The Effectiveness Of Mindfulness On Blood Pressure And Brain Wave Of Elderly People

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Abstract

Blood pressure in the elderly is considered as one of the health disturbing factors. In this study, we seek to evaluate the effectiveness of mindfulness-based therapy on blood pressure and brain waves in the elderly.

Method

The present study was a quasi-experimental with experimental and control groups. In this study, 8 elderly people were trained in 8 mindfulness techniques one by one. The brain waves and blood pressure of the subjects were then compared with those in the control group. In this study, a sphygmomanometer and electroencephalography device were used.

Results

The results showed that the mean blood pressure of the experimental group decreased compared to the control group in the post-test stage. Also, the alpha and theta brain waves of the experimental group increased compared to the control group.

Discussion

According to the findings of the present study, mindfulness method can reduce blood pressure in elderly people with high blood pressure and on the other hand, increase brain waves associated with relaxation, namely alpha and theta.

Keywords: mindfulness, blood pressure, brain wave

Introduction

Aging is a critical period of life due to biological, psychological and social changes and it is necessary to pay attention to the needs of these people (Estes, 2020). One of the diseases that increases the probability of occurrence with age is high blood pressure (Buford, 2016). High blood pressure, also called hypertension, is one of the most common cardiovascular diseases and makes you more prone to atherosclerosis, heart attack, stroke and kidney failure (Sun, 2015). Hypertension requires high blood pressure (above 140 degrees systolic and 90 degrees diastolic) and persistent, usually over several weeks or months (Buford, 2016). Etiologically, hypertension is divided into primary and secondary categories (Carretero & Oparil, 2000). Primary hypertension is when a specific cause cannot be found and occurs without any underlying disease (Sandberg & Ji, 2012). Secondary hypertension is used when the cause of high blood pressure can be found and has a variety of causes, including neurological, pharmacological, endocrine, cardiac and renal causes, so treatment of the underlying disease will cure it (Nugent et al., 2022). In most people with hypertension throughout the course of the disease, the signs and symptoms that indicate the presence of the
disease are few or nonexistent, so people with the disease are unknown in the community (Almeida, Silva, & Drager, 2020). The disease is usually known when its unfortunate complications such as brain, heart Lesions, etc. occur and every day a large number of people in the community die without having any signs and symptoms before that (Kim, Kim, Choi, Kwon, & Rim, 2020). The prevalence of hypertension in developing communities is increasing significantly (Burnier & Egan, 2019). Nearly 25% of adults have hypertension (Noubiap et al., 2019). Risk factors and predictors of high blood pressure include heredity, genetics, weight, nutrition, low physical activity, alcohol consumption, and social, psychological, and environmental factors (Nugent et al., 2022). Family tensions and environmental stresses are also risk factors for this disease (Cuffee, Ogedegbe, Williams, Ogedegbe, & Schoenthaler, 2014). In the statistical and diagnostic guidance of psychiatric disorders in DSM-5 blood pressure as one of the psychological diseases that affect psychological factors has been classified (Regier, Kuhl, & Kupfer, 2013). The overall rate of hypertension is related to emotional states or environmental conditions (Cuffee et al., 2014). Different studies have shown the effect of various psychological factors, including anxiety and stress in the development of cardiovascular disease, including blood pressure (Hildrum, Myklethun, Holmen, & Dahl, 2008; Mucci et al., 2016; Raglin & Morgan, 1987) Physiological mechanisms of blood pressure regulation may be influenced by psychological pressure (Arvin, Rasouli, Ashouri, & Safarzade, 2019). In this, the activation of the sympathetic neural system is a key factor. According to Esler (Esler, 2000), when the autonomic nervous system releases large amounts of stress hormones, it has a number of physiological consequences, including high blood pressure, stomach ulcers, and migraines (Nisar & Srivastava, 2018).

Anxiety is associated with the activation of the sympathetic nervous system that can cause blood pressure and also the atherosclerosis (Tokgozoglu & Canpolat, 2020). In addition, depression is often associated with increasing steroid hormones (Morsink et al., 2007), and these hormones increase the blood pressure and damage to the sheaths (Scoggins et al., 1984).

