The Effect of Handgrip Exercises on Blood Pressure

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Abstract

Background: Hypertension is a major risk factor that contributes to cardiovascular disease, including coronary artery disease, stroke, and heart failure.Aim of the study: That handgrip exercises may also be effective for assisting with blood pressure management and adjust ability of a low-intensity working.Methods: Twenty high normal and prehypertensive individuals without pharmacological, aged between 50and 65 years, males and Females, conducted with handgrip exercises for 8 weeks. Participant's performed 4×2 minute isometric handgrip exercises with their non-dominant hand, each separated by a 3-minute rest period, 3 days a week.Results: Blood pressure measurements were conducted at baseline and at the end of the protocol using a wrist blood pressure monitor. Eight weeks of isometric resistance training resulted in a 7-mmHg reduction of resting systolic blood pressure (SBP) (136±12 to 129±15); (P=0.04). Reductions of 4mmHg were also seen in mean arterial pressure (MAP) (100±8to96±11);(P=0.04).

Index terms— hypertension, handgrip exercises.

1 Introduction

vidences show that every year, worldwide9.4 million people deaths die from complications of hypertension, which has become a global public health problem.(1) Hypertension is a major risk factor that contributes to cardiovascular disease, including coronary artery disease, stroke, and heart failure. (2,3)Additionally risk factors increased the prevalence of hypertension include population growth, increased age and behavioral risk factors, such as unhealthy diet, tobacco use, consumption of alcohol, excess weight, exposure to persistent stress, high cholesterol, diabetes mellitus, and lack of physical activity. Furthermore, Strategies implemented to prevent and manage hypertension include reducing exposure to behavioral risk factors and early detection and treatment of hypertension. (4) That found a Prehypertension is characterized by systolic blood pressure of 120-139 mmHg and diastolic blood pressure of 80-89 mmHg, measured at rest. (5)High total peripheral resistance is the most commonly reported mechanism for the mildly increased blood pressure in hypertension, which is often accompanied by decreased arterial compliance. (6) Although it is unclear whether these changes occur in prehypertension. (21) Hypertension is responsible for 45%of cardiovascular deaths owing to heart disease and 51% owing to stroke worldwide.(1) Antihypertensive medications are effective at controlling blood pressure and have minimal side effects; however, only half the people with hypertension reach treatment goals. (38) Current first-line treatment for hypertension is nonpharmacological lifestyle modification including eating healthy diet, cessation of smoking, and increasing physical activity. (2,3,35) Currently, the recommended exercise program me for blood pressure management in adults is dynamic endurance aerobic exercise of at least 150-minute moderate intensity,75-minutevigorous intensity, or an equivalent combination of both each1week, as well as at least 2 days of muscle strengthening. (7)They found one important factor that may impact the effectiveness to lower blood pressure (BP) is the type of exercise performed. Analyses suggest isometric exercise may elicit BP reductions greater than those seen with dynamic aerobic and resistance exercise. (33,34) However, isometric handgrip activity may become a new tool in the nonpharmacological treatment of high BP. (30,32) Isometric exercise involves sustained contraction against an immovable load or resistance with no or minimal change in length of

the involved muscle group. Aerobic exercise performance has been shown to be inversely related to hemodynamic measurements. (38) Recent analyses suggest that isometric resistance training (IRT) may elicit blood pressure reductions greater than those seen with dynamic aerobic and resistance exercise.(2,8,9) A recent systematic review and subsequent meta-analysis confirms previous findings that IRT reduces systolic blood pressure (SBP) by almost 7mmHg, whereas diastolic blood pressure (DBP) and mean arterial pressure (MAP) were both lowered by almost 4mmHg.

