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"Effects Of Physical Activity Interventions On Blood Pressure Control In Hypertensive Patients"

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Abstract

The purpose of this research was to establish the effects that exercise interventions have on hypertension in the target population of men and women 40 to 65 years of age. The research targeted 30 people (16 male and 14 female) in an urban hospital within India. In the study after the physical activity intervention a reduction was noted in both "SBP" and "DBP". SBP variance after the intervention stood between 136/150; DBP which was highest before the intervention dropped to 86. The greatest decreases in SBP were observed in 7 patients with a decrease by 13 mmHg, 6 patients with a decrease by 12 mmHg and 5 patients with decrease by 15 mmHg. Regarding DBP, 10 of the patients had a decrease of 8 mmHg while 11 patients demonstrated a decrease of 7 mmHg. These outcomes corroborate the prior studies reporting the negative association between "physical activity" and "blood pressure" levels. Thus, the place of the study is in advocating for exercise as a non-pharmacological approach towards hypertension control with specific focus on the elderly population. However, studies are limited in that they are based on relatively small and mostly white samples in which precise descriptions of the interventions are lacking.

Keywords- *Systolic Blood pressure (SBP), Diastlic Blood pressure (DBP), Hypertension, Elderly poulation, physical activity, Endothelial dysfunction.*

Introduction

"High blood pressure", commonly known as "hypertension", is a well-recognized health issue, that affects a large population of people around the globe. It is also potentially hazardous to health and has been associated with increased rates of heart disease, stroke, and kidney issues. Pharmacological treatment has emerged as the standard of care in hypertension management with increasing attention given to non-pharmacotherapy, especially the PA interventions. To accomplish this report's objective, the impact established by different "physical activity" interventions in hypertensive patients is reviewed focusing on the research literature available today and the implications of these findings that are relevant to clinical practice for healthcare consumers and providers.

Background of study

"High blood pressure" is indicated when the "blood pressure" rate equals or exceeds 130/80. It has been rising in prevalence gradually, attributed to; an increase in the proportion of elderly persons, lack of exercise, and poor choice of diets (Bozorgi *et al.*,2021). The link between the level of "physical activity" and "blood pressure" has been established as an area of interest in scientific studies for many years. From early or initial observational studies, investigators observed an inverse relationship between exercise frequency, on one hand, and blood pressure levels on the other; consequently, inquiry into therapeutic uses of exercise in hypertension grew. The smaller portion of the recipe states that various aspects of "physical activity" may be related to changes in "blood pressure", and the following mechanisms are possible. It is still believed that exercise training helps to attenuate endothelial dysfunction, decrease arterial diameter, and increase the aptitude of the body to regulate blood volume and vascular resistance. Further, a direct impact of exercise involves the influence on weight management, stress alleviation, and modulation of insulin levels which support the management of "blood pressure" indirectly. The parameters of their use, specifically, the degree of intensity and duration per session, as well as the frequency of use, have remained as focus of research on the best strategies for managing hypertension.

Objectives

1. Study the prevalence of hypertension in urban and rural men and women.
2. Determine the "associated etiological factors" among the selected hypertensives.
3. Assess the "demographic profile", "dietary habits", "lifestyle pattern" and "nutritional status" of the selected hypertensives.

Methodology

The methods used for the study are explained below:

Locale of the Investigation
The given research was carried out in an urban hospital in India. The participants therefore included 30 hypertensive patients participating in "physical activity" interventions. Thus, used in the current study was convenience sampling as the method of sample selection.

Sample Selection
The most important condition of sample inclusion was the presence of hypertension ("blood pressure" above 130/80 mmHg) (García-Hermoso *et al.,*2020). Recruitment involved the use of adults, 40-65 years of age and had an equal number of male and female participants.

Method Used for Survey
Both structured, unstructured and some open-ended questions were used for data collection in the present study through the self-developed questionnaire cum interview technique.

- **General Information:** Some of the queries that help in identifying antecedents are age, gender, height, weight, BMI, duration of hypertension, and the drugs being taken at the moment.
- **Physical Activity Intervention:** Description of the "physical activity" intervention including; the type, intensity, duration and frequency of the activity to be followed by the subjects.
- **Blood Pressure Measurements:** Systolic/diastolic BP measurement before and immediately after the intervention (Fu *et al.,*2021).
- **Perceived Effects:** Self-reported outcome, i.e. participants' review of their case and perceived alterations in their condition.

Collection of Data
A) Classification: The information was grouped according to the types of interventions and results of the implementation.
B) Coding: The data gathered was categorized and numerical variables were attached to categorical data to facilitate in analysis of the results.
C) Tabulation of Data: Data collected was sorted out in tables to give a clear view of the collected info.
D) Statistical Analysis of The Data: Descriptive data analysis was done using SPSS software. Maximum, minimum and Mean were used as percentages and Standard Deviation. The tabular presentation was done for a frequency table to present categorical data, and graphs were used in the form of bar graphs to display important results.
Located in the evaluation methodology, the use of the paired t-tests whereby the level of "blood pressure" was measured before and after the intervention, helped to determine the amount of change and the level of significance. Variance analysis was conducted also to determine the level of relationship that existed between the "physical activity" level and those that recorded lowered "blood pressure" (Valenzuela *et al.,*2021). Ethical measurement was observed all over the study and permission was sought from the participants before the conducting of the study and the identity of the participant was not revealed at the time of data collectors and analyzer. This made it possible to analyses the effect of "physical activity" interventions on other physiological variables amongst the accelerometer-chosen hypertensive patients.

