Effect of Isometric Handgrip Strengthening Exercise on Blood Pressure among Hypertensive Patients

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Abstract

Hypertension (HTN) is a major risk factor contributing to cardiovascular disease, which is the main cause of death world wide. Isometric handgrip strength(HGS) exercise, a non-pharmacological lifestyle modification, has been recommended as a first-line treatment for hypertension. This study **aimed** to examine the effect of isometric handgrip strengthening exercise on blood pressure among hypertensive patients. **Subjects**: a quasi-experimental research design was conducted on sixty medicated hypertensive patients and divided attentively into two equal groups. Control group which, exposed to routine hospital care only. While study group was followed the isometric handgrip strength exercise program. Two tools were used for collecting data **Tool I** Patients' Assessment Interview Schedule and **Tool II** International Physical Activity Questionnaire-Long Form (IPAQ-LF).**Results:** there was a statistically significant reduction in systolic blood pressure between the study group with Mean ± SD (111.50±7.23 mmHg) and control group (126.16±7.32 mmHg) after 10 weeks of an exercise program with statistical significance between both groups at PV = ٠.00٠. There was a significant reduction in diastolic blood pressure between the study group with Mean ± SD (71.33±5.58mmHg) and control group (79.50±7.37 mmHg) with statistically significant between both groups after 10 weeks of exercise programPV = ٠.00٠. **Conclusion:** isometric handgrip exercise significantly reduced the SBP and DBP within 10 weeks of the study duration &therefore, the prescription of isometric handgrip exercise in addition to other lifestyle modifications should be encouraged for the hypertensive patient

Keywords:Isometric Exercise, Handgrip Strength, Hypertension

Introduction

Hypertension is considered a significant public health problem worldwide because of its high frequency and concomitant risk for morbidities[1]**.** It is a major risk factor for cardiovascular disease that affects 1·3 billion people and accounts for 17·9 million deaths worldwide annually. Most deaths from hypertension (around 75%) were in low-income and middle-income countries [2]. Hypertension is defined as having a systolic blood pressure (SBP) of 140 mmHg or more, and diastolic blood pressure (DBP) of 90 mmHg or more [3].

Hypertension is closely related to behavioral risk factors such as unbalanced diet, excess weight, alcohol use, tobacco consumption, physical inactivity, persistent exposure to tension or stress, as well as the presence of diabetes mellitus and high cholesterol levels. The prevention and management of hypertension include early detection and pharmacological Management and minimizing behavioral risk factors[4,5].

According to the American Heart Association,regular exercise is significant modifiable management of hypertensionand is recognized as a cornerstone therapy for the primary prevention, treatment, and control of high blood pressure. Regular aerobic exercise lowers resting systolic blood pressure by 5-7 mmHg on average, while resistance training exercise lowers resting systolic blood pressure by 2-3 mmHg in those with hypertension[6]. Exercise can be broadly categorized in two ways: dynamic (isotonic) or static (isometric) and within each of these categories, dependent on either aerobic or anaerobic metabolism. The dynamic exercise involves repetition of low-resistance motion and performance of external work, examples include running, walking, swimming, cycling and aerobic dancing. While static exercise involves sustained contraction

of skeletal muscles against fixed resistance and does not involve movement of the joints no external work is performed,examples include handgrip exercise[7].

Recently, adherence to recommended exercise criteria is generally poor worldwide, so isometric handgrip training has gained attention as there is some evidence about its BP-lowering effect [5].Handgrip training is simple to use (i.e., it can be done at any time and in any location), inexpensive, and thus accessible to the global population. It may be preferred by people who dislike physical activity, and it could be a valuable new therapeutic adjunct in the overall approach to treating hypertension. [8,9].

Isometric handgrip training improves endothelial dysfunction by shear-stress mediated improved bioavailability of nitric oxide and increased antioxidant activity, additionally exercise training has been shown that there is a decrease in muscle sympathetic nerve activity, increases cardiovascular capacity and decreases myocardial oxygen demand. [10,11].

Nurses play a vital role in isometric handgrip training programs. through the following preparation. 1.) Tell the patient to refrain from any strenuous physical activity and caffeine for two hours before the session. 2.) Maintain a well-ventilated environment. 3.) Before each testing session, tell the patient to empty their bladder to help them relax. 3.) Teach them how to use a handgrip dynamometer and how many sessions they should do every week. 4.) Before and after each session, take your blood pressure and heart rate. 5.) Learn how to take your blood pressure at home using the proper technique. Today the roles of nurses and nurse practitioners (NPs) in hypertension management involve all aspects of care, including detection, referral, and follow-up[12,13].

