Pak. j. life soc. Sci. (2024), 22(1): 1460-1469 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.1.0099

RESEARCH ARTICLE

Effect of Relaxation Techniques on Hypertensive Patients' Physiological Outcomes

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ARTICLE INFO

Received: May 24, 2024

Accepted: Jun 26, 2024

Keywords

Effect
Relaxation techniques
Hypertension
Physiological outcomes

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ABSTRACT

Relaxation techniques are considered one of the widely used techniques that are effective for a lot of medical conditions such as hypertension as well as psychological difficulties. It includes progressive muscle relaxation and deep breathing. This study aims to determine the effect of relaxation techniques (Progressive Muscle Relaxation and Deep Breathing) on hypertensive patient's physiological parameters (systolic and diastolic blood pressure, respiratory rate, heart rate, and oxygen saturation). A Quasi-experimental design was used to guide this study, it was conducted by use of a pre-posttest approach during the period 26th of November, 2023 to 7th of April, 2024. A non-probability (purposive) sampling was performed during a selection of (100) patients who attended the Outpatient Clinic in Al-Diwaniyah Teaching Hospital. These were divided into two equal groups: (50) patients for the control group and (50) patients for the intervention group. To reach the aims of the study the researcher used a socio-demographic and physiological parameter checklist sheet. The findings of the current study show significant decreases in systolic and diastolic blood pressure, heart rate, pulse rate, and oxygen saturation of participants were seen after relaxation techniques and there are highly statistically significant differences in post-test between the study and control group at all physiological parameter (at P 0.001). The researcher concludes that slow, deep breathing and progressive muscle relaxation can both be chosen in an attempt to lower blood pressure and other physiological parameters in hypertensive patients. The study recommended the necessity to carry out further studies in various setting while taking into account a diverse sample in order to be representative to reduce hypertension and other physiological parameters in patients with essential hypertension.

INTRODUCTION

Hypertension, also known as high or raised blood pressure, is a condition in which the blood in the vessels has persistently raised pressure. It is a serious medical condition and can increase the risk of heart, brain, eye, kidney, and other diseases. It is a major cause of premature death worldwide, with upwards of 1 in 4 men and 1 in 5 women over a billion people having hypertension (Belay et al., 2022).

Hypertension is defined as persistent systolic ≥ 130/140 millimeters mercury (mmHg) or at diastolic ≥ 80/90 mmHg for adults and is the leading preventable risk factor for cardiovascular disease (CVD) and all-cause mortality worldwide (Schmidt et al., 2020; Jam et al., 2018).

High blood pressure is largely asymptomatic, especially in the early stages, leading to its description as a 'silent killer' affecting 20% of the world's adult population and resulting in nine million deaths per year (Kitt et al.. 2019; Moussouni et al., 2022).

Over 1 billion million people around the world suffer from hypertension. By 2025, 1.5 billion people are expected to be affected by hypertension worldwide. Nearly 10 million deaths worldwide in 2015 were attributed to high blood pressure (Timsina etal., 2023).

Moreover, high blood pressure accounts for about (13.5%) of annual deaths in the world and directly accounts for (54%) of all strokes and (47%) of all coronary artery disease (Asemu et al.. 2021).

Hypertension can be managed by reducing and managing different stressors, regularly checking blood pressure, consulting with health professionals, treating high blood pressure, and managing other medical conditions. In addition, reducing modifiable risk factors is the best way to prevent hypertension and associated diseases of the heart, brain, kidney, and other organs, which can be done through lifestyle modifications, including weight management, a healthy diet, regular exercise, and stress management (Schmidt et al., 2020).

In this regard, hypertension requires comprehensive pharmacological and non-pharmacological treatment. Since 1983, the World Health Organization has suggested the use of the non-pharmacological approach in hypertension treatment. Progressive Muscle Relaxation (PMR) is one of the ten therapies that is mostly used in complementary therapy and alternative medication. PMR is a technique developed by Edmund Jacobson in 1920. This technique is designed to create a state of physiological and psychological relaxation in patients. It requires the patient to tense and relax various muscle groups while focusing awareness on proprioceptive and interceptive sensations (Ermayani et al., 2020).

Relaxation techniques are considered one of the widely used techniques that are effective for a lot of medical conditions such as hypertension as well as psychological difficulties. It includes progressive muscle relaxation and deep breathing. Therefore, involves cognitive, somatic, and behavioral dimensions (Hamdani etal., 2020). Also, (Mulyati etal., 2020) stated that PMR therapy is a simple and effective relaxation therapy to reduce muscle tension, stress, and high blood pressure and can reduce anxiety five times per week, improve physical function, reduce sleep disorders, reduce mental disorders, and improve quality of life.

