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# Effectiveness of emotional freedom technique on competition anxiety and salivary cortisol of elite taekwondo athletes

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## ABSTRACT

**Purpose of the study:** In competitive sports, athletes may experience impaired mental and physical function due to experiencing a series of negative emotions. Therefore, the aim of the present study is to determine the effectiveness of emotional freedom technique (EFT) on the psychological and physiological responses of competitive anxiety in elite taekwondo athletes.

**Methods:** This study included 29 elite male taekwondo practitioners in Tehran province who were selected by convenience sampling and randomly divided into groups of control (16 participants) and intervention (13 participants). In the pre-test (first competition), the cognitive components of competitive anxiety (cognitive anxiety, self-confidence and physical anxiety) and the physiological component of salivary cortisol of both groups were measured. The experimental group did 10 sessions of EFT training and the control group did only physical training. After the EFT intervention, the post-test (second competition) was taken. Data analysis was used in SPSS 22.

**Results:** After EFT intervention, the intervention group compared to control group, had a decrease in the components of cognitive anxiety, somatic anxiety and salivary cortisol, as well as an increase in the component of self-confidence.

**Conclusion:** EFT might be a useful tool for reducing the physiological and psychological anxiety of elite male taekwondo athletes. Thus it is suggested that sports psychologists and coaches use EFT to reduce the cognitive and physiological components of competitive anxiety in athletes.

**Keywords:** Emotional freedom technique, Salivary Cortisol, Competitive State Anxiety, Elite taekwondo players

**Conflict of interests:** the authors declare no conflict of interest.

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## Влияние техники эмоциональной свободы на тревожность во время соревнований и уровень слюнного кортизола у элитных спортсменов тхэквондо

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### АННОТАЦИЯ

**Цель исследования:** В соревновательном спорте спортсмены могут испытывать ухудшение психических и физических функций из-за переживания ряда негативных эмоций. Поэтому цель данного исследования — определить эффективность техники эмоциональной свободы (ТЭС) на психологические и физиологические реакции соревновательной тревоги у элитных спортсменов тхэквондо.

**Материалы и методы:** В исследование были включены 29 элитных мужчин, занимающихся тхэквондо в провинции Тегеран, которые были отобраны методом случайной выборки и случайным образом разделены на группы контроля (16 участников) и вмешательства (13 участников). В ходе предварительного тестирования (первое соревнование) были измерены когнитивные компоненты соревновательной тревожности (когнитивная тревожность, уверенность в себе и физическая тревожность) и физиологический компонент слюнного кортизола в обеих группах. Экспериментальная группа провела 10 сеансов ТЭС-тренинга, а контрольная группа — только физические тренировки. По окончании ТЭС-интервенции был проведен посттест (второе соревнование). Анализ данных проводился в программе SPSS 22.

**Результаты:** После ТЭС-интервенции в группе вмешательства по сравнению с контрольной группой наблюдалось снижение компонентов когнитивной тревоги, соматической тревоги и слюнного кортизола, а также повышение компонента уверенности в себе.

**Заключение:** ТЭС может быть полезным инструментом для снижения физиологической и психологической тревожности у элитных спортсменов тхэквондо. Таким образом, спортивным психологам и тренерам предлагается использовать ТЭС для снижения когнитивных и физиологических компонентов соревновательной тревожности у спортсменов.

**Ключевые слова:** техника эмоциональной свободы, кортизол слюны, соревновательная тревожность, элитные тхэквондисты

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### 1. Introduction

In recent years, considering the small performance difference between athletes in high-level sports competitions, the manipulation of arousal, anxiety and stress separates the winner from the loser [1]. The impact of unfavorable psychological conditions of an athlete is clearly visible on their performance [2, 3]. In sports psychology, understanding and studying individual differences in perception and subsequent behavior of individuals are discussed in order to help them deal with psychological pressures of the competition by recognizing these differences, finding out their causes and providing proper solutions [4].

