Effect of Biofeedback Assisted Relaxation in Treating Premenstrual Syndrome

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ABSTRACT

This study was conducted to determine the effect of biofeedback assisted relaxation in alleviating symptoms of premenstrual syndrome. Fifty volunteers' virgin girls suffering from premenstrual syndrome were selected from students of Faculty of Physical Therapy, Cairo University to participate in the study. Their age ranged from 18 to 22 years, and their body mass index was ≤ 28 kg/m². Each subject had been treated with relaxation training augmented by biofeedback twice/week for 6 weeks in addition to daily home routine, and assessment of premenstrual syndrome symptoms was done before and after treatment sessions for heart rate, respiratory rate, muscle tension (measured by T.G MYO-feedback 420v) and data of daily symptoms report (including behavioral and somatic symptoms). Results showed a statistically highly significant (P<0.001) decrease in HR, RR, T.G MYO-feedback 420v data as well as many of symptoms of daily report including: anxiety, irritability, depression, nervous tension, mood swing, feeling out of control, poor coordination, insomnia, confusion, headache and crying after the end of treatment compared to pre-treatment assessment. Accordingly, it could be concluded that the biofeedback assisted relaxation was found to be an effective, noninvasive, safe, cheap, easy to perform, simple and successful adjunct treatment method in reducing symptoms of premenstrual syndrome.
Key words: Premenstrual Syndrome, Relaxation Training, Biofeedback.

INTRODUCTION

Premenstrual syndrome (PMS) is a common cyclic disorder of young and middle-aged women, which characterized by emotional and physical symptoms that consistently occur during the luteal phase of the menstrual cycle. Although the etiology of this disorder remains uncertain, research suggests that altered regulation of neurohormones and neurotransmitters is involved[7].

Premenstrual syndrome is classified by the World Health Organization (WHO) in the International Classification of Disease (ICD) as gynecological disorder rather than mental disorder which usually start in the late teens or early twenties with gradually worsening symptoms[8].

This condition is characterized by troublesome symptoms lasting even to 14 days before menstruation. These symptoms include tension, irritability, depression, headache, anxiety and loss of self control[32].

The symptoms of PMS may include breast tenderness, pelvic pain, bloating, and tension. More severe symptoms include irritability, dysphoria, and mood lability. When these symptoms disrupt daily functioning, they are clustered under the name premenstrual dysphoric disorder (PMDD)[1] and women with PMDD experience marked disruption in their relationships and social activities at level similar to those with major depression[8].

The severity of symptoms varies in the population and relatively constant within each woman over two consecutive cycles,

particularly for emotional symptoms and influenced by age, race/ethnicity, and health status. PMDD involves a worsening of mood that interferes significantly with the woman's quality of life and may experience moodiness or anger that seems to be out of control, and may cause avoidance of friends or relatives during the week before menstruation[30].

To appreciate the extent to which these symptoms adversely affect women during their childbearing years, both tangible and intangible impact of functioning must be considered at a suboptimal level during several days of each menstrual cycle. Tangible impact can be viewed in terms of higher direct medical costs for women and, by extension, for the health plans in which they are enrolled when seeking medical attention. Outpatient visits to healthcare practitioners, laboratory testing and radiology procedures, as well as costs for treatment are higher for patients with PMS than for those without this disorder. In addition, indirect costs of menstrually related disorders, which are more difficult to quantify, stem from absenteeism, lost wages, and lower productivity, or presenteeism in the workplace. Intangible effects appear most apparently in the psychologic and emotional aspects that appear on social interactions and interpersonal relationships, and on women's overall sense of personal well-being[15].

Premenstrual syndrome affects 20%-50% of all women while premenstrual dysphoric disorder affects 3%-9% of all women. Because a significant number of women suffer from premenstrual disorders and may spend up to half of the month suffering from symptoms, so that it is important to identify and provide effective treatment for these women[12].

The majority of the female adolescents identify dysmenorrhea and premenstrual symptoms as problems that significantly affected their academic performance and are responsible for school absenteeism. Contradictory to common belief, premenstrual symptoms in adolescents are found to be as prevalent as symptoms of dysmenorrhea, and most of the girls are unaware of either causes or treatments of these symptoms[34].