Attention to personality traits and simultaneous prevalence of psychological problems in patients with hypertension is important. The results of some studies have shown that people with hypertension are more sensitive and worried than healthy subjects (Torres et al., 2019). The main way to treat blood pressure is drug, but over time, the incidence of adverse side effects of such drugs—sleeping, dizziness and erectile problems. As a result, researchers are looking for non-pharmacological treatments in this disorder (Mahmood et al., 2019). In recent decades, in addition to drug use, behavioral and psychological interventions or lifestyle changes have been used to prevent and control this disease. The maintenance of these interventions has been confirmed in various researches (Al-Wehedy, Abd Elhameed, & Abd El-Hameed, 2014; Bond Brill, 2011).

One of the effective psychological treatments in blood pressure can be cognitive behavioral therapies (Li et al., 2021), stress management (Duscek et al., 2008), anger management (Larkin & Zayfert, 1996), change in life and lifestyle change (weight loss, limitation of salt intake, regular exercise, smoking, …) (Al-Wehedy et al., 2014).

In the present study, the decision was made to implement 10 techniques based on the metacognitive model of mindfulness. According to research, the mindfulness has a significant effect on depression and anxiety. And since the causative factors of blood pressure is anxiety and stress, it is expected that this treatment can be effective in reducing blood pressure.

Self-Regulatory Executive Function Model

One of the most important and most influential models of explanation of mental disorders in recent years has been the model of self-regulation Executive Function of Wells and Matthews (Wells & Matthews, 2014). In the self-regulatory executive function model, all psychiatric disorders can be related to the ineffective pattern activity that is called Cognitive-Attentional Syndrome (Fergus, Valentiner, McGrath, Gier-Lonsway, & Jencius, 2013). This syndrome is a model of strategic processing that is launched by metacognitive knowledge stored in long-term memory. CAS because of the focus on threatening evaluation,
playing an inefficient role in providing information that can correct the incorrect assessments and beliefs and find new attention resources in order to provide compatible responses, creating bias in lower-level cognitive processing and in succession of environmental-interpersonal consequences is considered as an obstacle in the path to psychological sedation (Fergus, Bardeen, & Orcutt, 2012). According to this theoretical analysis, the adjustment in treatment should not only focus on the challenge with the credibility of concern and negative thoughts (such as what is done in traditional cognitive recognition), also focuses on modifying the CAS and changing the style of cognition. One of the most important strategies for doing this is the creation and expansion of the Detached Mindfulness (DM) (Asgarabad, Ahangi, Feizi, Sarmasti, & Sharifnezhad, 2018).

The Detached Mindfulness is a good condition for patients undergoing psychological treatment and the opposite and incompatible with CAS. In general, the mind of disconnect awareness includes a state in which despite the objective knowledge of internal thoughts and events, no response to cognitive effort) confirmation assessment, conceptual analysis, attempts to control or suppressing (or behavioral behavior. In general, Detached Mindfulness includes a state in which despite the objective knowledge of internal thoughts and events, no cognitive (confirmation assessment, conceptual analysis, attempts to control or suppressing) or behavioral response (Wells, 2005).

The purpose of the training of this group of cognitive techniques can be facilitated: the growth of metacognitive methods, increasing flexibility control in choosing cognitive behavioral strategies, the growth of new designs to adjust the activity of self-regulation executive performance, increasing non-confirmation processes and focused on modification ineffective beliefs and prevention of CAS activity in response to triggers (Gkika & Wells, 2015).

The levels of this model include these items:

Level 1: A lower level that is motivated by stimuli and is outside of conscious knowledge, but its products may lead to consciousness. Processing at this level is not very dependent on cognitive resources and is significantly reflective.

Level 2: A level of continuously controlled processing that includes conscious assessment of events, control of thought and action.

Level 3: The source of your knowledge (beliefs) is in long-term memory. These beliefs are metacognitive factors and include at least part of the processing design (Wells, 2005; Wells & Matthews, 2014).

**Electroencephalography and brain waves**

The cerebellum has different parts with different functions. One of these parts is the cortex. The cerebral cortex is the center of mental processes, the place of registration of senses, the beginning of voluntary actions, decision-making, and the role of action. The human brain is made up of a large number of nerve cells called neurons, through which different messages (nerve messages) are sent to different parts of the body and receive new messages. The message of the nerve inside the cell is in the form of an electric current (potential action) and in the intracellular cell it is in the form of a chemical conductor (neurotransmitter). The electrical activity of the neurons in the cranial surface is shaped by the electrical activity of the brain as the brain waves. Brain waves have different functions and functions are divided by frequency (Van Berkum, 2008). Faster waves have higher frequencies and slow waves have lower frequencies. All of these waves are present at all times, but depending on the operating conditions, it is overcome by a specific wave. Different brain waves and their functions are: delta, theta, alpha and beta wave (Desai, Tailor, & Bhatt, 2015).