The sportive setting, especially competitive and professional sports, is stressful due to the psychological pressure it imposes on athletes [5]. Anxiety is a phenomenon in which athletes perform worse than expected under stressful

situations [6]. In sports psychology, anxiety means an unpleasant sensation that is defined by vague and persistent feelings of worry and fear [7]. Three main dimensions have been distinguished in the experience of competition anxiety: a) Cognitive anxiety, b) Somatic anxiety, and c) Self-confidence. Cognitive anxiety involves one's thoughts regarding possible failure, whereas somatic anxiety includes the perception of physical signs of negative arousal. On the other hand, the self-confidence dimension refers to a person's belief in the ability to do a task. As a result, this usual dimension is related to lower competition anxiety and optimal performance [5]. The hypothalamus-pituitary-adrenal (HPA) axis is one of the most important physiological mechanisms regulating metabolism and energy production in the body, which plays an essential role in adjusting the physiological responses of the body, including the hormonal response to

stress [8]. The activation of this axis leads to the release of adrenocorticotrophic hormone from pituitary gland, which in turn stimulates the secretion of glucocorticoids (mainly cortisol) from adrenal gland cortex [9]. Several human and animal studies in the field of stress have indicated that the level of HPA axis hormones increases in threatening physiological and psychological conditions such as lack of control, unpredictability and self-conflict, all of which can be clearly distinguished in the sports environment, especially competitive sports [10]. In general, the results of these investigations have revealed the relationship between anxiety and performance, that is, anxiety can interfere with the athlete's performance. Therefore, managing anxiety can be of high importance for both athletes and coaches. There are various approaches for controlling anxiety [11], which include relaxation methods, biofeedback [11, 12], self-talk [13], regular exercise [14] and emotional free technique (EFT) [15, 16]. Despite the long history of research on anxiety in athletes, many issues in this field are still unresolved. Identifying these problems can help us define the context for further research on anxiety in athletes [17].

EFT, a behavioral treatment technique introduced in 1995 by Craig and Fowlie [18] as a simple method to reduce excessive anxiety, is a psychological intervention combining the elements of cognitive behavioral therapy and stimulation of acupressure points. EFT combines tapping on acupressure points with a focus on fear or negative emotions in order to alleviate fear sensitivity. In addition to tapping, the person accepts negative emotions and repeats their statements, working on cognitive reconstruction, identifying and correcting negative thoughts [19]. EFT leads to rapid stimulation and absorption of stress hormones such as cortisol [19], inhibiting the warning responses of sympathetic nervous system and replacing them with calming responses of the parasympathetic nervous system [20]. Clinical reports from coaches and athletes indicate that EFT is widely used in golf, baseball, and American football at professional and collegiate levels. Studies show that transient use of EFT can increase certain measures of performance in athletes [19]. Besides, recent systematic reviews indicate that EFT is effective for reducing all kinds of psychological disorders as well as state and competition anxiety and increasing sports performance [15, 16]. In elite taekwondo athletes, the reduction of biological and psychological anxiety by means of EFT technique is an important factor that seems to affect sports performance in anxiety-provoking situations such as sports environments. Therefore, the goal of the current research is to investigate the effectiveness of EFT technique on physiological and psychological components of competition anxiety in elite taekwondo athletes.

## 2. Materials and methods

The present research is a semi-experimental study given the nature of this topic and the executive goal of research, namely investigating the effect of EFT technique on psychological and physiological responses of competition anxiety

of elite taekwondo athletes. The intended design for this research, which has an intervention (EFT) and a control group, is of pre-test-post-test type. The population of this research included elite taekwondo athletes of Tehran Province in 2017–18, from which 29 athletes in the age range of 18–25 who expressed their consent to participate in research were selected by convenience sampling. The athletes had  $\geq 7$  years of experience in Taekwondo. All subjects were physically and mentally healthy, and those who did not meet these conditions were not included among these 29 subjects. All athletes provided written informed consent to participate in the study. The research was approved by a Research Ethics Committee of Sport Sciences Research Institute of Iran and was approved according to compliance with Ethical Standards in Research of the Ministry of Science, Research and Technology, with the code IR.SSRI.REC.1397.291 on 29/8/2018.

### Inclusion criteria:

- All participants were male;
- The age range of the sample was between 18 and 25 years;
- All participants were elite taekwondo athletes;
- They were in good physical and mental health.

