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Research article

The role of physical exercise in modifying cardiovascular parameters in hypertensive patients

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Abstract: Hypertension is among the top risk factors for cardiovascular diseases. Diversified rehabilitation programs are needed to limit the progression of the high blood pressure condition. The welfare of aquatic therapy is acknowledged, but hydrotherapeutic procedures are rarely used in cardiovascular diseases. The study aims to assess the impact of an exhaustive hydrokinetic thermo therapeutic program compared to other methods of treatment, i.e., cardiovascular rehabilitation program, recommendation for a healthy life, and antihypertensive medication. Four groups of patients (46 years ±0,32) diagnosed with hypertension participated in four different rehabilitation programs to analyze the impact on their effort capacity. Their ability to achieve average effort without the appearance of fatigue symptoms was studied for a period of eight weeks by monitoring six parameters: systolic blood pressure (SBP), diastolic blood pressure (DBP), Borg Scale, Medical Research Council Dyspnoea Scale (MRC-DS), pulse (P) and oxygen saturation (O2). Group A, which benefited only of recommendations for a healthy life, didn't register any significant p values between the initial and final evaluation; group B, which had medications and recommendations for a healthy life, registered significant p values for 2 parameters (SBP and P have $p<0.0001$); group C, which took part in a cardiovascular rehabilitation program, obtained significant p values for 5 parameters (SBP, DBP, Borg, MRC-DS and O2 have $p<0.0001$); Group D, the recipient of hydrotherapeutic program, registered significant p values for all statistically 6 monitored parameters (SBP, DBP, Borg, MRC-DS, P and O2 have $p<0.0001$). Physical activity in water performed regularly within a controlled therapeutic program with the thermal and electrotherapy components, leading to improved capacity for the effort by decreasing blood pressure values and dyspnea parameters.

Keywords: hydrokinetic therapy, thermotherapy, electrotherapy, effort capacity, arterial hypertension

1. Introduction

In the last 5 years the ESC guidelines have included in their content updates information regarding both the detection of arterial hypertension and the establishment of protocols with the role of controlling blood pressure values [1-6]. The removal of humans from nature due to modernization has led to the appearance of stress, sedentariness, and excess, which has, as a consequence, a considerable percentage increase in the population diagnosed with the diseases of the century,

among which is also arterial hypertension alongside diabetes, atherosclerosis, strokes, and heart diseases [7].

Two studies published in 2023 emphasize the percentage increase in patients with cardiovascular diseases in Romania and reveal that hypertension is at the top of the risk factors. [8-9].

Guidance ensures patients understand the importance of instituting drug and non-drug treatments as early as possible. Non-pharmaceutical treatments are recognized as necessary,, especially with regard to lifestyle changes [10-11]. Patients know little about this ”non-drug” part, represented by physical therapy [12].

For years, the incorrect tendency of hypertensive patients to limit their physical activity in order not to reach higher blood pressure values, not knowing that inactivity will have the exact opposite effect, has been emphasized [13]. Protocols adopted today by hospitals in Romania provide a method of recuperative treatment, alongside the medicinal treatment instituted by the specialist doctor, procedures in the sphere of electrotherapy, hydrotherapy, and hydro-kinesis therapy [14].

Patients should be informed about the damage to body systems caused by increased blood pressure by explaining the acronym „AOTHM” („target organ damage mediated by hypertension”) [15]. Swimming is recommended as a moderate physical activity for hypertensives [16].

Hydrotherapy benefits the hypertensive patient from several points of view. We primarily use the pleasure that water brings to the patient when coming into contact with it, followed by the unloading of weights, which reduces stress on the muscles and joints, based on the fundamental law of hydrostatics [17]. The gravitational discharge will benefit blood pressure, heart performance, and general and peripheral circulation.

Hypertensive background in middle-aged adults, i.e. 39-55 years old, about the severe complication of hemorrhagic or ischemic strokes were brought in three case studies published in 2022 and underline the acute need for interventional recovery programs for hypertensive patients so that such complications may be prevented [18-20]. One of these studies [18] emphasizes the efficiency of aquatic therapy as a recovery method in neuro-myo-kinetic apparatus along with the cardiovascular and metabolic functions.

For years, periodicals have avoided the analogy of hydrotherapy with cardiovascular diseases. In 2011, an article about hydrotherapy for venous conditions was published, so the benefits of hydrotherapeutic procedures were recognized for the vascular venous bed. Therefore, they certainly have an echo on the arteries as well [21]. A review in 2023 underlines the importance of non-pharmaceutical intervention for HTA represented by hydrotherapy, balneotherapy and spa therapy [22]. In the last 10 years, more and more articles have referred to swimming as a healthy possibility to prevent heart diseases and even improve cardiovascular health and HTA rates [23-29].