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), consider that PMS requires a minimum of five symptoms. Symptoms must be confirmed prospectively through daily rating over two consecutive menstrual cycles and must occur principally during the luteal phase. The symptoms should be evaluated prospectively because data suggest that retrospective reporting is inaccurate. Symptoms also, must be present for most cycles and result in some degree of functional impairment in daily life[13]. The demonstration of true cyclicity of symptoms by means of daily charting and questionnaires to rule out underlying behavioral, mood, or psychiatric disorders is essential[27].

Numerous hypotheses have been tested for the etiology of PMS, including progesterone deficiency, progesterone allergy, hypoglycemia, vitamin B deficiency, inappropriate aldosterone secretion, inappropriate prostaglandin activity, endorphin dysfunction, and disorders of monoamine oxidase or dopamine metabolism[33].

Obesity is strongly associated with PMS. Obese women had nearly a three-fold increased risk for PMS than non-obese women. PMS was more prevalent among whites and smokers. Since obesity is a modifiable risk factor, PMS management strategies should not only consider factors such as, high stress, and smoking but also obesity[16].

Managing premenstrual symptoms at the most fundamental level necessitates careful consideration of female reproductive biology.

Inhibiting ovulation using hormonal agents is a reasonable approach for reducing premenstrual symptoms, but the benefits of agents such as gonadotropin-releasing hormone agonists and the synthetic androgen danazol are largely offset by their adverse effects and costs. Combined oral contraceptives provide an alternative that is widely accepted by women experiencing premenstrual symptoms and by their physicians; and newer formulations with lower levels of estrogen and progestin, administered using a monthly regimen with a shortened pill-free interval, appear promising for alleviating patient distress from severe premenstrual symptoms[31].

Some studies suggests efficacy of calcium supply, cognitive therapy, while others suggest the effect of diet, magnesium, nonsteroidal anti-inflammatory drugs, diuretics, opiate antagonists, and alternative therapies[23].

Lifestyle changes-including dietary changes, exercise, vitamin B and calcium supplements, and stress reduction are the cornerstone of treatment for PMS. Massage and other relaxation methods offer considerable relief of symptoms[5].

Muscle tension as a function of sympathetic arousal may play a causal or contributory role in symptomatology in the premenstrual period. A significant positive correlation was found between the premenstrual physiologic symptoms that women predicted they would have, and the premenstrual frontalis EMG levels measured during relaxation. The results suggest that training for muscle tension reduction may reduce premenstrual symptoms[9].

Biofeedback is a non-invasive, cost-effective, and relatively safe treatment that makes people more aware of their bodies' functions and gives them an increased sense of responsibility about their health[6].

Benefits of biofeedback are brighter mood, fewer negative emotions, enhancement of performance, improvement of stress-related conditions, more energy, better sleep and improved immune response[20].

The purpose of this study was to determine the effect of biofeedback assisted relaxation training in alleviating symptoms of premenstrual syndrome.

SUBJECTS, MATERIALS AND METHODS

1- Subjects

Fifty volunteer virgin girls suffering from premenstrual syndrome, were selected from students of Faculty of Physical Therapy, Cairo University, to determine the effect of biofeedback assisted relaxation training in alleviating symptoms of premenstrual syndrome; they all had the following criteria:

Their age ranged from 18-22 years, and their Body Mass Index (BMI) < 28 kg/m^2, they had no past or present diagnosis of psychiatric illness, no cervical pain, no traumatic life events in the last 2 months before starting the study, no history of participation in relaxation training within the previous 6 months, and have no prescriptive medications.

Each subject must have 5 of the following symptoms before her menstrual blood flow begins (although not necessarily the same symptoms each month):
- Markedly depressed mood or feelings of hopelessness.
- Marked anxiety or tension, feeling keyed up or on edge.
- Marked shift in mood (suddenly tearful, overly sensitive).
- Persistent, marked anger or irritability, increased conflicts.
- Loss of interest in usual activities (e.g., study, work, hobbies).

