

Effect of Aerobic Training and Resistance Training on Blood Pressure in Indian: Systematic Review

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Abstract: ***Introduction:** Hypertension is a public health concern due to its magnitude, risks, difficulty in management, high medical and social costs and severe cardiovascular and renal complications. The number of deaths due to hypertension as primary cause was estimated to be over 7 million in 2002, approximately 13% of all reported deaths. Hypertensive adults will reach 1.5 billion by 2025; around 30% of the world population. Hypertension (HTN) is emerging as public health problems in various ethnic groups in the developing countries like India. Prevalence of hypertension has been found to be increasing in epidemic proportions in urban, rural and tribal population of India. **Objective:** To systematically review and report the articles from India in aerobic and resistance exercise on blood pressure. **Methodology:** Study was done on February 2016 in Google Scholar using search terms 'Aerobic' AND 'Resistance' AND 'Blood pressure' AND 'India'. 4 articles were identified for this review based on inclusion and exclusion criteria. **Results:** Studies were at least 6 weeks duration with 60-85% HRmax of intensity for 30-40 min duration. Total of 130 subjects participated with median of 10 subjects. The results suggest that there was mean reduction of -5.02 mmHg in SBP and -3.142 mmHg in DBP in aerobic training group and also there was reduction of -3.015 mmHg in SBP and -1.415 mmHg in DBP in resistance training group. **Conclusion:** The present review conclude that aerobic exercise training reduce the blood pressure more as compared to resistance training in Indians.*

Keywords: aerobic, resistance, blood pressure

1. Introduction

According to the World Health Organization, non-transmissible diseases will be the leading cause of functional disability in the next two decades and, among chronic degenerative conditions, arterial hypertension will be the most important cause. Hypertension is a public health concern due to its magnitude, risks, difficulty in management, high medical and social costs and severe cardiovascular and renal complications. The number of deaths due to hypertension as primary cause was estimated to be over 7 million in 2002, approximately 13% of all reported deaths. Hypertensive adults will reach 1.5 billion by 2025; around 30% of the world population. Hypertension (HTN) is emerging as public health problems in various ethnic groups in the developing countries like India. Prevalence of hypertension has been found to be increasing in epidemic proportions in urban, rural and tribal population of India^{1,2}.

A study was undertaken to assess the prevalence of hypertension, and knowledge, treatment practice and risk behaviors of tribal men and women ≥ 20 yr in nine major states in India during 2008-2009 by National Nutrition Monitoring Bureau (NNMB). Overall age-standardized prevalence of HTN was 26.3% (self-reported: 5.5%; newly detected: 20.8%). Urban residents of Tamil Nadu, Jharkhand, Chandigarh and Maharashtra (31.5, 28.9, 30.7 and 28.1%) had significantly higher prevalence of HTN compared with rural residents (26.2, 21.7, 19.8 and 24.0%, respectively). Hypertension, elevated blood pressure (BP), is rising at alarming rate in India. Overall prevalence for hypertension in India was 29.8%. Significant differences in hypertension prevalence were noted between rural and urban parts [27.6% and 33.8%;] and [17.9% and 40.8%]. Age, BMI, Waist circumference, Waist to hip ratio, Excessive salt

intake, Alcohol and Smoking are identified risk factors in India^{3,4}.

High blood pressure (BP) is one of the most important modifiable risk factors for cardiovascular diseases, which accounts for one in every eight deaths worldwide. Total deaths due to cardiovascular diseases were 9.1 million in developing countries and 1.5 million in India. It has been predicted that by 2020, there would be 111 per cent increase in cardiovascular deaths in India. HTN is directly responsible for 57 per cent of all stroke deaths and 24 per cent of all coronary heart diseases (CHD) in India^{5,6}.

Hypertensive patients usually have low aerobic capacity and strength due to under lying cardiovascular, neurological and renal disorders (Mercedes R.Carnethon 2005)⁷.

Dynamic aerobic endurance exercise involves large muscle groups in dynamic repetitive activities that result in substantial increases in heart rate and energy expenditure. Current thinking varies with respect to the preferred type of physical activity for BP; historically aerobic training has been preferred. Resistance training is activity in which each effort is performed against a specific opposing force generated by resistance and is designed specifically to increase muscular strength, power, and/or endurance. According to the type of muscle contraction, resistance training can be divided into 2 major subgroups: "dynamic" versus "static or isometric" resistance training. Dynamic resistance training involves concentric and/or eccentric contractions of muscles while both the length and the tension of the muscles change. Isometric activity has previously been associated with exaggerated hypertensive responses, but recent work has suggested isometric handgrip activity may become a new tool in the non pharmacological treatment of high BP^{8,9}.