Different research populations has highlighted the importance of exercise training and its benefits in controlling blood pressure values, and most of them registered a significant decrease in these values [30-32].

Additionally, several lines of evidence reveal the potential effect of hydrotherapy programs as adjuvant methods that may improve blood pressure, but more clinical trials are needed to sustain the benefits of this non-pharmaceutical approach [33]. An experimental study on rats underlines the beneficial effects of balneotherapy upon arterial flow that was maintained for up to six weeks. [34].

2. Materials and Methods

2.1. Hypothesis and objectives

Creating an exhaustive hydro-kinetic thermo therapeutic program, the study aims to assess the modifications of cardiovascular parameters in hypertensive patients by comparing it to other recovery methods: cardiovascular rehabilitation program, the recommendations for a healthy lifestyle, and antihypertensive medication.

The additional benefits of hydrotherapy program to hypertensive patients are:

- improving the parameters for carrying out activities
- adapting to the effort capacity
- controlling the blood pressure values
- reducing daily accumulated stress
- being able to exercise without the appearance of symptoms of fatigue: dyspnea, increased pulse and blood pressure values

The approach of four different treatment directions for hypertensives patients to observe the changes in cardiovascular parameters and to assess the impact of an exhaustive hydro-kinetic thermo therapeutic program compared to other methods of treatment, i.e. cardiovascular rehabilitation program, recommendation for healthy life and antihypertensive medication.

2.2. Participants and place

Over 300 patients were chosen from the records of cardiologists in Mureș county based on thirteen inclusion/exclusion criteria, the main of which was the diagnosis of arterial hypertension degree I. They all filled out questionnaires and were interviewed to form the database for the study. From the collected anamnesis we chose 100 patients who actually participated in the study and we managed to structure them into 4 homogenous groups of 25 patients each in accordance with 11 criteria.

The study was conducted at cardiologists' offices for the interviews and medical history and at Physiotherapy Balneo Center- Apollo Wellness Club Sângiorgiu de Mureș, Romania for the recovery program. The hydrothermal physical program was carried out over a period of 8 weeks with a frequency of 2-3 weekly sessions to reach the threshold of 20 implemented sessions. All patients were assessed before the implementation of the program and after 8 weeks of the program

The study compared 4 groups of patients: group A received exclusively recommendation for a healthy lifestyle (they refused medication), group B benefited from antihypertensive medication along with recommendations for a healthy lifestyle; group C, in addition to medication and recommendations for a healthy lifestyle, benefited from a cardiac rehabilitation exercises program; group D, beside medication and recommendations for a healthy lifestyle, participated in a hydrotherapeutic program.

2.3. Rehabilitation program

Recommendation for a healthy lifestyle includes: changing the diet to protect the cardiovascular system by reducing the salt and alcohol, no more smoking, increasing the amount of vegetables and fruits in order to maintain or reduce, if necessary, the weight, doing some physical activity every day, stress management.

Pharmaceutical recommendation was made by cardiovascular specialist according to individual particularity of each patient.

The cardiac rehabilitation exercises program was carried out during an 8-week period reaching 20 group meetings. Each session consisting of general mobilization of the body- the initial part for 10-15 minutes, walking or cycling from 20 up to 30 minutes and the recovery part based on stretching for 10-15 minutes. One session should not be more than 50 minutes in total and the intensity may reach a maximum of 65% of the effort capacity.

Hydrothermal therapy

1 session had 60-90 minutes in total but divided in 3 parts and with recommendation of 5 up to 15 minutes pause between procedures if needed, so that the intensity of the effort remained under 65%.

Part 1 of body preparation through electrotherapy or hydrotherapy procedures carried out individually by group patients -15-20 minutes:

- four cellular galvanic baths at a temperature of 37-38°C with negative polarity in the lower limbs and positive in the upper limbs -15-20 minutes,
- magnetodiaflux with lumbar and cervical applications – 20 minutes- the magnetic field effect on some systems will regulate blood pressure values:

central nervous and peripheral nervous, vascular and endocrine-hormonal (light bath with dry air by infrared irradiation, dry air sauna, infrared sauna).

Part 2 represents group hydrokinetic therapy in the pool:

- 10 minutes accommodation with the environment with or without assistive devices- floating
- 20 minutes active and stimulating exercises in the pool
- 10 minutes recovery-breathing and floating exercises.

For physical exercises, the 3 forces will be taken into account-body weight, hydrostatic lift (support) and hydrodynamic (vertically and in the direction of movement) [35]. For the initial and final part of this section swimming, as a free activity was supervised for the patients, considering the 3 phases of respiratory mechanism: inhale-apnea-exhale [36]. because the mobility of the diaphragm is greatly influenced and can be developed by swimming. Swimming falls under moderate physical activity if it is of short duration, similarly to walking, and crawling is an intense physical effort, just like running at about 8-0 km/h.