Delta (3-0.5 Hz): The slowest brain wave and the dominant wave in deep sleep (dreamless,) complex heart problems, deep anesthesia is the regulation of the internal clock. Growth hormone is released when this wave overcomes.
Theta (4-7Hz): The dominant wave of administration, learning, planning, self-evolution, self-esteem, self-emergency, creativity, insight, oppression, anesthetized, depression, anxiety, anger and excitement and learning.

Alpha (8-12Hz): The dominant wave of entertaining enjoyment of the environment, reducing anxiety, positive thinking, integrating the body, intuition, introspection, emotion balance, optimism, meditation, great interest, remembrance, cognitive function. When the eyes are closed, the brain produces many alpha waves, especially in the occipital region. When these waves are overcome, the secretion of serotonin increases and the immune system is strengthened.

Beta (12-25Hz): The predominant wave in complex mind operations such as speaking, arguing, etc., thinking of abstraction, alertness, stability of emotion, arithmetic, thinking, focusing, steady attention, tension and alertness. Metabolism increases when this wave is overcome.

SMR waves (12-18 Hz wavelength): The dominant wave when processing and focusing on calmness, mindfulness, relaxation of the body. Overcoming this wave strengthens the mind and body, creates coordination between the environment and the individual and helps to fall asleep and regulate body movements.

Beta with high wavelength (25-30 Hz) The dominant wave when under pressure is aggression and anxiety and increases metabolism.

Gamma wave (17-97 Hz): The wave that organizes the brain and coordinates and integrates information from different parts of the body. Overcoming this wave is associated with good memory, high data transfer speed, high levels of information processing and learning complex issues (Van Berkum, 2008).

Relationship between mindfulness and EEG

EEG activity patterns have been examined in specific meditation modes. A common feature of meditation has been the synchronization associated with theta and alpha events (Antonenko, Paas, Grabner, & Van Gog, 2010). Such coordination has been observed in various meditation exercises, including mindfulness, as well as exercises such as transcendental meditation, which involve focusing attention on a mantra with an inner voice. However, different types of meditation practice are associated with unique frequency patterns that reflect the shape of attention (Lehmann et al., 2012). For example, mindfulness is associated with increased alpha power and focused attention is associated with increased gamma activity and idiosyncratic meditation is associated with decreased alpha and beta (Hinterberger, Schmidt, Kamei, & Walach, 2014).

In addition, event-related potentials (ERPs) provide a benchmark for a large number of time-locked experimental trials, which allow the analysis of sensory, perceptual, and cognitive processing (Light et al., 2010). Such studies involve detailed analysis of transient neural populations that are directly manifested through a stimulus / event, often a stimulus related to an attention-based task (such as listening to an auditory signal) (Schoenberg and Speckens, 2014). The high temporal resolution of this approach, which includes millisecond accuracy, makes it possible to examine the early stages of information processing and subsequent transfers to higher-level cognitive operations. ERP studies have been used to validate the idea of mindfulness as a system of mindfulness training. For example, Van Leeuwen, Singer, and Melloni (2012) examined the effect of mindfulness training on hierarchical stimulus processing and attention selection, focusing on differences in the primary components of the visual evoked response (e.g., components P1 and N1). In order to focus on specific stimuli, meditators demonstrated the lack of faster attention engagement than a dominant global display, which shows that meditation increases the speed of attention allocation and movement, thus increasing the depth of information processing.

Other research has shown that use of mindfulness techniques can reduce the mind wandering of patients with OCD and increase the bandwidth of alpha and beta waves (Hawley, Rector, DaSilva, Laposa, & Richter, 2021). Other research has also shown that during mindfulness, theta waves increase in the frontal
and temporal regions, and on the other hand, alpha wave activity increases in the posterior regions of the brain (Lagopoulos et al., 2009).

In the meta-analysis performed for the effectiveness of mindfulness on EEG, the results showed that alpha and theta waves increase in the mindfulness state and no fixed pattern was shown for gamma, beta and delta waves and mindfulness. The researchers conclude that the increase in alpha and theta may indicate a state of calm consciousness (Lomas, Ivtzan, & Fu, 2015).

