



EFFECTS OF AQUATIC THERAPY ON SLEEP QUALITY AND QUALITY OF LIFE IN PATIENTS WITH ARTERIAL HYPERTENSION

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Abstract: Contextualization: Hypertension is a disease that essentially affects the balance of vasodilator and vasoconstrictor mechanisms, causing an increase in vessels blood pressure that may compromise tissue irrigation and cause damage to the organs. Cases may develop to a severe clinical

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presentation and affect sleep quality and quality of life of the patients. Objective: To evaluate whether aquatic therapy has a beneficial effect on sleep quality and quality of life in patients with hypertension. Method: All patients completed Berlin, Epworth, Minichal and Pittsburgh questionnaires, Hospital Anxiety and Depression Scale (HAD), and an open questionnaire. Patients participated in twice weekly sessions of aquatic therapy for 5 months. Results: The average age of the sample was 58 ± 8 years old. There was no significant improvement in sleep quality, evaluated by Pittsburgh questionnaire ($p = 0.05$), however, enhancements in daytime sleepiness ($p = 0.0048$) as well as in the number of hours of sleep at every 24 hours ($p = 0.04$), quality of life ($p = 0.002$) and level of anxiety ($p = 0.012$). Conclusion: Aquatic therapy is an effective alternative therapy for improving quality of life, decreasing anxiety, daytime sleepiness and reducing the chance of developing sleep apnea.

Keywords: Aquatic therapy; Sleep; Hypertension.

Introduction

Systemic arterial hypertension is a disease that essentially affects the balance of vasodilator and vasoconstrictor mechanisms, causing an increase in vessels blood pressure that may compromise tissue irrigation and cause damage to the organs irrigated by them (GIMENES *et al.*, 2008). Treatment demands lifestyle changes and continuous drug therapy supervision.

Among the main grievances of hypertensive patients is daytime sleepiness, the loss of nocturnal sleep and the presence of snoring. These complaints are present in a third of the patients with systemic arterial hypertension (SAH) (DRAGER *et al.*, 2002).

According to data from the World Health Organization (WHO), it is estimated that 20% of the Brazilian population is hypertensive and the

higher prevalence is found among people older than 60 years old (ARCA *et al.*, 2004). Since it is initially an asymptomatic disease, it might develop into severe stages, in which hospitalization is required, conveying a high socio-economic cost. SAH is responsible for about 40% of the cases of early retirement and work absenteeism (KOHLMANN *et al.*, 1999).

Studies performed in the last decades show that there is little doubt regarding the beneficial effect of physical exercise for the hypertensive patient (NEGRÃO; RONDON, 2001). Therefore, an alternative adjunct treatment for this disease is aquatic therapy, which main attributes are the increase in functional independence, enhancement of global motor coordination, reduction of the impact and weight load on joints, integration and socialization, stimulating self-confidence, reduction of anxiety, improvement of body image, relief of tension and stress and improvement of sleep quality (MOREIRA; CARIBÉ, 2009).

Randomized and controlled studies that evaluate the effects of aquatic therapy on sleep quality and quality of life in patients with systemic arterial hypertension can be very useful to find out new therapeutic possibilities for the treatment of SAH patients.

Objective

To evaluate whether aquatic therapy is beneficial to improve sleep quality and quality of life in patients with systemic arterial hypertension.

Methods

This prospective study assessed hypertensive patients of both sexes with ages ranging from 60 to 70 years old, which took place at Unasp (Adventist University of São Paulo) University Polyclinic. Patients recruited were the ones who responded to ads posted at the Polyclinic. This study protocol was approved by the local Ethics Committee.

All volunteers were informed about the procedures, discomforts and risks involved in the processes of evaluation and treatment. They subsequently signed an informed consent form. Patients answered to the following questionnaires: Berlin, Epworth, Pittsburgh, Hospital Anxiety

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and Depression Scale (HAD), Minichal and an open questionnaire about disease stability, frequency of hospitalizations in the last months, amount of hours of sleep per night and their perception about the interference of the lack of sleep in daily living activities.

The therapeutic program lasted 5 months and was organized into two weekly sessions (Mondays and Wednesdays) of aquatic therapy. Each 60 minutes session had four stages, all of them performed inside the water at the temperature of 31°C.