- Difficulties in concentration and focusing attention.
- Marked lack of energy, feeling very easily tired out.
- Marked change in appetite (overeating, or food cravings).
- Sleeping too much or having a hard time to sleep.
- Feeling overwhelmed or out of control.
- Physical symptoms (e.g., breast tenderness/swelling, headache, joint/muscle pain, bloated sensation, weight gain). (Adapted from Diagnostic and Statistical Manual of Mental Disorders, 4th edition, American psychiatric Association, 1994)[13].

The symptoms must occur during the most menstrual cycles and must interfere significantly with work, social activities or relationships.

Initial assessment of premenstrual tension symptoms was done in 2 consecutive months to confirm the diagnosis.

An informed consent form was signed by each subject before starting the study.

2- Materials

Weight-height scale was used to measure body weight and height, and then body mass index was calculated for each subject before the beginning of the study.

Cotton and alcohol were used to clean the skin over the upper fibers of trapezius before electrodes placement. Pillows, cushions and sheets: were used to support body parts in a comfortable relaxed position, as well as to cover the subjects.

Pulsimeter (Tunturi TPM 400DC-6V) was used to measure pulse rate at the beginning and at the end of the treatment sessions.

Stop watch was used for adjusting the duration of each relaxation training session and to measure the respiratory rate.

T.G MYO- feedback 420v was used before and after the treatment session as an evaluative tool (0 program - relaxation mode), through 2 surface electrodes placed over upper fibers of trapezius and another one earth electrode.

TR – 20 C was used as a treatment tool, through 2 surface electrodes placed over upper fibers of trapezius.

3- Methods

Daily symptoms report:

Daily symptoms were reported by each subject before starting and after the end of the treatment program.

Evaluative procedure:

The subject was assumed a comfortable relaxed half lying position in a quiet room, there were no tactile or auditory stimuli, there were no direct lights, and there should be no restrictive clothes, soft pillows and small cushions were used to support and accommodate her body curves.

Muscle tension over the upper fibers of trapezius was recorded by two adhesive surface electrodes of T.G Myo-feedback 420v following 0 program (relaxation mode) with reference electrode which was placed over the shoulder.

Before recording any data, the subject was asked to relax through keeping her eyes and mouth gently closed and display any disturbing thoughts from her mind, through observing and listening to her own regular breathing (in, out and a pause in between them) in order to achieve mental relaxation, and then she was asked to observe the signals of T.G Myo-feedback 420v during performing deep breathing exercises in the form of diaphragmatic breathing with feeling the air

flow in through her nose , and let the air slowly go out through the mouth with a sigh and felt the tension going with the expired air (3-5 repetitions). After feeling relax, HR, RR, T.G MYO-feedback 420v data were recorded. Then at the end of the evaluative session, 5 minutes of graduated circulatory exercises for both upper and lower extremities were done for circulatory adjustment.

Training procedure:

Two adhesive surface electrodes of TR-20C were placed over the upper fibers of trapezius after cleaning the skin with alcohol.

Then the subject placed in a comfortable relaxed half lying position in situation similar to that of the evaluative session (quiet room, no tactile, auditory or optic stimuli with the aid of soft pillows and small cushions to support and accommodate body curves). Then she was asked to note TR-20C signals while performing deep breathing exercises in form of diaphragmatic breathing, in addition to, relaxation training in form of tens-relax technique of both right and left hands.

Also, this procedure was then repeated with breathing control for all movements (flexion, extension, abduction and adduction of the finger joints, and also flexion, extension, ulnar and radial deviations as well as, circumduction of the wrist joints) of both right and left hands for 20 minutes. After that, the subject was instructed to return slowly to the active state gradually to avoid fainting,

through performing a gentle stretches for her limbs and a plenty of time was given for her body to be adjusted to an active state (about 5 minutes). This training procedure was repeated twice weekly for 12 sessions, and the subject was instructed to repeat this technique daily as a home routine (at evening after getting to bed).

Statistical Analysis

The collected data had been gathered and statistically analyzed through using Statistical Package of Social Sciences (SPSS), and paired t-test was used to compare between data before starting and after the end of the treatment program.