Significant of the study

The study was designed to help hypertension patients by lowering resting systolic blood pressure (SBP)

and diastolic blood pressure(DBP) after 10 weeks of isometric handgrip training (IHT). As a result, isometric handgrip training could serve as a prophylactic strategy for people at risk of hypertension and a non-pharmacologicaltherapeutic alternative for those who already have it.

Aim of the Study

Examine the effect of isometric handgrip strengthening exercise on blood pressure among hypertensive patients.

Research Hypothesis

Post implementation of isometric handgrip strengthening exercise program the hypertensive patients exhibited improve in the arterial blood pressure.

Subjects and Method

Research Design:

A quasi-experimental research design was utilized to achieve the study.

Setting:

The present study was conducted at the medical outpatient clinics of the Main Alexandria University Hospital at Alexandria.

Subjects:

A convenience sampling of 60 medicated hypertensive patients admitted to the above-mentioned setting. The study sample was randomly assigned and divided attentively into twoequal groups. The control group comprised of30 patients and was exposed to routine hospital care only. The study group comprised of 30 patients and they were followed the isometric handgrip strength exercise program.

The study sample was estimated based on the Epi-info -7 program using the following parameters

1- Population size: 150 patients
2- Expected frequency: 50%
3- Acceptable error: 10%
4- Confidence coefficient: 95%
5- Minimum sample size: 60

Inclusion criteria

Patients were considered eligible to participate in the study if they met the following criteria

1. Age group from 18 ≥ 60 years old.
2. The patient confirmed a diagnosis of hypertension.
3. Able to communicate verbally, and able to follow the instructions.

Exclusion criteria

- Class II, III, or IV heart failure;
- Recent cardiovascular event (last 3 months);
- Upper limp orthopedic limitations
- Physical or mental limitation that impedes the performance of physical exercises
- Carpal tunnel syndrome.

Tools:

Two tools were used by the researchers to collect the necessary data based on the review of relevant literature [8,9].

Tool I Patients' Assessment Interview Schedule:

This tool was developed by the researchers after reviewing related literature[4,5] to evaluate patient's health status. It consisted of two parts as the following:

Part I:Patients'Socio-demographic Characteristics: This part of the tool included age,gender, educational level, marital status, area of residence, and occupation.

Part II:Patients' Clinical Data: it wasincluded anthropometric measurements, body mass index. history of smoking, type of used medicationseither the prescribed and over-the-counter drugs (OTC), history of chronic diseases, family history of cardiovascular diseases and hypertension, how the disease was discovered, and disease duration.

Tool II International Physical Activity Questionnaire-long Form (IPAQ-LF). This tool was adopted by the researchersfromSebastiao et al.(2012)[14]. It consisted of three domains include job-related physical activity, transportation physical activity, housework, house maintenance, and caring for family, recreation, sport, and leisure-time

physical activity and time spent sitting. The total score of physical activity level was categorized as low, moderate, or high as follow:

Scoring System:

Category I.

(Lowphysical activity PA)

- Individuals who do not meet the criteria for category II and III.

Category II.

(Moderate physical activity PA)

- Three or more days of vigorous-intensity activity of at least 20 minutes per day.
- Five or more days of moderate-intensity activity or walking of at least 30 minutes per day.
- Five or more days of any combination of walking, moderate or vigorous-intensity activities achieving a minimum total PA of at least 10 hours/week.

Category III.

(High physical activity PA)

- Vigorous-intensity activity on at least 3 days achieving a minimum total physical activity (PA) of at least 25 hours/week, 7 or more than days of any combination of walking, moderate; or vigorous-intensity activities achieving a minimum total PA of at least 50 hours/week.

Method

The study was accomplished as follows:

Ethical and legal Considerations

- Written informed consent was obtained from every patient to participate in the study
- Confidentiality of patients' data was assured.
- The anonymity and privacy of the study participants were respected.
- The patients were informed that their participation was voluntary and they have the right to withdraw from the study at any time.

