilders through various Online communication platforms, including WhatsApp, Telegram, and Instagram. The questionnaire included two main sections. The first section was about 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, participation in other sports). The second section focused on recording any injuries experienced by the athletes over the past 6 months. This section utilized a diagram of the human body, divided into 82 numbered points representing various upper and lower body areas. Athletes were instructed to mark any points or areas where they had experienced pain, discomfort, or new musculoskeletal issues during bodybuilding training. Injuries were defined as any physical complaint resulting from exercise training that led to one or more of the following: (1) complete cessation of exercise and routine physical activities for at least 1 week, (2) modification of regular exercise activities in terms of duration, intensity, or mode for at least 2 weeks, or (3) any physical complaint necessitating consultation with a healthcare professional [20]. The online questionnaire also included the following instruments.

Obsessive passion for bodybuilders: Which was measured using the passion scale developed by Vallerand et al. (12). The validity and reliability of this questionnaire in Farsi have been proven (Cronbach's alpha = 0.86) [21] The obsessive passion scale consists of six items, such as "I have almost an obsessive feeling for training" and "If I could, I would only train." Participants rated their agreement with each statement on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The total score, reflecting the degree of obsessive passion, was computed as the mean of the scores for all six items, with higher scores indicating greater levels of obsessive passion.

The Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) was used to measure motivation to exercise, which was previously validated as an Iranian version of the BREQ-2 in a study [22]. This scale included 19 items assessing five subscales of motivation: external regulation, introjected regulation, identified regulation, and intrinsic regulation. The relative autonomy index (RAI) calculated the score of these subscales, with a higher RAI score indicating a higher level of intrinsic motivation.

The other instrument was the Pittsburgh Sleep Quality Index (PSQI), a valid and reliable questionnaire used to measure sleep quality [23]. This scale comprises 19 items that assess seven aspects of sleep, including sleep quality, duration, latency, efficiency, disturbances, use of sleep medication, and daytime dysfunction. This scale generates a composite score reflecting sleep quality and quantity, ranging from 0 to 21, where higher scores indicate poorer sleep quality. The validity and reliability (Cronbach's alpha = 0.78) of the Iranian version of PSQI were approved in a previous study [24].

Using IBM SPSS Statistics version 26, the data were analyzed through mean and standard deviation for quantitative variables and frequency and percentages for qualitative variables. Non-parametric tests, such as the

[DOI: 10.22034/IJMPP.10.1.1159]

Mann-Whitney U test and the Chi-square test, were employed to compare data between bodybuilders with and without a history of injury, as no quantitative variables followed a normal distribution. To mitigate errors from multiple significance testing, the significance level was adjusted using Bonferroni correction. A univariate logistic regression analysis was performed to test the potential association between each variable and the presence of an injury. Variables with a p-value less than 0.20 in the univariate analysis were subsequently included in the multivariable logistic regression model [10]. In the multivariable logistic regression model, backward elimination was used, retaining variables if their associated p-value in the multivariable model was less than 0.05. Only modifiable factors were included in the multivariable logistic regression analysis. To ensure that there is no multicollinearity among the independent variables and to improve model fitting, multicollinearity was assessed by examining the Variance Inflation Factor (VIF). The highest VIF was 1.4, indicating the absence of multicollinearity effects (typically, VIF values exceeding 3 suggest the presence of multicollinearity issues) [25]. We reported the results as odds ratios (OR) and 95% Confidence Interval (CI). The OR in categorical variables represents the change in odds of injury relative to the referenced category.