Part 3 with a duration of 20-30 minutes is represented by the breaststroke, which is a grouping of symmetrical simultaneous movements [37]. Patients who cannot swim were provided with floatation devices. The interdisciplinary team opted for this recovery method.

Hydrokinetic therapy program aims to combine the effects of water with those of controlled physical exercise. The water in the pool acts as a resistance against the desired movement, but at the same time it is also a way of supporting it. Patients are able to perform a series of exercises without feeling strain at the joint level.

During the exercises, the movement of the water around the body will be felt like a massage, to which are added the vasodilatory thermal effects. Relaxation will be felt both physically and especially mentally, eliminating stress and favoring the installation of the desired beneficial effect. Hydrotherapy took place in a pool with varying concentration of mineral salts. Sulphurous water has an anti-inflammatory effect, waters rich in bromine and iodine have a diuretic effect; waters rich in iron and arsenic have a beneficial tonic-stimulating effect against stress, radioactive substance have sedative effects, water has an analgesic and antispasmodic role and carbonic acid will have a tonic effect.

The thermal component has significant advantages: vasodilatation, lowering the pain threshold, general superficial and deep muscle relaxation. For these effects specific procedures were additionally chosen for superficial anatomical planes, mud packs and infrared radiation and for deep ones microwave and ultrasound. Water temperature is important, predominantly warm waters were used in the therapy, so that 65% of the maximum frequency of effort was not exceeded.

2.4. Assessment

The assessment for all 4 groups was carried out twice for the initial assessment- before and after an average effort- and similarly- before and after an average effort- for the final assessment, i.e. after the 8- week program. In order to register and compare their ability to achieve average effort without the appearance of fatigue symptoms six parameters were monitored: systolic blood pressure (SBP), diastolic blood pressure (DBP), Borg Scale, Medical Research Council Dyspnoea Scale (MRC-DS), pulse (P) and oxygen saturation (O2).

The correct measurement of blood pressure is always present in information and guides dedicated both to the population and medical specialists alongside generally approachable treatment direction [38]. Approved professional medical devices were used for data recording: blood pressure monitors P-200) and pulse oximeter (PM-60 Mindray) for oxygen saturation and heart rate respectively.

The tests chosen were the tracking of a series of easy-to-record effort parameters incorporated into a walk-like test. After the comfortable walking speed was calculated, the step length could be determined individually, the distance in meters that the patients had to walk in order to reach an average level of effort and thus the modified

parameters could be recorded [39]. In general, blood pressure values are correlated with heart rate, but in addition to this we proposed to add the intensity of the effort. Thus, we want to observe the reactivity of the cardiovascular system, for this will also consider oxygen consumption alongside the Borg scale for dyspnea and MRC fatigue scale.

The Borg scale is used to determine the patient's ability to move and it will record the effort with which the patient moves [40-41]. The Borg effort scale registers the intensity of the effort made, but from the patient's subjective perspective. Subjectivism in this situation is beneficial because a sedentary patient can perceive intense effort at a lower real intensity with a reduced heart rate, and on the opposite pole, for a trained patient fatigue will appear when performing a considerable effort i.e. later but at the same heart rate [38]. Borg Scale of Perceived Exertion Intensity [42-43]. The MRC scale-effective questionnaire for determining health status and estimating risks of complications [44-46].

3. Results

3.1. Data presentation

The obtained data were statistically processed with GraphPad Prism V.902, and the results are considered statistically significant if they have a result lower than or equal to the 0.05 threshold.

During the study, 2 tests were performed and for each time 2 values were recoded for each parameter; thus 2 tables resulted and each table has 2 subsections. Table 1 represents the data collected before the implementation of the program with the values (SBP, DBP, Pulse, Borg Scale, MRC Scale, O2 Saturation) before average effort and after the average effort. Table 2 represents the data collected after the implementation of the program 8 weeks of monitoring) with same values- before and after average effort.

3.1.1. Data obtained before the implementation of the program

At the initial moment, when measuring the parameters before the effort test, there was no significant difference between the means and medians of the 4 groups, all p values begin <0.05, thus confirming the homogeneity of the group (Table 1).

Table 1. Statistical analyses of the date obtained before the implementation of the program.