Written approvals:

- Written approval to carry out the study was obtained from the Ethical

Research Committee of the Faculty of Nursing, Alexandria University. Also, an official letter was submitted from the Faculty of Nursing, Alexandria University, to the director of the Medical Outpatient Clinic of the Main Alexandria University Hospital at Alexandria and to the director of nursing to obtain their approval for conducting the study, after explanation of the aim of the study.

Development of the study tools

- **Tool I** Patients' Assessment Interview Schedule was developed by the researchers based on the review of the recent relevant literature[8,9]. In addition, **Tool II**: International Physical Activity Questionnaire-long Form (IPAQ-LF) was adopted by the researchers from Sebastiao et al. (2012)[13].

Content validity

All tools were revised for content validity by panel of five experts in the field of Medical-Surgical Nursing, to test its contents validity, completeness, clarity of its items, and appropriateness of translations. Every jury member was informed about the aim and method of the study. Comments and suggestions of the jury were considered and the tool was modified accordingly

Reliability

The reliability of developed tool Iwas tested by using the Cronbach's Alpha Statistical Test. The tool proved to be internally reliable, with a Cronbach's Alpha Test at 0.913. The adopted tool II was tested by using the Cronbach's Alpha Statistical Test. The tool proved to be internally reliable, with a Cronbach's Alpha Test at 0.942.

Pilot study

A pilot study was carried out on 10% of the total studied subjects with hypertension to ascertain the clarity, feasibility, and applicability of the developed tools, then the necessary modifications were done. Patients included in the pilot study were excluded from the total number of study subjects.

Data collection

- Data collection was started after securing the administrative approval.
- The data were collected during patients' follow-up by researchers from each patient using the individualized interview.
- After explaining the purpose of the study by the researchers, the interview session for each subject was required approximately 30 to 45 minutes on an individual session.
- The data were collected throughout a period of 6 months from the beginning of August 2020 tothe beginning of January 2021. The purpose of the study was explained by the researchers to each patient.

The study was carried out in fourphases.

Phase I: Preparation Phase

- The researcher started by introducing herself to the patients and built therapeutic communication with patients to get cooperation after explaining the purpose of the study
- Instruct the patient to avoid vigorous physical activity and caffeine for 2 hours before the session
- Participants voided their bladder before each testing session for relaxation
- Patient weight and height were measured to calculate body mass index
- Pre-exercise blood pressure was monitored through the ambulatory blood pressure monitoring (ABPM) method.

Phase II:planning phase

- The final drafts of the developed tools were used to collect data to achieve the objective of this study
- After signing the informed consent, the patient was answered a questionnaire about the habitual level of physical activity & socio-

demographic and clinical data

- The isometric exercise sessions were performed on five consecutive days of the week for 10 weeks (session duration 15 minutes/session). The patient had their seated resting heart rate (HR) and BP measured after five minutes of rest. They were then required to perform an isometric handgrip contraction with one hand for 45 seconds at 30% of maximal voluntary contraction. A period of one minute followed this to act as a rest period. An isometric contraction using the other hand was then performed (at 30% maximal voluntary contraction) for 45-seconds. A one-minute rest period followed, and this procedure was repeated, resulting in four isometric contractions held for 45-seconds (two contractions per hand). This made the total duration of exercise 180-seconds (three minutes) per session. Five sessions made the total exercise duration of the treatment group for the entire study 15-minutes.

Phase III: Implementation

First session

- Patient interview occurred in a quiet, ventilated, temperature room
- The patient had their seated resting heart rate (HR) and BP measured after five minutes of rest. They were then required to perform an isometric handgrip contraction with one hand for 45 seconds at 30% of maximal voluntary contraction. A period of one minute followed this to act as a rest period. An isometric contraction using the other hand was then performed (at 30% maximal voluntary contraction) for 45-seconds. A one-minute rest period followed, and this procedure was repeated, resulting in four isometric contractions held for 45-seconds (two contractions per hand). This made the total duration

of exercise 180-seconds (three minutes) per session.

- The dynamometer was adjusted to participants' hands' size until the second joint of the index finger was at a 90-degree angle to the handle. The placements of the handle were marked for each hand at the same time. Participants stood straight with the feet hip apart and arms fully extended alongside the thigh with palms facing the thigh. The hand, which was in line with the wrist and forearm, performed a quick, maximally hard squeeze of the handle.

