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EFFECT OF ISOMETRIC EXERCISE TRAINING AND ART THERAPY ON BLOOD PRESSURE, STRESS AND QUALITY OF LIFE IN HYPERTENSIVE INDIVIDUALS: AN EXPERIMENTAL STUDY

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ABSTRACT

Background: Hypertension (HTN) significantly impacts cardiovascular health and healthcare in India, causing 57% of stroke deaths and 24% of coronary heart disease deaths. In 2005, 20.6% of Indian men and 20.9% of women had HTN, with projections rising to 22.9% and 23.6% by 2025. HTN raises blood pressure, affecting both mental and physical health, deteriorating quality of life, and increasing stress, anxiety, and depression among patients.

Method: An experimental study was conducted on primary hypertensive individuals between 35-65 years of age and randomly divided into two different groups based on inclusion and exclusion criteria. Group A (n=30) received Isometric exercise training and Group B (n=30) received combination of Isometric exercise training and Art therapy. A pre and post intervention of Blood pressure, DASS-21 and QOL SF-12 were measured as outcome measures for the study. The data were analyzed by SPSS 25 and Microsoft Excel.

Result: Within-group analyses of the data suggested there is significant difference (<0.05) in blood pressure, stress and physical QOL in both the groups and also depression and mental QOL in group B only. Between the group analyses of the data suggested significant difference in systolic bp, diastolic bp, depression, anxiety and mental QOL.

Conclusion: This study concluded that isometric exercise (GROUP A) enhances physical health among hypertensive individuals. The integration of isometric exercise with art therapy

(GROUP B) offers extensive advantages, notably lowering blood pressure, stress, and depression, while concurrently improving both physical and mental quality of life.

Keywords: Primary Hypertension, Blood Pressure, Stress, Anxiety, Depression, Quality of life, Isometric exercise, Art therapy

INTRODUCTION

Hypertension (HTN) is defined as a persistent increase in systolic arterial pressure that stays above 140 mm Hg or diastolic arterial pressure that stays above 90 mm Hg. The stages of HTN treatment are as follows: prehypertension, stage one, stage two, and stage three **(Table A)**. HTN usually has no symptoms until problems arise in different organs all throughout the body. For this reason, it has earned the moniker "silent killer." The primary and secondary categories are the two main types. Genetic variables, environmental factors (such as salt intake from food), stress, obesity, alcohol use, and other risk factors (such as age, inactivity, and glucose intolerance) all have an impact on the likelihood of developing primary hypertension **[1]**. The formula below is a typical technique for estimating the MAP: + 1/3 [SP-DP] = DP+ MAP **[2]**.

Table A

STAGES OF HYPERTENSION	SYSTOLIC BLOOD PRESSURE (mm Hg)	DIASTOLIC BLOOD PRESSURE (mmHg)
Prehypertension	120-130	80-89
Stage 1	130-140	90-100
Stage 2	140-160	100-110
Stage 3	>160	>110

Prolonged static muscular contraction without joint movement or altering the length of the impacted muscle groups is known as isometric resistance exercise **[3]**. The majority of studies conducted to far have been for shorter periods of time, and additional research is needed to determine the cardiovascular risk involved. IET was not used in this study's high-risk participants. Because it's easier to do, less expensive, and may require less time to complete than aerobic exercise, isometric exercise may have higher adherence rates than aerobic activity. According to one study's findings, IET may be used as an adjuvant exercise modality and may result in notable and clinically significant drops in blood pressure **[4]**.

At low to moderate intensities, isometric exercise is portable, requires little more than rudimentary equipment, and does not result in the same type of cardiovascular strain (such as the rate-pressure product) as aerobic exercise new research suggests that static handgrip activity may provide a unique non-pharmacological therapy

alternative for raised blood pressure, despite the fact that isometric exercise has historically been connected to heightened hypertension symptoms **[5]**. Because it's easier to do, less expensive, and may require less time to complete than aerobic exercise, isometric exercise may have higher adherence rates than aerobic activity **[6]**.

The National Center for Complementary and Alternative Medicine (NCCAM), established by the NIH in 1998, **[7]** acknowledges Creative Art Therapy (CAT) as a form of CAM. CAT combines psychoanalysis with artistic activities like painting and sculpture, **[8]** facilitating communication of complex emotions through art. It addresses non-physiological factors in blood pressure management, such as stress, medication non-adherence, and mental health issues **[9]**. Art therapy helps patients express their feelings using visual and symbolic representations, improving mental health by fostering relaxation, self-expression, and stress management **[10]**. A comprehensive review indicates that artistic engagement can enhance mental health, lower blood pressure, boost immunity, and reduce stress **[11]**.

