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EFFECT OF HIGH INTENSITY EXERCISE IN REDUCING THE BLOOD PRESSURE IN MILD TO MODERATE HYPERTENSIVE PATIENT

By

(Reg. No . 27101813)

PADMAVATH COLLEGE OF PHYSIOTHERAPY

PERIYANAHALLI

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Under the guidance of

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Assistant Professor,

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Submitted in Partial fulfillment of the requirements for the

Degree of **Master of Physiotherapy**

From

The Tamilnadu Dr. M.G.R. Medical University,

Chennai

PADMAVATH COLLEGE OF PHYSIOTHERAPY

PERIYANAHALLI

DHARMAPURI

CERTIFICATE

This is to certify that the project entitled **"EFFECT OF HIGH INTENSITY EXERCISE IN REDUCING THE BLOOD PRESSURE IN MILD TO MODERATE HYPERTENSIVE PATIENT"**

Submitted by the candidate

(Reg. No . 27101813)

is a bonafide work done in partial fulfillment of the requirements for the Degree of **Master of Physiotherapy** from

The Tamilnadu Dr. M.G.R. Medical University,

Chennai

Guide **Principal**

Viva-voce Examination held on ________________

Internal Examiner **External Examiner**

DECLARATION

I hereby declare and present my dissertation entitled entitled **"EFFECT OF HIGH INTENSITY EXERCISE IN REDUCING THE BLOOD PRESSURE IN MILD TO MODERATE HYPERTENSIVE PATIENT"** the outcome of the original research work undertaken and carried out be me , under the guidance of **Mr. J. HARI PRASATH, M.P.T. , MIAP.,** Assistant Professor, Padmavathi College of Physiotherapy, Periyanahalli, Dharmapuri , Tamilnadu.

I also declare that the material of this dissertation had not formed in any basis for the award of any other Degree previously from the Tamilnadu Dr. M.G.R. Medical University, Chennai.

(PURUSOTHAMAN.P)

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(PURUSOTHAMAN.P)

DEDICATED TO MY BELOVED

PARENTS , STAFFS

AND

LOVABLE FRIENDS

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INTRODUCTION

There is no natural dividing line between high and normal blood pressure as it is a continuous variable. The definition of hypertension, therefore using any specific cut off point is arbitrary. There have been multiple proposed cut off points for the definition of high blood pressure.

WHO in its Expert Committee report (1978) has arbitrarily defined hypertension in adults as "a systolic pressure equal to or greater than 160 mm Hg/or a diastolic pressure equal to or greater than 95 mm.

An important revelation in epidemiological hypertension research is that hypertension usually occurs in conjunction with other metabolically linked risk factors. The other risk factors that tend to accompany hypertension include glucose intolerance, obesity, left ventricular hypertrophy and dyslipidemia (elevated total LDL and small dense LDL cholesterol level, raised triglyceride, and reduced HDL cholesterol levels). Clusters of three or more of these additional risk factors occur at four times the rate expected by chance. This clustering is attributed to an insulin resistance syndrome promoted by abdominal obesity.

Therefore hypertensive patients can more appropriately be targeted for therapy for risk factor clusters rather hypertension alone. It needs to be emphasized that the risks of cardiovascular disorders are proportional to the levels of BP for any age or either sex.

Hypertension in India:

A number of studies have been conducted on prevalence of hypertension in India. These studies have been carried out in different geographic areas and in urban as well as rural area populations. Recent Indian studies have used the criterion for hypertension as systolic BP > 140 mm Hg and / or diastolic BP > 90 mm Hg. The present assessment of burden of disease includes only those studies of hypertension, which have been carried out between 1995 and 2002 and are based on adequate sample size and sound methodology. The meta analysis of eight studies carried out in urban areas gives a pooled prevalence rate of 164.18 per thousand (Table 22).

Similarly, the weighted average of prevalence rates of individual studies carried out in rural areas yielded a pooled prevalence rate of 157.44 per thousand (Table 22).

As about 70% of population lives in rural areas and 30% in urban areas in India, the pooled estimate for the country was derived by combining rural and urban estimates assigning weights in that proportion.