- Stage 1 - Warm-up: walking back and forth, making turbulence to increase resistance to the movement, during 15 minutes.
- Stage 2 - Global stretching: for 15 minutes, where each muscle group was stretched for a minimum of 25-30 seconds.
- Stage 3 - Aerobic activities: isotonic movements were performed by upper and lower limbs during 20 minutes.
- Stage 4 - Relaxation: patients remained floating, with the purpose of providing physical and mental well-being. This stage lasted 10 minutes.

Study Protocol

Questionnaires (Berlin, Epworth, Pittsburgh, Minichal, HAD, and the open questionnaire) were self administered and were responded by patients themselves. When they demonstrated any difficulty reading or interpreting a question, one of the researchers offered help, without interfering in the patient's answer.

Berlin Questionnaire

This instrument has the purpose to find out if the subject is predisposed to sleep apnea. The score is divided into three categories, each one of them having a different punctuation (MOREIRA; CARIBÉ, 2009). Having

two or more positive categories indicates a great chance to present sleep apnea disorder, however, final diagnosis is given after a polysomnography.

Epworth Scale

Epworth scale analyzes the likelihood of sleeping during daytime activities. Answers vary from no chance to high chance of sleeping (BIASO-LII; MACHADO, 2006).

Mini Questionnaire of Quality of Life in Arterial Hypertension - Minichal

This is considered to be the most specific questionnaire about quality of life for hypertensive patients. Minichal comprises 17 questions divided into two domains (mental status and somatic manifestations), with four options of answer ranging from 0 (No, not at all) to 3 (Yes, a great deal). Patient had to answer the questions making reference to the last 7 days. The closest to 0 the answer is, the better the patient's quality of life (NETZER *et al.*, 1999).

Pittsburgh Questionnaire

This instrument is aimed at a self evaluation of sleep quality in the preceding month. It contains questions ranging from the difficulty in falling asleep to taking naps during the daytime. The more positive the answers, the higher the difficulties in having a good sleep quality (MURRAY, 1991).

Hospital Anxiety and Depression Scale - HAD

HAD scale has already been validated in Portuguese by Botega *et al.* (1995) and Gimenes *et al.* (2008). It comprises 14 questions to evaluate symptoms of anxiety and depression in patients with physical disease, and it is divided into two groups: seven questions to evaluate anxiety and seven other for depression. Each question has a score that varies from 0 to 3 and the sum of each subscale defines patient's category: 0-7 non-cases; 8-10 doubtful cases; 11-21 defined cases (SCHULZ *et al.*, 2008).

Open Questionnaire

This questionnaire was designed by the researchers and applied during a clinical consultation. Its development was motivated by the need to acknowledge some data not found in existing validated instruments. We intended to learn about the amount of hours of sleep per night, patient's

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perception about the interference of the lack of sleep in daily living activities, current drug therapy, as well as their schedule and the need to attend the emergency service for any disease-related crisis.

Six-minute walk test

The six-minute walk test was performed by all patients, according to a standardized protocol (MURRAY, 1991). They were closely supervised by biotelemetry, which allows precise and constant monitoring of heart rate and blood oxygen saturation (SpO₂) throughout the test. Patients walked along a 27m corridor. Technicians escorted and encouraged subjects with the standardized statements: “you are doing well” or “keep up the good work,” but were asked not to use other phrases. Subjects were instructed to walk at their own pace, attempting to cover as much ground as possible in 6 minutes.

Inclusion Criteria

To participate in this study, it was necessary to present the following primary requirements:

- clinical diagnosis of arterial hypertension;
- to be clinically stable, making use of the drugs prescribed by the physician;
- to have a physician’s forwarding letter to take part in aquatic therapy;
- to have signed the informed consent form.

Exclusion Criteria

Subjects with the following conditions were excluded from the study:

- current smoker, defined as the ones who remain smoking until the beginning of the study;

- severe comorbidities associated, as decompensated heart diseases, orthopedic diseases in upper and lower limbs that would prevent the performance of the activities, and the ones with motor sequels from neurologic diseases that could interfere in the ability to exercise.
- subjects who do not participate in at least 95% of the aquatic therapy sessions.