(2) Low-to moderate-intensity isometric handgrip exercise can be performed anywhere, requires relatively inexpensive equipment, and does not elicit the same level of cardiovascular stress as aerobic exercise.(**??** I strength is associated with lower BP. (23,24) Recent work suggests that IRT may become a new tool in the non-pharmacological treatment of high blood pressure. (10,12) males and individuals aged ?45 years, may acquire greater blood pressure reductions from IRT (13). Randomized controlled studies of IRT, for ?4 weeks in duration, have predominately used a 30% maximum voluntary contraction (MVC) and a sedentary control. (9) Ray and Carrasco(**??**4) utilized a sham group, which held a handgrip dynamometer, but did not generate any force. Previous studies have utilized a low intensity during isometric leg training. (15,16)We have found no reported studies, which have utilized an intensity <10% MVC handgrip exercise with prehypertensive and/or hypertensive participants. In addition, previous studies of 4 to 10 weeks duration have focused on people aged between 20 and 35 years or 60 and 80 years with a sedentary control. In addition isometric handgrip study with 10 participants aged 52±5 over 6 weeks have conduct. (17) II.

2 Methods

This study conduct on Port Said Hospital extended from April 2018 to January 2019. The participants with high normal and pre hypertensive, aged between 50 and 65 years recruited from out Hospital clinic. Participants from males and Females had a resting SBP ?130mmHg and/or a resting DBP?85mmHg, were receiving pharmacotherapy to treat their BP. written informed consent. Participants were excluded if they had known cardiovascular disease or multiple comorbidities, smokers, carpal tunnel, and arthritis which may have been aggravated with handgrip exercise. Participant baseline characteristics are displayed in. Participants trained 3 days per week for 8 weeks non-dominant hand. Participants then completed 4 sets of 2-minute isometric handgrip contractions separated by 3-minute rest periods.

3 Table 1: Entheroment

Pre and post intervention blood pressure was established to assess resting SBP, DBP, heart rate (HR), and MAP. The wrist blood pressure monitor method to enable continuous noninvasive BP measurements. All post tests were conducted 24 hours after the final day of week 8 IRT and within 2 hours of the initial pretesting time of day. Blood pressure was measured in the participants' dominant arm Baseline and 24-hour post-IRT blood pressure measurements were conducted with the participant lying supine, with their arm relaxed by their side. Spss version was used to calculate the mean and standard deviation for the last 15, 30, 60, and the entire 120seconds of baseline and post-IRT recording.

4 III.

Results 20 participants who completed the 2 months study of IRT, to establish the size of reduction in blood pressure, a 120-second resting baseline blood pressure recording was taken before and 24hours post-IRT Paired t test (Table 2). Wrist blood pressure monitor measurements were Paired t test analysis of blood pressure, MAP, and HR. Two months of isometric handgrip training resulted in a significant reductions were 7-mmHg reduction in baseline versus post intervention SBP of (p=0.04*). Paired t test however, there were no significant reductions in DBP. Significant reductions were observed in MAP from baseline to post intervention of 4mmHg (p=0.04*) in (Table 5). Analysis indicated an unchanged (P=0.37). ANOVA measures for 15, 30, 60, and 120seconds of pre-and post-resting SBP, DBP, MAP, and HR showed that the only data with statistically significant variation across the 4 measurements, the SBP and MAP as seen in Table 2 were significant with * $P < 0.04$, Based on this analysis, it was determined that the 120-second data were more stronger.

IV.

5 Discussion

The main finding of this study was that significant reductions in SBP and MAP in individuals conducting IRT for 8 weeks. The reduction in SBP was clinically significant 7mmHg and MAP 4 mmHg. The 5reduction in SBP is considered clinically meaningful (>3mmHg). (24,25) Evidence demonstrated, the effect of isometric handgrip exercise on reducing BP in normotensive and hypertensive populations. (22) In addition, the positive associations between handgrip strength and BP explained the mechanism that Peripheral vascular resistance increases with chronological age due to reduced sympatholytic, which results in an elevated sympathetic tone. (19,18) And vascular resistance increased with morphological changes in the arteriolar network. (11) Furthermore, BP is associated with the age-associated loss of lean mass. (37,36) The results seen in this study reflect those seen in previous IRT studies, which also demonstrated significant reductions in SBP over an 8-week period. (2,35,8,13) When baseline blood pressure was added as a covariate, secondary analysis showed that SBP, DBP, MAP, and HR

were all significantly reduced. Although it is unclear whether the size of these reductions is clinically meaningful, it found that the magnitude of blood pressure reductions following IRT is directly related to pre-training blood pressure levels . (**??**6