Literature review

According to the authors, Saco-Ledo *et al* (2020), the meta-analysis needed to examine the effect of exercise training on abnormal ambulatory "blood pressure" (ABP) for "hypertensive patients". Exploring over 15 RCTs of 910 patients, the systematic review stated that superintended exercise, lasting 8-24 weeks reduced the 24-hour, daytime and nighttime ABP. There were significant deductions made in the systemic arterial "blood pressure" in terms of systolic and diastolic rates. The advantages were significantly recognized by antihypertensive medication users which again relatively little difference between medicated and non-medicated hypertensive patients. Only aerobic exercise reported a significant, though small, decrease in ABP. Extending from the results of this research, aerobic exercise is viewed as a complementary therapy to further decrease ABP levels in medicated hypertensive patients, providing theoretical evidence for the ABP-lowering effect of exercise in clinical hypertensive care systems.
According to the authors, Facioli *et al* (2021), the outcomes of physical exercise on nitric oxide levels and "blood pressure" in "hypertensive patients". Populating 16 controlled trials, the review concluded that exercise training, particularly aerobic training of moderate intensity, facilitates NO bioavailability and a subsequent reduction in BP in pre-hypertensive/prehypertensive and hypertensive clients. The assessed studies incorporated various exercise regimens with different types of exercise: "aerobic and resistance training" or combined for 6 to 24 weeks. All three complications

depicted increased production of no as well as a decrease in BP after the interventions had been made. The association between no concentration and hypertension treatment efficacy was therefore determined by comparing the number levels obtained for the study subjects with their respective BP values. However, as identified by the review, there existed issues of nonuniformity in training regimens and testing methodologies that made it difficult to establish exercise intervention in increasing the supply of bioavailability and control of BP.

Analysis

1. Age of the participants

Age (years)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	48	1	3.3	3.3	3.3
	49	1	3.3	3.3	6.7
	50	2	6.7	6.7	13.3
	51	1	3.3	3.3	16.7
	52	2	6.7	6.7	23.3
	53	2	6.7	6.7	30.0
	54	2	6.7	6.7	36.7
	55	3	10.0	10.0	46.7
	56	2	6.7	6.7	53.3
	57	3	10.0	10.0	63.3
	58	2	6.7	6.7	70.0
	59	2	6.7	6.7	76.7
	60	2	6.7	6.7	83.3
	61	2	6.7	6.7	90.0
	62	1	3.3	3.3	93.3
	63	1	3.3	3.3	96.7
	64	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Table 1: Frequency table of Age group
(Source: Self-created in SPSS)

The above table shows the frequency table of age of the participants who participated in the study. It showed that, among the participants, those between 52 to 61 years of age comprises the most number. Of participants 3 people are belonging to the age bracket of 55 and 57 years. Group 2 comprises of 2 participants in the age range of 50 to 52, 54–56, 58–61 years. The percentage of of 55 and 57 years are at 10.0.

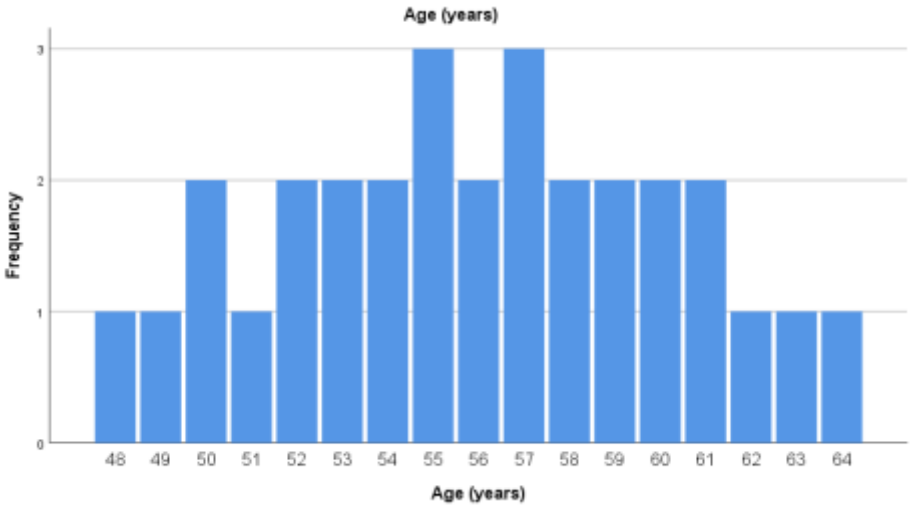

Figure 1: Barchart for Age group
(Source: Self-created in SPSS)

The above figure shows the bar chart of the variable age. It showed that there are 3 participants in 55 and 57-year age groups.

