# ISOLATED AND COMBINED EFFECT OF RESISTANCE AND AEROBIC TRAINING ON MEAN ARTERIAL PRESSURE OF UNTRAINED MEN

***Dr. C. Selvaraj,*** *Assistant Professor, Vinayaka Missions College of Physical Education, Salem.*

***Dr. C. Arulraj****, Director of Physical Education, Government College of Engineering, Thirunelveli.*

## ABSTRACT

The purpose of this investigation was to examine the isolated and combined effect of resistance and aerobic training on mean arterial pressure of untrained men. To achieve the purpose of the study, forty untrained men from Salem district, Tanilnadu, India were randomly selected as subjects. Their age was ranged between 40 years to 45 years. They were randomly divided into four groups and each group consisted of ten participants. Group-I performed resistance training, group-II performed aerobic training, group-III performed combined resistance and aerobic training and group-IV acted as control. The mean arterial pressure was selected as dependent variable and it was assessed by using digital blood pressure monitor. The research design of the study was random group design. The data collected from the experimental and control groups on mean arterial pressure was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test. Further, percentage of changes was also calculated. In addition the data collected from the four groups prior to and post experimentation on mean arterial pressure was statistically analyzed by applying the analysis of covariance (ANCOVA). Since, four groups were involved, whenever the obtained 'F' ratio value in the adjusted post test mean was found to be significant, the Scheffe's test was applied as post hoc test. It is concluded that due to the effect of isolated resistance, aerobic and combined training the mean arterial pressure of the untrained men was significantly decreased.

***Key Words:*** *Isolated and combined resistance and aerobic training, Mean arterial pressure, Untrained men*

## INTRODUCTION

Aging is a complicated process and extremely individualized, with the onset or absence of illness representing only one element in quality of life in middle age. While aerobic fitness is partly determined by genetics, and to that extent, the luck of the universe, much of a person's fitness, especially by middle age, depends on physical activity. So, exercising during midlife, especially if we haven't been, can pay enormous later-life benefits. Someone in midlife who moves from the least fit to the second-to-the-least-fit category of fitness gets more benefit," in terms of staving off chronic diseases, than someone who moves to the highest fitness grouping from the second-highest. It's good to

stay active throughout life but adopting healthy choices in adulthood has significant benefits, based on a recent study that links increased physical activity in middle age to reduced risk of death.

As populations continue to extend life expectancy, a central concern is whether the added time comprises years of healthy life and promotes a high health-related quality of life into old age. Physical activity *(PA)* is defined as any bodily movement produced by skeletal muscles that result in energy expenditure. PA encompasses exercise, sports, and physical activities performed as part of daily living, occupation, leisure, or active transportation. Exercise is a subcategory of PA that is planned, structured, and repetitive and that has as a final or intermediate objective for improvement or maintenance of physical fitness. Physical function is the capacity of an individual to perform the physical activities of daily living. Physical function reflects motor function and control, physical fitness, and habitual PA (Garber et al., 2011).

Inactivity and aging increase the risk of chronic disease, and older people often have multiple chronic conditions (NFH, 2010). The exercise recommendations from WHO include both aerobic exercise and strength exercises to reduce the risk of illness. If older adults cannot follow the guidelines because of chronic conditions, they should be as active as their ability and conditions allow (Chodzko-Zajko et al., 2009).

Exercise has countless benefits for those of all ages, including a healthier heart, stronger bones and improved flexibility. For seniors, there are additional benefits, like the fact that regular exercise reduces the risk of chronic diseases, lowers the chance of injury and can even improve one's mood. As we age, our muscle mass begins to decrease. When we enter our forties, adults can lose 3-5% of muscle mass with each subsequent decade of life. Muscle is an essential contributor to our balance and bone strength; it keeps us strong. Without it, our mobility and independence become compromised.

A substantial volume of research has been dedicated to examining training induced improvements in musculoskeletal strength and cardiorespiratory endurance in response to strength and endurance training programs performed concurrently as compared to either strength or endurance programs performed separately. Properly adhering to the principles of progressive overload and specificity as well as allowing for adequate recovery time for training elicited adaptations of fat free mass to occur becomes increasingly more difficult

given that combined training programs characteristically have a higher training volume than separate training programs. Recovery from the training stress accumulated during combined training is different from that which is acquired from separate training in that the body is adapting to the stimuli associated with two separate modes of training, as opposed to one. Therefore, the amount of recovery time incorporated into a combined training program can be divided into two categories: the recovery time between each exercise session regardless of the training mode and the recovery time between exercise sessions of the same mode. The recovery processes unique to each mode of training must occur simultaneously when performing the two exercise sessions in succession, as opposed to evenly distributing the recovery interval between the two. Few studies have addressed the effect of concurrent training on physiological parameters associated with either training mode.