The aims of this research
Due to the importance of aging and increasing diseases such as blood pressure in this period, the use of treatment methods to reduce and manage blood pressure is very important. On the other hand, non-pharmacological methods are used in this field because lifestyle changes can prevent the disease in the elderly. Also, using brainwave measurement methods to evaluate the effectiveness of mindfulness techniques can provide unbiased information to create peace of mind through these techniques. Therefore, the aim of this study was to evaluate the effectiveness of mindfulness on blood pressure and brain waves in the elderly with high blood pressure.

Methods
The design of the present study was quasi-experimental with pretest-posttest with a control group.

Participance
The statistical population of this study included the elderly with high blood pressure who referred to health centers in Baghdad in 2021. From this number, people who had blood pressure above 14 and were willing to participate in meetings were selected and participated in the research. Age above 60 and blood pressure 14 and above were considered as the criteria for entering the study. Absence from more than two sessions and unwillingness to attend sessions were recognized as exclusion criteria. We selected 8 people as a sample in the mindfulness training group and considered the same number for the waiting group. Sampling was available.

Research tools
after obtaining written consent, pre-test evaluations were performed. The following tools were used to collect data:

1. barometer

2. Quantitative electroencephalograph (QEEG) is a device for evaluating and measuring brain waves and their related characteristics. In this method, the evaluators have fixed a number of electrodes on the cap with a special order. This cap receives the brain waves placed on the head. Brain waves were recorded in different modes. In this study, the received waves were analyzed using Norogide software. Brain waves are separated by frequency and displayed in different colors based on the intensity of activity. They are presented in the form of color heads called brain maps.

Conduction
Since EEG method was used in this study, it was not possible to conduct a group study and the sample was studied one by one. In addition to using common antihypertensive drugs, the experimental group received training in mindfulness techniques, and the control group received only common antihypertensive drugs. Two separate mindfulness skills training sessions were conducted. Blood pressure and brain waves were measured before and after each session. The mean blood pressure and brain waves of the experimental and control groups were calculated in two sessions and used as the basis for data analysis. To control the time variable, all subjects were tested in the morning from 10 to 12 in the morning.
Mindfulness treatment in this study included eight mindfulness techniques that were presented to the experimental group in two sessions. In order to maintain ethical principles, mindfulness interventions were performed for the control group after the research. These techniques include: 1. Metacognitive Guidance 2. Free Association Task 3. Prescriptive Mind- Wandering 4. Suppression Counter- Suppression Experiment 5. Tiger Task 6. Clouds Image 7. Attention Training Technique.

1. Metacognitive Guidance
   This technique involves asking a series of questions that one asks oneself when exposed to situations. This technique is intended to enhance metacognition, distraction, and attention release, and can be used in natural situations and in provocative and anxious situations. In fact, one asks oneself whether one's thoughts are only about what is happening around us or whether we are exposed to a storm of inner thoughts.

2. Free Association
   Facilitate passive observation and flow of internal events that occur in the face of internal stimuli. Facilitate metacognition, distraction, attention span, and low conceptual processing. We say a number of words to patients and ask them to allow their minds to respond freely to the words and not to have control and analysis over their thoughts or responses. They just have to look at the impact they receive passively.

3. Prescriptive Mind- Wandering
   This technique is intended to facilitate the mind of detached consciousness, especially in cases where excessive effort is made to control the mind. Excessive attempts to control the mind are seen in the avoidance of emotional-cognitive disorders and disorders in which there is a fear of disturbing thoughts. These efforts are problematic because they can hinder the automated cognitive control processes that are needed in real situations. We explain to the patient that when we do not remember someone's name and it is the tip of our tongue, whatever we try to remember the name is not possible, but when we leave the mind free, it comes to mind automatically. We ask them to open their minds for 3 minutes with their eyes closed and then we ask them what happened in their minds.

4. Suppression Counter- Suppression Experiment
   Many patients have a strong desire to get rid of their thoughts and empty their minds, and adopt strategies to achieve the goal and want to get the thoughts out of the mind and not think about it. We explain to them that mindfulness is different from trying not to think. Trying not to think is futile. We ask them to try not to think about the blue rabbit for 3 minutes and see if they can or not.

5. Tiger Task
   In this task, patients are directed to observe the involuntary aspects of the simulation of the experience of dissociative mindfulness. At first, you can do the exercise with natural images and then with disturbing thoughts. The natural image we use is a tiger. We ask patients to imagine the image of a tiger and to make an effort to influence and change behavior. If the tiger moved or ... there is no problem but they should not move it and should be able to be completely passive.

