

## **Respiratory physical therapy influence on the stress level in hypertensive persons in the age group 40-60 years**

*Influența kinetoterapiei respiratorii asupra nivelului de stres la persoanele hipertensive din grupa de vârstă 40-60 de ani*

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### **Abstract**

*Background.* The introduction of a program of respiratory physical therapy in people with essential hypertension in the age group of 40-60 years influences their stress level.

*Aims.* Hypertension is known as a cardiovascular risk factor that promotes coronary and cerebral atherosclerosis. Another cardiovascular risk factor, stress, is commonly associated with hypertension and may even be the generator of the latter. The increasing share of hypertensive people and the increasing presence of daily stress in human life have led us to study to what extent respiratory physical therapy, whose benefits are known, can help reduce these risk factors.

*Methods.* This study, type application, was completed between September 2012 – August 2013 on a number of 24 subjects, divided in two groups, one experimental and the other control, diagnosed with essential arterial hypertension. Information on the stress level of the subjects before and after the application of respiratory kinetotherapy was gathered through some questions evaluating stress in 6 important areas. Each answer was given a number of points, and the overall score placed each subject in a certain stress level area (dangerously low, low, normal, high, dangerously high).

*Results.* The individual evolutions of the subjects of the experimental group show statistically significant differences between the tests, the mean of the experimental group being smaller, while the control group did not show any significant differences. In the comparative analysis between the groups, the effect size index (0.336) shows a small to moderate difference in favor of the experimental group (a lower stress level).

*Conclusions.* Reducing the level of stress in experimental research subjects gives respiratory physical therapy a psychotherapeutic role on those with essential hypertension.

**Keywords:** essential arterial hypertension, respiratory physical therapy, stress level.

### **Rezumat**

*Premize.* Introducerea unui program de kinetoterapie respiratorie la persoanele cu hipertensiune arterială esențială, aflate în grupa de vârstă 40-60 de ani, influențează nivelul de stres al acestora.

*Obiective.* Hipertensiunea arterială este cunoscută ca factor de risc cardiovascular ce intervine în favorizarea aterosclerozei la nivel coronarian și cerebral. Un alt factor de risc cardiovascular, stresul, se asociază frecvent hipertensiunii arteriale și poate fi chiar generator al acesteia din urmă. Ponderea crescută a persoanelor hipertensive și prezența în continuare a stresului cotidian în viața omului ne-au determinat să studiem în ce măsură kinetoterapia respiratorie, ale cărei beneficii sunt cunoscute, poate contribui la reducerea factorilor de risc amintiți.

*Metodă.* Studiul de față, de tip aplicativ, a fost efectuat în perioada septembrie 2012 - august 2013 pe un număr de 24 de subiecți cu vârsta cuprinsă între 40-60 ani, împărțiți în două loturi, unul experimental și altul martor, diagnosticați cu hipertensiune arterială esențială. Informațiile privind nivelul de stres al subiecților înainte și după aplicarea kinetoterapiei respiratorii au fost colectate prin intermediul unor întrebări prin care a fost inventariat stresul pe 6 domenii importante. Fiecărui răspuns i s-a acordat un număr de puncte, iar punctajul general obținut a încadrat fiecare subiect într-o anumită zonă a nivelului de stres (primejdios de scăzut, scăzut, normal, ridicat, primejdios de ridicat).

*Rezultate.* Evoluțiile individuale ale subiecților grupei experimentale arată existența unor diferențe semnificative statistic între testări, media grupei experimentale fiind mai mică, în timp ce la grupa de control nu prezintă diferențe semnificative. La analiza comparativă între loturi, indicele de mărime a efectului (0,336) arată existența unei diferențe mici spre mijlocie, în favoarea lotului experimental (un nivel de stres mai mic la acesta).

*Concluzii.* Reducerea nivelului de stres la subiecții cercetării experimentale conferă programelor de kinetoterapie respiratorie un rol psihoterapeutic asupra celor cu hipertensiune arterială esențială.

**Cuvinte cheie:** hipertensiune arterială esențială, kinetoterapie respiratorie, nivel de stres.

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## Introduction

Hypertension is a condition, but also a cardiovascular risk factor. Numerous specialty studies have identified the association between blood pressure variability and increased mortality and cerebrovascular and coronary events in hypertensive patients (Bădilă, E. et al., 2013).

Moreover, researchers such as Rothwell, PM. et al. (2010) or Fratolla, A. et al. (1993), who have been following hypertensive persons for several years, show the relationship between increased blood pressure and target organ damage such as left ventricular hypertrophy.