6 Conclusion

Reduction in SBP after 8 weeks of IRT, indicating that IRT may be an alternative exercise for people who are unable to reach the current recommendations of 2.5 hours of weekly aerobic exercise, to aid in their blood pressure management. IHG exercise training might be a simple, effective, inexpensive and non-pharmacological method in lowering blood pressure. [1] [2]

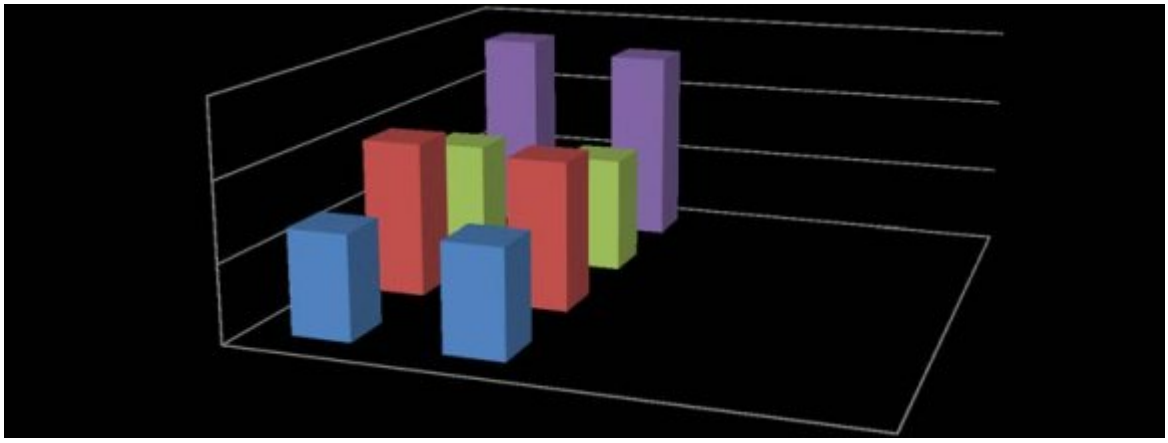

Figure 1:

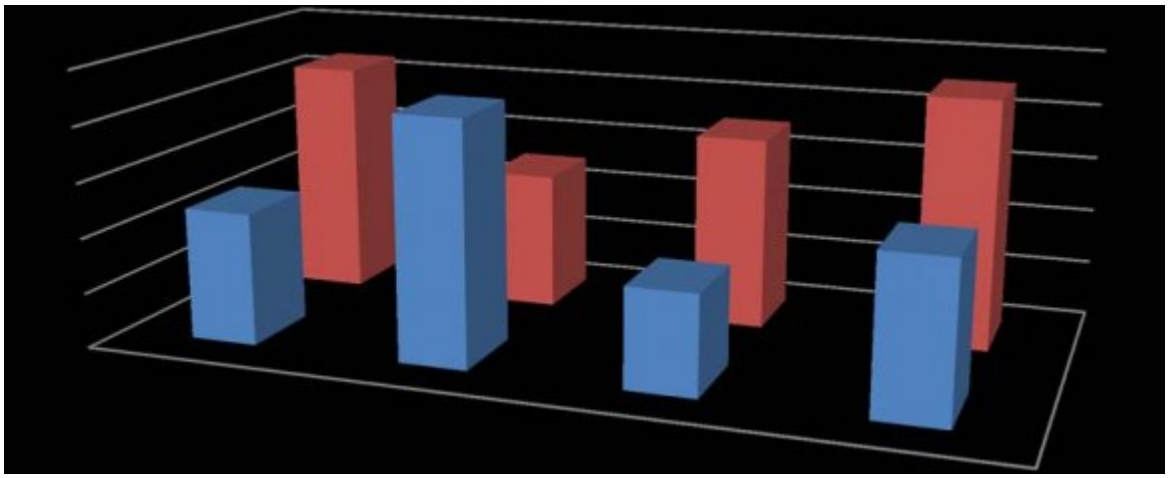

Figure 2:

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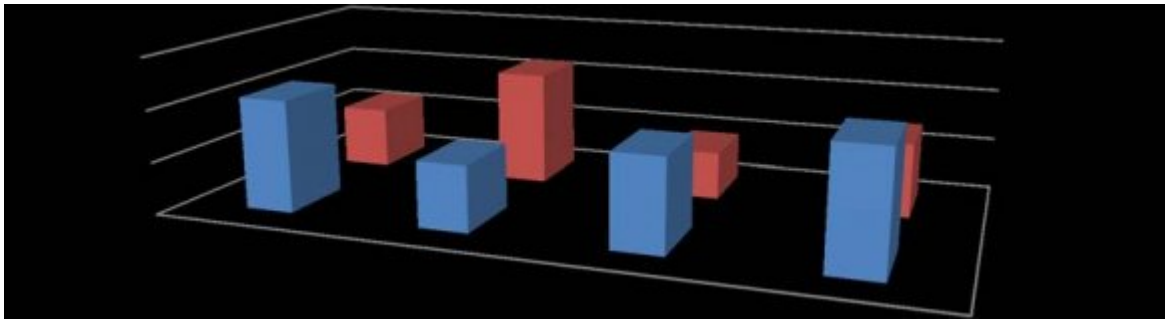

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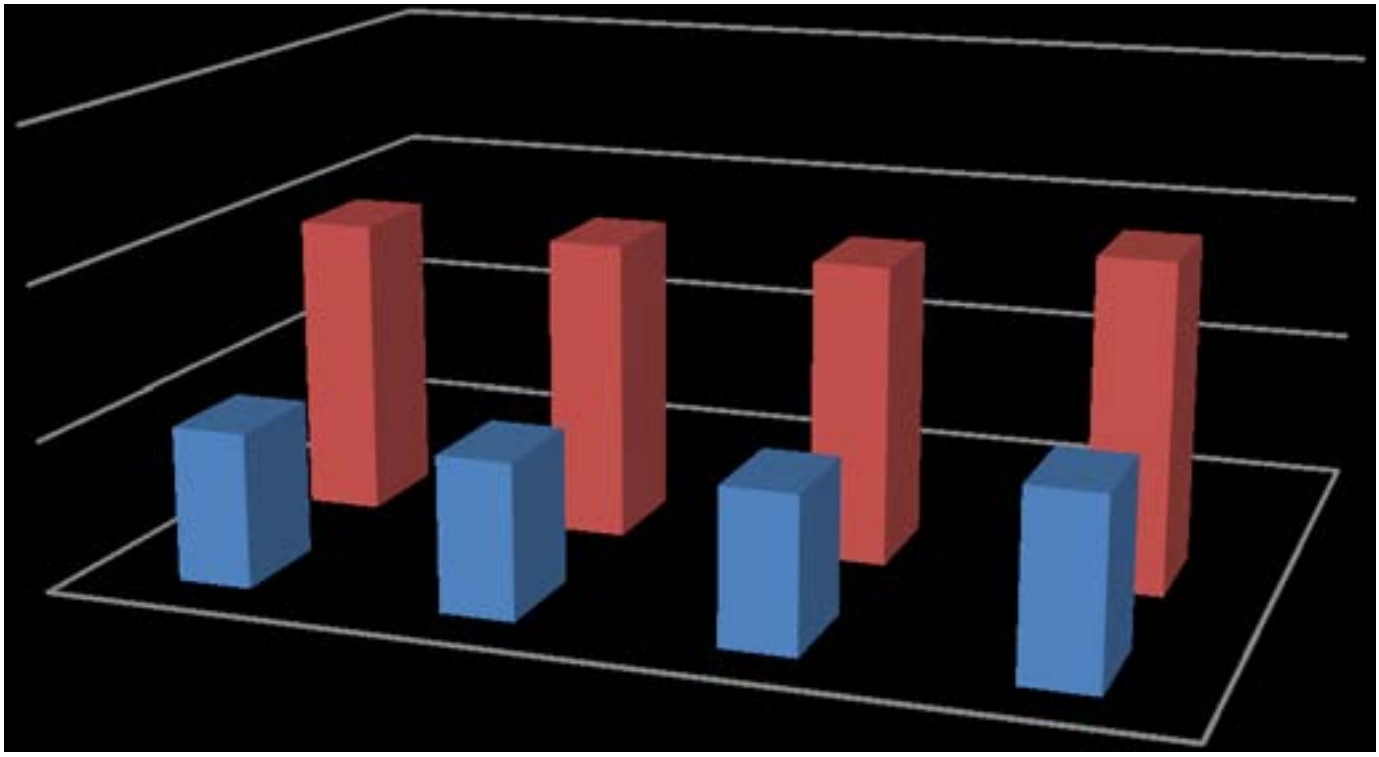