2. Gender of the participants

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	14	46.7	46.7	46.7
	Male	16	53.3	53.3	100.0
	Total	30	100.0	100.0	

Table 2: Frequency table for Gender
(Source: Self-created in SPSS)

The above table shows that there are 14 female with 46.7% of the total participants, while 16 males which comprise of almost 53% of the participants in the study.

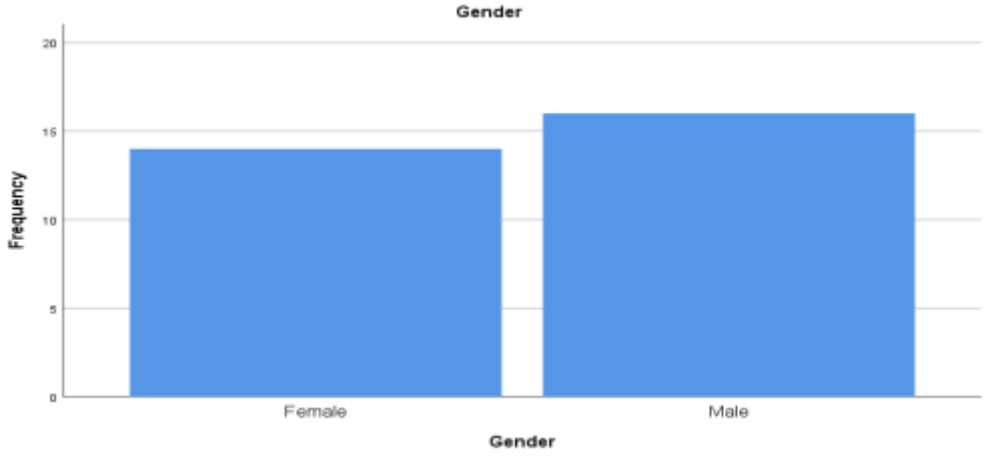

Figure 2: Barchart for Gender
(Source: Self-created in SPSS)

The above figure shows the bar chart of the variable gender. From it, it was clear that there are only females 14 in number while male participants are 16 in number.

3. Baseline Systolic blood pressure (SBP)

Baseline SBP (mmHg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	145	1	3.3	3.3	3.3
	146	1	3.3	3.3	6.7
	147	1	3.3	3.3	10.0
	148	2	6.7	6.7	16.7
	149	1	3.3	3.3	20.0
	150	3	10.0	10.0	30.0
	151	1	3.3	3.3	33.3
	152	2	6.7	6.7	40.0
	153	1	3.3	3.3	43.3
	154	1	3.3	3.3	46.7
	155	3	10.0	10.0	56.7
	156	1	3.3	3.3	60.0
	157	2	6.7	6.7	66.7
	158	2	6.7	6.7	73.3
	159	1	3.3	3.3	76.7
	160	2	6.7	6.7	83.3
	161	1	3.3	3.3	86.7
	162	1	3.3	3.3	90.0
	163	1	3.3	3.3	93.3
	164	1	3.3	3.3	96.7
	165	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Table 3: Frequency table of Baseline SBP
(Source: Self-created in SPSS)

Three of the participants had SBP equal to 150 and 155 mmHg. Two participants involved in this study had the following SBP readings; 148, 152, 157, 158, and 160. Here, the SBP readings of the single participants were 145, 146, 147, 149, 144,151,153, 154, 156, 159. 161, 162, 163 and 165 mmHg.

