Effects of sleep quality on internal-external anxiety in elite shooters before competitions

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The study aimed to identify the relationship between sleep and anxiety from a new perspective of controlling anxieties and investigating the effects of sleep. The subjects of this study were 76 elite shooting athletes, including members of the national team. The Hamilton Anxiety Scale was used to measure the competition anxiety and quality of sleep was measured using PSQI of the shooters. As a result of the analysis, it was found that sleep quality affects intrinsic anxiety. The effect of sleep quality on intrinsic anxiety was approximately 18% (R2=18.1). Thus, it was confirmed that sleep quality affects intrinsic anxiety. Therefore, the results of this study suggested that the shooters' sleep quality has a negative effect on athletes' anxiety during competitions.

KEY WORDS: Anxiety, Competion, Sleep.

Introduction

The anxiety experienced by athletes during competitions is a major factor hindering successful results and the effect of anxiety on competition is tremendous (Blasquez et al., 2009, Mateo et al., 2012, Morales et al., 2012). Traditionally, anxiety is defined as an unpleasant emotional reaction (irritability, tension, worry, concern, etc.) and can be a factor that interferes with the match by inducing the arousal of the autonomic nervous system (Chung, and Kim, 1999; Martens et al., 1990, Hwang, 2018). The view on the negative impact of anxiety in competitions is still strong. Undoubtedly, anxiety is one of the most independent psychological factors that must be controlled and overcome to achieve successful results. If a fundamental emotion such

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as anxiety is not experienced, it may be perceived as a maladaptive factor of the environment. So, how can the anxiety experienced by shooters in competitions be controlled or overcome? The cause of anxiety experienced by players during competitions are varied. Anxiety that affects competitors can range from disposition (Bienvenu et. al, 2001) and pursuit (Hwang, and Kim, 2015), previous experiences of failure such as injury (Choi, Kim, and Lee, 2018), and self-confidence (Vealey, 1986). competencies (Ommundsen and Pederson, 1999), and repeated mistakes resulting from anxieties. It may be caused by environmental factors such as an opponent's skill level, a referee's decision, or the weather. Therefore, studies have been conducted to eliminate the cause of anxieties or regulate the response to it.

Therefore, based on the control model of anxiety of Melelliu et al. (2003), Carver and Scheier (1988), and Jones et al. (1995), the process of controlling and overcoming anxiety is an important approach to achieving tasks successfully. The reason for exploring factors influencing anxiety is that anxiety affects the onset and maintenance of several psychological disorders (Ehring and Watkins, 2008). Recently, it has been studied as cognitive vulnerability acting on manic symptoms (McEvoy et al., 2018), non-suicidal self-harm (Richmond, Hasking, and Meaney, 2017), and paranoid thinking (Freeman et al., 2012) (Lee, and Hwang, 2021). The former is a rumination that occurs in depression, and the latter is a worry that occurs when feeling anxious. They share many attributes as repetitive cognitive activities (Watkins, Moulds, and Mackintosh, 2005).

The perspective on the causes affecting anxiety recently changed from the cognitive-behavioral approach to the qualitative experience of sleep. The quality of sleep is a subjective evaluation of one's sleep pattern, and a comprehensive indicator, such as the time it takes to fall asleep and the number of times one wakes up during sleep (Buysse et al., 1989; Jang, 2021). Studies examining the relationship between sleep and anxiety reported that the latter was strongly associated with sleep quality (Fuller et al., 1997; Horvath et al., 2016; Ramsawh et al., 2009). Particularly, it was suggested that low sleep quality resulted in stronger expressions of anxiety. Therefore, it is necessary to study the effects of sleep on controlling and overcoming anxiety during competitions, such as riflery, that require absolute psychological stability. Athletes' experiences due to anxiety can be defined as a widespread, very unpleasant, and inexplicit and is accompanied by physical and behavioral symptoms. Physical symptoms include hyperactivity of the autonomic nervous system such as chest palpitations, increased blood pressure, tachycardia, sweating, hyperreflexia, dilated pupils, tremors, gastrointestinal disorders, and frequent urination. Behavior-

al symptoms include irritability and muscle cramps. Surprisingly, an imbalance in breathing can have a major impact on shooting performance. Therefore, symptoms of psychological and physical anxiety negatively affect the shooter's concentration and eventually become the main cause of hindering success. Therefore, this study aimed to identify the relationship between sleep and anxiety from a new perspective of controlling anxieties and investigating the effects of sleep.