Figure (1) Illustrates the DigitalDynamometer; Handgrip Strength[15]

- **Second, Third, Fourth, and Fifth** sessions per week are the same procedure as the first session & made the total exercise duration of the treatment group for the entire study 15-minutes.
- Digital and manual dynamometer used in the study

Manual Handgrip Exercise Technique

1- Start with a lower amount of resistance first, then, work way up to more resistance.

Hold the grip in the right hand, then squeeze

2- Squeeze the hand exerciser fully with the arm straight.

- Do not twist the arm or body when squeeze the exerciser. Keep the arm straight, with the arm raised at the side.
- Do this exercise by standing with the legs slightly apart or sitting down with the feet on the floor.
- May find doing this exercise in front of a mirror can be helpful to ensure that the form is correct.

Hold for at least five seconds, then release.

3. Repeat for at least 2 minutes, then rest for 1 minute.

4. Shift to the left hand and repeat the squeeze-and-hold pattern.
5. Do this for at least two minutes.
6. Continue with the process, until four complete sets are performed for each hand for a total of 15 minutes of squeezing.
7. As the exercise becomes much easier, try holding the contractions for at least a few seconds more on each hand until strength is build up.

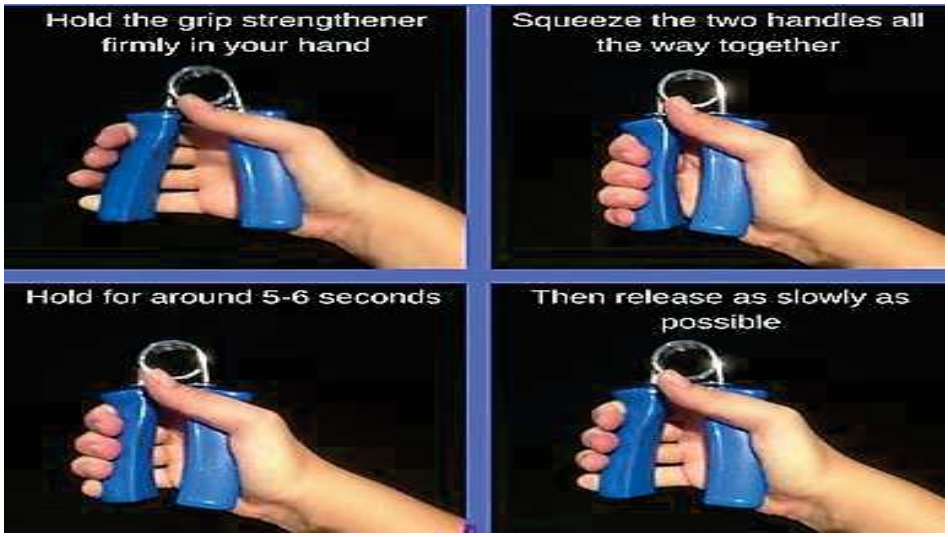

Figure (2) illustrates the Handgrip Exercise Technique.[16]

Phase IV: Evaluation phase

- Blood pressure BP measurements were recorded immediately before the first 45 seconds contraction, and immediately after the fourth 45 seconds contraction. This indicated the acute response to the treatment. After sitting for three minutes, HR and BP were measured again.

Statistical Analysis

Data were computerized and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using numbers and percent. Quantitative data were described using range (minimum and maximum), mean, and standard deviation. The significance of the obtained results was accepted at the 5% level.

The tests used were

Chi-square testfor categorical variables, to compare between different groups

Fisher's exactcorrection for chi-square when more than 20% of the cells have expected count less than 5

Student t-testfor normally distributed quantitative variables, to compare between two studied groups

ANOVA with repeated measures: For normally distributed quantitative variables, to compare between more than two periods or stages.

Results

Table (1) Illustrate the frequency distribution of the study and control groups according to their socio-demographic characteristics.

Regarding **gender**, it was noticed that the majority of both study and control groups (73.3%- 60.0%) respectively were female. In relation to age around half (50%) of the study group and (40%) of the control group were between age (40<50years old). Regarding education, it was observed that around half (53.3%) of the study group and the majority of the control group (73.3%) had a secondary degree of education. Concerning their marital

status, the majority of both the study and control group (83.3%-80.0%) respectively were married, regarding occupation it was noticed that (43.3%) of the study group and (33.3%) of the control group had officer work. Concerning the area of residence, the majority of both the study and control group (86.7%-93.3%)were from the urban areas.