INITIAL -BEFORE MEDIUM EFFORT						
Group / Parameter	**A**	**B**	**C**	**D**	**p value**	**Observation**
SBP	148 (143.5-151.5)	150 (145-154.5)	151 (144-155)	150 (144-156.5)	0.83	-
DBP	94 (92-96)	93 (90-95)	94 (93-96.5)	94 (92-96)	0.7	-
Borg Scale	3 (2-4)	3 (2-3)	3 (2-4)	3 (2-3.5)	0.67	-
MRC Scale	1 (0-1)	0 (0-1)	1 (0-1)	1 (0-1)	0.47	-
Pulse	76.16 ±8.30	74.16 ±9.99	77.04 ±10.81	78.8 ±12.87	0.48	-
O2 Saturation	96 (96-98)	97 (94.5-98)	97 (94-98.5)	97 (95-98)	0.99	-

INITIAL-AFTER MEDIUM EFFORT						
Group / Parameter	**A**	**B**	**C**	**D**	**p value**	**Observation**
SBP	182 (176-189.5)	183 (170.5-191.0)	186 (182-194.5)	193 (186-194.5)	**0.001**	A-D, B-D
DBP	111 (98-130)	124.0 (110.5-132)	128 (123-134)	130 (123-135.5)	**0.006**	A-C, A-D
Borg Scale	5 (3.5-7)	5 (4-6.5)	6 (4.5-8)	6 (4.5-7.5)	0.41	-
MRC Scale	2 (1.5-3)	3 (2-4)	3 (2-3.5)	3 (2-4)	0.09	-
Pulse	111.5 ±15.65	113 ±18.79	82.44 ±10.87	80.76 ±12.11	**< 0.0001**	A-C, A-D
O2 Saturation	95 (93-96)	92 (87-94.5)	90 (86-94)	89 (84-93)	**0.0002**	A-C, A-D

A-group control; B -group experiment (medication +recommendation); C -group experiment (medication +recommendation+ kinetic recovery program); D- group experiment (medication +recommendation+ hydrokinetic recovery program); SBP – systolic blood pressure; DBP – diastolic blood pressure; Borg Scale -fatigue scale; MRC Scale -dyspnea scale; pulse- heart beats rate; O2- oxygen.

At the initial moment when measuring the parameters after the effort test, there is a significant difference between the averages and medians of the 4 groups, for different parameters (Table 1):

- the median SBP of group A differs significantly from the median of group D, p=0.001; group A showed significantly lower SBP values than group D
- the median SBP of group B differs significantly from the median of group D, p=0.006; group B showed significantly lower SBP values than group D
- the median DBP of group A differs significantly from the median of group D and C, p=0.001; group A showed significantly lower DBP values than groups C and D
- the Borg scale and MRC scale did not register significant differences between the means and the medians of the 4 groups at the initial test before the effort
- the average pulse in group A is significantly higher than the average pulse in groups C and D, p<0.0001
- median O2 saturation in group A is significantly higher than median of groups C and D, p=0.0002

3.1.2. Data obtained after the implementation of the program

At the final moment- after the 8 weeks program- we measured the parameters before and after the medium effort and we registered a significant difference between the averages and medians of the 4 groups for different parameters (Table 2):

Table 2. Statistical analyses of the results after the implementation of the program

FINAL- BEFORE MEDIUM EFFORT						
Group / Parameter	A	B	C	D	p value	Observation
SBP	151 (143-157)	149 (145-154)	152 (142-155)	152 (143.5-156)	0.89	
DBP	95 (93-97.50)	94 (93-96.5)	94 (94-96.5)	94 (92.5-97)	0.55	
Borg Scale	3 (2-4)	3 (2-3)	1 (1-2)	1 (1-2)	**< 0.0001**	A-C, A-D, B-C, B-D
MRC Scale	1 (1-2)	0 (0-1)	0 (0-1)	0 (0-1)	**0.0004**	A-B, A-C, A-D
Pulse	76 (70.50-83.0)	72 (65-84.5)	65 (60-77)	71 (60.5-82)	**0.01**	A-C
O2 Saturation	97 (96-98)	97 (94-99)	98 (97-99)	98 (97.5-99)	**0.0006**	A-C, A-D

FINAL- AFTER MEDIUM EFFORT						
Group / Parameter	A	B	C	D	p value	Observation
SBP	182 (176-191.0)	180 (169-189)	154 (148.5-156)	157 (151-158)	**< 0.0001**	A-C, A-D, B-C, B-D
DBP	115 (98.5-136.0)	123 (110.5-131.5)	97 (95-101)	98 (97-99)	**< 0.0001**	A-C, B-C, B-D
Borg Scale	6 (4-7)	5 (4-6)	2 (1-3)	2 (1-3)	**< 0.0001**	A-C, A-D, B-C, B-D
MRC Scale	2 (2-3)	3 (2-3)	1 (1-2)	1 (1-2)	**< 0.0001**	A-C, A-D, B-C, B-D
Pulse	115 (99.50-128.0)	110 (97-128)	110 (97-128)	94 (84-98.5)	**< 0.0001**	A-C, A-D, B-C, B-D
O2 Saturation	95 (92.5-96)	93 (90.5-96)	95 (93.5-96)	94 (92.5-96)	0.69	

A -group control; B -group experiment (medication +recommendation); C -group experiment (medication +recommendation+ kinetic recovery program); D- group experiment (medication +recommendation+ hydrokinetic recovery program); SBP – systolic blood pressure; DBP – diastolic blood pressure; Borg Scale -fatigue scale; MRC Scale -dyspnea scale; pulse- heart beats rate; O2- oxygen.