Statistical Analysis

Data are expressed as means \pm standard deviations. To investigate the normality of the data, we used the Kolmogorov-Smirnov test. We employed paired Student's t test. to analyze pre and post intervention results. We considered $p < 0.05$ to be statistically significant. Sample size was calculated based on the outcome variable (time of sleep per day) from the equation, namely the expected effect/standard deviation (E/S) ratio. In this study, the expected effect chosen (time of sleep per day) was 30min, and the sample standard deviation considered was the variability after the performance of the activities. Therefore, for an $\alpha = 0.05$ and a statistical power of $\beta = 0.2$, thirty-seven patients were necessary to achieve significance outcomes.

Results

Study population was 40 patients, with a mean age of 58 ± 8 years old, and diagnosis of hypertension (2 men and 38 women). Mean body mass index (BMI) was $28,3 \pm 5,2$ and $29,7 \pm 6,1$ kg/m^2 pre and post intervention, respectively. Patients had a mean of 12 years since the diagnosis of hypertension, and diuretics and angiotensin-converting enzyme inhibitors were the most commonly used drugs (Table 1).

Table 1: Clinical and demographic characteristics

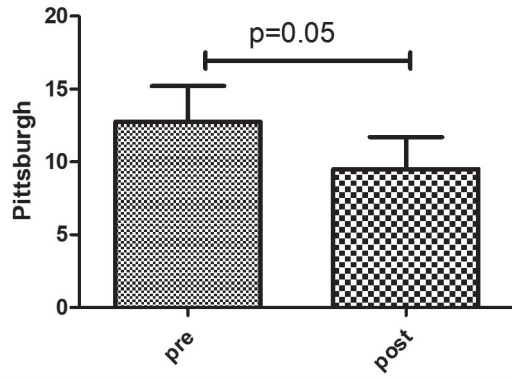
Variables	
Age (y)	58±8
White/non (%)	62/38
Male/female (%)	5/95
Height (m)	1.65
Body mass index (kg/m ²)	28,3±5,2
Former smoker, no. (%)	21(50,8)
Never smoked	9(19,2)
Pack years, median (IQR)	49 (21-74)
SMWD(m)	402±29
Alcohol consumption (%)	10(25)

BMI categories: low ≤ 21 kg/m², normal = 21-25 kg/m², overweight = 25-30 kg/m², obese ≥ 30 kg/m². SMWD = 6-minute walk test distance.

Over the aquatic therapy program, there was no hospitalization of any of our subjects, nor decompensation of the hypertensive scenario. None of the patients rejected to perform the proposed activities and all took part in at least 95% of them. Eleven patients (22%) were able to reduce the anti-hypertensive medication dose according to medical prescription.

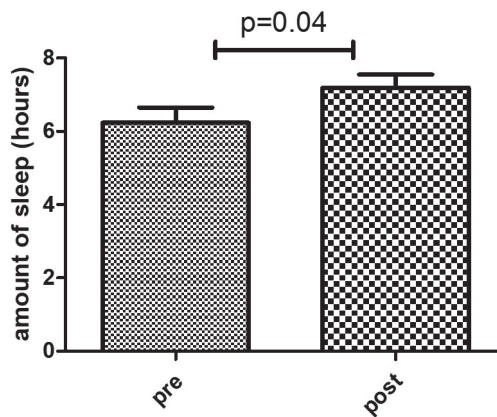
Sleep quality evaluation performed before and after the aquatic therapy program revealed that there were no statistically significant improvements. Initially, the mean score in Pittsburgh questionnaire was 12.7, and afterwards it was 9.5 (p=0.05), as shown in Figure 1.

Figure 1: Evaluation of sleep quality before and after the aquatic therapy program in patients with hypertension.



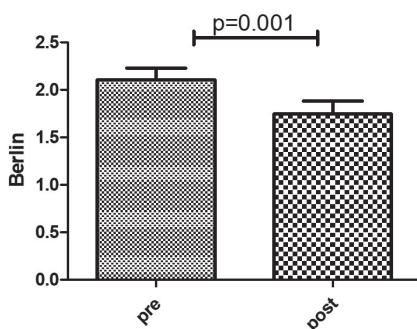
However, there was a significant improvement in the number of hours of sleep per night after the aquatic therapy program ($p=0.04$). The initial mean was $6.2 \pm 1.8h$ and at the end of the intervention we registered a mean $7.1 \pm 1.6h$ (Figure 2).