Cardiac rehabilitation in India

Cardiac rehabilitation is recently developed service and diversified programs are offered across different health care settings. In one study it was reported that cardiac rehabilitation shows 24% reduction in all source mortality and 25% reduction in cardiac related mortality. Apart from benefits in cardiac rehabilitation complications occurs due to exercise which are less common but severe. Haskell (1978) reported that the incidence of death during exercise training of cardiac patient is 1 per 212182 patient hours. Most of the deaths are due to cardiac arrhythmias. It is because of excess intensity during normal exercise or failure to heed symptoms induced by exercises.

So a great responsibility falls on the professionals to determine the correct exercise program with correct intensity for different kind of patient.

Exercise for Hypertension:

Hypertension “silent killer”

The new classification of "pre-hypertensive" (SBP 120-139 and DBP 80-89 mmHg) has been introduced to identify individuals who are at a higher risk of developing hypertension, pointing out an important fact that hypertension is a modifiable risk factor.

Exercise as a lifestyle modification is beneficial to a wide variety of health conditions. Specific to hypertension, the benefits of exercise have been promoted by a number of organizations and agencies including the American Heart Association, the American College of Sports Medicine, the Surgeon General of the United States, The National Institutes of Health, and the Centers for Disease Control (Wallace, 2003).

CARDIARESPIRATORY FITNESS(CRE)

Cardiac rehabilitation is based upon the concepts and ideas developed by Herman Hellerstein, which date back to the 1950's (1). Cardiac rehabilitation has evolved over the past 50 years into a program which has two basic goals:

1,To improve the health status of the cardiac patient with coronary artery disease (CAD) and to reduce the risk of recurrence of cardiac events (1).

2.In order to achieve these goals, most cardiac rehabilitation programs have specific curricula targeted towards assisting the patient in multidisciplinary fields, such as physical fitness, social interaction, nutrition counseling, and psychological support .

The demographics of the cardiac rehabilitation population was once predominantly comprised of primarily male coronary artery bypass graft (CABG) patients, but now includes both the young and elderly, males and females, those with chronic comorbidities (diabetes, hypertension, hyperlipidemia), and persons who have had other surgeries such as angioplasty.

Aerobic exercise training has long been used in the treatment of patients with CAD . Schuler et al. (5) noted that the progression of CAD might be slowed and even reversed in patients participating in a low-fat diet and regular exercise program intervention. Exercise training has been shown to lower heart rate (HR) and blood pressure (BP), improve high-density and low-density lipoprotein cholesterol balance, decrease insulin resistance, and help to decrease body weight . These benefits are often enhanced by a multidisciplinary cardiac rehabilitation program involving education, counseling, supervised exercise, and nutrition evaluation .

Due to the multiple physical needs of patients in cardiac rehabilitation, it is important to incorporate different modes of exercise. However, the exercise-induced stress on the cardiovascular system can differ with various modes of exercise, thus eliciting different risks and training effects. Some of the most common exercise modalities used in cardiac rehabilitation are the treadmill, cycle ergometer, and seated rowing machine. Previous investigations in asymptomatic populations have found that the treadmill produces higher oxygen consumption (VO_2) and HR values, with lower ratings of perceived exertion (RPE) scores than other modes of exercise. However, due to the relatively high impact characteristics of treadmill walking and running, many patients cannot safely utilize this mode of exercise. The elliptical cross-trainer is a new, low-impact exercise modality that may be beneficial for use in the cardiac rehabilitation setting. Presently, there has been no research done on this modality in a cardiac rehabilitation setting. Therefore, the purpose of this study was to determine the cardiopulmonary effects of cycle ergonometer single high intensity exercise session/day / week,

Cardiarespiratory fitness(CRE) or Aerobic Fitness – Ability of the heart, lungs, and blood vessels to supply oxygen to working muscles and ability of the muscles to use the available oxygen to continue work or exercise

It is otherwise defines as:

- Capacity to meet the energy demands of maximal work
- Capacity to deliver oxygen to working muscles
- Capacity to extract oxygen at working muscles

VO_2 max

VO_2 max is the most commonly used index to assess CRE. It is the largest amount of oxygen that an individual can utilize during strenuous exercise to complete exhaustion and has become the accepted measure of CRE and has 2 factors to determine

Delivery Factors: Blood supply (cardiac output, redistribution of blood flow) and Carrying capacity (Hb, RBC)

Extraction factors: Muscle mass and Capillary density

VO_2 max is measured in liters/minute or ml/minute (absolute) or ml/kg/min (relative to body weight). It Ranges between 15 ml/kg/min (sedentary with disease) to 75 ml/kg/min (young endurance runner) Women about 10-20% lower than men.