Progressive relaxation is arguably one of the easiest to undertake to manage stress and hypertension. Furthermore, after having progressive muscle relaxation, people report a feeling of happiness and refresh which also induces hormones like serotonin. Progressive relaxation therapy is expected to produce a relaxed body condition and free from everyday tension (Rosyada et al., 2022).

In addition to PMR, there is a Slow Deep Breathing (SDB) therapy, which is breathing slowly from 16-20 times per minute to 10 times per minute or less. Deep and slow breathing will provide the body with the opportunity for diaphragmatic breathing and it can dramatically change the body's physiology because it activates relaxation centers in the brain (Manoppo & Anderson, 2019; Rashid et al., 2023).

Deep breathing, which is also known as diaphragmatic breathing, is a technique that is based on the notion that mind and body integration produces relaxation. The technique requires participants to contract the diaphragm, slowly inhaling and exhaling. Deep breathing has been shown to have a positive impact on various factors like stress, anxiety, and negative affect in numerous studies (Kanval et al., 2024; Toussaint et al., 2021). As well as, (Hamdani et al., 2020) argued that relaxation

techniques work through physiological and psychological mechanisms to deal with muscular tension and a state of peace where a person does not experience negative thoughts such as tension, anxiety, or fear. The impact of relaxation techniques can be measured using physiological and psychological indicators; Physiological indicators such as heart rate, blood pressure, respiratory rate, muscle tension, and blood flow, provide an objective measure of relaxation response.

METHODOLOGY

Design of the Study: A quasi-experimental design was used to guide this study, it was applied by use of a pre-posttest approach for two groups of samples (study and control) during the period from 26th of November, 2023 to 7th of April, 2024.

Setting of the Study: The study was conducted at the Outpatient Clinic in Al-Diwaniyah Teaching Hospital.

Sample of the Study: A purposive (non-probability) sampling has been performed for all hypertensive patients, the total number of patients who participated in the study was (100) patients were divided into two groups; (50) patients a study group and were exposed to the program (50) patients who are not exposed to the program considered as a control group. The criteria for selecting the study samples are patients who were diagnosed with primary/essential hypertension at least six months ago with blood pressure ≥ 130/90 and willing to participate in the study with ages ranging from 18 to less than 65 years old. Patients with other co-morbid diseases such as cardiovascular disease, kidney disease, acute respiratory disease, diabetes, etc.… and patients who do not complete the program are excluded from the study.

Instrument: To determine the effect of the relaxation techniques (progressive muscle relaxation and deep breathing), the researcher uses instruments consisting of (2) tools:

Tool I: The Socio-Demographic characteristics of hypertensive patients. This part is concerned with the collection of basic socio-demographic data obtained from the patients by interview questionnaire sheet that involved five items (age, gender, marital status, educational level, and occupational status).

Tool II: Physiological Parameter Checklist Sheet for hypertensive patients. This part consists of five items (systolic and diastolic blood pressure, respiratory rate, heart rate, and oxygen saturation).

Procedure: The study was conducted according to the following steps:

1. All participants in both groups were interviewed individually and informed about the study's purpose and obtaining formal consent from each patient to participate in the study before enrollment.

2. The (**50**) patients in the control group received only routine hospital care, then tools (**I** and **II**) (pre-test) were collected from the patients. After seven days the (tool **II**) was re-administered for the control group as post-test.

3. The following (**50**) patients were recruited as the study group. Where the researcher interviewed each patient individually and explained the purpose of the study and the benefits, steps, frequency, and duration of progressive muscle relaxation and deep breathing, during this interview tools (**I** and **II)** were collected from the patient, after training each patient in the study group on progressive muscle relaxation technique and deep breathing started after the pre-test was completed the researcher explained that each muscle group would be tensed for **5** seconds and then relaxed for **10** seconds **twice**/**7**days, and slow deep breathing **twice**/**7**days.

4. After 14 sessions of relaxation techniques the patients were assessed by using tool **II** (post-test).

Statistical Methods: Data have been analyzed through the use of the Statistical Package for Social Science (SPSS) application.