### Exclusion criteria:

- Unwillingness to continue and participate in the research;
- Absence on the day of the research and failure to attend all training sessions of the present study;
- Injury during different stages of the research;
- Performing exercises other than those of the present study during the research;
- Using medications that affect the function of the adrenal glands and cortisol secretion.

In pre-test stage, necessary and sufficient explanations were presented about research objectives and cooperation of subjects in the research, and in the prearranged competition, saliva samples were taken from all 29 persons to measure the cortisol hormone level, and all of them were subject to Sport Competition Anxiety Test (SCAT; Martens, 1977) [21]. This 27-item questionnaire is divided into three subscales of cognitive anxiety, physical anxiety and self-confidence, each of which has 9 questions. It should be noted that this questionnaire is scored in a four-point Likert scale. Reliability coefficient for three subscales of cognitive anxiety, physical anxiety and self-confidence is 0.85, 0.86 and 0.75, respectively. The gold standard method was used to measure hormones in this study [22]. In this collection method, the athlete completely emptied their mouth of saliva by swallowing, bent forward while seated, lowered their head, and allowed saliva to flow into a container. After that, the remaining saliva in mouth was contained into a microtube and transferred to the laboratory for measurement in a cold chamber. This procedure was done 25 minutes before the competition. Warmup protocol included 5 min jogging exercise, 5 min dynamic stretches for the joints, with a 5 min rest interval in a sitting position (Romarateabala, Nakamura, Castillo, Gorostegi-Anduaga and Yanci [23].

All the subjects were forbidden to eat anything two hours before the competition, and they should not have used any

stimulants over the past 24 hours. It should be noted that the cortisol measurement kit made by German Zelbio Company was used in this research. To create a competitive atmosphere for competition anxiety, selection matches were held to place athletes in the main team, where each athlete with three out of five wins was assigned to the main team. Subsequently, in a joint meeting, self-talk skill was taught before the start of the competition to reduce competition anxiety.

After the pre-test, 10 EFT sessions were taught and practiced for the intervention group (13 subjects), and the control group with 16 subjects only practiced Taekwondo physical skills during these 10 sessions. It should be noted that the EFT group was reduced from 13 persons at the beginning of the study to 11 due to insufficient participation of a number of subjects in the training program and the injuries of athletes due to the nature of Taekwondo. After the training sessions and in the second competition, the athletes filled out the competition anxiety questionnaire a second time 25 minutes before their competition.

## 2.2. EFT technique

In EFT process, two steps are used: 1) We mentally focus on specific issues and at the same time 2) Tap some of the meridian points with our fingertips to stimulate them and simultaneously repeat a sentence. If properly done, EFT apparently resolves disorders of the meridian system, and thereby often reduces the time required for conventional treatment from months or years to a few minutes or hours. In EFT, you

need to tap three times, approximately seven times on each point [24].

The principles of EFT (basic EFT method)

Tapping is a simple maneuver, but some basic, mechanical steps are necessary to dramatically increase its effectiveness, regardless of who uses it [24].

## Statistical analysis

The data were analyzed using SPSS software (version 24), and descriptive statistics was used to calculate the mean, variance, standard deviation, and range of changes. Afterwards, we used skewness, kurtosis and Shapiro—Wilk tests to check the normality of data distribution as well as Cronbach's alpha to determine the internal homogeneity of data. Considering the normal distribution of data, multivariate analysis of covariance determined the contribution of independent variables to predicting the psychological and physiological responses of athletes to pre-competition anxiety (PCA).

## 3. Results

Descriptive demographic features of the current research are presented in Table 1.

Table 2 shows mean and standard deviation of age and sports history of elite male taekwondo athletes. Mean and standard deviation of intervention group (11 subjects) were 20.91 and 8.64 and control group (16 subjects) 20.94 and 9.25, respectively.