This research investigated the benefits of isometric exercise and creative art therapy on hypertension patients' blood pressure, trait anxiety, depression, and QOL.

MATERIALS & METHODOLOGY

This experimental study employed random sampling and involved 60 participants from Sainath Hospital, Bopal-Ghuma, Ahmedabad. The study duration was 4 weeks with 5 sessions per week. Inclusion criteria: Participants aged 35-65, who signed consent forms, had primary hypertension, were physically active, had a BMI above 24.9, and a history of hypertension for at least one year. Exclusion criteria: Smokers, individuals with diabetes (using insulin or oral hypoglycemics), previous cardiovascular events, cancer history, congestive heart failure, kidney disease, significant peripheral vascular disease, or major comorbidities were excluded. Tools: Goniometer, straps, gripper, craft supplies, canvas, oximeter, stethoscope, and sphygmomanometer were used. Outcome measures: Blood pressure (SBP, DBP, resting BP), Depression, Anxiety and Stress Scale (DASS), and Quality of Life (SF-12).

Procedure

The study, approved by the institution's ethics committee, began with baseline measurements of systolic, diastolic and resting blood pressure. Participants meeting the inclusion criteria were randomly divided into two groups. Group A performed isometric exercises thrice weekly for four weeks, continuing their medication. Group B followed a 5-day weekly protocol, with isometric exercises thrice and art therapy twice weekly, also continuing their

medication. Outcome measures, including blood pressure, heart rate, and oxygen levels, were recorded daily. Depression, anxiety, stress, and QOL scales were assessed at the beginning and end of the study.

Isometric exercise protocol

Hand grip [4, 6]: The hand grip exercise regimen required the subjects to squeeze and exert force on the dynamometer with their dominant hand for 4 × 2 minutes, and the rest period is four min. The patients were also directed to sustain the dynamometer for 2 minutes at a predetermined 20% MVC. The subjects received visual feedback for maintaining the 20% MVC from the dynamometer pointer, which read the scale. Each training session involved four repetitions of this process, followed by a four-minute break. The subjects' position during the exercise training was sitting with their upper limbs supported by a chair. In order to avoid the excessive pressor reactions caused by strenuous isometric efforts, the isometric exercise training used in this study consisted of brief handgrip contractions alternating with rest intervals.

Wall squat [5, 6]: Participants performed wall squats for 2 minutes or until fatigue, receiving vocal encouragement and time updates. They were instructed to breathe normally to avoid the Valsalva maneuver. Over four weeks, participants attended three sessions per week, totaling twelve sessions. Each session included four 2-minute wall squats with 2-minute seated breaks. A clinical goniometer and Velcro straps measured the knee joint angle. The goniometer was gently secured to the left leg, with specific anatomical points used for alignment. Participants maintained a 135° knee flexion for 2 minutes initially, reducing by 5° each stage over ten sessions. In the final two sessions, joint angles were assigned randomly and repeated.

Art therapy protocol [7, 10, 11]

The subjects covered in the art therapy sessions were adapted from Beebe's study on the benefits of CAT for “children with asthma,” as there were no specific resources for chronically ill adult patients.

In the first session, titled “Who am I?”, participants introduced themselves and shared two positive and two negative qualities about their daily lives. They then created a personal playlist to listen to during the art therapy sessions for a calming effect. Participants were instructed to draw and paint a symbol or object representing themselves. On the other side of the paper, they wrote a letter to themselves, imagining they were speaking to themselves from another perspective, detailing what they wanted to change, understand, or express that only they knew.

In the second session, “Draw a Life Tree,” participants traced their hand on paper to create a tree with branches and leaves. They

wrote personal likes (e.g., "I like playing cricket") on the leaves, qualities they possess (e.g., "I am a good listener") on the branches, and things they are grateful for (e.g., "I am grateful for my friend Sneha") in the middle of the tree. Around the roots, they wrote about what supports them (e.g., "I am supported by my family").

The third session, "Feelings Related to Illness," focused on the emotions associated with high blood pressure (HBP). Participants were given two cardboard masks to paint: one depicting how they felt when their blood pressure was high and the other illustrating how they felt when they were well. They then shared feedback about their work and took the masks home.