RESULTS

Table 1: Distribution of the Participants (Study and Control Groups)

Demographic Characteristics	Subgroups	Study group no= 50		Control group no= 50	
		f.	%	f.	%
Age groups	≤ 40	8	16	8	16
	41 – 45	21	42	17	34
	46 – 50	16	32	16	32
	51 – 55	4	8	4	8
	56 +	1	2	5	10
	Mean ± S.D.	44.96 ± (4.44)		46 ± (5.77)	
Sex	Male	31	62	29	58
	Female	19	38	21	42
Marital status	Single	11	22	10	20
	Married	25	50	23	46
	Widower	10	20	9	18
	Absolute/separate	4	8	8	16
Educational level	Read and write	10	20	6	12
	Primary school	20	40	10	20
	Intermediate school	4	8	5	10
	Secondary school	9	18	13	26
	Institutes graduated and above	7	14	16	32
Occupation status	Governmental employee	22	44	20	40
	free business	9	18	13	26
	Housewife	16	32	11	22
	Not work	3	6	6	12
Total		50	100%	50	100%

According to Demographic Characteristics (n==50) , f= Frequency, n= number of samples, %= Percentage.

Table (1) demonstrates the frequency count for selected demographic characteristics of two groups (study versus control). Regarding hypertensive patient age; the mean age in the study group is (44.96) while in the control group, patients are (46). Concerning patient sex, (62%; and 58%) were male for the study and control groups respectively, and the predominant percentage of both groups was married. A high percentage of the hypertensive patients (40%) graduating from primary school in the study group and (32%) in the control group were institute or bachelor graduates. In this regard, the majority of the sample (44%; 40%) for the study and control groups respectively were governmental employment.

Table 2:Evaluation of the Effect of Relaxation Techniques on Patient's Physiological parameter at Pre and post-test Measurements for the Study Group

Parameter	Period measurement	Study group n=50				
		Mean	S.D	t-test	d.f	Sig
Systolic BP	pre	146.7	8.899	14.355	49	H.S 0.001
	post	137.6	8.644			
Diastolic BP	pre	92.4	5.554	10.995	49	H.S 0.001
	post	87.2	4.861			
HR	pre	84.4	6.505	14.981	49	H.S 0.001
	post	75.26	5.374			
RR	pre	24.28	2.563	20.755	49	H.S 0.001
	post	16.28	2.941			
SPO2	pre	93.74	2.545	-2.840	49	H.S 0.007
	post	94.32	2.094			

n= number of samples, S. D= Standard deviation, t-test= Paired Samples Test, d. f= degree of freedom=49, Sig. = Significance, High Significant at $p<0.001$. BP = blood pressure, HR heart rate, respiratory rate, SPO2= oxygen saturation.

Table (2) demonstrates high statistically significant differences between the pre-test and post-test regarding physiological parameters (systolic and diastolic blood pressure, heart rate, respiratory rate, and oxygen saturation) at P- value equal to or less than 0.01) when analyzed by Paired-Sample t-test.

Table (3) Mean Difference (Paired t-test) Between the Control Group for Physiological Parameters at pre and post-test.

Parameter	Period measurement	Control group n=50				
		Mean	S.D	t-test	d.f	sig
Systolic BP	pre	144.3	10.595	-1.416	49	0.163 N.S
	post	147	7.284			
Diastolic BP	pre	93.7	5.515	1.026	49	0.310 N.S
	post	92.6	5.646			
HR	pre	87.66	10.263	-.021	49	0.983 N.S
	post	87.7	5.779			
RR	pre	23.64	4.719	-1.345	49	0.185 N.S
	post	24.08	4.365			
SPO2	pre	92.96	1.851	-.489	49	0.627 N.S
	post	93.06	1.963			

n= number of sample, S.D= Standard deviation, t-test= Paired Samples Test, d.f= degree of freedom=49, N.S=Non Significant at $p>0.05$

Table (3) demonstrates non-significant differences between the pre-test and post-test regarding physiological parameters (systolic and diastolic blood pressure, heart rate, respiratory rate, and oxygen saturation) at P- value equal to or less than 0.05) when analyzed by Paired-Sample t-test.