Figure 2: Amount of hours of sleep in patients with hypertension pre and post aquatic therapy program



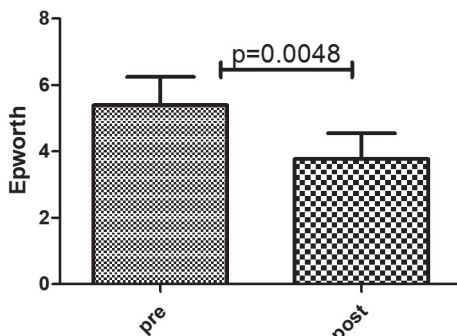
Regarding the assessment of the risk of snoring pre and post intervention, we observed a statistically significant improvement in the occurrence of snoring during sleep, as well as its frequency and intensity. Initial mean found in Berlin Questionnaire was 2.1 ± 0.78 , and at the end of the program we found 1.74 ± 0.84 ($p=0.001$), as shown in Figure 3.

Figure 3: Evaluation of the occurrence of snoring during sleep in patients with hypertension pre and post aquatic therapy program



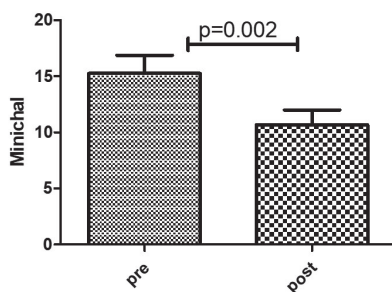
Daytime sleepiness, as evaluated by Epworth questionnaire, presented a significant improvement after the aquatic therapy period. Initial mean was 5.39 ± 5.26 and at the end of the program we observed a mean of 3.76 ± 4.86 ($p=0.0048$), in Figure 4.

Figure 4: Assessment of daytime sleepiness in patients with hypertension pre and post aquatic therapy program



The improvement in quality of life of our hypertensive patients was assessed by Minichal questionnaire. We noticed a significant improvement in this variable after the intervention. Before the treatment patients had a mean of 15.25 ± 8.5 and at the end of the program there was an alteration to 10.6 ± 6.9 ($p=0,002$), as shown in Figure 5.

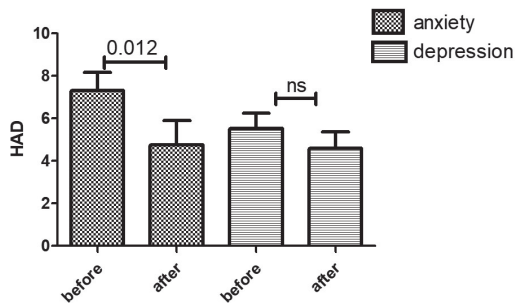
Figure 5: Evaluation of quality of life in patients with hypertension pre and post aquatic therapy program.



Anxiety indexes evaluated by HAD questionnaire demonstrated that there was a statistically significant reduction in the risk of anxiety after the intervention. Mean score was

7.29 ± 3.53 at the beginning and 4.76 ± 4.67 at the end of the program ($p=0.012$). Regarding depression risk, there was no statistically significant change. Initial mean was 5.52 ± 2.9 , and at the end of the therapy protocol it decreased to 4.58 ± 3.22 (Figure 6).

Figure 6: Assessment of anxiety and depression in patients with hypertension pre and post aquatic therapy program.



Discussion

Amongst the findings of this study, some must be particularly highlighted. First, aquatic therapy was efficient and effective as a treatment for this group of patients. Secondly, patients who presented increase in hours of sleep at every 24 hours and the ones who improved their sleep quality were among those that, according to physician recommendation, have reduced the dose of the anti-hypertensive medication.