During the fourth session, "Pain Management, Artwork, and Imagery," participants reflected on their experiences of physical or mental pain and what brought them comfort. They were given paint and instructed to use colors together without creating specific images, painting for five minutes at a time, six times with different color schemes. Afterward, they discussed how the exercise affected them and which colors made them feel better. The session emphasized that certain colors could lower blood pressure and improve mood. Participants were asked to imagine themselves wrapped in their favorite calming color, like a blanket, to use this imagery when feeling discomfort, stress, or increased blood pressure.

Each session lasted approximately two hours and was divided into two one-hour sessions per day, twice a week. There were four therapy exercises in total, divided into eight sessions.

RESULTS

The SPSS version 25 and Microsoft Excel were used for the analyses of data. The Confidence Interval for the study was kept at 95%. The significance level was kept at <0.05. More of the data of this study is >0.05 which suggested the data is non-parametric.

Table 1: Statistical Tests for the Present Study.

Statistical test for Group A: Within-group	**Mann-Whitney test**
Statistical test for Group B: Within group	**Mann-Whitney test**
Statistical test for the between group analyses	**Wilcoxon test**

Table 2: Demographic Data

SAMPLE SIZE (60)	GROUP A	GROUP B	P VALUE
AGE (YEARS)	49.5 ± 8.57	54.17 ±8.22	0.5
GENDER	53.33% FEMALE 46.66% MALE	50% FEMALE 50% MALE	

Interpretation: The study enrolled 60 subjects, 30 in each group. Control group: average age 49.5 ± 8.57, 53.33% male, 46.66% female. Intervention group: average age 54.17 ± 8.22, 50% male, 50% female.

Table 3: baseline comparison of all outcomes in both group A and group B [between group]

BETWEEN GROUP A & B	GROUP A		GROUP B		P VALUE
	MEAN	SD	MEAN	SD	
SYSTOLIC BLOOD PRESSURE	143.27	7.78	141.33	8.34	0.179
DIASTOLIC BLOOD PRESSURE	72.33	10.43	73.13	12.01	0.39
DEPRESSION	8.6	3.68	8.73	3.13	0.44
ANXIETY	5.2	3.09	4.80	2.71	0.297
STRESS	10.47	6.05	11.67	4.96	0.20
SF 12 PHYSICAL COMPONENT	41.99	5.94	41.23	6.48	0.31
SF 12 MENTAL COMPONENT	43.26	8.11	43.51	6.97	0.44

A baseline comparison of all outcome measures did not show a significant value of $p < 0.05$. all the outcomes were greater than 0.05 ($p<0.05$)

Table 4: Within The Group Analysis of Primary Hypertensive Recipients After 4 Weeks of Exercise Among Group A

GROUP A	MEAN		SD		P VALUE
	PRE	POST	PRE	POST	
SYSTOLIC BLOOD PRESSURE	143.27	137.87	7.78	7.28	0.0073
DIASTOLIC BLOOD PRESSURE	77.33	66.87	10.43	9.91	0.041
DEPRESSION	8.6	7.67	3.68	3.28	0.30
ANXIETY	52	4.93	3.09	3	0.73
STRESS	10.47	8.53	6.05	4.45	0.17
SF 12 PHYSICAL COMPONENT	41.99	46.12	5.94	5.80	0.0081
SF 12 MENTAL COMPONENT	43.26	44.66	8.11	7.77	0.497

Within the group A comparison outcome measures suggested p value less than 0.05 except depression, anxiety, stress and mental QOL. Hence, the group intervention was somewhat effective

Table 5: Within The Group Analysis of Primary Hypertensive Recipients After 4 Weeks of Exercise Among Group B

GROUP B	MEAN		SD		P VALUE
	PRE	POST	PRE	POST	
SYSTOLIC BLOOD PRESSURE	141.33	136.07	8.34	8.23	0.016
DIASTOLIC BLOOD PRESSURE	73.13	66.67	12.01	10.77	0.032
DEPRESSION	8.73	5.8	2.64	3.13	0.00023
ANXIETY	4.8	3.67	2.71	2.41	0.092
STRESS	11.67	8.13	4.96	4.36	0.0048
SF 12 PHYSICAL COMPONENT	41.23	44.53	5.84	6.48	0.042
SF 12 MENTAL COMPONENT	43.51	48.87	6.97	5.95	0.0022

Within the group B comparison all outcome measures suggested p value less than 0.05 except anxiety. Hence, the group intervention was effective