Table (4) Mean Difference (Independent Sample t-test) Between the Study and Control Group for Physiological Parameter at pre and post-test

Parameter	groups		Statistical test n=50				Significant
			Mean	S.D	t-test	p-value	
Systolic BP	Pre-test	Study	146.7	8.899	1.227	0.223	N.S
		Control	144.3	10.595			
	Post-test	Study	137.6	8.644	-5.880	0.001	H.S
		Control	147	7.284			
Diastolic BP	Pre-test	Study	92.4	5.554	-1.174	0.243	N.S
		Control	93.7	5.515			
	Post-test	Study	87.2	4.861	-5.125	0.001	H.S
		Control	92.6	5.646			
HR	Pre-test	Study	84.4	6.505	-1.897	0.061	N.S
		Control	87.66	10.263			
	Post-test	Study	75.26	5.374	-11.146	0.001	H.S
		Control	87.7	5.779			
RR	Pre-test	Study	24.28	2.563	0.843	0.402	N.S
		Control	23.64	4.719			
	Post-test	Study	16.28	2.941	-10.478	0.001	H.S
		Control	24.08	4.365			
SPO2	Pre-test	Study	93.74	2.545	1.752	0.083	N.S
		Control	92.96	1.851			
	Post-test	Study	94.32	2.094	3.104	0.002	H.S
		Control	93.06	1.963			

BP= Blood pressure, HR= Heart rate, RR= Respiratory rate, SPO2= Oxygen saturation, S.D = Standard Deviation, t-test= Independent Samples, N.S=Non Significant at $p>0.05$, H.S: High Significant at $p<0.001$

Table (4) shows there are highly statistically significant differences in the post-test between the study and control group at all physiological parameters (at P equal to or less than 0.001). On the other hand, there are no statistically significant differences in the pre-test between the study and control group of all physiological parameters (at P equal or more than 0.05) when analyzed by independent sample t-test.

DISCUSSION

Relaxation therapies of progressive muscle relaxation, and breathing exercises have an impact on patients with hypertension as they produce a relaxation response within the body and thus, are efficient in lowering the stress and blood pressure in the patients. These are popular and regularly used and researched therapies in the care of hypertensive patients. Progressive muscle relaxation is a relaxation technique involving tensing and relaxing the various muscle sets of the human body to produce a relaxation response in the body. Breathing exercises are also a type of relaxation technique that involves slow and deep inhaling and exhaling to increase the oxygen content of the body without the use of a device performed for therapeutic purposes (Bhardwaj & Koul, 2021).

Through the data analysis distribution of demographic variables, the percentage distribution of participants concerning age group reveals the highest percentage (42%) and (34%) for the study and control groups respectively within the age group (41-45 years) with mean age of the patients in the study group (44.96) and (46) in the control group, also reveal that the majority 31(62%); 29(58%) for the study and control groups respectively were male concerning sex groups. These results are consistent with the study conducted by (Salah Mohamed et al., 2022) who reported that men for the study group (47.80) and (45.91) for the control group. These results also are congruent with the

study conducted by (Mustafa MA & Hassan, 2020) who reported that (72%) of patients in the experimental group and (76%) in the control group were male. Moreover, this finding was consistent with the study conducted in China (Xiao et al., 2020) which reported that males have the highest percentage (53.85%; 57.50) of the study and control groups respectively. Also, this finding is in line with a study done by (AL-Ashour, 2014) who reported that males have the majority percentage (80%) of the study group and the highest percentage (60%) of the control groups.

The percentage distribution of samples concerning marital status reveals about 25 (50%); and 23(46%) of the study and control groups respectively were married. This result is supported by a study conducted by (Mustafa MA & Hassan, 2020) who revealed that the majority of the patients in the experimental and control groups respectively 46 (92%) and 48(96%) were married. Also, the result of the current study consisted of the study carried out by Abbasiah et al., (2023) which revealed that the majority (93.4 %) of participants were married.

Concerning the education level of the sample, the result of the current study revealed that the highest percentage 20(40%) of the study group was primary school graduates, while 16(32%) of the control group were institutes graduated and above. This result is consistent with a study conducted by Nazari et al., (2022) which revealed that the highest percentage of the study sample and control group respectively (36.7%); (46.7%) was diploma qualification level. Moreover, the result of the current study consisted of the study carried out by Noefitasari and Idris, (2022) which revealed that the majority (56,7%) of participants were primary school graduates. Moreover, this finding was consistent with the study conducted by Ikhwan et al., (2019) who reported that primary school education level has the highest percentage (52.08%) of the study. Also, (Al-Naffakh and Ali, 2019) reported that the primary school education level has the predominant percentage.

Concerning the occupational status of the sample, the result of the current study revealed that the highest percentage (44%); (and 40%) of study and control groups respectively were governmental employment. These results are consistent with a study conducted by (AL-Abedi et al., 2023) who reported that (53.8%) of the study sample are government employees.

The results of the study show that the provision of relaxation exercises in the form of progressive muscle relaxation and deep breathing affects improving the physiological parameters (blood pressure, respiratory rate, heart rate, and oxygen saturation) in hypertensive patients. There were significant changes before and after the relaxation exercise was given. In the control group, there were no differences in the results of the pretest and post-test with $p < 0.05$.