Table (2) Illustrate the frequency distribution of the study and control groups according to their clinical data.

Regarding medical history,it was noticed that around two-fifth of the study group (40.0%) and (43.3%) of the control group had diabetes mellitus. Concerning the duration of disease (40.0%) of the study group diagnosed with hypertension from 3<5 years while about half of the control group diagnosed with hypertension from1<3 years, the majority of both study and control group (90.0%-93.3%)respectively discovered hypertension by suffering from symptoms, the majority of both study and control group (80.0%-83.3%) do not have a family history of hypertension and don't smoke. Regarding BMI more than two-thirds of both the study and control group were overweight.

Table (3) Illustrate the frequency distribution of the study and control groups according to their level of physical activity.

Regarding Job-related physical activity, it was noticed that more than two-thirds of both the study and control group (60.0%,66.7%) respectively had a moderate level of job-related physical activity, around half of the study group (50.0%)had a moderate level of housework, house maintenance, and caring for family-related physical activity while (63.3%) of the control group had a low level, also about (60.0%) of the study group had a moderate level of time spent related physical activity while half (50.0%) of the control group had a low level. Concerning Transportation

physical activity (63.3%) of the study group had a low level, while (76.7%) of the control group had a moderate level. Regarding recreation, sport, and leisure-time physical activity (60.0%, 63.3%) of both the study and control group had a moderate level. regarding the total physical activity, there's no statistically significance between study and control group P (1.000).

Table (4) Illustrates a comparison between study and control groups regarding systolic blood pressure pre and post isometric exercise it was noticed that the difference in systolic blood pressure reduction between the studygroup with Mean ± SD (111.50±7.23 mmHg) and control group (126.16±7.32 mmHg) after 10 weeks of an exercise program with statistically significant between both groups P (0.000*). This table also, showed that highly statistically significant within the study group pre and post-exercise program P (0.000*). It is noteworthy to report that the study group had a greater reduction in blood pressure reading.

Table (5) Illustrated a Comparison between study and control groups regarding Diastolic blood pressure pre and post-isometric exercise.

It was noticed that the difference in diastolic blood pressure reduction between the studygroup with Mean ± SD (71.33±5.58 mmHg) and control group (79.50±7.37 mmHg) with statistically significant between both groups after 10 weeks of exercise program P (0.000*). This table also showed that highly statistically significant within the study group pre and post-exercise program P (0.000*). It is noteworthy to report that the study group had a greater reduction in diastolic blood pressure reading.

Table (1)Frequencydistribution of the study and control groups according to their Socio-demographic characteristics.

Socio-demographic Characteristics	Study group		Control group	
	No.	%	No.	%
Age in years:				
• 20<30	2	6.7		
• 30<40	5	16.7	6	20.0
• 40<50	15	50.0	12	40.0
• 50≤60	8	26.7	12	40.0
Mean ± SD	2.96±.850		3.20±.761	
(P-value)t=-1.286 (P=٠.267)				
Gender:				
• Female	22	73.3	18	60.0
• Male	8	26.7	12	40.0
Level of education:				
• Illiterate	4	13.3	2	6.7
• Read & write	4	13.3		
• preparatory	2	6.7	4	13.3
• Secondary	16	53.4	22	73.3
• University Education	4	13.3	2	6.7
Marital status				
• Married	25	83.3	24	80.0
• Divorced	1	3.3		
• Widowed	3	10.0	4	13.3
• Single	1	3.3	2	6.7
Occupation				
• Officer	13	43.3	10	33.3
• Manual work	5	16.7	9	30.0
• Housewife	7	23.3	8	26.7
• Technical work	5	16.7	3	10.0
Residence area				
• Rural	4	13.3	2	6.7
• Urban	26	86.7	28	93.3

n = number of studied patients

Table (2) Frequency distribution of the study and control groups according to their clinical data.