RESULTS

In table (1), the mean value of HR before starting the treatment was (75.63±4.67 b/min), it was decreased to (71.90±3.82 b/min) after the end of the treatment, while the mean value of RR before starting the treatment was (18.06±1.93 B/min) and it was decreased to (15.80±2.03 B/min) after the treatment program. Comparing between the mean values of pre and post treatment program, the difference was found to be statistically highly significant (P<0.001) decrease in both HR and RR after the treatment as illustrated in fig. (1).

Table (1): Hemodynamic changes in response to the treatment program.

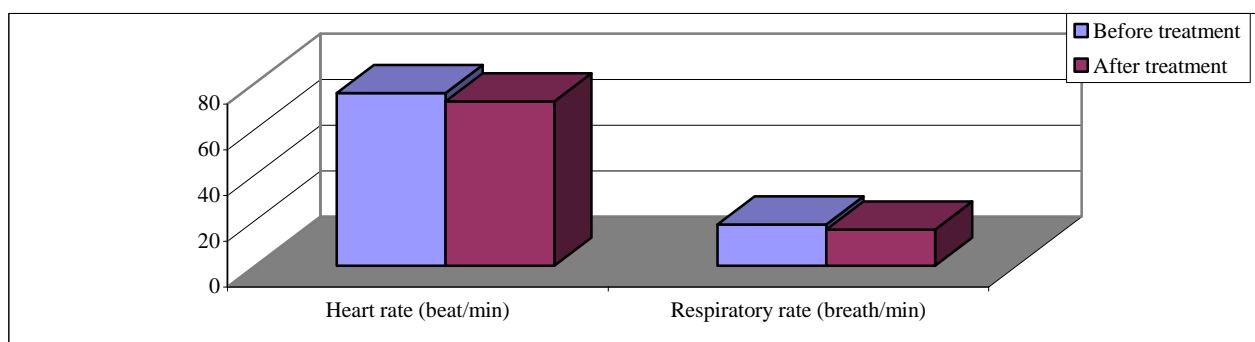|	Heart rate (beat/min)	Respiratory rate (breath/min)
Before treatment	75.63±4.67	18.06±1.93
After treatment	71.90±3.82	15.80±2.03
Mean Difference	3.73±2.5	2.26±1.14
t-value	8.16	10.86
P-value	<0.001	<0.001

Fig. (1): Hemodynamic changes in response to the treatment program.

The mean value of T.G MYO-feedback 420v before starting the treatment was (283.0+69.70 µv), while it was decreased to (112.0+18.82 µv) after the end of the treatment program. Comparing between the mean values of pre and post treatment program, there was a statistically highly significant (P<0.001) decrease in muscle tension recorded by T.G MYO-feedback 420v after the treatment program as illustrated in table (2) and fig. (2).

Table (2): T.G MYO-feedback 420v results before and after the treatment program.

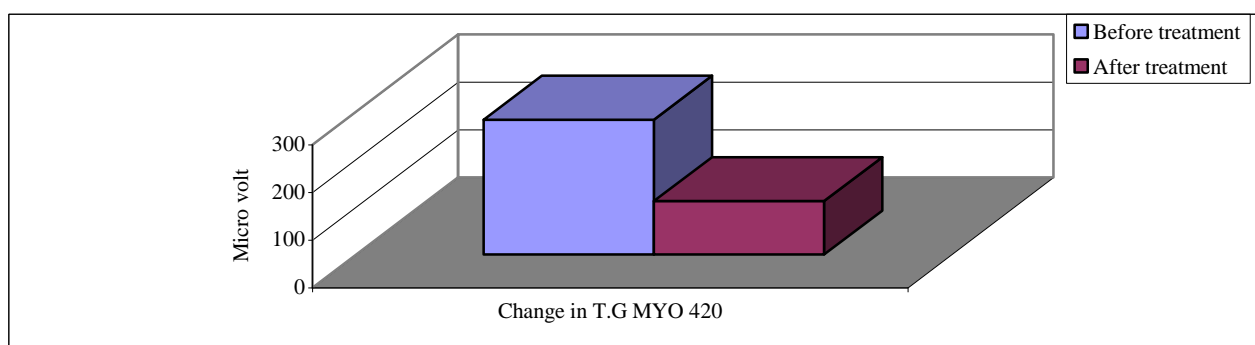|	Before treatment	After treatment
Mean ± SD	283.0±69.70	112.0±18.82
Maximum	390.0	155.0
Minimum	140.0	80.0
Mean Difference	171±50.88	
t-values	12.6	
P-values	<0.001	

