3-28-2023

Blood Pressure in Normotensive Young Adults Is Not Influenced by Resistance Training Rest Interval Duration

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RESEARCH DIRECTS in HEALTH SCIENCES

2023, Volume 3 (Issue 1): 3 OPEN ACCESS

Blood Pressure in Normotensive Young Adults Is Not Influenced by Resistance Training Rest Interval Duration

Direct Original Research

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Open Access

Published: March 28, 2023

Research Directs in Health Sciences: *2023, Volume 3 (Issue 1): 3*

ISSN: 2768-492X

Abstract

Introduction: We aimed to examine the effect of resistance training rest interval length on chronic changes of systolic (SBP) and diastolic blood pressure (DBP).

Methods: 27 normotensive young adults were randomly assigned to one of three rest interval length groups: 30-sec, 90-sec, or 150-sec. Baseline and post-training SBP and DBP measurements were obtained. Participants trained and logged their sessions in a smartphone application three times per week for 8 weeks. They also measured their blood pressure weekly with a home kit. Changes in SBP and DBP between the three groups were tested using a mixed model 3 x 2 ANOVA with follow-up post-hocs as necessary.

Results: There was no significant interaction between rest interval group and time for SBP or DBP. For SBP, there was a significant main effect for time, $p<0.001$ (pre: 115 mmHg vs. post: 108 mmHg).

Conclusions: SBP and DBP were not significantly influenced by rest interval length over time. The resistance-training program had no effect on DBP but significantly decreased SBP regardless of rest interval. These results indicate that young normotensive adults may use short, moderate, or long duration rest intervals to elicit reductions in SBP.

Key Words: hypertension, smartphone, home-blood pressure monitor

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Introduction

Ischemic heart disease and stroke are the leading causes of death worldwide accounting for over 15 million deaths in 2019.[1] In the United States, diseases of the heart are the leading cause of death.[2] Hypertension or high blood pressure is a major risk factor associated with myocardial infarction, ischemic heart disease, and stroke.[3]

Resistance training is an effective intervention in the chronic reduction of hypertension.[4-5] The acute hypotensive response has been demonstrated while using loads of 60% to 80% 1RM.[6] Five sets of 8 to 10 repetitions produce a greater acute hypotensive response than three sets.[7] One systematic review included three chronic studies of which only one demonstrated a reduction in SBP, and none of the studies demonstrated a change to DBP.[7] The chronic study that demonstrated a reduction in SBP included a population of non-hypertensive elderly women who completed a 12-week resistance training program of three sessions per week of eight exercises with two sets, and 10 to 15 repetitions. The researchers did not identify the rest interval used in the exercise program.[8] This study was conducted in the young adult population to explore the potential for using resistance training as a treatment, as well as a preventative technique,

for hypertension and other diseases of the heart. This study investigated the following question: In individuals participating in a custom smartphone-based home exercise resistance training program, what is the effect of rest intervals on chronic reductions in SBP and/or DBP?

Methods

Participants

A statistical power analysis for sample size estimation was performed, based on the effect size from Nino et al. (2017), the projected sample size needed was N=27. Twenty-seven volunteers consented to participate in this study. Participants were randomly assigned to one of three rest interval groups (30 second, 90 second, 150 second). The Institutional Review Board (IRB) at Nova Southeastern University and the IRB at Southern Nazarene University approved this study.

Protocol

The participants underwent training regarding the use of a home-based blood pressure monitoring system and completed a demographic survey. Systolic and diastolic blood pressure were measured by the researcher prior to and after participation in the resistance-training program. Participants completed an 8-week resistance training program that was delivered via a smartphone application. The exercise program included three sessions per week with three sets of 10 repetitions of four exercises per session (see Appendix A) at an intensity of 65% 1RM. Participants reported their exercise session data using the community/social feed in the app. Weekly the participants used an A&D Medical UA-651 Deluxe Blood Pressure Monitor to measure and record their blood pressure. The UA-651 unit has been validated for use in general populations.[9-10]

Statistical Analysis

To determine the influence of rest interval and time on SBP and DBP two mixed model 3 (group) x 2 (pre-post) ANOVAs were conducted, $p<0.05$. Baseline data were screened to examine group differences in the dependent variables using a one-way ANOVA, $p<0.05$. Means and standard deviations were calculated for baseline, eight weekly measurements, and post-test values of SBP and DBP. Statistical Package for the Social Sciences (SPSS, ver. 26) was used for all statistical analyses.