Descriptive information regarding the scores of competition anxiety, self-confidence and salivary cortisol are

Table 1

### Description of the emotional freedom technique

Таблица 1

### Описание техники эмоциональной свободы

Goal setting	The first thing they did was to mentally identify what increased their anxiety. This "goal" is the basic EFT instruction. Athletes considered only one issue at a time
Measurement of primary anxiety	Athletes reported the intensity of anxiety before starting the work. For this purpose, they were asked to rate their anxiety on a scale of 0–10; 10 indicating the highest anxiety level and 0 lack of anxiety
Correction	Athletes were asked to start each strike round with a correction, make a simple sentence and tap the dots continuously while pronouncing it. In this way, the system finds out what it wants to focus on. To make the desired sentence, they had to have two goals in mind: 1) Acknowledging the existence of anxiety 2) Believing in their abilities despite the presence of anxiety We always target the negatives in the sentences because they are the ones that cause energy disturbance, and the basic instruction of EFT also eliminates them and results in tranquility. But in usual methods and famous self-help books, they emphasize positive thinking and avoid negative ones. Although this seems to be good, according to our goal, it only covers the negatives with pleasant words to some extent. However, EFT targets and neutralizes negativity. In this way, the positives that are natural have a chance to emerge
Step points	This is the most important part of basic EFT instruction that stimulates energy pathways in the body. To do it, the athletes were requested to tap on the points of steps mentioned in Table-1 and at the same time say the reminder phrase to keep their focus on the subject. For example: "Although I have anxiety, I believe deeply and completely in my abilities"
Reassessing anxiety	At the end of the work, we asked the athletes to determine the intensity of anxiety by assigning a number between 0 and 10, which was compared with the previous value to determine how much progress they made. If it did not reach 0, they were asked to repeat the process until it reached 0 or a constant value

presented in Table 3, which indicates pre-test and post-test results.

According to Table 3, mean of cognitive anxiety changed from 28.18 in pre-test to 22.27 in post-test, mean somatic anxiety from 23.45 in pre-test to 20.91 in post-test, mean self-confidence from 20.55 in pre-test to 25.64 in post-test, mean salivary cortisol from 27.80 in pre-test to 26.39 in post-test,

while the scores of control group for these four variables did not show significant changes. To compare the effectiveness of progressive muscle relaxation on the aforementioned variables of elite male taekwondo athletes in the two groups, analysis of covariance was used to determine the differences between groups in post-test, the results of which are reported in Table 4.

Table 2

#### Mean and standard deviation of age and sports history of elite taekwondo athletes

Таблица 2

#### Среднее значение и стандартное отклонение возраста и спортивного стажа элитных тхэквондистов

Variable	Group	Number	Mean $\pm$ SD	Minimum	Maximum
Age	EFT	13	20.91 $\pm$ 2.77	18	25
	Control	16	20.94 $\pm$ 2.14	18	25
Sportive record	EFT	13	8.64 $\pm$ 1.74	7	12
	Control	16	9.25 $\pm$ 1.69	7	12

Table 3

#### Mean and standard deviation of scores of competition state anxiety questionnaire and salivary cortisol

Таблица 3

#### Среднее значение и стандартное отклонение результатов анкеты по оценке тревожности в соревновательной ситуации и уровня кортизола в слюне

Variable	Test	Intervention		Control	
		M	SD	M	SD
Cognitive	Pretest	28.18	2.40	22.69	2.91
	Posttest	22.27	1.95	22.50	2.58
Somatic	Pretest	23.45	3.30	21.50	2.68
	Posttest	20.91	2.63	22.06	3.11
Self-confidence	Pretest	20.55	1.04	21.44	2.61
	Posttest	25.64	2.46	21.69	2.63
Cortisol	Pretest	27.80	1.40	27.97	1.83
	Posttest	26.39	1.82	27.71	1.39

Table 4

#### ANCOVA results for the scores of cognitive anxiety, physical anxiety, self-confidence and salivary cortisol in post-test

Таблица 4

#### Результаты ANCOVA для оценок когнитивной тревожности, физической тревожности, уверенности в себе и уровня кортизола в слюне после тестирования

Dependent variable	Effect	Degree of freedom	Mean square	F	Significance level	Eta-squared
Cognitive	Pretest	1	107.35	83.57	0.0001	0.78
	Group	1	61.94	47.87	0.0001	0.67
Somatic	Pretest	1	147.77	53.7	0.0001	0.69
	Group	1	44.77	16.26	0.0001	0.40
Self-confidence	Pretest	1	106.17	44.07	0.0001	0.65
	Group	1	144.46	59.97	0.0001	0.71
Cortisol	Pretest	1	44.64	150.22	0.0001	0.86
	Group	1	14.45	48.61	0.0001	0.67