Also, studies by Bădilă, E. et al. (2012) and Volpe, M., Tocci, G. (2009) confirm the subclinical impairment of some organs (heart, kidneys, brain), explaining the need for a thorough evaluation of the hypertensive patient in terms of cardiovascular risk.

One of the cardiovascular risk factors commonly associated with high blood pressure, considered as a generator but also as a consequence of it, is stress that modern science defines as any type of change causing physical, emotional or psychological pressure, which can contribute to the development of psychic resistance, awareness, new perspectives, a sense of control if its time of action is short (Davidji, 2015).

Too much beneficial stress (eustress) can degenerate into distress, manifesting by different reactions: anger, anxiety, sadness, depression, negative emotions that affect cardiac consistency and cause chaos in the body physiology (Servan-Schreiber, D., 2007). Stress, associated directly with hypertensive disease, generates overall sympathetic tone (Cinteză, M., 2012).

In dealing with distress, breathing exercises play an important role (Arădăvoaice, G., 2010), which contributes to better oxygenation of body tissues, regulates cardiac activity, develops thoracic capacity, stimulates digestive organs and immunity, stabilizes the mental state and favors a state of emotional balance. Exercises of deep breathing "release us from stress" (Rodríguez, J., 2007) and produce a general relaxation state by inhibiting the sympathetic vegetative nervous system (Mantak, C., William, UW., 2017).

Specialists emphasize the significant relationship between cardiovascular complications and increased blood pressure during stress (Pickering, TG., 1982).

Hypertension is a risk factor for cardiovascular complications (Parati, G. et al., 2013), but difficult to control with conventional antihypertensive drug therapy (Parati, G. et al., 2008).

Thus, the treatment of this disease consists not only of a decrease of tension values, but also of cardiovascular risk (Mancia, G. et al., 2013). In this regard, specific antihypertensive medication should be associated with other forms of treatment to achieve these goals.

We consider that the introduction of respiratory physical therapy in the treatment of patients with essential hypertension belonging to the age group of 40-60 years influences their stress level and contributes to the reduction of the number of cardiovascular ischemic events and to the increase of the quality of their life.

## Objectives

The respiratory physical therapy objectives were adapted to the needs of the subjects of this study and consisted of the following:

- Balancing the nervous system and improving the mental state of the patients;
- Facilitating vasodilation in skeletal muscles in order to stimulate blood circulation
- Increasing vital capacity by increasing chest elasticity;
- Educating subjects and their families in order to adopt a rational lifestyle that will allow reducing as many cardiovascular risk factors as possible.

## Hypothesis

The introduction of a program of respiratory physical therapy for hypertensive people in the age group of 40-60 years influences their stress level.

## Material and methods

In accordance with the Helsinki Declaration, the Amsterdam Protocol and the Directive 86/609/EEC, the Ethics Committee's approval was obtained from the Department of Physical Education and Sport of the National University of Physical Education and Sports for the conduct of the experimental research.

We note the written consent of the subjects regarding their participation in the research.

Research protocol

### a) Period and place of the research

The study was conducted between September 2012 and August 2013 at the *Spine Health* Medical Recovery Center in Bucharest. Patients enrolled in the study were treated on an outpatient basis for 12 consecutive weeks with three respiratory gymnastics programs (the first program between weeks 1-3, the second program between weeks 4-8, and the third program between weeks 9-12).

### b) Subjects

The study was conducted on 24 subjects, 14 females and 10 males, aged 40-60 years, diagnosed with essential hypertension.

Of the 24 subjects, 4 withdrew during the first 3 weeks for personal reasons, and 8 subjects did not want to be actively involved in this research, establishing the composition of two groups, an experimental (E) group and a control (C) group, with a total number of 12 subjects.

The subjects of the study were selected according to the following inclusion criteria:

- Resting cardiac frequency above 60 beats/minute,
- Blood pressure below 180 mmHg,
- Absence of lung diseases,
- Absence of serious cardiovascular disease,
- Absence of angina pectoris or other significant symptoms during the exercise and effort test: vertigo, breathing difficulty (dyspnea), headache,
- Subjects accepting to cooperate in the research,
- Conscious involvement of the subjects.

### c) Tests applied

The subjects who met the conditions for inclusion in the experiment were specifically evaluated to know their

stress levels and assess to what extent respiratory physical therapy in people with essential hypertension reduces mental tension.

In this regard, we applied for a category C stress test. The lack of a category C stress test, validated on the Romanian population, determined the use of the test designed by Melgosa, J. (2000) and mentioned by Arădăvoaice, D. (2010).