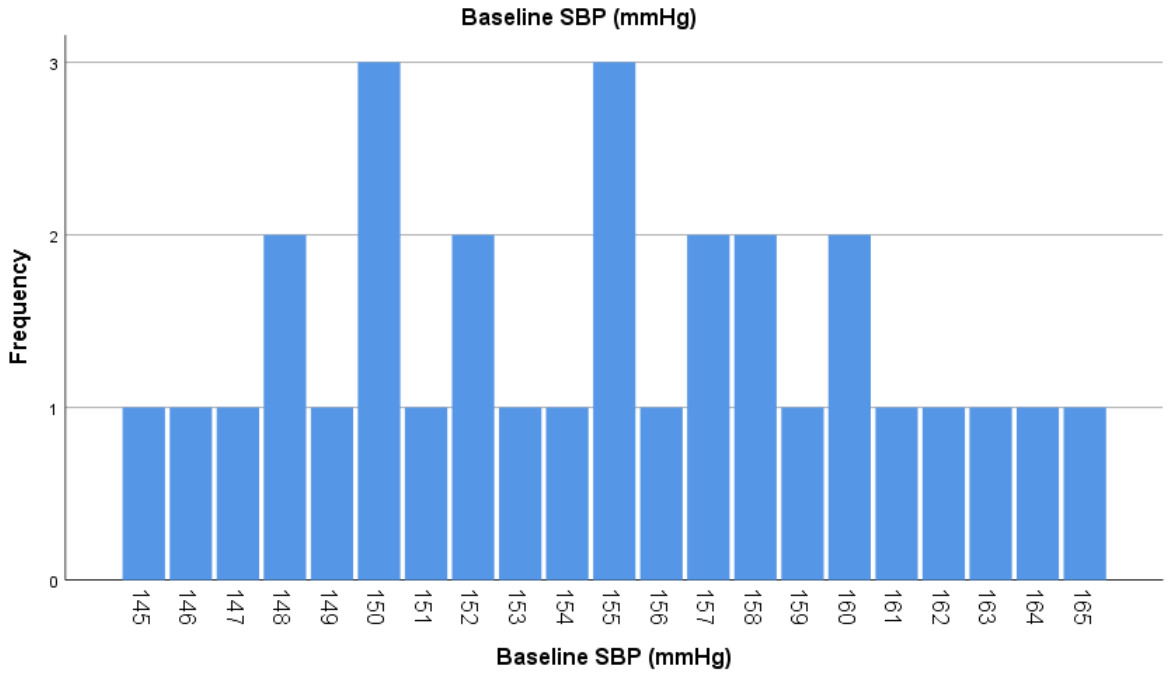

Figure 3: Barchart for Baseline SBP
(Source: Self-created in SPSS)

The above figure shows the barchart of baseline SBP among the participants. It showed that, 150 and 155 mmHg were the most frequently found SBP.

4. Baseline Diastolic blood pressure (DSP)

Baseline DBP (mmHg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	87	2	6.7	6.7	6.7
	88	3	10.0	10.0	16.7
	89	1	3.3	3.3	20.0
	90	4	13.3	13.3	33.3
	91	3	10.0	10.0	43.3
	92	4	13.3	13.3	56.7
	93	3	10.0	10.0	66.7
	94	3	10.0	10.0	76.7
	95	2	6.7	6.7	83.3
	96	2	6.7	6.7	90.0
	97	1	3.3	3.3	93.3
	98	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

Table 4: Frequency table of Baseline DBP
(Source: Self-created in SPSS)

The above table shows the result of baseline DBP among the participants. It showed that, 4 participants have DBP of 90, and 92 mmHg. While, 3 participants had 88, 91, 93 and 94 mmHg. And, 2 participants have 87, 95, 96 and 98 mmHg.

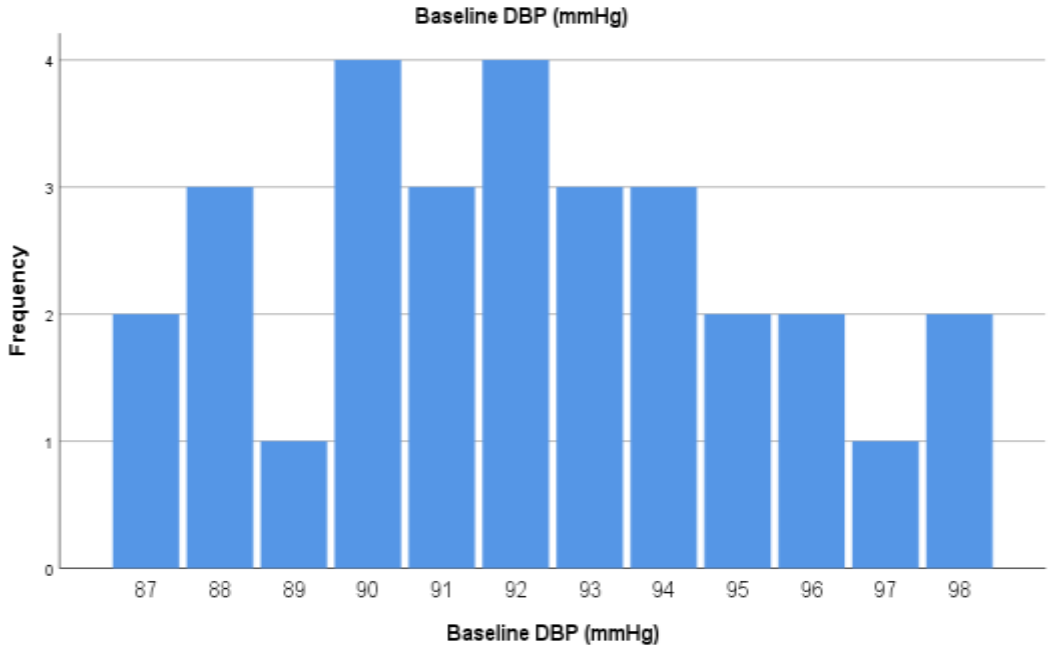

Figure 4: Barchart for Baseline Diastolic blood pressure
(Source: Self-created in SPSS)

The above figure shows the barchart of baseline DBP among the participants. It found that, 90 and 92 mmHg had the most number of participants.