Progressive relaxation is a relaxation technique that combines deep breathing exercises and a series of specific muscle contractions and relaxations. Progressive muscle relaxation exercise trains an individual on how to relax effectively and reduce tension in the body. It is a method to help reduce tension so that body muscles can relax. It works by inducing relaxation to reduce sympathetic nerve activity and increase parasympathetic nerve activity resulting in vasodilation of arteriolar diameter. The parasympathetic nerve will then release acetylcholine that inhibits sympathetic nerve activity and decreases cardiac muscle contractility and venous and arterial vasodilation. Progressive muscle relaxation possesses a vasodilatory property that can dilate blood vessels and decrease blood pressure directly. This relaxation technique is inexpensive, brings no side effects, easy to do, and calms the body and mind (Rosyada et al., 2022).

Deep breathing relaxation has a part in boosting the parasympathetic nervous system as well as the autonomic and central nervous systems. Blood pressure is influenced by the autonomic nervous system by lung stretch receptors and arterial baroreceptors. During times of rest, the parasympathetic nervous system controls the respiratory and cardiovascular systems. Deep, relaxed breathing can drop blood pressure by relaxing receptors, increasing vagal tone, and decreasing sympathetic nerve activity (Butar et al., 2022)

This result is concordant with a study conducted by (AM et al., 2023) to determine the effectiveness of progressive muscle relaxation as a complementary therapy in managing blood pressure among adults with hypertension. The study reported there was a decreased systolic blood pressure to 29.9 mmHg and diastolic blood pressure to 14.7 mmHg. PMR significantly decreased systolic and diastolic blood pressure among adults with hypertension.

The results of the current study by study conducted by Ikhwan et al., (2019) to analyze the differences in blood pressure of hypertension sufferers who are given progressive muscle relaxation and slow deep breathing, concluded that progressive muscle relaxation and slow deep breathing exercises have an influence in efforts to reduce blood pressure in patients with hypertension against blood pressure significantly and both can be selected to reduce blood pressure.

Additionally, another study conducted by (Gupta, 2014) to examine the effect of Progressive Muscle Relaxation combined with deep breathing technique on reducing essential hypertension, resulted in finding was a significant reduction in systolic and diastolic BP progressive muscle relaxation & deep breathing techniques which agrees with the finding of the current study.

Similarly, the study performed by (Toussaint et al., 2021) is consistent with the current study which shows effectiveness of relaxation exercises (progressive muscle relaxation and slow deep breathing) in promoting both psychological and physiological relaxation states were significantly higher for the relaxation groups as compared to the control group.

Moreover, the results of the current study in line with a study conducted by (Ismansyah et al., 2019) to determine the effect of progressive muscle relaxation and slow deep breathing on the vital signs of hypertensive patients, found that there was an effect of progressive muscle relaxation toward the vital signs, systolic blood pressure, diastolic, and pulse values obtained p = 0.000, respiration 0.020, body temperature 0.006. At the same time, interventions with slow deep breathing obtained p-value of systolic 0.011, diastolic 0.001, pulse 0.000, and respiration 0.012.

Additionally, another study conducted by (Pathan et al., 2023) to investigate the combined effect of slow breathing exercise (SBE) and progressive muscle relaxation (PMR) technique on blood pressure (BP), heart rate (HR), respiratory rate (RR), and anxiety in patients diagnosed with essential hypertension. The study showed there were significant changes in HR, RR, SBP, and DBP in essential hypertensive patients following slow breathing, PMR technique alone, and combined SBE plus PMR technique compared to the control group. Therefore, the combined treatment of the SBE plus PMR technique can effectively reduce the HR, RR, SBP, DBP, and anxiety in essential hypertensive patients compared to both interventions.

Similarly, this finding is consistent with that obtained by (Manoppo & Anderson, 2019) to analyze the effect of PMR and SDB to control BP and HR on hypertension clients. The results showed the influence of PMR, SDB, and combined PMR-SDB techniques on BP and HR ($p < 0.05$).

CONCLUSION

Based on the study's findings, it can be said that slow, deep breathing exercises and progressive muscle relaxation can both be chosen in an attempt to lower blood pressure and other physiological parameters in hypertensive patients.

Recommendations

To reduce hypertension and other physiological parameters in patients with essential hypertension, the researcher suggested combining pharmacological therapies with non-drug therapy (relaxation techniques intervention) in the management of hypertension.

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