Figure 4:

2

	Pre	Mean, s	post	P
Systolic	136±12		129±15	0.04 *
Diastolic	77±7		75±9	0.21
MAP	100±8		96±11	0.04 *
HR	67±9		69±11	0.37

[Note: IFigure 1]

Figure 5: Table 2

3

Systolic(mmHg)	15 s	30s	60s	120s	ANOVA (F)	P
Pre	135±13	135±13	135±13	136±12	0.482	0.58
Post	129±16	128±16	129±16	129±15	0.414	0.67
P	0.07	0.06	0.06	0.04		

*[Note: *Table3exhibits comparisons between 15, 30, and 60-second sampling, against the 120-secondSystolic blood pressure recordingFigure 2]*

Figure 6: Table 3 :

4

Diastolic(mmHg)	15 s	30s	60s	120s	ANOVA (F)	P
Pre	76±7	76±7	77±7	77±7	2.204	0.13
Post	75±9	74±9	74±9	75±9	0.120	0.86
p	0.43	0.32	0.27	0.21		

Figure 7: Table 4 :

5

MAP(mmHg)	15 s	30s	60s	120s	ANOVA (F)	P
Pre	99±9	99±9	99±9	100±8	1.466	0.25
Post	95±11	95±11	95±11	96±11	0.143	0.87
P	0.12	0.07	0.05*	0.04*		

Figure 8: Table 5 :

5

[Note: exhibits comparisons between 15, 30, and 60-second sampling, against the 120-secondMAP recordingFigure 4]

Figure 9: Table 5

6

HR(bpm)	15 s	30s	60s	120s	ANOVA (F)	P
Pre	67±9	67±9	67±9	67±9	0.247	0. 71
Post	69±12	69±11	69±11	69±11	0.814	0. 42
P	0.33	0.34	0. 43	0.37		

Figure 10: Table 6 :

6

[Note: exhibits comparisons between 15, 30, and 60-second sampling, against the 120-secondHR recording]

Figure 11: Table 6

[Psychophysiology ()] , *Psychophysiology* 2013. 50 p. .

[Lim et al. ()] 'A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions'. S Lim , T Vos , A Flaxman . *Lancet* 1990-2010. 2010. 2012. 380 p. . (: a systematic analysis for the global burden of disease study)

[Frontera et al. ()] 'Aging of skeletal muscle: a 12-yr longitudinal study'. W R Frontera , V A Hughes , R A Fielding , M A Fiatarone , W J Evans , R Roubenoff . *J Appl Physiol* 2000. 88 p. .

[Corish and Kennedy ()] 'Anthropometric measurements from a cross-sectional survey of Irish free-living elderly subjects with smoothed centile curves'. C A Corish , N P Kennedy . *Br J Nutr* 2003. 89 p. .

[Brook et al. ()] 'Beyond medications and diet: alternative approaches to lowering blood pressure: a scientific statement from the'. R Brook , L Appel , M Rubenfire . *American Heart Association. Hypertension* 2013. 61 p. .