Method

Participants

The subjects of this study were 76 elite shooting athletes, including members of the national team. The participants included 28 individuals who were members of the Korean national team for about two years, from 2020 to 2021, and the type of firearms were air rifles, air pistols, and shotguns. Among them, 26 players had poor sleep quality (5 points or higher), and 50 players had good sleep quality (less than 5 points).

Measurements

The Hamilton Anxiety Scale was used to measure the competition anxiety of the shooters. Hamilton developed the scale in 1959 as a test to measure the level of anxiety according to situations, and its validity and reliability have been proven. It consists of 14 items, and each item is evaluated using a Likert scale (0=none, 1=mild, 2=moderate, 3=severe, and 4=severely dysfunctional). The total score ranges from 0 to 56 and consists of two anxiety symptoms: mental and physical. Higher scores indicate higher anxiety symptoms. In this study, the Cronbach alpha of psychological anxiety was 0.751, and the Cronbach' α coefficient of physical anxiety was 0.830. The total Cronbach alpha of Hamiltonian anxiety was reliable as 0.814). The Korean version of the Beck Anxiety Inventory (BAI) developed by Beck et al., and adapted by Kwon, was used to evaluate the anxiety levels of office workers. The BAI consists of 21 items, ranging from 0 to a maximum of 63 on a scale of 0 to 3 for each question; a higher score means a higher level of anxiety. Cronbach's alpha in this study was 841.

The quality of sleep was measured using PSQI-K, which was adapted by Sohn et al. (2012) after translating the Pittsburgh Sleep Quality Index (PSQI) developed by Buysse et al. (1989) into Korean and verifying the reliability and validity. PSQI is a questionnaire consisting of 19 items in 7 categories, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each score ranges from 0 to 3, and the total score ranges from 0 to 21, with a score of 5 or higher indicating that sleep is disturbed. A higher score means poor quality of sleep. Cronbach's alpha in the previous study on the sleep quality questionnaire was 0.80, and Cronbach's alpha in this study was 0.717.

The data analysis was conducted using Windows SPSS/PC Ver. 21.0 statistical program and presented the mean and standard deviation. First, the independent variable T-test was conducted to examine the difference in anxiety according to the level of sleep quality. Second, correlation analysis was performed to examine the relationship between sleep quality and anxiety, and multiple regression analysis was performed to examine factors that determine sleep quality. All statistical significance levels were α=0.05.

Results

The results of analyzing the difference in anxiety according to the level of sleep quality are shown in Table I below.

As shown in Table I, by examining the difference in anxiety according to the level of sleep quality, the group with poor sleep quality (47.61±17.85) showed higher intrinsic anxiety than the group with good sleep quality (34.52±11.19). Third, in terms of psychological anxiety, the group with poor sleep quality (8.69±3.79) showed higher anxiety than the group with good sleep quality (5.96±3.76). However, a difference in physical anxiety was not recorded.

RELATIONSHIP BETWEEN SLEEP AND ANXIETY.

Correlation analysis was performed on sleep quality, intrinsic anxiety, and psychological and physical anxiety to investigate the effects of sleep on anxiety. The results are shown in Table II.

As a result of the analysis, sleep quality was found to be correlated with intrinsic anxiety (r=.425), psychological anxiety (r=.402), and physical anxiety (r=.367). These results indicated that poorer sleep quality resulted in higher intrinsic, psychological, and physical anxiety.

TABLE I
The difference in anxiety depending on the sleep quality

Variable	Poor		Good		t	p
	Mean	**Deviation**	**Mean**	**Deviation**		
Intrinsic anxiety	47.61	17.85	34.52	11.19	2.779	.009
Psychological anxiety	8.69	3.79	5.96	3.76	2.111	.042
Physical anxiety	8.15	5.88	6.08	4.29	1.239	.223

TABLE II
Correlation Between Sleep Quality And anxiety.

Variable	Sleep quality	Intrinsic anxiety	Psychological anxiety	Physical anxiety
Sleep quality	1			
Intrinsic anxiety	.425**	1		
Psychological anxiety	.402*	.668**	1	
Physical anxiety	.367*	.820**	.646**	1

Multiple regression analysis was performed to confirm the impact of sleep on anxiety. The results are shown in Table III.