Findings

Out of the 335 bodybuilders who participated in the questionnaire, 15 were excluded due to inaccurate data, including failure to meet the eligibility criteria. The characteristics of the bodybuilders are presented in Table 1, categorized into two groups based on their injury history. Among the bodybuilders, 58% (n = 187) were male. Those who reported experiencing an injury showed notably higher levels of obsessive passion for bodybuilding and scored lower on sleep quality (indicating poorer sleep quality). The majority of bodybuilders (70%) had less than 5 years of experience in bodybuilding, while 57% and 54% reported engaging in bodybuilding sessions lasting over 60 minutes and more than 3 sessions per week, respectively. About 53.1% of bodybuilders had a BMI falling within the healthy range (18 < BMI < 25), and 42% participated in other sports. Additionally, 53% of bodybuilders did not have a coach, while 52% held a bachelor's degree or higher. Most participants reported incorporating warm-up exercises (96%) and cool-down exercises (70%) into their routines.

Out of the 320 bodybuilders surveyed, 172 participants (53.8%) reported experiencing at least one injury within the last six months. Among them, 117 participants (40%) reported multiple injuries, with 89 participants reporting two injuries and 28 participants reporting three injuries. In terms of gender distribution, 108 participants (63%) of male bodybuilders and 64 participants (37%) of female bodybuilders reported at least one injury. The knee and shoulder were the most commonly reported injury locations, accounting for 19% of all injuries, followed by the finger and wrist, which accounted for 13% of reported injuries. Refer to Table 3 for the breakdown of injury locations by gender.

Continuous data are expressed as mean and standard deviation (tested by the Mann-Whitney test). All categorical data are expressed by the number of runners and percentages (using the Chi-square test). The bold p-value shows the statistically significant difference between those with and without an injury history. The distribution of Bodybuilding injury location in participants' bodies is shown in Table 2. Furthermore, the differences in these injuries based on gender were shown in Table 3. The multivariable regression analysis results presented in Table 5 demonstrate that mental aspects, sleep quality, and other aforementioned factors constitute a model of risk factors associated with bodybuilding injuries. To further explore the association between these factors and bodybuilding injuries, a separate multivariable logistic regression analysis was conducted, with only mental aspects and sleep quality included as covariates. The findings indicated that obsessive passion (odds ratio [OR]: 1.58, 95% confidence interval [CI]: 1.19-2.10, p = 0.001) and sleep quality (OR: 1.08, 95% CI: 1.03-1.13, p = 0.001) were

[DOI: 10.22034/IJMPP.10.1.1159]

Table 1) Bodybuilder's characteristics (comparing characteristics between bodybuilders with injury history and those without injury history)

Variable		Total bodybuilders	Bodybuilders with injury history	Bodybuilders without injury history	P-value
Sex	Female N(%)	133 (41.6)	64 (37.2)	69 (46.6)	
	Male, N (%)	187 (58.4)	108 (62.8)	79 (53.4)	0.111
Total		320 (100)	172(53.8)	148(46.2)	
Age (years)		26(6)	27(5.9)	25(6)	0.008
Obsessive passion		5.1(91)	5.3(89)	4.9(89)	≤0.0001
BREQ-2		11.1(86)	11.2(86)	10.9(85)	0.11
Sleep Quality		10.1(4.9)	10.9(4.8)	9.1(4.7)	≤0.001
Bodybuilding experience (years)		5(4)	5(4)	4(4)	0.84
Up to 2		128(40)	63(36.6)	65(43.9)	
Between 2 - 5		95(29.7)	50(29.1)	45(30.4)	0.217
Over 5		97(30.3)	59(34.3)	38(25.7)	
Bodybuilding sessions (No/week)		3(1)	4(1)	3(1)	0.039
Up to 3		146(45.6)	71(41.3)	75(50.7)	0.092
Over 3		174(54.4)	101(58.7)	73(49.3)	
Bodybuilding duration (min/session)		80(25)	81(25)	77(25)	0.182
Up to 60		138(43.1)	68(39.5)	70(47.3)	0.162
Over 60		182(56.9)	104(60.5)	78(52.7)	
Practice time					
Morning		55(17.2)	37(21.5)	18(12.2)	0.015
Afternoon		123(38.4)	55(32)	68(45.9)	
Night		142(44.4)	80(46.5)	62(41.9)	
BMI (kg/m2)		25(0.3)	25(0.4)	24(0.3)	0.83
Normal		174(54.4)	84(48.8)	90(60.8)	
Overweight		113(35.3)	67(39)	46(31.1)	0.091
Obese		33(10.3)	21(12.2)	12(8.1)	
Bodybuilding company	Group,	41(12.8)	22(12.8)	19(12.8)	0.909
	Alone,	279(87.2)	150(87.2)	129(87.2)	
Following a Bodybuilding program	No	29(9.1)	15(8.7)	14(9.5)	0.819
	Yes	291(90.9)	157(91.3)	134(90.5)	
Having a coach	No	171(53.4)	94(54.7)	77(52)	0.639
	Yes	149(46.6)	78(45.3)	71(48)	
Other sports	No	186(58.1)	94(54.7)	92(62.2)	0.175
	Yes	134(41.9)	78(45.3)	56(37.8)	
Warm-up	Yes	308(96.3)	169(98.3)	139(93.9)	0.42
	No	12(3.7)	3(1.7)	9(6.1)	
Cool down	Yes	225(70.3)	123(71.5)	102(68.9)	0.613
	No	95(29.7)	49(28.5)	46(31.1)	