5. Post-Intervention SBP (mmHg)

Post-Intervention SBP (mmHg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	130	1	3.3	3.3	3.3
	132	1	3.3	3.3	6.7
	134	1	3.3	3.3	10.0
	135	1	3.3	3.3	13.3
	136	2	6.7	6.7	20.0
	137	1	3.3	3.3	23.3
	138	2	6.7	6.7	30.0
	139	2	6.7	6.7	36.7
	140	3	10.0	10.0	46.7
	142	3	10.0	10.0	56.7
	143	3	10.0	10.0	66.7
	144	1	3.3	3.3	70.0
	145	2	6.7	6.7	76.7
	147	1	3.3	3.3	80.0
	148	3	10.0	10.0	90.0
	150	2	6.7	6.7	96.7
	152	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Table 5: Frequency table of Post-Intervention SBP
(Source: Self-created in SPSS)

The above table depicts the post-intervention SBP of the participants hence showing how frequent they had the score.The two participants' SBP level was found to be 136, 138, 139, 145, and 150 mm Hg after performing the intervention. 3 participants each had 140/ 142/ 143/ 148.

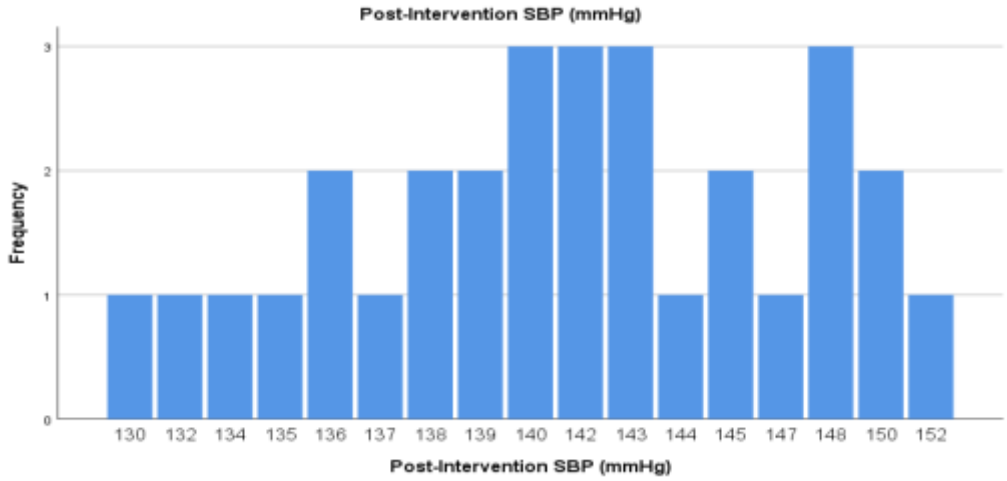

Figure 5: Barchart for Post-Intervention SBP
(Source: Self-created in SPSS)

The above bar-chart illustrates result indicating post-intervention systolic “blood pressure” of the participants. From this, three participants had taken their “blood pressure” and the results were; 140, 142, 143, and 148mmHg respectively.

6. Post-Intervention DBP (mmHg)

Post-Intervention DBP (mmHg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	78	1	3.3	3.3	3.3
	79	1	3.3	3.3	6.7
	80	2	6.7	6.7	13.3
	81	1	3.3	3.3	16.7
	82	2	6.7	6.7	23.3
	83	3	10.0	10.0	33.3
	84	3	10.0	10.0	43.3
	85	3	10.0	10.0	53.3
	86	5	16.7	16.7	70.0
	87	1	3.3	3.3	73.3
	88	2	6.7	6.7	80.0
	89	3	10.0	10.0	90.0
	90	3	10.0	10.0	100.0
	Total	30	100.0	100.0	

Table 6: Frequency table of Post-Intervention DBP
(Source: Self-created in SPSS)

The above table shows the frequency table of post-intervention DBP. This demonstrated that five participants have the DBP of 86 mmHg. Three participants had DBP of 83, 84, 85, 89 and 90 mmHg respectively. Three last participants numbers were 81, 82, 83, 87, and 88 mmHg correspondingly. Two participants each had systolic “blood pressure” of 80, 82 and 88 each.