Fig. (2): T.G MYO-feedback 420v results before and after the treatment program.

Also, the mean value of most of the behavioral symptoms of daily symptoms report (anxiety, irritability, depression, tension, mood swing, feeling out of control, insomnia, confusion and crying) showed a highly significant (P<0.001) decrease after the end of treatment program when compared to the pre-treatment values, while the food craving is the only behavioral symptom which showed a non-significant (P<0.08) change as observed in table (3).

Table (3): Behavioral symptoms of daily symptoms report before and after the treatment program.

Symptoms	Before ttt	After ttt	t-Value	P-Value
Anxiety	2.70±0.68	1.98±0.62	-6.49	
Irritability	3.00±0.34	2.50±0.48	-5.55	
Depression	2.82±0.46	2.37±0.58	-6.57	
Tension	3.35±0.27	2.23±0.42	-13.38	
Mood Swing	3.47±0.31	2.39±0.53	-10.77	P<0.001
Feeling out of control	3.35±0.27	2.19±0.38	-13.35	
Insomnia	3.41±0.30	2.12±0.47	-14.23	
Confusion	3.35±0.15	2.14±0.40	-19.24	
Crying	3.49±0.25	2.13±0.41	-18.29	
Food craving	2.27±0.62	2.12±0.52	-1.79	P<0.08

And according to the somatic symptoms (headache, feeling of fatigue and poor coordination) showed a highly significant (P<0.001) decrease after treatment when compared to the pre-treatment values, while the remaining symptoms (aches, breast tenderness, cramps and swelling) showed a non-significant (P>0.05) change after the treatment program as observed in table (4).

Table (4): Somatic symptoms of daily symptoms report before and after the treatment program.

Symptoms	Before ttt	After ttt	t-Value	P-Value
Headache	3.17±0.41	2.59±0.53	-6.63	
Feeling of fatigue	2.62±0.36	2.16±0.54	-5.83	P<0.001
Poor coordination	2.63±0.67	2.19±0.63	-5.87	
Aches	2.27±0.55	2.18±0.59	-1.77	P<0.09
Breast tenderness	2.94±0.46	2.92±0.46	-1.90	P<0.07
Cramps	2.38±0.56	2.27±0.59	-1.88	P<0.07
Swelling	2.31±0.42	2.14±0.48	-1.93	P<0.06

The mean value of total behavioral symptoms of daily symptoms report showed a highly significant (P<0.001) decrease after treatment when compared to the pre-treatment values, while the total somatic symptoms of daily symptoms report showed a significant (P<0.02) decrease and the total score of daily symptoms report showed a highly significant (P<0.001) decrease after the treatment as observed in table (5) and fig. (3).

Table (5): Changes of daily symptoms report before and after the treatment program.