Table 2) Distribution of Bodybuilding injury location of participants' bodies

Body Location of Injury	
Location	Total N (%)
Knee	55(19)
Lower leg/Achilles	9(3.1)
Foot/toe	3(1)
Ankle	8(2.8)
Hip/groin/buttock	16(5.5)
Thigh	22(7.6)
Lower back	38(13.1)
shoulder	55(19)
finger/wrist	39(13.5)
elbow	11(3.8)
forearm	3(1)
upper back	10(3.5)
Arm	9(3.1)
Chest	7(2.4)
Abdomen	4(1.4)

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Table 3) Description of injury location by gender.

Injury	Women N (%)	Men N (%)
Knee	20(17.7)	35(20)
Lower leg/Achilles	3(2.7)	6(3.4)
Foot/toe	2(1.8)	1(0.6)
Ankle	4(3.5)	7(4)
Hip/groin/buttock	8(7.1)	7(4)
Thigh	8(7.1)	14(8)
Lower back	15(13.3)	23(13.1)
shoulder	16(14.2)	39(22.3)
finger/wrist	16(14.2)	20(11.4)
elbow	5(4.4)	6(3.4)
forearm	1(0.9)	2(1.1)
upper back	6(5.3)	4(2.3)
Arm	4(3.5)	4(2.3)
chest	3(2.7)	4(2.3)
Abdomen	2(1.8)	3(1.7)

The findings of the univariate logistic regression analysis comparing injury versus injury-free bodybuilders are presented in Table 4.

Table 4) Univariate logistic regression analysis, injury versus injury-free bodybuilders

Variable	OR (95% CI)	P
Sex(Female [R])	1.47(0.94-2.30)	0.089
Age	1.04(1.-1.08)	0.034
Obsessive passion	1.62(1.25-2.09)	0.000
BREQ-2	1.39(1.08-1.81)	0.011
Sleep Quality	1.08(1.08-1.13)	0.001
Bodybuilding Experience (years)		
Up to 2[R]	Reference	
Between 2 - 5 years	1.14(0.67-1.95)	0.614
Over 5 years	1.60(0.93-2.73)	0.084
Training sessions (No/pw)		
Up to 3[R] session	Reference	
Over three sessions	1.46(0.93-2.27)	0.093
Bodybuilding duration (min/session)		
Up to 60[R] minutes	Reference	
Over 60 minutes	1.37(0.88-2.14)	0.163
Practice time		
Morning[R]	Reference	
afternoon	0.39(0.20-0.76)	0.006
Night	0.62(0.32-1.20)	0.163
BMI		
Normal[R]	Reference	
Overweight	0.60(0.09-3.68)	0.581
Obese	1.04(0.17-6.46)	0.960
Bodybuilding company (alone [R])	0.99(0.51-1.92)	0.990
Following a Bodybuilding program(yes[R])	0.91(0.42-1.96)	0.819
Having a coach(yes[R])	1.11(0.71-1.72)	0.636

a (References)

associated with bodybuilding injuries. The Nagelkerke R2 value suggests that these factors can collectively explain 10% of the variance in bodybuilding injuries. Furthermore, the classification accuracy indicates that this model was correct approximately 62% of the time.