Table 6: Between the Group Comparison of All Outcomes In Both Groups

BETWEEN GROUP A & B	GROUP A		GROUP B		P VALUE
	MEAN	SD	MEAN	SD	
SYSTOLIC BLOOD PRESSURE	137.87	7.28	136.07	8.23	0.187
DIASTOLIC BLOOD PRESSURE	66.87	9.91	66.67	10.77	0.015
DEPRESSION	7.67	3.28	5.8	2.64	0.009
ANXIETY	4.93	3	3.67	2.41	0.038
STRESS	8.53	4.75	8.13	4.36	0.367
SF 12 PHYSICAL COMPONENT	46.12	5.8	44.53	5.84	0.147
SF 12 MENTAL COMPONENT	44.66	7.77	48.87	5.95	0.010

There is significant effect present in group B which shows effect in both mental and physical aspects compare to group A in BP, Stress and QOL

DISCUSSION

A smaller amount of research indicates that isometric exercise training might be linked to a decrease in vascular sympathetic modulation, although a greater amount of studies has looked into possible advantageous changes in vascular function. Specifically, it has been noted that in hypertensive patients with reactive hyperaemia, isometric exercise training

enhances capillary reliant vasodilator (such as nitric oxide mediated vasodilation) **[12]**. In a study conducted in 2021, Yuki Nemoto et al. concluded that an 8-week course of IHG training significantly lowered the morning and evening home blood pressure of hypertensive Japanese patients receiving treatment. A larger increase in the maximum grip strength as a result of IHG training was also linked to greater BP reductions **[13]**. Home-based IET can be conducted with some degree of confidence in individuals with a wide range of RBP, according to Benjamin D. H. Gordon's study, which used unsupervised home-based IET programs and highlighted an intriguing possibility for community-based solutions to treat hypertension. Longer training programs can result in sustained post-training reductions in RBP, particularly in individuals with HTN. This study's findings also show that isometric exercise protocols can be implemented at an unsupervised level because they are safe and effective; however, in our study, the protocols were supervised **[14]**. In 2013, Veronique A. Cornelissen carried out a systematic study to examine the effects on adults' resting blood pressure (BP) of isometric resistance training, combined resistance and endurance training, dynamic resistance, and endurance. They concluded that although combined training only lowers DBP, isometric resistance training, dynamic resistance, endurance, and isometric resistance training all lower SBP as well as DBP, with isometric resistance training having the most ability to do so. Their objectives were to find the biggest BP improvements and to measure and compare BP changes for every training mode **[15]**. In our study, statistically significant changes seen in SBP and DBP by isometric exercise both group A and group B. Our research shows that combining twice-weekly creative art therapy with four times-weekly isometric exercise over four weeks reduces depression and improves function and quality of life in hypertensive patients. Creative art therapy notably reduces stress, anxiety, and sadness, enhancing overall wellbeing, which is beneficial compared to isometric exercise alone **[16]**. Ali *et al*. showed stroke patients felt less alone and nervous after creative art therapy group talks, which allowed them to vent frustrations and optimism for recovery, aiding emotional rehabilitation **[17]**. Creative art therapy can improve psychosocial and functional scores. However, insufficient research exists on its physical function benefits. Adriaan Visser's 2008 study showed improved quality of life in cancer patients **[18, 19]**. While evidence supports art therapy for neuromuscular disorders, fewer studies focus on hypertensive patients. Mullarkey's 2017 study found no significant blood pressure improvement in Black American women

following art therapy **[7]**. Jolaade Kalinowski's 2021 study concluded stress management could lower blood pressure and enhance cardiovascular disease prevention in Black women, suggesting its effectiveness in managing blood pressure **[20]**.

Art therapy and isometric exercise, it has been very comfortable for patient with hypertension. Thus, the present study demonstrates that art therapy and isometric exercises are more effective on BP, DASH and improved QOL of patient than isometric exercises alone.

CONCLUSION

Isometric exercise alone reduces stress, systolic and diastolic blood pressure, and enhances physical well-being in hypertensive patients but does not significantly improve mental well-being, anxiety, or depression. Combining isometric exercise with art therapy offers broader benefits, significantly reducing blood pressure, stress, and depression while enhancing both physical and mental quality of life. These findings underscore the multifaceted nature of hypertension management, highlighting that while isometric exercise improves physiological parameters, adding art therapy addresses psychological aspects, offering a more comprehensive treatment approach.

Ethics: On 29th DEC 2022, the research was approved by the Institutional Ethics Committee for Human Research Sainath Hospital, Ahmedabad (IECHR-Sainath Hospital). With Approval Number: IECHR-SAINATH HOSPITAL/AHMC/74.

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