Methods of Determining VO_2 max

Sub maximally

Field exercise tests, such as the 6- and 12-min walking tests

Shuttle run or shuttle walk test and

Stepping tests

Maximally

Graded exercise test-GXT (either on a Treadmill or on a cycle Ergometer)

Karvonen method

The Karvonen method factors in Resting Heart Rate (HR_{rest}) to calculate Target Rate (THR), using a range of 50%–85%:

$THR = ((HR_{max} - HR_{rest}) \times \%Intensity) + HR_{rest}$

Example for someone with a HR_{max} of 180 and a HR_{rest} of 70: 50% intensity: $((180 - 70) \times 0.50) + 70 = 125$ bpm 85% intensity: $((180 - 70) \times 0.85) + 70 = 163$ bpm.

RATE OF PERCEIVED EXERTION

Perceived exertion is how hard you feel your body is working. It is based on the physical sensations a person experiences during physical activity, including increased heart rate, increased respiration or breathing rate, increased sweating, and muscle fatigue. Although this is a subjective measure, a person's exertion rating may provide a fairly good estimate of the actual heart rate during physical activity* (Borg, 1998).

RPE scales were developed by Borg to rate the intensity of exercise. Borg Scale is a subjective evaluation of how hard your body is working at any given point during a workout. The Borg scale uses 15 grades ranging from 6 to 20. A rating of 12-16 is equal to 60-80% of maximal oxygen uptake, while 15-17 has been correlated to >80%. RPE 17-19 seems to utilize almost 100% of oxygen and the body uses anaerobic metabolism to generate energy. Williams and Eston (1989) concluded that the Borg RPE scale is a valid measure of exercise intensity for both regulating and indicating intensity of exercise.

REVIEW OF LITERATURE

1. Post exercise hypotension is sustained during subsequent bouts of mild exercise and simulated activities of daily living

J R MacDonald[1,2], C D Hogben[1], M A Tarnopolsky[1,2] and J D MacDougall[1,2]

"We conclude that post exercise hypotension persists during mild exercise and simulated ADL. Acute exercise may serve as a non-pharmacological aid in the treatment of hypertension."

2. **Exercise intensity alters postexercise hypotension**

Linda S. Pescatello , Margaux A. Guidry , Allison Kerr Amy L. Taylor , Amy N. Johnson , Carl M. Maresh , Nancy Rodriguez, Paul D. Thompson.

"Conclusions LITE and MOD evoked PEH throughout the daytime hours. Lower intensity dynamic exercise such as walking, contributes to BP control in men with hypertension."

3. Fagard R. **Physical exercise in the management of hypertension:a consensus statement by the world hypertension league.**

“Exercise programmes can contribute to the management of hypertension enhance the sence of well -being,and they may improve life expectency.They need not be arduous and can be designed to fit in to everyday activity,”

4. Cleroux J, Kouame N, Nadeau A, Coulombe A, Lacourciere Y. **Aftereffects of exercise on regional and systemic hemodynamics in hypertension.**

“It is concluded that a decrease in regional vascular resistance in skeletal muscles and possibly in the skin in hypertensive patients may contribute importantly to the antihypertensive effect of prior exercise. A decreased sympathetic nervous activity, as seen from lower plasma norepinephrine levels, may be involved in this effect.”

5.Bennett T, Wilcox RG, Macdonald IA. Post-exercise reduction of blood pressure in hypertensive men is not due to acute impairment of baroreflex **function**. Clin Sci 1984; 67: 97-103.

5. Paulev PE, Jordal R, Kristensen 0, Ladefoged J. **Therapeutic effect of exercise on hypertension**. Eur J appl Physiol 1984; 53: 180-185.

“The reduced nervous and humoral sympathetic activity following aerobic exercise seems capable of explaining the low TPR, and the continuous rise in the muscular vasodilatator dopamine may be of importance."

6. Running 2 miles per day every day for 3 months lowered blood pressure in 101 out of 105 subjects (Cade R, et al. 1984). In another study, jogging 60 minutes per day (target HR was 60-70% of age-adjusted maximum), twice weekly for 3 years, produced a satisfactory BP-lowering response (Ketelhut RG, et al. 2004).