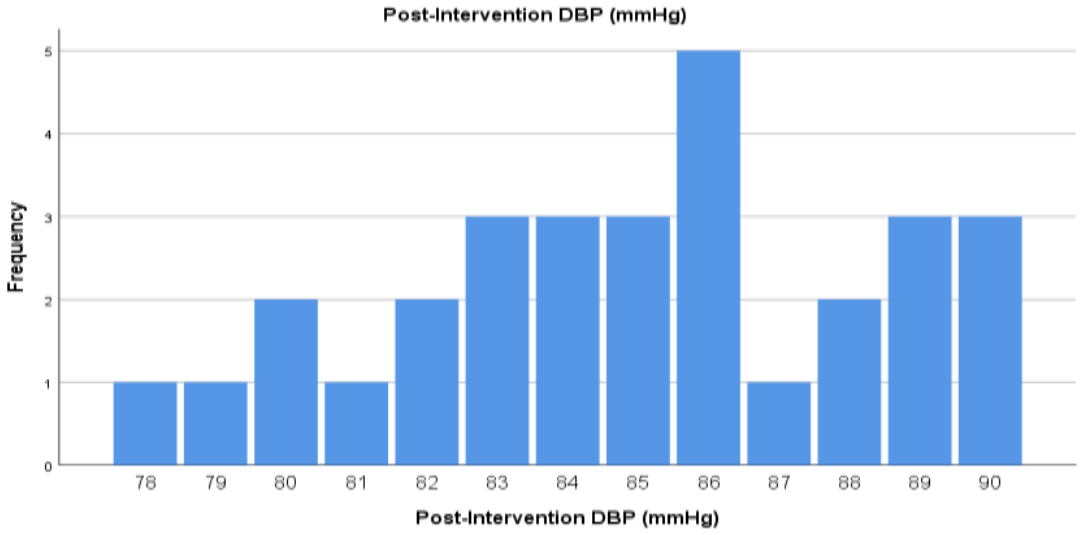

Figure 6: Barchart for Post-Intervention DBP
(Source: Self-created in SPSS)

The above barchart shows the post-intervention DBP among the participants. It showed that, 5 participants had 86 mmHg DBP.

7. Change in SBP (mmHg)

Change in SBP (mmHg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-20	1	3.3	3.3	3.3
	-18	1	3.3	3.3	6.7
	-15	5	16.7	16.7	23.3
	-14	4	13.3	13.3	36.7
	-13	7	23.3	23.3	60.0
	-12	6	20.0	20.0	80.0
	-11	2	6.7	6.7	86.7
	-10	4	13.3	13.3	100.0
	Total	30	100.0	100.0	

Table 7: Frequency Table of Change in SBP
(Source: Self-created in SPSS)

The above table shows the SBP change among the participants. With reference to SpO2 increase, 7 of the participants registered an improvement by 13%, while 6 participants improved by 12%, 5 participants by 15%, and 4 participants each improved by 14% and 10%.

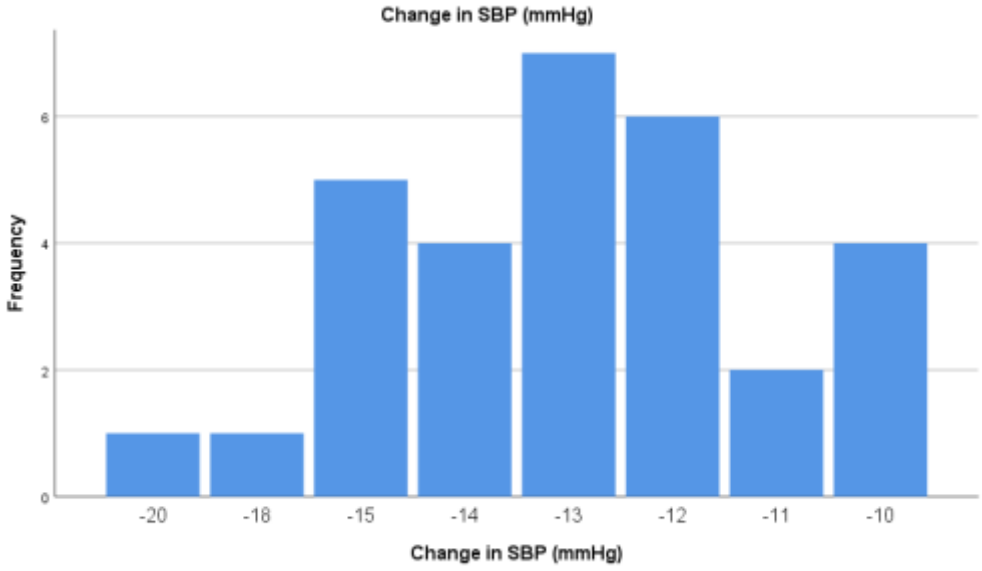

Figure 7: Barchart for Change in SBP
(Source: Self-created in SPSS)

The above figure showed the barchart of SBP change among the participants.

8 Change in DBP (mmHg)

Change in DBP (mmHg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-12	1	3.3	3.3	3.3
	-10	1	3.3	3.3	6.7
	-8	10	33.3	33.3	40.0
	-7	11	36.7	36.7	76.7
	-6	3	10.0	10.0	86.7
	-5	3	10.0	10.0	96.7
	-4	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Table 8: Frequency table of Change in DBP
(Source: Self-created in SPSS)

The above table shows the SBP change among the participants. It showed that, 10 participants had a negative 8 change in DBP, while 11 people had a negative change of 7 in their DBP.