According to the data in Table 4, single-variable ANCOVA results show a significant difference between control and intervention groups, and separately indicates the differences in components of somatic anxiety, cognitive anxiety, self-confidence and salivary cortisol. According to this Table, since the  $F$ -value of covariance variable (pre-test) is significant at 0.05 level, it is correlated with the independent variable. After removing the effect of pre-test, there is a significant difference between means of the two groups for control and experimental groups in post-test scores of cognitive anxiety ( $F = 47.87, P < 0.001$ ), somatic anxiety ( $F = 16.26, P < 0.001$ ), self-confidence ( $F = 59.97, P < 0.001$ ) and salivary cortisol ( $F = 48.61, P < 0.001$ ).

Overall, the findings reveal that after EFT intervention, the intervention group, unlike control group, had a decrease in the components of cognitive anxiety, somatic anxiety and salivary cortisol, as well as an increase in the component of self-confidence.

#### 4. Discussion

The EFT technique has three main elements that can be effective in sports, especially in reducing anxiety and cortisol in taekwondo athletes, as follows: The "Setup Statement" or the statement that the athlete repeats while striking is made up of two elements. The first part is a statement of the problem presented by the athlete, and is given to the athlete while striking a specific acupressure point by saying a sentence such as "Although I have a tough match..." to focus on the issue that is causing the anxiety. The athlete repeats the name of the problem while striking. This focus on the problem is reminiscent of the exposure techniques practiced in Prolonged Exposure (PE) and other exposure therapies. The second half of the launch statement guides the athlete toward accepting the situation as it is: "I deeply and completely accept myself..." This cognitive framework is similar to certain techniques used in cognitive therapies that seek to correct the athlete's dysfunctional cognitions and emotional responses to events. The US government's Institute of Medicine [25] found that therapies that use exposure and cognitive shift were efficacious. EFT's Setup Statement draws from elements of these two established therapies. The third ingredient used by EFT is tapping on points used in acupuncture and acupressure (acupoints). According to Fox and Malinowski [26], EFT stimulation is an active ingredient. This finding supports studies that use fMRI to measure the effects of acupuncture on brain regions associated with anxiety [27]. These studies consistently report acupuncture to rapidly regulate these brain regions. They are also consistent with studies that use electroencephalogram (EEG) to evaluate EFT. They have found that EFT reduces brain wave frequencies associated with anxiety or enhances waves associated with relaxation, as well as producing other beneficial physiological changes [28–30]. When protocols developed from exposure and cognitive therapies are paired with acupressure, their effects appear to be enhanced [31]. So, given these materials and the results of the present study, Sport psychologists and coaches can easily

and without the need for a specific protocol, use the EFT technique before the start of the competition, as well as during rest and stoppage of the competition to reduce cortisol, competitive anxiety and improve athlete performance [32].

Researchers in sports psychology are attempting to identify variables affecting sports performance, including anxiety, which can lead to a sharp decrease in athletes' performance. The ability to control anxiety during competition and even take advantage of it distinguishes a professional from a non-professional athlete [33]. When athletes are confronted with anxiety, mental skills train them to regulate their autonomic arousal by identifying physiological signs associated with intense stimulation such as heart rate and continuous breathing, after which the athletes are able to apply this technique to reduce their stress levels to a range beneficial for performance.

The present study investigated the effectiveness of EFT on psychological and physiological aspects of competition among elite taekwondo athletes. In the psychological dimension, the results showed that EFT technique in the intervention group reduced the somatic and cognitive anxiety components of competition anxiety but increased the self-confidence in the intervention group after the self-talk in the post-test relative to pre-test. However, the components of competition anxiety and self-confidence had no significant changes in post-test compared to pre-test in control group. Therefore, it can be stated that EFT intervention before the start of sports competitions reduces cognitive and somatic anxiety but increases self-confidence of elite taekwondo athletes, which is in agreement with the research by Rowe [34] who investigated the effect of EFT on psychological symptoms and detected long-term impact on psychological symptoms after the subjects participated in an EFT workshop. Furthermore, these findings were in line with the research by Boath, Stewart and Carryer [16] and Feinstein [15] who showed the effectiveness of EFT technique in reducing various psychological disorders, decreasing state and competition anxiety, and increasing sports performance. In explaining these findings, according to Vygotsky's theory of cognitive development [35], it can be inferred that people know their behavioral characteristics by focusing on their problem, adjusting their behavior by gaining more knowledge about themselves. This process leads to the emergence of a methodological-therapeutic method; whenever a person experiences stress or anxiety, they can manage these conditions using the Emotional Freedom Technique (EFT) and repetition of phrases to enhance their performance. Athletes regulate their anxiety by focusing their attention and improving concentration [36].