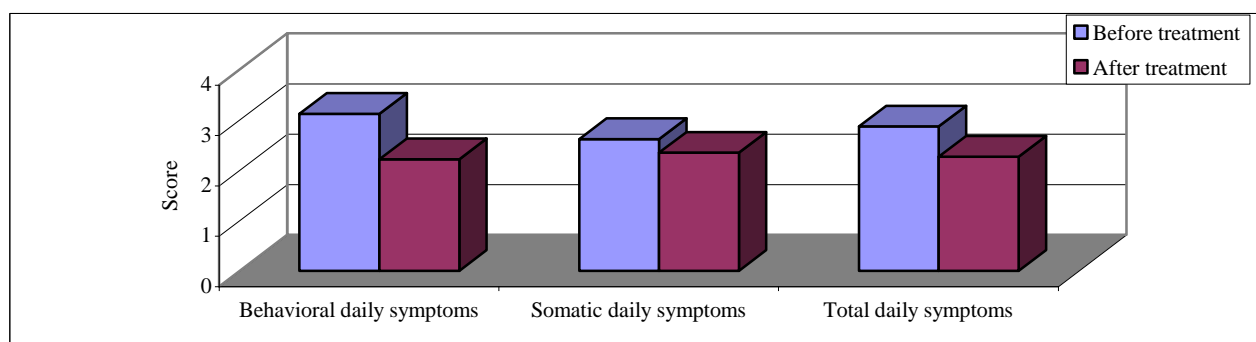|	Behavioral Symptoms	Somatic Symptoms	Total Daily Symptoms Report
Before treatment	3.12±0.36	2.62±0.50	2.87±0.43
After treatment	2.22±0.48	2.35±0.55	2.27±0.54
Mean Difference	0.90±0.42	0.27±0.22	0.60±0.21
t-value	-6.85	-3.21	-6.64
P-value	P<0.001	P<0.02	P<0.001

Fig. (3): Changes of daily symptoms report before and after treatment program.

DISCUSSION

Concerning the change occurred in heart rate (HR), the results showed a highly significant decrease (P<0.001) in base line values of HR, this result is agree and confirmed by that of Sivasankaran et al. (2006)[28], who conduct a study to examine the effects of yoga and meditation on hemodynamic and laboratory parameters, and they found significant reduction in HR. This reduction in HR could be attributed to a suggestion of an additional linkage between neural centers controlling both breathing and heart rates[17], and also to the effect of relaxation in promoting parasympathetic activity[4].

With the fact that profound relaxation of the skeletal muscles would elicit relaxation response as it was proved that the release of tension in skeletal musculature had the effect of calming the mind. Relaxation response counteracted the effects of sympathetic activity by promoting the action of parasympathetic nervous system, thereby exploiting the reciprocal nature of the two parts of the autonomic nervous system[4].

Concerning respiratory rate (RR), the results of this study showed a highly significant reduction (P<0.001), the decrease in RR after practicing relaxation training technique in this study is in agreement with the results of Paul et al. (2003)[21] who reported a significant reduction in RR in healthy subjects after practicing biofeedback relaxation technique.

Because biofeedback can be said to modulate the traffic over vagal pathways involved in maintaining air way tone[21], reduction in the mean (HR) & (RR) could be also, attributed to the fact that breathing is considered as a key for relaxation, it is associated with increased parasympathetic activity and reduction in sympathetic activity[22].

Regarding to data obtained from T.G MYO-feedback 420v in this study the results showed a highly significant reduction (P<0.001) of muscle tension however, the decrease was 171 µv less than base line mean value of 283 µv.

In this study, the reported mean value of the percentage of change was about 61%, this result is in agreement with Goodale et al. (1990)[10], who conduct a randomized clinical trial of 46 women with PMS and they found a significant mean value of percentage of change about 58% in the patients who received relaxation training. Accordingly, this statistical difference could be explained by application of relaxation training which augmented by biofeedback in our study.

Also, regarding to the data obtained from the daily symptoms report, the results showed a highly significant reduction (P<0.001) in mean values of anxiety, irritability, depression and tension. These results are confirmed by that of Holland et al. (1991)[11] who concluded that anxiety and depression in cancer patients had been reduced after relaxation training.

These results are also documented by Barbara (1995)[3] who found a significant reduction (P<0.05) of anxiety and depression in ladies in the 1st 4 weeks of post partum period after participating in a relaxation training program.

And the results of this study are supported by that of Kim and Kim (2005)[13] who concluded that relaxation training has a positive impact on anxiety and depression in cancer patients.

Accordingly, the reduction of anxiety; irritability, depression and tension could be attributed to decrease in neuromuscular activity during relaxation training leading to decreased proprioceptive input to the hypothalamus, which subsequently decrease activity of sympathetic nervous system and decrease the state of cerebral cortex excitability[13].