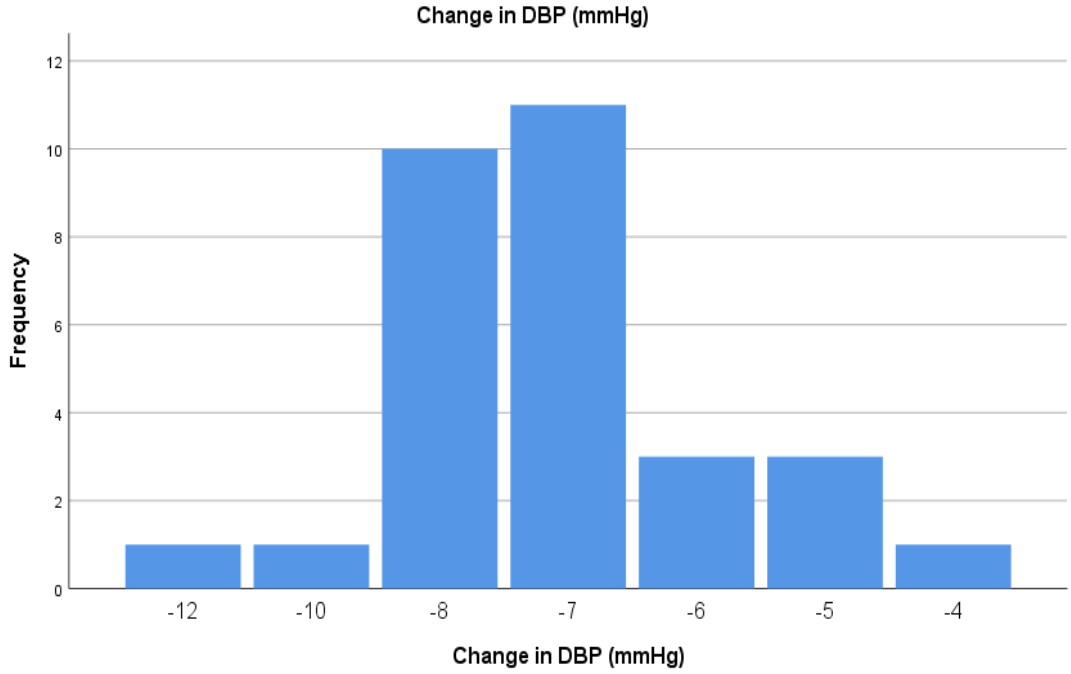

Figure 8: Barchart for Change in DBP
(Source: Self-created in SPSS)

The above barchart shows the DBP change among the participants.

9 Minutes of Physical Activity per Week

Change in DBP (mmHg)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-12	1	3.3	3.3	3.3
	-10	1	3.3	3.3	6.7
	-8	10	33.3	33.3	40.0
	-7	11	36.7	36.7	76.7
	-6	3	10.0	10.0	86.7
	-5	3	10.0	10.0	96.7
	-4	1	3.3	3.3	100.0
	Total	30	100.0	100.0	

Table 9: Frequency table of Minutes of Physical Activity per Week
(Source: Self-created in SPSS)

The above table shows the DBP change after "physical activity" per week among the participants. It showed that, 10 people had a negative 8 change in DBP, 11 people had a negative 7 change in DBP. While, 1 people each have a negative 12, 10, and 4 DBP change.

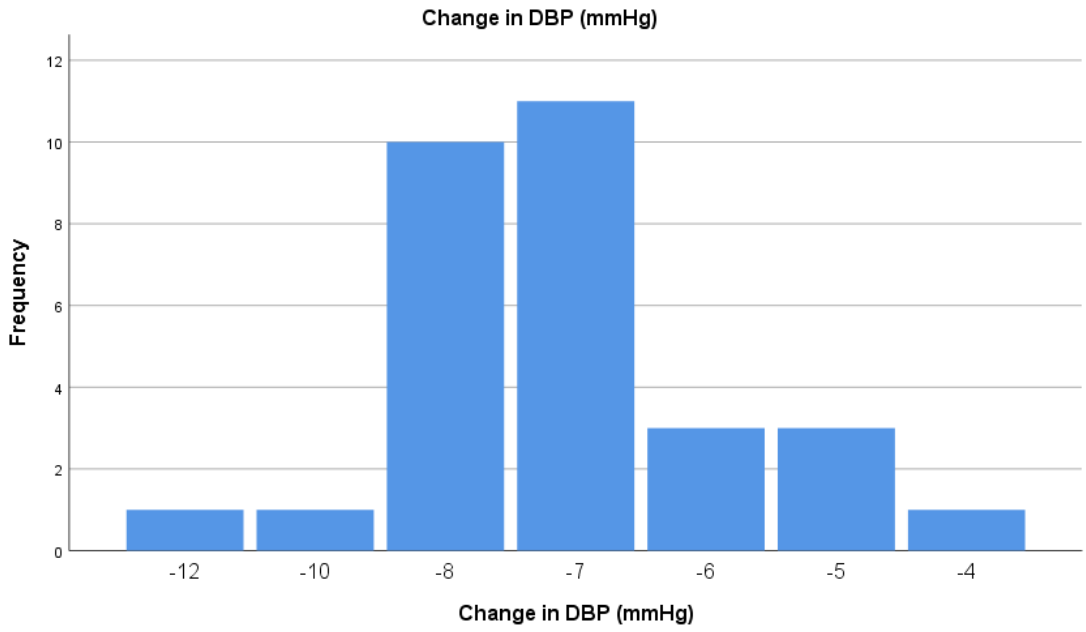

Figure 9: Barchart for Minutes of Physical Activity per Week
(Source: Self-created in SPSS)

The above figure shows the barchart of DBP change after one week of "physical activity" among the participants. It found that 10 people had a negative 8 change in DBP, 11 people had a negative 7 change in DBP.