- the Borg Scale of group A differs significantly, it is higher than groups C and D, $p<0.0001$
- the Borg Scale of group B differs significantly, it is higher than groups C and D, $p<0.0001$
- the MRC Scale of group A differs significantly, it is higher than groups C and D, $p<0.0004$

- The subjects of group A have significantly higher pulse average compared to the group C, $p<0.01$
- Group A patients have significantly lower median O2 saturation compared to groups C and D, $p<0.0006$

At the final moment after performing the stress test, except for saturation, significant differences were obtained for all parameters (Table 2):

- group A has significantly higher median SBP compared to groups C and D, $p<0.0001$.
- group B has significantly higher median SBP compared to groups C and D, $p<0.0001$.
- group A has significantly higher median DBP compared to group C, $p<0.0001$.
- group B has significantly higher median DBP compared to groups C and D, $p<0.0001$.
- group A has significantly higher Borg median compared to groups C and D, $p<0.0001$.
- group B has significantly higher Borg median compared to groups C and D, $p<0.0001$.
- group A has significantly higher MRC median compared to groups C and D, $p<0.0001$.
- group B has significantly higher MRC median compared to groups C and D, $p<0.0001$.
- group A has significantly higher MRC median compared to groups C and D, $p<0.0001$.
- group B has significantly higher MRC median compared to groups C and D, $p<0.0001$.
- group A has significantly higher hart rate median compared to groups C and D, $p<0.0001$.
- group B has significantly higher hart rate median compared to groups C and D, $p<0.0001$.

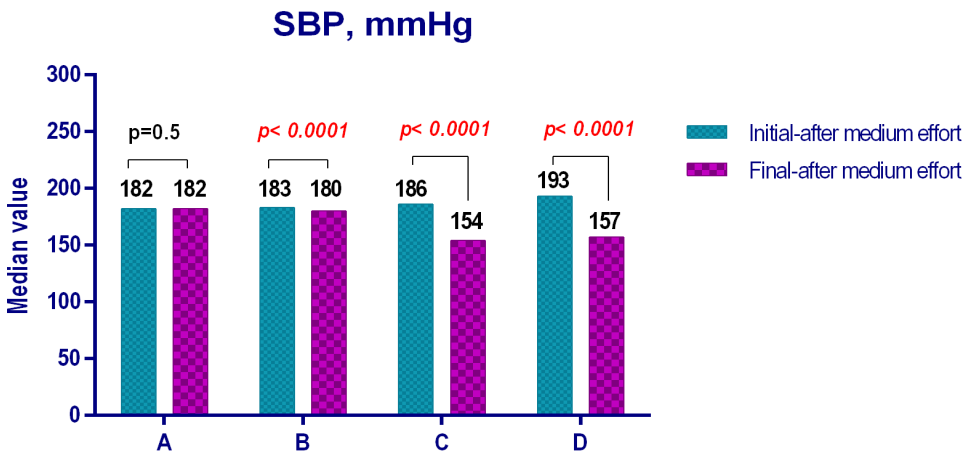
3.2. Interpretation of the results

The recorded date shows us that the patient's body reacts differently to the effort even before the implementation of the program. The individual's adaptability to effort can only be partially predicted. starting from this premise, the recorded date was compared differently in order to actually see the changes of each groups for each parameter.

3.2.1. SBP values for groups A, B, C and D

- group A recorded equal values -stagnation of SBP value
- groups B, C and D recorded significant values between initial and final assessment, $p<0.0001$
- group B registered a decrease of SBP values by 3 mmHg units
- group C registered a decrease of SBP values by 32 mmHg units
- group D registered a decrease of SBP values by 36 mmHg units (Figure 1)

Figure 1. SBP values comparison between initial and final for groups A, B, C and D