Previous meta-analyses have examined the effects of aerobic training, dynamic resistance training in isolation on BP, although a meta-analytic comparison of all different exercise modalities, strictly limited to randomized controlled trials and eliminating data from crossover studies, has not been conducted^{10,11,12,13}. The aims of this work were to conduct a systematic review and meta-analysis of randomized controlled trials to compare the effects of aerobic training, dynamic resistance training on the magnitude of change in SBP and DBP in Indian populations, examine whether magnitudes of change in SBP and DBP were related to exercise program characteristics, that is, program duration, exercise session duration, exercise intensity, exercise mode, weekly exercise duration, or weekly session frequency.

2. Methods

A database of randomized controlled trials on the effect of exercise training on BP is searched. A systematic search was conducted of resistance training, aerobic and combined training for the period January 1, 2016 until February 28, 2016. The search strategy included key words "Aerobic", "Resistance", "Exercise", and "Blood Pressure" and "India". The inclusion criteria for this meta-analysis were as follows: (1) randomized controlled design trials of exercise training for a minimum of 3-4 weeks; (2) participants were adults (age 20-40 years) (3) the study reported before and after mean and SD (or standard error) of resting BP in exercise and control groups or mean change and SD (or standard error) in exercise and control groups; and (4) the study was published in a journal up to February 2016. Any studies not meeting these criteria were excluded.

3. Results

The primary outcome measures were changes in resting SBP and DBP. Descriptive data of treatment groups and participants are reported as the mean SD or median and range. Effect sizes for each study group were calculated by subtracting the pre exercise value from the post exercise value (post-pre).

Chaudhary S. et al¹⁰ 2010 investigated the effect of Aerobic and Resistance training on cardiovascular fitness in 20 obese sedentary females (35-45 years) for 6 weeks. Resistance Training protocol consisting with Intensity of 4 sets of 10 repetitions and frequency was 3 times/week. Training started with 10 lifts with 50% of 10RM, then 75% of 10 RM, and progressed to 100% of 10RM. Regular aerobic training reduced SBP from 128.10±4.954 mmHg to 124.20±2.820 mmHg and DBP from 85.00±3.265 mmHg to 81.80±3.119 mmHg. There was significant reduction in resting blood pressure (mean SBP -3.9±2.134 mmHg and DBP -3.2±0.146 mmHg). Aerobic Training protocol consisting of 30 minute

duration at 60-70% HRmax and frequency was 3 times/week. Regular aerobic training reduced SBP from 128.10±4.954 mmHg to 124.20±2.820 mmHg and DBP from 85.00±3.265 mmHg to 81.80±3.119 mmHg. There was significant reduction in resting blood pressure (mean SBP -3.9±2.134 mmHg and DBP -3.2±0.146 mmHg).

Purvi K.Changela¹¹ 2013 compared the effect of Aerobic and resistance training on cardiovascular fitness in 10 young obese sedentary females (19-25 years). Resistance training was given for alternate days for 6 weeks with Intensity of 4 sets of 10 repetitions. Training was started with 10 lifts with 50% of 10RM, then 75% of 10 RM, and progressed to 100% of 10RM. Results showed SBP reduced from 131.70±4.667 to 127.20±3.190 mmHg and DBP reduced from 83.00±2.160 to 82.60±1.349 mmHg and significant mean difference in SBP (-3.73±0.15 mmHg) and DBP (-1.73±0.49 mmHg). Aerobic training was given for 3 days a week at 50-75% MHR. Training given for 40 minutes duration included warm up and cool down time for 2 months. Results showed SBP reduced from 131.70±4.083 to 123.70±2.540 mmHg and DBP reduced from 86.20±2.820 to 80.70±2.750 mmHg and significant mean difference in SBP (-8.0±1.54 mmHg) and DBP (-5.5±0.07 mmHg).

Patel H. et al¹² 2014 investigated the effect of aerobic training and resistance training on 60 hypertensive patients (30-55 Years). Training given for 30 minutes duration included warm up and cool down time for 6 weeks. Results showed mean difference was -1.60±0.503 mmHg for SBP and -1.80±0.410 mmHg for DBP after 6 weeks. Training given for 30 minutes duration included warm up and cool down time for 6 weeks. Results showed mean difference was -3.35±.933 mmHg for SBP and -2.00±.649 mmHg for DBP after 6 weeks training.