[Wong and Wright ()] 'Blood pressure lowering efficacy of nonselective beta-blockers for primary hypertension'. G W Wong , J M Wright . *Cochrane Database Syst* Rev2014.

[Millar et al. ()] 'Cardiovascular reactivity to psychophysiological stressors: association with hypotensive effects of isometric handgrip training'. P J Millar , S R Bray , M J Macdonald . *Blood Press Monit* 2009. 14 p. .

[Badrov et al.] *Cardiovascular stress reactivity tasks successfully predict the hypotensive response of isometric handgrip training in hypertensives*, M B Badrov , S Horton , P J Millar .

[Hess et al. ()] 'Clinically meaningful blood pressure reductions with low intensity isometric handgrip exercise. A randomized trial'. N C Hess , D J Carlson , J D Inder , E Jesulola , J R Mcfarlane , N A Smart . *Physiol Res* 2016. 65 p. .

[Nuckols et al. ()] 'Cost implications of improving blood pressure management among U.S. adults'. T K Nuckols , J E Aledort , J Adams . *Health Serv Res* 2011. 46 p. .

[Owen et al. ()] 'Effect of isometric exercise on resting blood pressure: a meta-analysis'. A Owen , J Wiles , I Swaine . *J Hum Hypertens* 2010. 24 p. .

[Bearden ()] 'Effect v of aging on the structure and function of skeletal muscle microvascular networks'. S E Bearden . *Microcirculation* 2006. 13 p. .

[Millar et al. ()] 'Effects of isometric handgrip training among people medicated for hypertension: a multilevel analysis'. P J Millar , S R Bray , C L Mcgowan . *Blood Press Monit* 2007. 12 p. .

[Baross et al. ()] 'Effects of the intensity of leg isometric training on the vasculature of trained and untrained limbs and resting blood pressure in middle-aged men'. A W Baross , J D Wiles , I L Swaine . *Int J Vasc Med* 2012. 2012 p. .

[Parker et al. ()] 'Evidence for reduced sympatholysis in leg resistance vasculature of healthy older women'. B A Parker , S L Smithmyer , S S Jarvis , S J Ridout , J A Pawelczyk , D N Proctor . *Am J Physiol Heart Circ Physiol* 2007. 292 p. .

[Millar et al. ()] 'Evidence for the role of isometric exercise training in reducing blood pressure: potential mechanisms and future directions'. P J Millar , C L Mcgowan , V A Cornelissen . *Sports Med* 2014. 44 p. .

[Millar et al. ()] 'Evidence for the role of isometric exercise training in reducing blood pressure: potential mechanisms and future directions'. P J Millar , C L Mcgowan , V A Cornelissen , C G Araujo , I L Swaine . *Sports Med* 2014. 44 p. .

[Cornelissen and Smart ()] 'Exercise training for blood pressure: a systematic review and metaanalysis'. V A Cornelissen , N A Smart . *J Am Heart Assoc* 2013. 2 p. .

[Cornelissen and Smart ()] 'Exercise training for blood pressure: a systematic review and metaanalysis'. V A Cornelissen , N A Smart . *J Am Heart Assoc* 2013. 2 p. e004473.

[Mozaffarian et al. ()] 'Heart disease and strokestatistics-2016 update: a report From the'. D Mozaffarian , H J Fullerton , V J Howard . *American Heart Association. Circulation* 2015. 133 p. .

[Ferrier et al. ()] 'Intensive cholesterol reduction lowers blood pressure and large artery stiffness in isolated systolic hypertension'. K E Ferrier , M H Muhlmann , J P Baguet , J D Cameron , G L Jennings , A M Dart . *J Am Coll Cardiol* 2002. 39 p. .

[Carlson and Dieberg ()] 'Isometric exercise training for blood pressure management: a systematic review and meta-analysis'. D Carlson , G Dieberg , N . *Mayo Clin Proc* 2014. 89 p. .