The effects of aquatic therapy on sleep quality, anxiety and depression in hypertensive patients is an undiscussed matter in the literature, although it is largely relevant. Sleep habits and sleep disorders can be objectively assessed through polysomnography, or subjectively assessed through structured standardized questionnaires. Pittsburgh Sleep Quality Index (PSQI) is one of those instruments, and has been validated by Buysse *et al.* (1989) and Murray (1991). Our research solely used the subjective evaluation through questionnaire, in order to assess possible cases of sleep disorder, as one third of the hypertensive patients present this disorder (BOTEGA *et al.*, 1995).

There are evidences that obstructive sleep apnea syndrome (OSAS) and SAH frequently coexist, not only for having common risk factors (obesity, sedentarism and age), but also because OSAS contributes for the genesis of SAH. OSAS causes hemodynamic and metabolic alterations not only during sleep, they persist over 24 hours, causing daytime sleepiness, which is associated to household and traffic accidents.

Acute consequences of apnea, including hypoxemia, hypercarbia, repeated awakenings and increase in the negativity of intrathoracic pressure, may affect the regulation of arterial blood pressure through neural and humoral mechanisms. Evidences that explain the association of SAH with OSAS show that patients with OSAS have an increased sympathetic activity, reduction of the sensitiveness of baroreceptors, vascular hyper-responsivity and alteration in salt and water metabolism, which may contribute to increase in arterial blood pressure (YOUNG *et al.*, 1997).

Estimates of the United States Department of Transportation refer that around two hundred thousand accidents with motor vehicles every year are related to sleep (BOTEGA *et al.*, 1995). Excessive daytime sleepiness (EDS) is a cause of psychological stress, reduction of productivity, increase in the risk of occupational and household accidents and decrease in quality of life (PEDROSA *et al.*, 1999). Our results were statistically significant for the beneficial effects of the treatment in patients with EDS, diminishing from 5.39 to 3.76 the mean of patients who presented such comorbidity. Khasky and Smith (1999) have applied the questionnaire in 112 drivers, and found out that 28% of them presented EDS. Our results indicate that a structured aquatic therapy program may assist the reduction of EDS.

Beneficial effects of aquatic therapy may explain the increase in hours of sleep at every 24-hour period, as well as the post treatment improvement in sleep quality. In aquatic environment, regardless of the employed technique, it is known that body unleashes a series of reactions that tends to reduce sympathetic nervous system activation, characterizing a response to relaxation (CUNHA; CAROMANO, 2003). Khasky and Smith (1999) have stated that all means to promote relaxation take to one or more independent factors of the relaxation state (sleepiness, mental quietude, physical relaxation, mental relaxation, strength and consciousness, absence, contentment, love, gratitude and transcendence) which might explain the improvement in sleep quality and the increase in hours of sleep.

In the present study we utilized the HAD to analyze whether aquatic therapy had a beneficial effect in patients with this kind of comorbidity, and we verified the existence of 30% of patients with anxiety and 11% with depression. These results are similar to the ones found by Scalco *et al.* (2005) and Souza *et al.* (2008) who also demonstrated a reduction in anxiety and depression after a physical activity program. According to Stein *et al.* (*apud* VIEGAS; OLIVEIRA, 2006), social anxiety disorder precedes depressive disorders. Our program produced statistically significant results solely for anxiety treatment, mainly because of the small number of subjects with

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depression. Aquatic exercises seem to be more attractive than the terrestrial ones. They do not promote pain due to the lack of impact in joints and provoke release of endorphins, bringing physical and mental well-being, sensation of self efficacy and social interaction among people of a same age group, who might have similar problems (SCALCO *et al.*, 2005). Therefore, aquatic therapy could also be an alternative treatment for patients with anxiety, and for those who seek depression prevention.

The efficacy of a therapy depends primarily on patient's adhesion to treatment. Another positive aspect of aquatic therapy in this study was adhesion, as all of the patients attended more than 95% of sessions. Balestra *et al.* (2017) has shown that one of the best ways to promote adhesion to therapy is to let patients perceive positive results from the treatment. In our study, adhesion was facilitated as we handled with a pleasant activity that displayed physical, psychological and social benefits.

Conclusion

Based on the findings of the present study, we conclude that an aquatic therapy program has beneficial effects for patients with systemic arterial hypertension, improving their quality of life, reducing daytime sleepiness and anxiety and increasing the amount of hours of sleep per night.

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