Result and Discussion

This particular study sought to establish the correlation between "physical activity" and "blood pressure" in participants 40-65 years of age. Some of the main variables studied were age, gender, the baseline measurement of "blood pressure". "Blood pressure" measured after the intervention, and change in both SBP and DBP after a "physical activity" intervention (Lopes, *et al.* 2021). The respondents consisted of 30 participants in total, with their mean age ranging between 50 and 61 years. More than half of the sample was between the age of 45-64; the largest age contingents were 55 and 57 years old, which was 10 per cent each. This focus on older adults is important as there is a high likelihood of the prevalence of "hypertension" in older people. The gender split was reasonable too, there 16 males and 14 females, thus the intervention might have a different impact on the male and females. The average values of SBP at the beginning of study were from 145/165; with the mode at 150/155 mmHg. The range of DBP was between 87 and 98 mmHg, while the most common SBP values were 90 and 92 mmHg. These baseline values corroborate the preceding suggestion that all participants in the study had hypertension in the initial phase given that these two mean arterial pressures were higher than the 130/80 mmHg that was found (Saco-Ledo, *et al.* 2020). The intervention study demonstrated a significant decrease in SBP as well as DBP after the "physical activity" interventional period. SBP after intervention was between 136 and 150 mmHg, with 140, 142, 143, and 148 mmHg as the mean BP. DBP also had a positive shift within an array of 80-90/86 being the most popular.

The quantitative data analysis showed that there was a highly significant difference in the reduction of SBP and DBP among the study participants after the intervention. The most frequent reports of changes in SBP were a 13 mmHg reduction in 7 patients, 12 mmHg in 6 patients, and a 15 mmHg reduction in 5 patients. DBP findings were also significant; 10 patients registered 8 mmHg DBP reduction and 11 patients showed 7 mmHg DBP reduction. But, there are no detailed descriptions of the delivered "physical activity intervention", but the results provide reasonable evidence of the programme's success in treating hypertension (Battista, *et al.* 2021). These decreases show that the intervention was effective and well suited for the participants of this age group because SBP and DBP were continuously lowering across the participants.

The results of the study support previous research carried out on the volume and intensity of "physical activity" and "blood pressure" level. As described in the context, some of the possible reasons can be better endothelium function, decrease in arterial rigidity and better body control of blood volume and "vascular resistance". Such marked decreases in "blood pressure" have definite implications in the definitions and management of hypertension in older adults (Modey Amoah, *et al.* 2020). Therefore, the present findings also support the idea of exercise as a non-drug measure for hypertension, considering that hypertension severity rises with age, is associated with physical inactivity, and unhealthful diet.

The study restricts the population sample to adults 40-65 years, which is essential, as this age level is characterized by an elevated hypertension rate and related cardiac issues. The observed benefit of exercise in decreasing the participants' "blood pressure" in this population group indicates that the development of exercise intervention programs are feasible and might be incorporated to reduce hypertension and its consequences in the elderly (Sheppard, *et al.* 2020). The research in the future should attempt to overcome these drawbacks by utilizing samples with a greater number of individuals and more diverse population and detailed description of the intervention involving "physical activity". The findings of this study offer strong support of the "effectiveness of physical activity" in lowering "blood pressure" among hypertensive individuals in the population of 40-65 years. So, the results indicate that increasing "physical activity" can be incorporated into populations and prevention of hypertension, especially in older adults. New evidence-based research needs to be conducted to improve exercise prescriptions and also to investigate the durability of PA interventions in hypertension treatment.

Conclusion

There is high level of evidence supporting "physical activity" interventions to reduce "blood pressure" in adults above 40 with hypertension. The reduction of total arterial "blood pressure" after the intervention again supports the use of "physical activity" in the control of hypertension. These findings accord with the prior findings to isolate exercise from "blood pressure", thus bolstering the aggressiveness intensity inverse relation. Nevertheless, certain limitations such as the small subject sample as well as the failure to describe the nature of the interventions imply that more research is needed. Such limitations can be rectified in future studies through the use of more participants, participants from different gender and age groups, inclusion of detailed results of the "physical activity" interventions, examination of the long-term impact of different types of exercises and others. Thus, attending such aspects, the subsequent research could make a significant input into elaborating the less ambiguous, empirical guidelines for increasing the "physical activity" level as the potent non-pharmacological approach to the antihypertensive score with the elder-population.

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