[Inder et al. ()] 'Isometric exercise training for blood pressure management: a systematic review and meta-analysis to optimize benefit'. J D Inder , D J Carlson , G Dieberg . *Hypertens Res* 2015. 39 p. .

[Jodie et al. ()] 'Isometric exercise training for blood pressure management: a systematic review and meta-analysis to optimize benefit'. D I Jodie , J C Deborah , Gudrun D James , R M , Nicole Cl Neil , A . *Hypertension Research* 2016. 39 p. .

[Carlson et al. ()] *Isometric exercise training for blood pressure management: a systematic review and metaanalysis*, D J Carlson , G Dieberg , N Hess , P Millar , N A Smart . ClinProc2014. Mayo. 89.

[Kelley and Kelley ()] 'Isometric handgrip exercise and resting blood pressure: A meta analysis of randomized controlled trials'. G A Kelley , K S Kelley . *J Hypertens* 2010. 28 p. .

[Kelley and Kelley ()] 'Isometric handgrip exercise and resting blood pressure: a meta-analysis of randomized controlled trials'. G A Kelley , K S Kelley . *J Hypertens* 2010. 28 p. .

[Kelley and Kelley ()] 'Isometric handgrip exercise and resting blood pressure: a meta-analysis of randomized controlled trials'. G A Kelley , K S Kelley . *J Hypertens* 2010. 28 p. .

[Millar et al. ()] 'Isometric handgrip training lowers blood pressure and increases heart rate complexity in medicated hypertensive patients'. P J Millar , A S Levy , C L Mcgowan . *Scand J Med Sci Sports* 2013. 23 p. .

[Ray and Carrasco ()] 'Isometric handgrip training reduces arterial pressure at rest without changes in sympathetic nerve activity'. C A Ray , D I Carrasco . *Am JPhysiol Heart CircPhysiol* 2000. 279 p. .

[Taylor et al. ()] 'Isometric training lowers resting blood pressure and modulates autonomic control'. A C Taylor , N Mccartney , M V Kamath . *Med Sci SportsExerc* 2003. 35 p. .

[Kingwell ()] 'Large artery stiffness: Implications for exercise capacity and cardiovascular risk'. B A Kingwell . *Clin Exp Pharmacol Physiol* 2002. 29 p. .

[Hansen et al. ()] 'Metabolic modulation of sympathetic vasoconstriction in exercising skeletal muscle'. J Hansen , M Sander , G D Thomas . *Acta Physiol Scand* 2000. 168 p. .

[Truijen et al. ()] 'Noninvasive continuous hemodynamic monitoring'. J Truijen , J J Van Lieshout , W A Wesselink . *J ClinMonitComput* 2012. 26 p. .

[Chobanian et al. ()] 'Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure'. A Chobanian , J Wright , E Roccella . *Hypertension* 2003. 42 p. .

[Peters et al. ()] 'Shortterm isometricexercise reduces systolic blood pressure in hypertensive adults: Possiblerole of reactive oxygen species'. P G Peters , H M Alessio , A E Hagerman . *Int J Cardiol* 2006. 110 p. .

[Howden et al. ()] 'The effects of isometric exercise training on resting blood pressure and orthostatic tolerance in humans'. R Howden , J T Lightfoot , S J Brown . *Experiment Physiol* 2002. 87 p. .

[Wiles et al. ()] 'The effects of performing isometric training at two exercise intensities in healthy young males'. J D Wiles , D A Coleman , I L Swaine . *Eur J ApplPhysiol* 2010. 108 p. .

[Millar et al. ()] 'The hypotensive effects of isometric handgrip training using an inexpensive spring handgrip training device'. P J Millar , S R Bray , M J Macdonald . *J CardiopulmRehabilPrev* 2008. 28 p. .

[Ramos et al. ()] 'The six-minute walk distance is a marker of hemodynamic-related functional capacity in hypertension: a case control study'. R A Ramos , F S Guimaraes , I Cordovil , A De Sa Ferreira . *Hypertens Res* 2014. 37 p. .