## METHODOLOGY

### Subjects and Variables

To achieve the purpose of the study, forty untrained men from Salem district, Tanilnadu, India were randomly selected as subjects. Their age was ranged between 40 years to 45 years. They were randomly divided into four groups and each group consisted of ten participants. Group-I performed resistance training, group-II performed aerobic training, group-III performed combined resistance and aerobic training and group-IV acted as control. The mean arterial pressure was selected as dependent variable and it was assessed by using digital blood pressure monitor.

### Training Protocol

Training was administered for twelve weeks with four training units per week. The experimental group-I performed resistance training, group-II performed aerobic training, and group-III performed combined resistance and aerobic training. The resistance training program was a total body workout consisting of 3 sets of 6-10 repetitions on 6 exercises that trained all the major muscle groups. A percentage of each subject's one-repetition maximum for each exercise was used to determine the intensity of each week. The intensity and number of repetitions performed for each exercise was progressively increased. The aerobic exercise was performed with 65- 80% HRR. The intensity was increased as training progressed. Combined resistance and aerobic training group performed resistance training during every odd numbered week and endurance training during every even numbered week.

**Statistical Technique**

The data collected from the experimental and control groups on mean arterial pressure was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated. The data collected from the four groups prior to and post experimentation on mean arterial pressure was statistically analyzed, by applying the Analysis of Covariance (ANCOVA). Since, four groups were involved, whenever the obtained 'F' ratio value in the adjusted post test mean was found to be significant, the Scheffe's test was applied as post hoc test. The level of confidence is fixed at 0.05 for significance.

**RESULT**

The outcome of 't' test and also changes in percentage on Mean Arterial Pressure of the chosen 4 groups are mentioned in table-I

**Table-: Dependent 'T' Test Output on Mean Arterial Pressure**

| Group | Test | N | Mean(M) | SD | MD | Percentage (%) | 'T'-Test |
|---|---|---|---|---|---|---|---|
| **Resistance Training(RTG)** | Pre | 10 | 86.70 | 1.76 | 1.10 | 1.26 | 11.00* |
| | Post | | 85.60 | 1.71 | | | |
| **Aerobic Training(ATG)** | Pre | 10 | 87.30 | 1.33 | 4.10 | 4.69 | 41.00* |
| | Post | | 83.20 | 1.47 | | | |
| **Combined Training(CTG)** | Pre | 10 | 86.30 | 1.49 | 2.10 | 2.43 | 21.00* |
| | Post | | 84.20 | 1.68 | | | |
| **Control(CG)** | Pre | 10 | 87.10 | 1.52 | 0.80 | 0.91 | 1.30 |
| | Post | | 87.90 | 0.99 | | | |

* *Table value: [df 9=2.26 (0.05 level)]*

The chosen 4 group's initial and final (pre & post) test scores on Mean Arterial Pressure (RTG= 86.70 & 85.60; ATG = 87.30 & 83.20; CTG= 87.10 & 87.90) vary noticeably because the dependent 't' test results of resistance (11.00), aerobic (41.00) as well as combined training (21.00) groups were better than the needed table value *[df 9=2.26 (0.05 level)]*. Subsequent to 12 weeks of resistance (RT), aerobic (AT) and combined (CT) training 1.26%, 4.69% and 2.43% of decrease in on Mean Arterial Pressure was observed.

Further, all the 4 group's Mean Arterial Pressure data (pre&post) was analyzed through ANCOVA and the final results are exhibited in table number–2.

**Table-2: Derived ANCOVA Results on Mean Arterial Pressure of Untrained Men**

| Group's Adjusted Means on MAP | | | | S o V | S.S | df | M.S | 'F' |
|---|---|---|---|---|---|---|---|---|
| Resistance Training (RT) | Aerobic Training (AT) | Combined Training (CT) | Control (CG) | | | | | |
| 85.70 | 82.97 | 84.69 | 87.72 | B | 117.82 | 3 | 39.27 | 49.65* |
| | | | | W | 27.68 | 35 | 0.79 | |

*(Table value:[df 3 & 35 = 2.87(.05 level)])* **Significant*

The adjusted Mean Arterial Pressure means of RTG, ATG, CTG and CG are 85.70, 82.97, 84.69 and 87.72 respectively. The derived ANCOVA statistics result on Mean Arterial Pressure confirmed that the adjusted means of all 4 groups (RTG, ATG, CTG & CG) fluctuate drastically, because the resultant 'F' value (49.65) is more than table value [df 3 & 35 = 2.87(.05 level)].