Another finding of the present study was that in the physiological dimension of competition anxiety, the intervention group showed significantly reduced cortisol levels in post-test, while the cortisol level did not decrease in control group. These results are consistent with the studies by Craig and Fowlie [18], Lambrou, Pratt and Chevalier [30], Gallo [37], Feinstein [15], Clond [38] and Patterson [39],

Church, De Asis and Brooks [40], which can be attributed to the fact that EFT causes rapid stimulation and absorption of stress hormones such as cortisol. Besides, with reference to the research by Church and Brooks [19], it can be said that EFT inhibits the warning responses of sympathetic nervous system and replaces them with calming responses of parasympathetic nervous system. Studies by Feinstein [15] have shown that the neuronal, genetic, neurotransmitter and hormonal pathways are involved when EFT reduces psychological stress. A study of EFT using electroencephalography (EEG) indicates the decrease in brain frequencies associated with anxiety [30].

According to the mentioned statements, EFT causes the hypothalamus (center of psychological pressure) to reduce the adrenocorticotrophic secretion from anterior pituitary gland. Adrenocorticotrophic hormone is the main stress hormone that stimulates the outer cortex of adrenal glands, which leads to the release of glucocorticosteroid hormones, especially cortisol. In research related to mental stress, the level of free cortisol in blood or other body fluids such as saliva indicates the level of anxiety of a person and causes an increase in heart rate, breathing, immune system suppression, as well as a decrease in protein synthesis but an increase in lactate. Therefore, according to the results of Rudolph and McAuley's research [41], which showed that low cortisol concentration is related to positive psychology, as well as Lader's research [42] indicating that high concentration of

cortisol is associated with negative emotional diseases such as anxiety, EFT is likely to affect the hypothalamus and thereby cortisol secretion, reducing its levels that in turn leads to mitigation of vital signs as well as physiological and psychological anxiety.

### 5. Conclusion

In general, the results of the present study showed that EFT reduces the physiological and psychological anxiety of elite male taekwondo athletes. Thus it is suggested that sports psychologists and coaches use EFT to reduce the cognitive and physiological components of competitive anxiety in athletes. In addition, various psychological skills and techniques should be used to control competition anxiety before and during sports competitions.

It is suggested that these interventions should be studied in different sports fields and various performance levels of athletes. More importantly, in most studies and the background of EFT technique, long-term and continuous effectiveness of this technique is mentioned, which we suggest to be investigated in future researches. Among the limitations of this research is the generalization of results to non-elite taekwondo athletes as well as other sports. Because according to Pushkarev et al.'s research, the competitive anxiety index in elite athletes is significantly related to age, sport, and gender [43]. Moreover, it is recommended that these results be used with caution because Matching was not made in the groups.

### Authors' contributions:

**Mahdi Mollazadeh** — methodology, data collection and interpretation, writing original draft, project administration, formal analysis, and manuscript submission.

**Hassan Gharayagh Zandi** — methodology, data collection and interpretation, writing original draft, project administration, and formal analysis.

**Behrooz Ghorbanzadeh** — methodology, data collection and interpretation, writing original draft.

**Rahman Soori** — methodology, data collection and interpretation, project administration, formal analysis, and writing original draft.

### Вклад авторов:

**Махди Моллазаде** — методология, сбор и интерпретация данных, написание текста статьи, администрирование исследование, формальный анализ и подача рукописи.

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**Бехруз Горбанзаде** — методология, сбор и интерпретация данных, написание текста статьи.

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