The stress test included questions related to 6 important areas (items), namely: lifestyle, environment, symptoms, job/occupation, relationships and personality.

The interpretation of the test consists of locating the level of stress through the score obtained in a certain area:

- Zone 1 (from 0 to 48 points) - The level of stress is dangerously low.
- Zone 2 (48-72 points) – The stress level is low.
- Zone 3 (72-120 points) – The stress level is normal.
- Zone 4 (120-144 points) – The stress level is considered high.
- Zone 5 ( $\geq 144$  points) - The stress level is dangerously high.

#### d) Studied moments

The subjects in the two (experimental and control) groups were evaluated at the beginning of the program (T1) and at the end of the 12 weeks (T2) from the start of the program.

The respiratory physical therapy program aimed at achieving the physiotherapy objectives recommended for subjects with essential hypertension, according to Mark, V., Dan, M. (2007), adapted to the needs of the subjects of this study.

The program was conducted under close supervision and the cardio-respiratory parameters (blood pressure, heart rate, respiratory rate, saturation of arterial blood in oxygen) were periodically measured. To avoid possible incidents, the subjects were individually worked. All subjects in the experimental group attended the 3 schedules.

Physical training was conducted in the heart area of low and moderate intensity exercise, using the value of 60-75% of the reserve heart rate. The progress of the intensity of the respiratory physical therapy session was gradual, individualized for each subject.

The central element of training was to establish synchronization of the slow movements of the body with the breathing rate. In all exercises breathing forced the rhythm, and the body followed it. The duration of each breath was increased progressively according to the ability of each subject to adapt to the effort and to focus on the movement and the ventilator process. Depending on the rate of respiration specific to each subject, in the first 3 weeks the duration of the program was 20-30 minutes, in weeks 4-8 it was 40-90 minutes, and in weeks 9-12 it lasted 60-75 minutes.

The program included aerobic exercises represented by ample and slow movements of the upper, lower limbs and torso to increase the myocardial contraction force, as well as exercises based on coordination, balancing, trunk twisting to rebalance the nervous system. The exercises were aimed at awareness of the respiratory act through the correct learning and exercising of diaphragmatic, thoracic and complete breathing. Account was taken of the ability

of each subject to expand the chest box during inspiration and to control the contraction of abdominal muscles during expiration. We emphasize the importance of achieving inspiration and expiration as slow, deep and prolonged as possible, and the execution of breathing phases at the nose, except for those exercises in which the expiration was sound and those requiring oral air removal due to the low tolerance of the subjects.

Of the following methodological aspects, we mention:

- Correct body alignment was observed;
- Exercises were performed from positions that facilitated breathing. The following positions were used: sitting with abducted lower limbs on the seat and on the fitness ball, lying down, lying on the side, lying on the knee, standing on the knee and standing with abducted lower limbs;
- Exercises were used in which the holding of the hands during practice blocked the scapulohumeral girdle, knowing that on a fixed scapula the mobilizing thoracic muscles (serratus anterior muscle, minor pectoral muscle) take a better support point than the mobilization of the upper limbs ;
- Exercises were aimed at toning the respiratory muscles to increase pulmonary volumes, to control and coordinate the respiratory rhythm with influences on the rhythm of the heart. Thus, the main muscles were: inspiratory muscles (diaphragm, external intercostals), accessory muscles (scalene, serratus posterior, sternocleidomastoid, pectoral, trapezius and dorsal) and expiratory muscles (abdominal, intercostal, lumbar, the sternum triangle);
- Exercises were aimed at toning the postural and perineal muscle;
- Exercises were performed in the mirror to observe the movement and thus, to allow the mind and body to work together, the will being important in their practice.

#### e) Statistical processing

For statistical characterization of the experimental group E and the control group C we used statistical indicators of the central trend (arithmetic mean, median, quartile 1 (Q1), quartile 3 (Q3)), indicators of spreading (standard deviation, minimum and maximum values, coefficient of variation). The listed indicators were applied to the overall score obtained in the stress test.

The data of each subject were entered into the database. Analysis of statistical indicators and verification of statistical assumptions were carried out with the specific SPSS 17.0 software (Statistical Package for the Social Sciences).

To compare the initial and final tests for the C group or the initial and final tests for the E group, we used the non-parametric Wilcoxon signed ranks for two paired samples in the control group and the non-parametric Friedman tests for multiple samples, and Wilcoxon signed ranks as a post hoc test with the Bonferroni correction for the Friedman test. The Bonferroni correction considers the significance threshold equal to 0.05 divided by the number of comparisons that can be made. In this case,  $\alpha = 0.017$ . The comparison of the final tests between the experimental group and the control group was performed with the non-parametric Mann-Whitney test for two independent samples.