Since it is highly significant (adjusted means), the follow up test statistics was applied as in table-3.

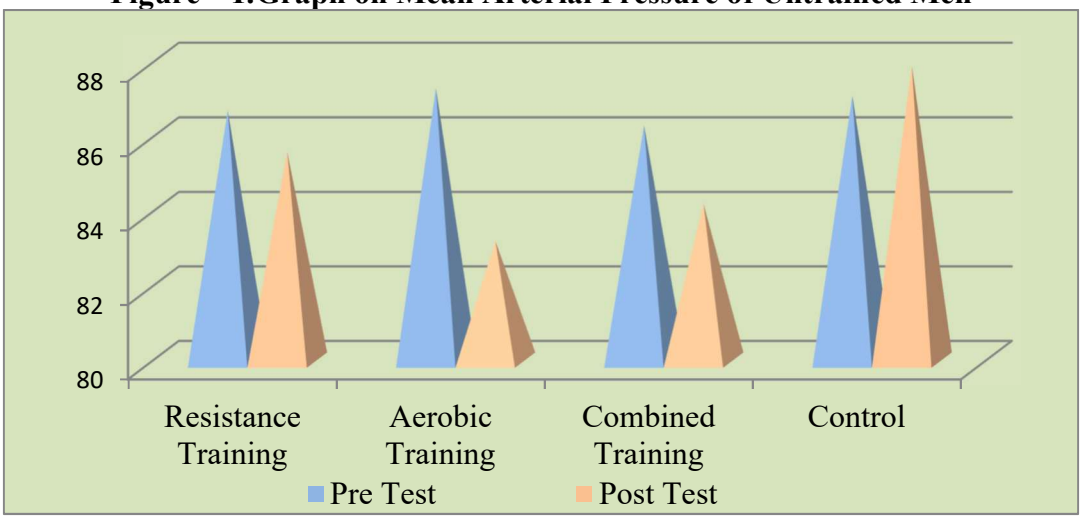
**Table-3: Post Hoc (Scheffe's) Test Results on Mean Arterial Pressure of Untrained Men**

| Adjusted Means on MAP of | | | | Mean Differences (MD) | Confidence interval(CI) |
|---|---|---|---|---|---|
| Resistance Training (RT) | Aerobic Training (AT) | Combined Training (CT) | Control (CG) | | |
| 85.70 | 82.97 | | | 2.73* | 0.90 |
| 85.70 | | 84.69 | | 1.01* | 0.90 |
| 85.70 | | | 87.72 | 2.02* | 0.90 |
| | 82.97 | 84.69 | | 1.72* | 0.90 |
| | 82.97 | | 87.72 | 4.75* | 0.90 |
| | | 84.69 | 87.72 | 3.03* | 0.90 |

***Significant***

The follow up test **(**Scheffe's**)** results confirmed that due to resistance (RT=2.02); aerobic (AT=4.75) and combined (CT=3.03) training the middle aged men's Mean Arterial Pressure level was greatly reduced. Though, aerobic training (AT) was much better than resistance (RT=2.73) and combined (CT=1.01) training protocols and also combined training (CT) was superior to resistance training (RT=1.72) because the mean differences (MD) are higher than CI value (0.90). The 4 group's Mean Arterial Pressure scores are displayed in diagram-I.

**Figure – I:Graph on Mean Arterial Pressure of Untrained Men**




## DISCUSSION

Resistance training can reduce major CVD risk factors (including dyslipidemia and type 2 diabetes) (Strasser & Schobersberger, 2011) and blood pressure responses to stress (Gauche et al., 2017). In 2 meta-analyses, resistance exercise significantly reduced systolic and diastolic blood pressure by approximately 3 mm Hg (Cornelissen & Fagard, 2005; Kelley & Kelley, 2000). Significant reductions of approximately 6 mm Hg in systolic and approximately 7 mm Hg in diastolic blood pressure after resistance exercise training in older adults with prehypertension, and never-treated hypertension have been reported (Heffernan et al., 2013). Similarly, high-volume resistance exercise can promote a reduction of mean 24-hour and awake systolic blood pressure in older adults (Scher et al., 2011). A reduction in diastolic blood pressure by 5 mm Hg reduces the risk of stroke by an estimated 34% and ischemic heart disease by 21% (Law, Wald & Morris, 2003). Because of the known benefits, resistance training is considered a nonpharmacological treatment to lower blood pressure (Brook et al., 2013).