Clinical Data	Study group		Control group	
	No.	%	No.	%
Medical History for chronic disease				
• Cardiovascular diseases	5	16.7	12	40.0
• Kidney diseases	8	26.6	2	6.7
• Diabetes mellitus	12	40.0	13	43.3
• Others - **Hepatitis C**	5	16.7	3	10.0
Disease duration				
• From 6 months to <1 year			3	10.0
• 1<3 years	8	26.7	15	50.0
• From 3<5 years	12	40.0	5	16.7
• >5 years	10	33.3	7	23.3
Disease discovery				
• Discovered by periodic check-up			1	3.3
• Discovered by suffering from symptoms	27	90.0	28	93.3
• Accidental discovered	3	10.0	1	3.3
Smoking:				
• Yes	6	20.0%	4	13.3
• No	24	80.0	26	86.7
Family history of hypertension				
• Yes	6	20.0	5	16.7
• No	24	80.0	25	83.3
Body Mass Index kg/m^2				
• Normal weight	9	30.0	7	23.3
• Over weight	19	63.3	19	63.3
• Obese	2	6.7	4	13.3
Handgrip strength in k/g	28.76 ±6.18		28.80±7.05	
Mean ± SD				

n = number of studied nursing students

Table (3) Frequency distribution of the study and control groups according to their level of physical activity

Physical Activity	Study group		Control group	
	No.	%	No.	%
Job-related physical activity				
• Low	8	26.7	7	23.3
• Moderate	18	60.0	20	66.7
• High	4	13.3	3	10.0
Housework, house maintenance, and caring for family				
• Low	6	20.0	7	23.3
• Moderate	15	50.0	19	63.3
• High	9	30.0	4	13.3
Time spent sitting				
• Low	7	23.3	15	50.0
• Moderate	18	60.0	9	30.0
• High	5	16.7	6	20.0
Transportation physical activity				
• Low	19	63.3	5	16.7
• Moderate	9	30.0	23	76.7
• High	2	6.7	2	6.7
Recreation, sport, and leisure-time physical activity				
• Low	5	16.7	5	16.7
• Moderate	18	60.0	19	63.3
• High	7	23.3	6	20.0
Total physical activity	9.40 ±1.56		9.40± 1.24	
(P-value) t (55.244) P(1.000)				

n = number of studied nursing students

t: Independent sample T-test

Table (4) Comparison between study and control groups regarding systolic blood pressure pre and post isometric exercise.

Blood pressure parameter	Study group (n=30)		Control group (n=30)		Test of sig.		
	Pre	post	pre	post		p_1	p_2
	Mean ± SD.	Mean ± SD.	Mean ± SD.	Mean ± SD.			
Systolic blood pressure (SBP)	125.80±6.39 mmHg	111.50±7.23 mmHg	122.86±8.32 mmHg	126.16±7.32 mmHg		0.131	٠.00٠*
Significance test Within group P_3	t(7.982) P (0.000*)		t (-2.159) P (0.039)				

n = number of studied patients

*: Statistically significant at p ⩽ 0.05

p_1: p-value comparing between study and control group pre (Independent Samples T-test)

p_2: p-value comparing between study and control group post. (Independent Samples T-test)

p_3: p-value comparing within-group pre and post (paired sample test)

Table (5) Comparison between the study and control groups regarding diastolic blood pressure pre and post-isometricexercise.

Blood Pressure Parameter	Study group (n=30)		Control group (n=30)		Test of sig.	
	pre	post	pre	post	p_1	p_2
	Mean ± SD.	Mean ± SD.	Mean ± SD.	Mean ± SD.		
Diastolic blood pressure	79.83±7.69	71.33±5.58	78.16±7.66	79.50±7.37	0.4،4	0.000*
Significance test Within group P_3	t (5.498) P (0.000*)		t (-1.356) p (0.185)			

n = number of studied patients

* Statistically significant at p ≤ 0.05

P_1- p-value comparing between study and control group pre (Independent Samples t-test)

P_2- p-value comparing between study and control group post. (Independent Samples t-test)

P_3- p-value comparing within-group pre and post (paired sample test)

Discussion

Every year, millions of people die from cardiovascular disease around the world. Heart attack, heart failure, and stroke are all consequences of cardiovascular disease(CVD). High cholesterol, a sedentary lifestyle, elevated blood pressure (BP), and high triglyceride levels are all known risk factors for CVD. Hypertension has a significant impact on public health[17].