**Table I**  
General averages on items at the initial and final testing of the two groups.

Items	Averages on stress test items in the initial testing (T1) of the groups		Averages on stress test items in the final testing (T2) of the groups		p Group E T1-T2	p Group C T1-T2
	E	C	E	C		
	Lifestyle	23.58	23.16	19.83	23.25	-
Environment	20.16	16.41	15	15.5	-	-
Symptoms	17.16	21.41	13.66	21.91	-	-
Job	17	14.58	15.08	13.08	-	-
Relationships	20.66	20.41	20.58	20.08	-	-
Personality	18.08	21.33	16.05	21.5	-	-
General score	124,83	125.33	109.92	124.58	0.006	0.720

## Results

Table I reflects the general averages of the stress test items at the initial and final evaluation of the two groups, and the value of the p (Asymp. Sig) coefficient from the Wilcoxon nonparametric test resulting from the processing of the overall score obtained in the two tests.

In the case of the general score obtained by the E group in the stress test, the data distribution around the mean is relatively homogeneous in two tests, the coefficients of variation being equal to 19.02% and 15.28% for the final test. The averages are equal to 124.83 points for the initial testing and 109.92 points for the final testing. The nonparametric Friedman test shows that there are significant differences between the mean scores of the tests (Chi-Square = 9.500, Asymp. Sig = 0.009 < 0.05). The Post Hoc Wilcoxon test, with the Bonferroni correction, indicates significant differences between the final and initial testing ( $Z = -2.751$  and  $p = 0.006 < 0.017$ ). Analysis of stress test items applied to C group shows, by means of the nonparametric Wilcoxon test, that there are no significant differences between the mean scores of the two tests ( $Z = -0.358$ , Asymp. Sig. (2-tailed) = 0.720 > 0.05).

The comparative analysis shows that the overall score values accumulated by each subject in the stress test are distributed around the relatively homogeneous mean of both the experimental group and the control group, the coefficients of variation being equal to 15.28% and 16.59%, respectively, at the final test.

The averages are equal to 109.92 in the experimental group and 124.58 in the control group. The non-parametric MANN-WHITNEY test shows that there are no significant differences between the mean scores of the two tests ( $Z = -1.647$ , Asymp. Sig. (2-tailed) = 0.100 > 0.05).

## Discussions

Half of the initial values obtained in group E subjects were in the area where stress is very dangerously high (values above 120), while the other 6 cumulated between 91 and 111 points, the latter thus being in the normal stress area with values ranging from 72-120.

After application of the respiratory physical therapy program, all subjects recorded overall scores, with the exception of subjects 10 (DL) and 11 (BM), whose scores increased insignificantly, from 102 to 107 points and 103 to 111 points, respectively, continuing to be in the same normal stress area, where tension moments alternate with relaxation.

Statistical processing indicates large differences between the initial and final tests; the effect size index is 0.46, which entitles us to assert that breathing exercises contribute to improving mental tone.

The processing of the results obtained in the control group C establishes the lack of significant differences between the two tests. The effect size index (0.07) shows that there is a very small difference between the two tests.

In terms of stress, most (8) subjects are in the high stress area and need to find the resources to get a positive attitude. However, a decrease of the stress level in 2 subjects is seen: 1 (AF), female, 60 years old, retired, and 8 (MM), male, 41 years old, a plumber, as well as the maintenance of the initial score obtained in a subject: 12 (CF), aged 58, retired.

In the comparative analysis between groups, the effect size index (0.336) shows a small difference in favor of group E (a lower level of stress in group E).

Reducing the level of stress in experimental group subjects gives the respiratory physical therapy program a psychotherapeutic role in the case of those with essential hypertension and turns it into a means of combating stress.

## Conclusions

1. Respiratory physical therapy, by confirming the hypothesis of our research, is a means of fighting stress present in hypertensive subjects. This effect is reflected in a good functioning of all systems, predominantly the cardiovascular and respiratory systems.

2. Exhaustive and deep breathing exercises lead to general relaxation by decreasing muscle tone during expiration due to activation of the parasympathetic nervous system.

3. Inclusion of diaphragmatic breathing in both respiratory kinetic and daily activities contributes to the control of the heart and respiratory rate, allows for the flexibility of the trunk muscles by contraction-relaxation alternation, and optimizes the level of stress.

4. Personalized, controlled and systemic application of respiratory physical therapy reduces the stress level in hypertensive individuals and thus improves the quality of their lives.

## Conflicts of interests

There are no conflicts of interests.

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