Miller, Laurance and Austin (1971) stated that repeated and continuous physical exercises may produce extensive change in the respiratory system and the amount of vital capacity increased after a period of training programme. These reviews considers the effect of endurance training on the key parameters of aerobic (endurance) fitness and attempts to relate these changes to the adaptations seen in the body's physiological systems with

training. The importance of improvements in the aerobic fitness parameters to the enhancement of endurance performance is highlighted, as are the training methods that may be considered optimal for facilitating such improvements (Jones & Carter, 2000).

In addition, resistance training combined with endurance training in older coronary heart patients results in enhanced strength and function (Hollings et al., 2017; Hurley, Hanson & Sheaff, 2011). Guidelines and recommendations of physical activity for elderly people by the American Heart Association (AHA) and the American College of Sports Medicine (ACSM) in 2007 highlight the importance of performing aerobic activity of moderate intensity for 30 minutes per day for at least 5 times a week, performing resistance activity 2 times a week on alternate days (Nelson et al., 2007; Peterson & Gordon, 2011). In summary, based on the previous findings it is suggested that combined training protocols should be performed 2–3 times per week. Lower combined training frequency (1 session per week of strength and 1 session per week of endurance training) may also promote marked neuromuscular and cardiovascular changes in untrained older adults.

**CONCLUSION**

Due to resistance, aerobic and combined training the untrained men's Mean Arterial Pressure level was greatly reduced. Though, aerobic training (AT) was much better than resistance and combined training protocols and also combined training (CT) was superior to resistance training. Subsequent to 12 weeks of resistance (RT), aerobic (AT) and combined (CT) training 1.26%, 4.69% and 2.43% of decrease in Mean Arterial Pressure was observed. Based on this finding it is recommended that the coaches, trainers and physical educators may incorporate combined training to alter physiological parameters of untrained men.

**REFERENCES**

Brook RD, Appel LJ, Rubenfire M, et al., (2013). Beyond medications and diet: Alternative approaches to lowering blood pressure: A scientific statement from the American Heart Association. *Hypertension,* 61: 1360–1383.

Chodzko-Zajko W. J., Proctor D. N., Fiatarone Singh M. A., et al., (2009). Exercise and physical activity for older adults, *Medicine & Science in Sports & Exercise*, 41(7): 1510–1530.

Cornelissen VA, Fagard RH. (2005). Effect of resistance training on resting blood pressure: A meta-analysis of randomized controlled trials, *J Hypertens*, 23: 251–259.

Garber C. E., Blissmer B., Deschenes M. R., et al., (2011). Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise, *Medicine & Science in Sports & Exercise*, 43(7): 1334–1359.

Gauche R, Lima RM, Myers J, et al., (2017). Blood pressure reactivity to mental stress is attenuated following resistance exercise in older hypertensive women, *Clin Interv Aging,* 12: 793–803.

Heffernan KS, Yoon ES, Sharman JE, et al., (2013). Resistance exercise training reduces arterial reservoir pressure in older adults with pre hypertension and hypertension, *Hypertens Res.,* 36: 422–427.

Hollings M, Mavros Y, Freeston J, Fiatarone Singh M. (2017). The effect of progressive resistance training on aerobic fitness and strength in adults with coronary heart disease: A systematic review and meta-analysis of randomised controlled trials, *Eur J Prev Cardiol.,* 24: 1242–1259.

Hurley BF, Hanson ED, Sheaff AK. (2011). Strength training as a countermeasure to aging muscle and chronic disease, *Sports Med*., 41: 289–306.

Jones, A.M., Carter, H.C. (2000). The effects of endurance training on parameters of aerobic fitness, *Sports Medicine*, 29: 373-386.

Kelley GA, Kelley KS. (2000). Progressive resistance exercise and resting blood pressure: A meta-analysis of randomized controlled trials, *Hypertension,* 35: 838–843.

Law M, Wald N, Morris J. (2003). Lowering blood pressure to prevent myocardial infarction and stroke: A new preventive strategy, *Health Technol Assess,* 7: 1–94.

Miller, M., Laurance, E & Austin, T. (1971). *Physiology of Exercise* (6th ed), The C.V. Mosby Company: *Saintlouis*, 106-119.

Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, et al., (2007). Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association, *Med Sci Sports Exerc*., 39(8): 1435–1445.

Peterson MD, Gordon PM. (2011). Resistance exercise for the aging adult: clinical implications and prescription guidelines, *Am J Med*., 124(3): 194–198.

Scher LM, Ferriolli E, Moriguti JC, Scher R, Lima NK. (2011).The effect of different volumes of acute resistance exercise on elderly individuals with treated hypertension, *J Strength Cond Res*., 25: 1016–1023, 2011.

Strasser B, Schobersberger W. (2011). Evidence for resistance training as a treatment therapy in obesity. *J Obes.,*: pii: 482564, 2011.