Jaiswal et al¹³ 2015 evaluated the effect of Interval and Circuit training on blood pressure, heart rate and rate of perceived exertion in individuals with 30 prehypertensive subjects (20-40 years). Resistance exercise was given 30 minutes with intensity of 60% to 80% of 1 RM for 5 days in a week for 6 weeks. Regular resistance training reduced SBP from 128.26±2.91 to 124.53±3.06 mmHg and DBP reduced from 81.73±2.12 to 80.00±2.61 mmHg. Author showed mean difference of SBP (-3.73±0.15) and DBP (-1.73±0.49). Aerobic Exercise was 40 minutes on a treadmill with intensity alternating between 50% (2 min) and 80%(1 min) of Reserve Heart Rate for 5 days in a week for 6 weeks. Regular aerobic training reduced SBP from 129.46±2.87 mmHg to 124.6±1.95 mmHg and DBP from 81.37±2.37 mmHg to 79.86±2.56 mmHg. Author showed mean difference of SBP (-4.86±0.91 mmHg) and DBP (-1.87±0.19 mmHg).

Table 1: Summary of Aerobic and Resistance training on blood pressure in Indians

Author et al	Type of study Sample Size Duration	Pre SBP	Post SBP	Pre DBP	Post DBP	Mean Difference (MD) in mmHg
Chaudhary S.et al ¹⁰	Experimental study(35-45 years) Control=10 AT=10 RT=10	AT 128.10±4.954 RT 129.70±4.498	AT 124.20±2.820 RT 126.70±3.713	AT 85.00±3.265 RT 83.70±2.311	AT 81.80±3.119 RT 83.50±2.877	AT SBP -3.9±2.134 DBP -3.2±0.146 RT SBP -3.0±0.785 DBP -0.4±0.566
Purvi K.Changela ¹¹ 2013	Experimental study(19-25 years) AT=10 RT=10	AT 131.70±4.083 RT 131.70±4.667	AT 123.70±2.540 RT 127.20±3.190	AT 86.20±2.820 RT 83.00±2.160	AT 80.70±2.750 RT 82.60±1.349	AT SBP -8.0±1.54 DBP -5.5±0.07 RT SBP -3.73±0.15 DBP -1.73±0.49
Patel H.et al ¹² 2014	Experimental study(30-55 Years) AT=30 RT=30					AT SBP -3.35±.933 DBP -2.00±.649 RT SBP -1.60±0.503 DBP -1.80±0.410
Jaiswal et al ¹³ 2015	Experimental study(20-40 years) AT=15 RT=15	AT 129.46±2.87 RT 128.26±2.91	AT 124.6±1.95 RT 124.53±3.06	AT 81.37±2.37 RT 81.73±2.12	AT 79.86±2.56 RT 80.00±2.61	AT SBP -4.86±0.91 DBP -1.87±0.19 RT SBP -3.73±0.15 DBP -1.73±0.49

4. Discussion

In this present review, we analyzed data from 4 experimental studies assessing the effect of aerobic and resistance training at least 6 weeks duration on blood pressure in Indian adults. The results suggest that there was mean reduction of -5.02 mmHg in SBP and -3.142 mmHg in DBP in aerobic training group and also there was reduction of -3.015 mmHg in SBP and -1.415 mmHg in DBP in resistance training group. This review revealed that reduction in blood pressure which reached statistical significance in aerobic training group may be because of favorable changes in vascular compliance, which might have occurred after exercise training thus could reduce peripheral resistance¹⁰. Aerobic training group might have extra benefits due to less myocardial oxygen consumption and load and increasing HDL¹⁴. This mean effect is similar to the findings of an earlier Metanalysis focusing on aerobic training and resting blood pressure (Kelley et al 2001, E.M.Murtagh et al 2015)¹⁵. A previous prospective western study reported that a 2 mmHg reduction in SBP would result in 10% lower stroke mortality and 7% lower mortality from ischaemic heart disease or other

vascular causes in middle age (prospective studies collaboration, 2002) thus highlighting the clinical significance of even small changes in resting blood pressure¹⁶. Endurance, dynamic resistance, and isometric resistance training lower SBP and DBP, whereas combined training lowers only DBP¹⁷. Data from a small number of isometric resistance training studies suggest this form of training has the potential for the largest reductions in SBP.

5. Conclusion

The present review conclude that aerobic exercise training reduce the blood pressure more as compared to resistance training in Indians.

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