Aerobic exercise is recommended as a non-pharmacological intervention to lower BP. However, aerobic exercise may not be medically appropriate for

all patients who are with elevated BP, and many individuals do not engage in the recommended amounts of regular aerobic exercise. Handgrip exercise has also been shown to lower BP, suggesting this could be an alternative option to aerobic exercise. In the limited amount of research on handgrip exercise and BP with individuals who have hypertension, researchers have found that reductions in BP were comparable to more intense aerobic activity. However, more studies need to be conducted with individuals with prehypertension and hypertension[7,10].

In this study, there was a statistical significant decrease in the mean value of SBP & DBP in both groupsin response to five consecutive days of the isometric training program for 10 weeks. There were no significant associations between total physical activity and blood pressure in both groups.

The result of the present study noticed a positive and significant reduction in systolic blood pressure between the studygroup with Mean ± SD (111.50±7.23 mmHg) and control group (126.16±7.32 mmHg) with statistically significant between both group pre and post after 10 weeks of an exercise program P (0.000*). In my opinion, this might be due to that the handgrip exercise program can be performed anywhere, at home, at the work during free time or even whilst reading or studying. Hence IHT is a very convenient type of exercise for busy patients who very often fail to show compliance to dynamic aerobic or resistance exercises.

This result comes in line with **Hanfy et al.(2019)**[18] who conduct the effect of isometric handgrip on blood pressure in post-menopausal hypertension, and who found that a simple program of isometric exercise, in bouts of 20minutes undertaken four times a week, with a weekly exercise time of 1hour, can reduce systolic blood pressure by about 10mmHg and diastolic blood pressure by about

7mmHg. These are very substantial reductions, comparable with those achieved with a single pharmacological agent and substantially more than the 3mmHg or reduction resulting from regular handgrip exercise. The greater reductions in resting blood pressure for isometric exercise compared with other modes of exercise suggest that there might be a more powerful effect on resting blood pressure **Dong et al.(2019)** and**Manimala et al.(2015)**[19,20].

However, this result agreed with those of **Devereux et al.(2015)**[21]who found that 4 weeks of isometric exercise training induced changes in immediate post-exercise blood pressure and index of baroreflex sensitivity responses. Furthermore, these altered immediate responses were associated with training-induced reductions in resting blood pressure. This is the first suggestion that very short term (immediate) cardiovascular responses following isometric exercise may be important in defining chronic reductions in resting SBP following a period of isometric exercise, on the other hand,this result contradicted with **Pagonas et al.(2017)**[22]whoconduct a study about Aerobic versus isometric handgrip exercise in hypertension: A randomized controlled trial.Their results indicated that isometric handgrip training, performed according to a typical protocol, did not reduce BP in hypertensive patients.

Regarding DBP, the result of the present study noticed a positiveand significant reduction in diastolic blood pressure between the studygroup with Mean ± SD (71.33±5.58 mmHg) and the control group (79.50±7.37 mmHg) with statistically significant between both groups after 10 weeks of exercise program P (0.000*). Possible mechanisms for these effects include improvements in conduit and resistance due to vessel endothelium-dependent dilation, oxidative stress, and autonomic regulation of heart rate

and BP as a result of regular isometric handgrip training **Garg et al.(2014)**[23]. This result agreed with those **Jørgensen et al.(2018)**[24]who found that isometric handgrip training has been considered a promising intervention to reduce cardiovascular risk in adults, given the positive effects on cardiovascular variables. The meta-analytical study showed a reduction in systolic blood pressure of 5mmHg in hypertensive. Another advantage of the handgrip exercise is the easy implementation that allows it to be carried anywhere, including at home**Farah et al.(2018)**[25].

Finally, isometric handgrip training exercise has emerged as an alternative exercise modality to reduce BP and serve as a prophylactic intervention for those at risk of developing hypertension. Its use has been supported by different meta-analyses and was recently included in important scientific statements as a promising useful tool in the management of BP**Cornelissen (2013)** and**Cahu Rodrigues et al. (2020)**[26,27].

Conclusion

Based on the result of the current study it can be concluded thatisometric handgrip exercise significantly reduced the SBP and DBP within 10 weeks of the study duration andtherefore, the prescription of isometric handgrip exercise inaddition to other lifestyle modifications should be encouraged for the hypertensive patient.

Recommendations

Based on the findings of the present study were as the following

- Replication of the same study on a larger sample of patients with hypertension at different geographical areas for evidence of the results and generalization
- Develop and implement health teaching programs to improve patients' knowledge regarding hypertension disease and its treatment.

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