As a result of the analysis, it was found that sleep quality affects intrinsic anxiety. The effect of sleep quality on intrinsic anxiety was approximately 18% (R^2=18.1). These results suggest that intrinsic anxiety is closely related to sleep because when sleep quality is poor, intrinsic anxiety increases.

TABLE II
Multiple Regression Analysis Of Sleep Quality On Anxiety.

Independent variable	Dependent variable	R	R²C	Beta	t	Sig
Sleep quality	Intrinsic anxiety	.425	.181	.425	2.820	.008

Discussion

The importance of the relationship between sleep and anxiety has been demonstrated in studies to identify specific psychological disorders in individuals (Turvey et al., 2002; Goldstein et al., 2008; Wong et al., 2016). Insomnia is negatively correlated with achieving tasks in previous studies (Jansson and Linton, 2006) and additionally, affects daytime activities, which can cause deterioration of various cognitive functions, such as concentration and memory, resulting in reduced job efficiency (Fortier-Brochu et al., 2013). Therefore, the comprehensive evaluation and management of insomnia in office workers are crucial from a social point of view. Furthermore, insomnia is a symptom that appears in depression and anxiety, and the relationship be-

tween these factors has been studied repeatedly. Therefore, this study examined the effects of the shooters' sleep quality on anxiety during competitions. The analysis revealed that according to sleep quality there were significant differences in intrinsic and psychological anxiety, but not in physical anxiety. A study on the relationship between sleep and emotion reported that sleep is a major factor in anxiety. In particular, examining the effect of emotion on performance (Beedie, Terry, and Lane, 2000) provided evidence that inappropriate sleep can increase anxiety, considering the burnout experienced by athletes while exerting and recovering during games (Hassan, 2018). The result was similar to the study on sleep quality and anxiety caused by Covid-19 (Dian-Jeng et al., 2020). In other words, the emotional change in anxiety about the game, the cancellation of international competition due to the pandemic, and the pressure of a successful match were the main factors that contributed to the close relationship between sleep and anxiety. Consequently, sleep was closely related to anxiety, particularly to intrinsic anxiety. Research explaining the relationship between sleep and anxiety (Christoph et al., 2020; Rossi et al., 2020; Jang, 2021) reported differences in results depending on cultural and regional characteristics. As a result of comparing overseas and domestic patients, approximately 19~21% of the population experienced anxiety, and 7~16% experienced moderate or more severe insomnia, which can be interpreted as intrinsic anxiety that influences competition anxiety when explaining the relationship between sleep and anxiety. The effect of sleep quality on stable intrinsic anxiety is more concerning than competition-related anxiety. We can speculate that subjects with poor sleep quality amplify intrinsic anxiety while maintaining a high state of instability and arousal (Nyer et al., 2013). Therefore, the quality of sleep experienced by athletes before a competition is a key factor. The quality of sleep from the night before can be an important clue to predict the psychology and emotions of the next day (Franzen, Siegle, and Buysse, 2008; Scott and Judge, 2006; Totterdell et al., 1994). A positive sleep quality, results in higher life satisfaction (Shin, Kim and Lim, 2017). People who experience psychological difficulties, such as depression and anxiety, report sleep problems (Alfano and Gamble, 2009; Wulff et al., 2010) and low quality of sleep among adolescents in South Korea was a factor affecting mental health, causing anxiety and depression (Yoon, 2016). A study on Scottish adolescents found that poor sleep quality was positively correlated with depression and anxiety, and negatively correlated with self-esteem (Woods and Scott, 2016).

These results suggest that sleep influences anxiety, negatively affecting shooters' performance. Based on these results, it can be predicted that improving sleep quality has positive effects on anxiety control. In particular,

by understanding the relationship between sleep and anxiety, we can expect more successful results from the shooters.

Conclusions

The purpose of this study was to investigate anxiety control and improve performance through the relationship between sleep quality and anxiety experienced by 76 elite shooting athletes during competitions. The conclusions of this study are presented below.

First, by examining the difference between anxiety and the level of sleep quality, the group with poor sleep quality showed higher levels of intrinsic and psychological anxiety, except for physical anxiety.

Second, analyzing the correlation between sleep quality and intrinsic, psychological, and physical anxieties, anxiety positively correlated with sleep quality. In other words, poor quality of sleep resulted in higher levels of anxiety.

Third, it was confirmed that sleep quality affects intrinsic anxiety. Therefore, the results of this study suggested that the shooters' sleep quality has a negative effect on athletes' anxiety during competitions.

Acknowledgments

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