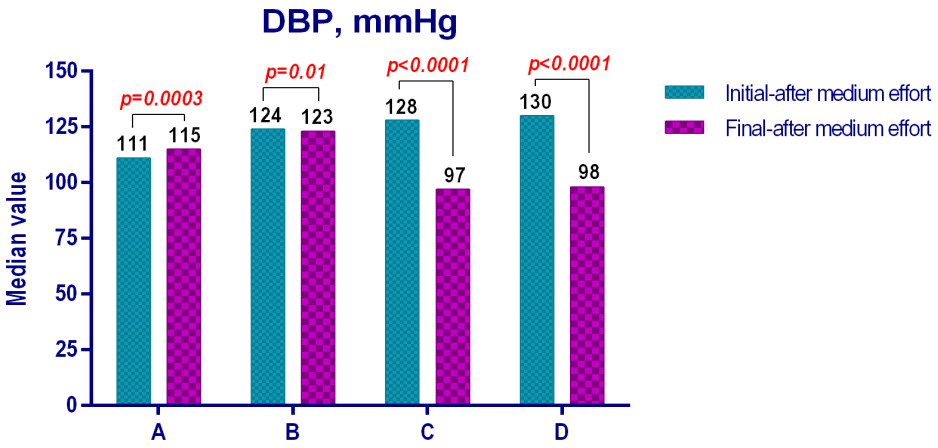


Description: SBP normal range 120-129

3.2.2. DBP values for groups A, B, C and D

- Group A recorded statistically significant values, p=0.0003 but it is actually an increase in DBP value by 4 mmHg units
- groups B, C and D recorded a statistically significant decrease in DBP values
- group B recorded a decrease in DBP value by 1 mmHg unit
- group C recorded a decrease in DBP value by 31 mmHg units
- group D recorded a decrease in DBP value by 32 mmHg units (Figure 2)

Figure 2. DBP values comparison between initial and final for groups A, B, C and D



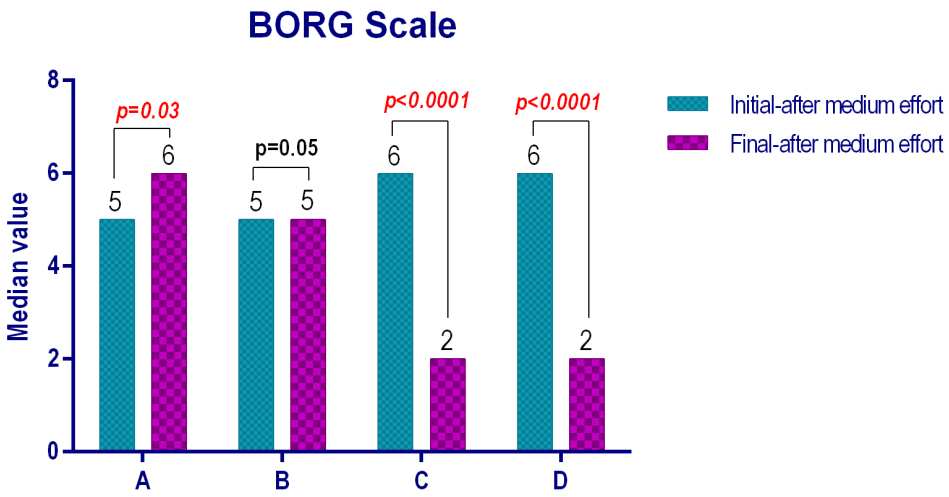
Description: DBP normal range 70-79

3.2.3 Borg Scale for groups A, B, C and D

- Group B stagnated, same value was registered both in the initial and final testing

- group A regressed with an increase value by 1 unit
- groups C and D made progress both with a decrease of the 4 units for each group (Figure 3)

Figure 3. Borg Scale comparison between initial and final for groups A, B, C and D

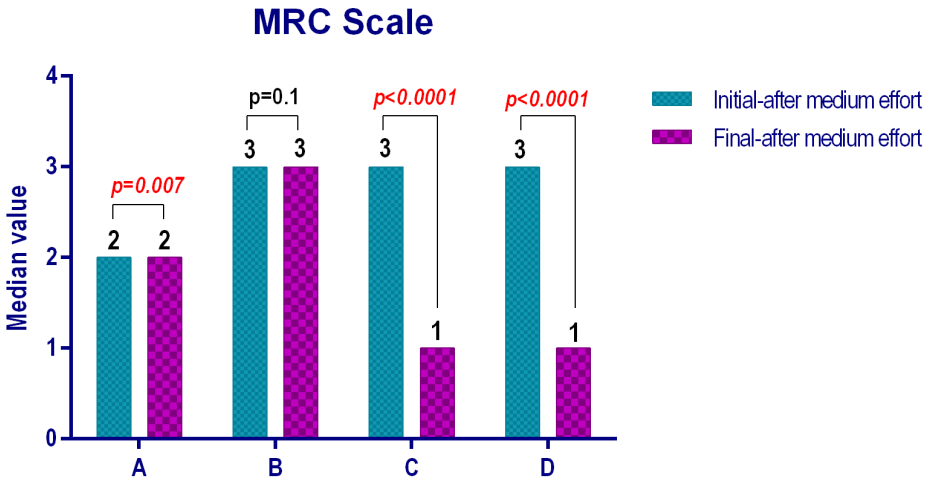


Description: 0-nothing at all; 10-maxmal

3.2.4. MRC Scale for groups A, B, C and D

- groups A and B have stagnated and remained at the same values for initial and final testing, i.e. 2 respectively 3 units
- groups C and D progressed with a decrease of 2 units for each group (Figure 4)