Results

Participants were randomly assigned to each of the three interval groups. An ANOVA showed that SBP was not similar at baseline between the three groups ($F(2, 14)=4.38$, $p=0.033$). Participants in the 30-sec (107 +/- 15 mmHg) and 90-sec (114 +/- 7 mmHg) groups had lower mean baseline SBP than the 150-sec group (126 +/- 6 mmHg, $p=0.033$). There were no statistical differences between groups for DBP, ($F(2, 14)=2.62$, $p=0.108$) which ranged from 62 to 73 mmHg.

Systolic Blood Pressure

There was no significant main effect for group ($F(2, 14)=0.44$, $p=0.65$), meaning systole was not significantly different between the groups regardless of time. Additionally, there was no significant interaction between rest interval group and time ($F(2, 14)=2.31$, $p=0.136$). However, there was a significant main effect for time ($F(1, 14)=17.26$, $p<0.001$) meaning all groups significantly decreased SBP as a result of the program.

Diastolic Blood Pressure

Diastolic blood pressure showed no significant interaction between rest interval group and time ($F(2, 14)=0.803$, $p = 0.467$). There were also no significant main effects for group ($F(2, 14)=0.007$, $p=0.993$) or for time ($F(1, 14)=0.017$, $p=0.898$).

Table 1 Mean Systolic and Diastolic Blood Pressure for Week 1 and Week 8

	Week 1		Week 8	
	SBP	DBP	SBP	DBP
30-sec rest	117 ± 8 mmHg	68 ± 6 mmHg	110 ± 12 mmHg	71 ± 17 mmHg
90-sec rest	110 ± 11 mmHg	69 ± 6 mmHg	108 ± 9 mmHg	71 ± 7 mmHg
150-sec rest	119 ± 8 mmHg	72 ± 6 mmHg	107 ± 8 mmHg	67 ± 9 mmHg

Data are Means ± SD

Figure 1 Mean Systole Over 8 Weeks of Weight Training for the Three Rest Interval Groups

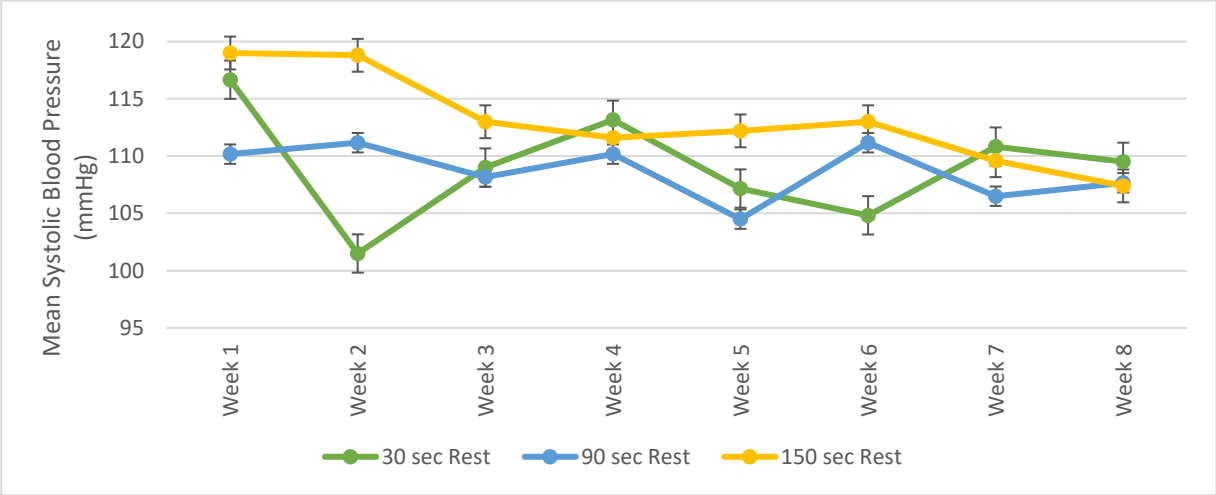

Figure 2 Mean Diastole Over 8 Weeks of Weight Training for the Three Rest Interval Groups