6. Clouds Image
   In this task, we ask patients to imagine thoughts like clouds in the sky. There is no need to move the clouds and this is not possible at all. They must allow thoughts to move like a cloud and pass and go.

7. Passenger Train Analogy
   It is like depicting clouds. Patients think of themselves as passengers on a train who pass in front of them by train and walk away.

8. Recalcitrant Child Analogy
To practice dissociative mindfulness, patients view negative thoughts like a child behaving badly in the store. If you pay attention to him, the situation will get worse. So, we have to be passive observers from a distance without doing anything. The same should be true of thoughts.

**Data analysis method**

Study data were analyzed by SPSS 22 software using covariance analysis.

**Results**

The mean age of the subjects in the control and experimental groups was 63 and 63.2, respectively. Also, in the experimental group, there were 3 females and 5 males, and the same amount was selected for the control group.

Table 1 shows the mean and standard deviation of the research variables in the experimental and control groups separately in the pre-test and post-test stages.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mindfulness</td>
<td>control</td>
<td>mindfulness</td>
<td>control</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Sd</td>
<td>Mean</td>
<td>Sd</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>15.25</td>
<td>1.27</td>
<td>15.39</td>
<td>1.86</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>10.25</td>
<td>0.86</td>
<td>10.69</td>
<td>1.20</td>
</tr>
<tr>
<td>Alpha</td>
<td>16.25</td>
<td>3.28</td>
<td>17.26</td>
<td>4.05</td>
</tr>
<tr>
<td>Betha</td>
<td>13.28</td>
<td>2.69</td>
<td>14.85</td>
<td>2.06</td>
</tr>
<tr>
<td>Theta</td>
<td>7.96</td>
<td>1.36</td>
<td>8.02</td>
<td>0.93</td>
</tr>
<tr>
<td>Deltha</td>
<td>13.68</td>
<td>4.36</td>
<td>14.26</td>
<td>4.69</td>
</tr>
</tbody>
</table>

In order to perform the Covariance test, the assumptions of normal distribution of scores and homogeneity test of variances were performed. The Shapiro-Wilkes test was used to determine whether the distribution of post-test scores was normal. The Shapiro Wilkes index for the post-test scores of the research variables was all insignificant, which means that the distribution of scores is normal. Levine test was also used to check the homogeneity of the variances. Levin's test results were also obtained for non-significant research variables ($p < 0.05$), indicating that the distribution of scores between the two experimental and control groups in the post-test phase did not differ.

Also, to check the homogeneity of the variance-covariance matrix assumption, the BOX test was used and the results of this test in the post-test phase showed that the value of the BOX was not significant ($p = 0.76, F= 0.61 = BOX =61.8$) and assume of homogeneity of the variance-covariance matrix was obtained.

To investigate the effect of experimental intervention, multivariate analysis of covariance on post-test scores, by controlling research pre-tests (blood pressure, Alpha, Betha, Theta, Deltha brain waves) was done. Table 2 shows the results of multivariate analysis of covariance on post-test scores with pre-test control.

**Table 2. Results of multivariate analysis of covariance on post-test scores of variables**
The contents of Table (3) show that there is a significant difference between the experimental and control groups in terms of research variables (p <0.001).

Based on this, it can be stated that at least in one of the dependent variables, there is a significant difference between the experimental and control groups. The effective size for the Wilks' Lambda effect is 0.556, which means that 55% of the difference between the two groups is related to the experimental intervention.

To investigate the difference point, a one-way analysis of covariance was performed on blood pressure, Alpha, Beta, Theta, Delta brain waves in the MANCOVA text, the results of which are presented in Table 3.

**Table 3. Results of ANCOVA analysis on the mean post-test scores of the blood pressure, Alpha, Beta, Theta, Delta brain waves.**