Figure 4. MRC Scale comparison between initial and final assessment for groups A, B, C and D

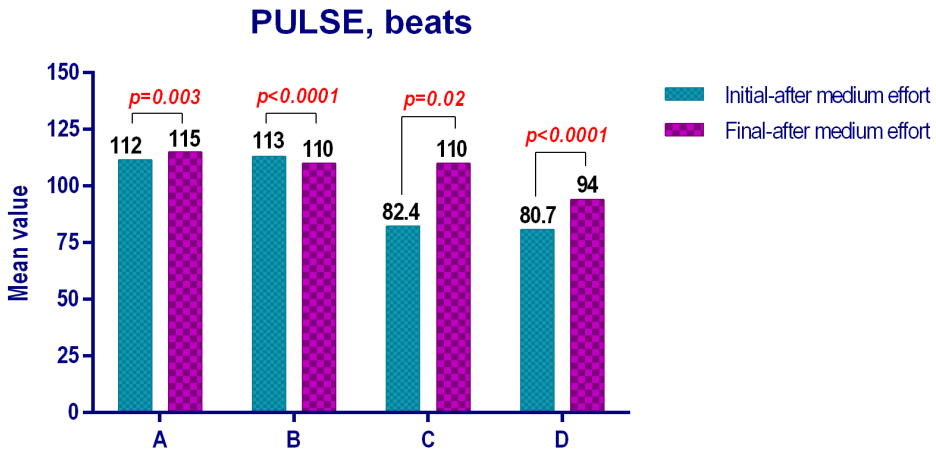


Description: 0-milde; 5-severe

3.2.5 pulse values for groups A, B, C and D

- group B recorded significant statistically significant values, p=0.0001, with a decrease of 3 units
- groups A, C and D recorded statistically significant increases in pulse values, which means that the body adapts faster to the effort and manages to better supplement the O2 need from the type of effort
- group A experienced an increase in pulse value of 3 units
- group C experienced an increase in pulse value of 27.6 units
- group D experienced an increase in pulse value of 33.3 units (Figure 5)

Figure 5. Pulse values comparison between initial and final for groups A, B, C and D

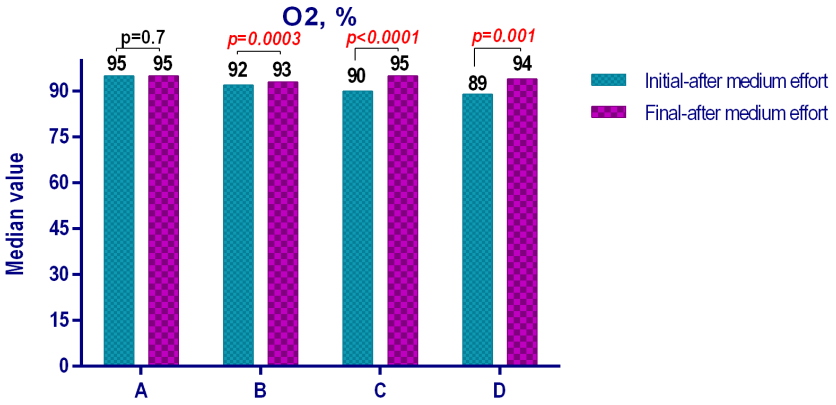


Description normal range: 60-100/minute

3.2.6. O2 saturation values for groups A, B, C and D

- group A has stagnated
- group B registered an increase saturation by 1unit
- groups C and D registered an increase saturation by 5 units for each group (Figure 6)

Figure 6. O2 saturation values comparison between initial and final for groups A, B, C, D



Description: normal range: 95-100%

4. Discussion

Group A, which relied only on recommendations for a healthy lifestyle, didn't register any significant p values between the initial and final evaluation; SBP, P, O2 and MRC parameters stagnated, DBP and Borg parameters increased

Group B, which had both medications and recommendations for a healthy lifestyle, registered significant p values for 2 parameters (SBP and P have $p<0.0001$); SBP and P decreased; DBP and O2 increased, Borg and MRC parameters stagnated

The C group, which took part in a cardiovascular rehabilitation program, obtained significant p values for 5 parameters (SBP, DBP, Borg, MRC-DS and O2 have $p<0.0001$); SBP, DBP, Borg and MRC parameters decreased; p and O2 increased

Group D, recipient of hydrotherapeutic program registered significant p values for all statistically 6 monitored parameters (SBP, DBP, Borg, MRC-DS, P and O2 have $p<0.0001$). SBP, DBP, Borg and MRC parameters decreased; P and O2 increased.