Discussion

In their systematic review, Corso et al.[7] identified only three chronic resistance training studies, of which only one study demonstrated a significant reduction in SBP.[7] All the rest interval groups in this study experienced a significant reduction in their SBP after 8 weeks of resistance training. Limitations of this study include self-reporting of blood pressure and exercise data, nutritional factors, and anxiety levels experienced by the participants.

Figueriedo et al.[11] demonstrated that both 60-second and 120-second rest intervals produce similar acute hypotensive responses. Lemos et al.[12] demonstrated that 90-second rest intervals produce a longer acute hypotensive response than 40-second rest intervals. Alemi et al.[13] found that 120-second and 180-second rest intervals significantly reduced SBP, and 60-second rest interval did not significantly reduce SBP. The results of this study are similar to the findings of Lemos et al.[12] and Alemi et al.[13] in that the longest rest interval group demonstrated the greatest decrease in SBP. However, Lemos et al.[12] and Alemi et al.[13] measured the acute post exercise hypotensive response, and this study measured the chronic response.

Cornelissen et al.[4] showed that resistance training chronically reduced blood pressure in 28 normotensive populations with an average reduction of 4 mm Hg SBP and 4 mm Hg DBP. MacDonald et al.[14] reported that moderate intensity

dynamic resistance training programs resulted in an average decline in SBP by 3 mm Hg and DBP by 2 mm Hg. Participants with hypertension showed an average of 6 mm Hg reduction in SBP and an average of 5 mm Hg reduction in DBP. Those with prehypertension showed an average of 3 mm Hg reduction in both SBP and DBP. Those with normal blood pressure showed no change in SBP and an average reduction of 1 mm Hg in DBP.[14] Nino et al.[15] discussed the potential that higher starting blood pressure values in their study may have influenced the measured training effect.[15] In this study, the 150-second group experienced a reduction in mean SBP of 12 mm Hg, the 90-second group experienced a reduction of 3 mm Hg, and the 30-second group experienced a reduction of 8 mm Hg. In this study, the experimental group that began with the highest Week 1 measures experienced the greatest decrease in SBP.

Based on the results of this study, resistance training is an effective treatment to decrease SBP in a normotensive population. Rest interval length may not significantly affect blood pressure in young normotensive adults. All rest interval groups in this study experienced a decrease in SBP after participating in the 8-week resistance-training program, which seems to indicate that young normotensive adults can participate in resistance training exercise with short, moderate, or long duration rest intervals and experience similar effects to their SBP. While there was no statistical significance for the effects of rest interval group on SBP, the 150-second group experienced the greatest decrease in mean SBP. Therefore, the use of a longer duration rest interval between sets may be the most advantageous to decrease SBP, and may be appropriate to prevent hypertension and/or treat prehypertension.

Conclusions

Despite the limitations of this study, the following conclusions may be drawn:

1. Rest interval length in an 8-week generalized resistance-training program had no significant effect on SBP in normotensive young adults.
2. The 8-week generalized resistance-training program significantly lowered SBP in normotensive young adults regardless of rest interval length.
3. Rest interval length had no significant effect on DBP and did not significantly lower DBP in normotensive young adults regardless of rest interval length.

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Appendix A, Exercises included in weekly exercise sessions

Session 1	Session 2	Session 3
Leg press	Leg curls	Leg extensions
Leg extensions	Bench press	Leg curls
Shoulder press	Lat pull downs	Bicep curls
Bicep curls	Triceps extensions	Triceps extensions