<table>
<thead>
<tr>
<th>variable</th>
<th>Type III Sum of Squares</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic blood pressure</td>
<td>159.55</td>
<td>2</td>
<td>79.77</td>
<td>26.42</td>
<td>0.001</td>
<td>0.616</td>
<td>1</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>74.63</td>
<td>2</td>
<td>37.31</td>
<td>14.93</td>
<td>0.001</td>
<td>0.475</td>
<td>0.998</td>
</tr>
<tr>
<td>Alpha</td>
<td>169.35</td>
<td>2</td>
<td>88.67</td>
<td>12.35</td>
<td>0.001</td>
<td>0.597</td>
<td>1</td>
</tr>
<tr>
<td>Beta</td>
<td>130.35</td>
<td>2</td>
<td>65.17</td>
<td>1.08</td>
<td>0.250</td>
<td>0.102</td>
<td>0.302</td>
</tr>
<tr>
<td>Theta</td>
<td>50.06</td>
<td>2</td>
<td>25.03</td>
<td>15.41</td>
<td>0.01</td>
<td>0.615</td>
<td>1</td>
</tr>
<tr>
<td>Delta</td>
<td>132.15</td>
<td>2</td>
<td>66.07</td>
<td>0.923</td>
<td>0.269</td>
<td>0.247</td>
<td>0.268</td>
</tr>
</tbody>
</table>

The results in Table 3 show that the covariance analysis of Systolic blood pressure and diastolic blood pressure (p< 0.001) is significant. Also, the analysis of covariance shows that the difference between the scores of the experimental and control groups in alpha and theta waves were significant in the posttest stage (p <0.001). However, the differences between the two groups in delta and beta brain waves were insignificant.

**Discussion**

The results of the present study showed the effectiveness of mindfulness training on hypertension in the elderly with hypertension. These results are consistent with the findings of Ponte Márquez et al. (2019), Conversano et al. (2021), Nejati, Zahiroddin, Afrookhteh, Rahmani, and Hoveida (2015) . The effectiveness of mindfulness training on systolic and diastolic blood pressure in patients with hypertension can be explained by using the role of stress and anxiety as one of the most important factors influencing the severity of hypertension symptoms. Stress and anxiety are almost always associated with physical stress, and people usually first experience a physiological response to them. In Response to Hypothalamic Axis Anxiety - The pituitary and adrenal glands (HPA) and the sympathetic axis become active. In this process, hormones are secreted, including cortisol, which play an important role in the pathology and exacerbation of hypertension. In this regard, past research has shown that teaching mindfulness techniques can be effective in reducing worry and anxiety(Evans & Segerstrom, 2011). The effectiveness of mindfulness techniques can be related to lifestyle changes in people with high blood pressure. As shown in the 2015 study by Nejat et al., MBCT reduces depression and negative thoughts, and
in turn increases the healthy lifestyle in individuals. mindfulness techniques teach clients to take a non-judgmental and accepting approach to negative thoughts. This approach therefore leads to a reduction in stress and thus a reduction in blood pressure. However, these results contradict Blom et al. (2014) findings. Blom et al. Conclude that mindfulness-based stress reduction has no clinical or statistical effect on hypertensive individuals. Perhaps the reason for this discrepancy in the findings is that in Blom's study, there were people who did not have hypertension and were in prehypertension stage. However, in our study, elderly people with hypertension were studied.

On the other hand, the results of the present study showed that mindfulness techniques can be effective on the brain waves of the elderly with hypertension. These results showed that the amount of alpha and theta waves increased after the intervention. This finding is in line Desai et al. (2015), Hinterberger et al. (2014), Lomas et al. (2015). Researchers consider synchronization alpha wave as one of the main signs of peace of mind in the state of mindfulness(Desai et al., 2015). Numerous studies have shown that increased alpha wave coordination occurs during meditation compared to rest. This happens to both novice and experienced people alike(Lomas et al., 2015). However, some research has shown that mindfulness techniques reduce alpha waves(Lehmann et al., 2012). It should be noted that the sample of these studies is non-clinical, while the sample of the present study is hypertensive people. Shaw (1996) has resolved this contradiction by distinguishing between internal and external attention. In this way, external attention leads to a decrease in alpha wave and internal attention or intention leads to an increase in alpha power. Mindfulness seems to increase people's inner attention and thus increase the power of alpha waves.

Theta activity is associated with a variety of cognitive activities, including attention change and orientation, new information processing, and memory in episodic encryption and retrieval (Lomas et al., 2015). In general, mindfulness skills lead to increased internal attention in the brain.

One of the limitations of our study was that due to the inability of the elderly to visit the test site, the number of sessions was limited to two sessions. Also in this study, mediating variables such as anxiety and increased sympathetic system function were not studied. And these can be used as research suggestions for researchers.

Reference

47. Van Leeuwen, S., Singer, W., & Melloni, L. (2012). Meditation increases the depth of information processing and improves the allocation of attention in space. Frontiers in human neuroscience, 6, 133.