Discussion

The present study aimed to examine the prevalence of bodybuilding injuries among bodybuilders and explore the relationship between these injuries and various factors, including mental aspects, sleep quality, and other potential risk factors. In this study,

[DOI: 10.22034/IJMPP.10.1.1159]

factors such as higher levels of obsessive passion, poorer sleep quality, and gender were found to be associated with bodybuilding injuries. Our findings highlight

Table 5) Multivariable logistic regression analysis* for each injury location

Injury Variables	Bodybuilding injuries	Knee	Shoulder	Lower back	Finger/wrist
Sex	2.11 (1.21-3.67) P=0.008*	2.86(1.21-6.75) P=0.016*	2.40(1.19-4.83) P=0.014*	2.66(1.03-6.83) P=0.042*	
Age		1.07(0.88-0.98) P=0.010*			1.07(1.01-1.13) P=0.010*
Obsessive passion	1.65(1.26-2.17) P=0.000*	1.55(1.06-2.27) P=0.022*	2.01(1.35-3) P=0.001*		1.58(1.03-2.41) P=0.035*
Sleep Quality	1.07(1.02-1.13) P=0.005*		1.11(1.04-1.19) P=0.002*	1.10(1.02-1.19) P=0.007*	
afternoon	0.33(0.15-0.72) P=0.005*	0.19(0.06-0.58) P=0.004*	`	0.22(0.06-0.79) P=0.020*	
Warm-up	0.23(0.05-0.98) P=0.047*				
Nagelkerke R2 (%)	18	18	19	17	13
Classification accuracy (%)	65.6	74	76	80	78.3

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

the significant roles played by mental aspects and sleep quality in the occurrence of bodybuilding injuries, collectively accounting for half of the total variance attributed to all factors.

Regarding epidemiology, the prevalence of bodybuilding injuries within the preceding six months was found to be 53.8%. This figure aligns with earlier research on injury rates among amateur bodybuilders, which has reported prevalence rates ranging from 45% to 83% [1, 3, 26]. The frequency of reported injuries and the criteria used to define injuries can influence the reported incidence rates. The lower back was the most frequently reported area of injury among both beginner (63.04%) and elite (52.31%) bodybuilders. Following lower back injuries, other commonly reported injuries included those to the shoulder, chest, finger, and wrist [1]. Shoulder and knee injuries are prevalent among both men and women, with men experiencing higher severity of injuries compared to women [26].

Regarding mental aspects and sleep, a stronger obsessive passion for bodybuilding was linked to increased odds of experiencing bodybuilding injuries. Essentially, individuals who approach bodybuilding with a more obsessively passionate attitude are more prone to reporting injuries related to bodybuilding. Previous research has indicated that mental factors like harmonious passion, obsessive passion, and mental detachment could influence the occurrence of injuries [27-29] and injury rehabilitation [30] Mental aspects influence training variables such as the training load that a bodybuilder could tolerate before incurring an injury [31] Obsessive passion for bodybuilding served as a robust driving force for training; bodybuilders persist in their training routines regardless of their physical capabilities and limitations [12]. Our analysis revealed that the impact of obsessive passion became notable when comparing bodybuilders who reported multiple injuries to those with a single injury. Those reporting multiple injuries exhibited significantly higher levels of obsessive passion compared to those with only one injury. This suggests that obsessive passion compels bodybuilders to persist in training even when

[DOI: 10.22034/IJMPP.10.1.1159]

they are injured.