The patients of the study benefited from an individualized program through which the dosage of the effort would bring maximum results in the shortest possible time. The physical therapy program was carried out according to the physical needs of the group. A series of physical training exercises were designed with the possibility of individual dosage (number of repetitions/times of execution) according to their tolerance. The sessions were held under the supervision of physiotherapists and balneal physiotherapist assistants who were actively involved and intervened when needed through warnings, encouragement and corrections. In carrying out the kinetic therapeutic program, the characteristic symptomatology of the hypertensive patient will be considered: headache or pressure in the occipital area, feeling dizziness or different ringing noises in the ears, less often, different sensations hard-to-define in the precordial area [47]. During 24 hours the blood pressure of a person can register physiological variations depending on a number of factors; for example, lower values are recorded in the morning and higher in the evening, or values are known to increase in inspiration and decrease in expiration, also exposure to cold, exertion or emotions will increase blood pressure values [48].

Specialists in the field have demonstrated the involvement of all muscle groups in the type of swimming, whether freestyle or defined by a specific style [49]. During swimming, successive and harmonious movements are made for the limbs and trunk. The water currents against the movement as well as the speed will proportionally increase the resistance of the water to the body; in general, for swimmers in the case of the upper part of the body we emphasize the development of the scapula-humeral belt, but in the lower limbs both flexor and extensor muscle groups will be required [37].

Hydrotherapy sessions come with a number of general and specific contraindications for our group, in addition to the inclusion/exclusion criteria, the following were added: not to perform other physical exercises before hydrokinetic therapy session, to have at least 3 hours since the last meal, not to have dermatological pathology or skin lesions. To be avoided in the hydrokinetic therapy program is the activity in water with a high concentration of sodium bicarbonate, or other types of pools were the water exceeds 36° C. Hyper thermic or hot procedures are also contraindicated [50]. We must emphasize that the chances in normal breathing during exertion on another occasion can be easily achieved, it can mainly consist of other symptoms, i.e. headaches, dizziness, difficulty concentrating, visual disturbances, epistaxis, clear signs of changes in normal blood pressure values [51]. Obviously, the aim of the recommendations is to prevent complications and disease progression.

Future action in this field should consider the following: informing all socio-professional categories about the negative effect of sedentarism in general and especially with regard to cardiovascular diseases, of which HBP is on the first place; emphasizing to the general public about the necessity of daily physical activity at home alongside other sports or recreational activities; the modernism of today's domestic life,

greatly limits physical effort; implementing at the level of employing companies of specific programs of physical activity that can be integrated.

It is known that arterial hypertension is a cardiovascular risk factor-each increase of 20mmHg in the systolic value and 10 mmHg in the diastolic value doubles the risk of acute myocardial infarction [16]. We must not forget the aspect of education and family with regard to the physical activities carried out daily at home, but especially sports- recreational activities to increase the capacity for effort / improve the quality of life, wellbeing, and prevent the progression of cardiovascular damage.

Extending research in order to compare the main methods of recovery program with hydrotherapy ones in hypertensive population is needed. In the last 5 years, the increasing interest in swimming is sustained by the expanding numbers of pools which means that hydrokinetic program may have a good start regarding the population access to pools.

5. Conclusions

Physical activity in water performed regularly within a controlled therapeutic program with both thermal and electrotherapy component led to improvement effort capacity by decreasing blood pressure values and dyspnea parameters.

The implemented hydro thermo kinetic program has been statistically proven to have brought significant improvements in terms of the body's adaptation to effort and the decrease in blood pressure values

A strict and rigorous 8-week intervention program has brought advantages in the life of hypertensive patients, and its continuation will constitute a chance for a better, more dynamic life with a lower percentage of immediate or long-term cardiovascular complications.

Antihypertensive medication not only regulates blood pressure values, but also helps patients follow recovery programs that involve physical effort. without medication hydro kinetics therapy sessions would be too a risk to take.

The implemented program is based on the new direction approached in terms of physical activity. It has been shown that when it is carried out collectively, in an organized and especially competitive setting, they are better for the simple reason that they are carried out longer periods of time may become a lifestyle. The participants claimed that joining such a common interest group can turn a rehabilitation program into lifestyle, thus changing them completely.

Existing research are poor into hydrokinetic approach regarding cardiovascular rehabilitation programs and even lower for hypertension population. Future research should be continued by increasing the number of participants, by extending the territorial area to more regions and by reaching all levels of hypertension so that hydrotherapy to be included into the routine protocols of hypertensive patients.

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