Also, when studying the effect of treatment program on mood swing, feeling out of control, poor coordination and insomnia, the results showed a highly significant (P<0.001) reduction of the severity of these symptoms. These results are supported by Rapaport et al. (2005)[25] who stated that mood disorders had been reduced by relaxation training in patients suffering from depressive disorders.

Regarding to insomnia the result of this study is confirmed by that of Morgenthaler et al. (2006)[19] who stated that insomnia had been reduced in chronic hypnotic older adults, after practicing relaxation training. Also Bain (2006)[2] stated that fatigue, disturbed sleep,

concentration problems and pain had been reduced after relaxation training.

These results are also, supported by Rosenzweings et al. (2003)[26] who stated that tension, anxiety, confusion, coping skills had been significantly reduced on a study examining the effect of relaxation technique on medical students, and this is in agree with Mizuno et al. (1999)[18] who found that general illness, confusion, social dysfunction had been reduced after practicing relaxation training.

Concerning the effect of biofeedback relaxation training in the following variables: confusion, headache, crying and fatigue, the results of this study showed a highly significant (P<0.001) reduction in their mean deferences. This results is confirmed by that of Powers et al. (2001)[24] who concluded that headache had been significantly reduced after relaxation training (P<0.05) in pediatric headache, it was also supported by Soderbery et al. (2006)[29] who reported a significant reduction of tension headache in adolescent and children after practicing relaxation training program.

Although the improvement in one of the behavioral symptoms and some of the somatic symptoms was non significant (P> 0.05), the total score of daily symptoms report showed a highly significant (P<0.001) reduction in the mean value after the treatment program.

Finally, it could be concluded that biofeedback relaxation training showed a significant reduction in HR, RR, T.G MYO-feedback 420v and almost all variables of daily symptoms report. So, biofeedback relaxation training was found to be an effective, noninvasive, safe, cheap, easy to perform, simple and successful adjunct treatment method in alliviating premenstrual syndrome.

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الملخص العربي

تأثير تمرينات الاسترخاء المحفزة بواسطة التغذية الرجعية في علاج أعراض ما قبل الدورة الشهرية

تهدف هذه الدراسة إلى معرفة تأثير تمرينات الاسترخاء المحفزة بواسطة التغذية الرجعية في علاج أعراض ما قبل الدورة الشهرية . وقد أجريت هذه الدراسة على خمسين فتاة متطوعة من طالبات كلية العلاج الطبيعي ، جامعة القاهرة ، تعانين من إضطرابات ما قبل الدورة الشهرية . وقد تراوحت أعمارهن من 18 إلى 22 عاما وكان معدل كتله الجسم $\geq$ 28 لئيلو جرام/متر مربع وقد تم علاجهن بتمرينات الاسترخاء المحفزة بواسطة التغذية الرجعية وأستمر العلاج لمدة ستة أسابيع بواقع مرتين أسبوعياً بالإضافة إلى برنامج منزلي يومي . وقد تضمنت القياسات المسجلة معدل ضربات القلب ، معدل التنفس ، مقدار التوتر العضلي مقاسا بواسطة التغذية الرجعية والتقرير اليومي للأعراض (متضمنا الأعراض المزاجية و البدنية) وأوضحت النتائج أن هناك إنخفاض ذو دلالة معنوية عاليةً في معدل ضربات القلب ومعدل التنفس ومعدل التوتر العضلي المقاس بجهاز التغذية الرجعية. كما وجد انخفاض ذو دلالة معنوية عالية في الأعراض الآتية : العصبية والأرق والإحباط والشد العصبي وتقلب المزاج وعدم التحكم في النفس وعدم القدرة على النوم والابتعاد عن المجتمع والصداع والبكاء والتعب . وقد أسفرت النتائج عن أن تمارين الاسترخاء بواسطة التغذية الرجعية وسيلة ، فعالة ، آمنة ، غير مكلفة ، سهلة الاستخدام ، بسيطة وناجحة لتخفيف أعراض ما قبل الدورة الشهرية .

الكلمات الدالة : أعراض ما قبل الدورة الشهرية ، تمرينات الاسترخاء ، التغذية الرجعية .