Previous studies have highlighted that poor sleep quality is associated with an increased risk of bodybuilding injuries. In essence, bodybuilders who were experiencing poorer sleep quality were more prone to reporting injuries related to bodybuilding. This aligns with findings from other research that have identified insufficient sleep as a risk factor for sports-related injuries [15-18]. When focusing solely on sleep duration, a study revealed that getting less than 8 hours of sleep per night is correlated with a heightened risk of injuries among adolescent athletes [15]. Investigating sleep quality, which encompasses various aspects of sleep as assessed in our study, appears to be more pertinent for studying sports injuries compared to solely examining sleep duration. Adequate sleep quality is crucial for facilitating muscle adaptation and repair, as well as enhancing concentration [16]. This leads to enhanced recovery and performance in sports endeavors such as bodybuilding. Conversely, inadequate sleep quality elevates the risk of sustaining injuries [15]. One should recognize that being injured can contribute to poor sleep quality.

According to training-related factors, this study showed that afternoon training sessions may potentially lower the risk of sports injuries compared to morning sessions (OR 0.19_0.33). While there is also a trend suggesting the same for night training, further investigation is necessary to confirm its significance. Studies propose that training in the afternoon might expand the range of diurnal fluctuations in neuromuscular function [32].

Based on demographic factors, the findings reveal a notable gender difference in the likelihood of sports injuries. In this regard, males had a significantly higher risk (OR 2.11-2.66) compared to females. This aligns with the results of a systematic review encompassing 20 studies, which included injury data from various sports such as soccer, rugby, handball, basketball, field hockey, and volleyball. Across these studies, a consistent pattern emerged, indicating a higher incidence of injuries among male players compared to females [33].

Despite the study's strong points, some limitations should be considered. It's essential to interpret our survey findings with caution. This study employed a cross-sectional design, which made it challenging to establish causal relationships between risk factors and bodybuilding injuries. Additionally, there was a potential for recall bias, as all data were collected via self-reported questionnaires, and injuries were also self-reported. To mitigate this bias, we provided clear definitions for each type of bodybuilding injury. This study investigates the relationship between mental aspects and sleep quality regarding bodybuilding injuries. Given the associations found, future prospective studies among amateur bodybuilders are needed to confirm whether these factors truly pose risk factors for bodybuilding injuries.

As a practical implication, it's suggested that to prevent and manage bodybuilding injuries, it's crucial to consider mental aspects and sleep alongside training-related factors. We suggest implementing personalized training programs that incorporate counseling to raise awareness about the potential risks associated with an obsessive passion for bodybuilding, as well as the significance of obtaining sufficient and quality sleep. Encouraging passionate bodybuilders to engage in educational programs can help them integrate training more harmoniously. Harmonious passion fosters flexible persistence, enabling individuals to maintain full control over their activities and adjust or halt training when encountering adverse conditions [34]. Several studies have reported exercise and nutritional interventions as effective modalities for improving sleep quality [35-37]. These interventions may help enhance bodybuilders' sleep quality.

Conclusion

Our findings regarding the correlation between mental aspects and sleep quality in relation to these injuries emphasize the need for further research to establish causality. It's recommended that researchers and clinicians consider these factors when devising strategies for preventing and managing bodybuilding injuries.

[DOI: 10.22034/IJMPP.10.1.1159]

Acknowledgments

The authors of this study would like to thank all participants who took part in this study.

Authors' contributions: All authors helped in the conception and design of the study. Furthermore, they contributed to drafting the original manuscript, reviewing and editing it. All authors approved the final version of the manuscript for publication.

Conflict of interest: The authors declared no conflicts of interest.

Ethical considerations: The authors have thoroughly considered the moral implications of conducting this study. All participants provided written consent to take part in this study. The research was conducted by the principles outlined in the Declaration of Helsinki. The study protocol received approval from the Research Ethics Committee of the Faculty of Sport Sciences and Health, University of Tehran, Tehran, Iran, with the following ethical code. (IR.UT.SPORT.REC.1403.008).

Funding: This research did not receive any funding from public, commercial, or non-profit funding agencies.

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[DOI: 10.22034/IJMPP.10.1.1159]