7. Cade R, Mars D, Wagemaker H, et al. **Effect of aerobic exercise training on patients with systemic arterial hypertension**. ***Am J Med*** 1984;77:785-790.

"One hundred five patients with established diastolic hypertension were enrolled in an exercise program to examine the effect of aerobic conditioning on blood pressure. In four patients, the decrease in mean blood pressure was less than 5 mm Hg; in all others, there was a significant decline in arterial blood pressure. In 58 patients who were not taking drug medication in the pre-exercise period, mean blood pressure decreased by 15 mm Hg. Of 47 patients receiving drug therapy during the pre-exercise period, 24 were able to discontinue all medication. Mean blood pressure in this group fell from 116.9 +/- 6.5 mm Hg to 97.2 +/- 9.2 mm Hg as a result of exercise. In patients still taking antihypertensive drugs, mean pressure decreased from 120.9 +/- 28.8 mm Hg to 104.4 +/- 17.9 mm Hg after three months of exercise. It is concluded that in patients physically and emotionally able to exercise, a significant decline in blood pressure can be achieved."

8. Kelley GA, Kelley KS, Tran ZV. Walking and resting blood pressure in adults: a meta-analysis. ***Prev Med*** 2001;33(2 pt 1):120-127.

"Conclusion Walking exercise programs reduce resting blood pressure in adults."

9.. Kiyonaga A, Arakawa K, Tanaka H, et al. **Blood pressure and hormonal responses to aerobic exercise. *Hypertension***

These results indicate that exercise therapy is a potent nonpharmacological tool for the treatment of essential hypertension, especially of the low renin type. Both diminished sympathoadrenergic activity and enhancement of prostaglandin mechanisms might be responsible for the falls in arterial pressure.

10. **A review on post-exercise hypotension in hypertensive individuals**

Paulo Gomes Anunciação; Marcos Doederlein Polito Universidade Estadual de Londrina, Londrina, PR – Brasil

"Apparently, aerobic exercises promote a greater and longer reduction in BP levels than resistance exercises. However, further studies applying resistance exercise in hypertensive individuals are necessary. There is not one prescription model for weight-training exercise that can promote greater reductions in the blood pressure values of hypertensive individuals. However, considering the individuals' safety, the exercise intensity should be around 50% of 1MR, with a minimum of one-minute intervals (between sets and exercises), using especially the great muscle groups. Moreover, long series of exercises that leads to exhaustion should be avoided, as they can induce greater BP increases."

"In most studies, the prescription of aerobic activities ranged from 50% to 60% of the $VO_{2max.}$ performed continuously during 30 to 45 minutes. It is significant that there are still findings that conflict relative to the best intensity and duration of this modality of exercise."

11. **Cardiopulmonary exercise testing in patients with pulmonary arterial hypertension: an evidence-based review**, Arena R, Lavie CJ, Milani RV, Myers J, Guazzi M.

Currently, CPX is not widely utilized in patients with PH. Although more research is required in a number of areas, the present evidence-based review indicates this exercise testing technique may provide valuable information in the PH population

12. By Benjamin Moorehead, MD WVU Department of Orthopaedics Member AMSSM ,

"In most instances exercise including high intensity training and competition is acceptable and even beneficial to blood pressure, you should discuss the role of exercise and training with your physician to determine not only what level of training is safe for you, but also so that your physician can choose the best medications to effectively treat the hypertension without having a deleterious effect on your training."

13. Low-intensity exercise training decreases cardiac output and hypertension in spontaneously hypertensive rats ,Acácio Salvador Véras-Silva, Katt Coelho Mattos, Nilo Sérgio Gava, Patricia Chakur Brum, Carlos Eduardo Negrão, and Eduardo Moacyr Krieger,,+ Author Affiliations,[1] Hypertension Unit, Heart Institute, Faculty of Medicine, and Exercise Physiology Laboratory, Physical Education and Sports School, University of São Paulo, São Paulo, Brazil 05403–000 Submitted 28 April 1997. accepted in final form 6 August 1997.

"conclusion, low-intensity exercise training decreases heart rate and cardiac output and, in consequence, attenuates hypertension in SHR. In contrast, high-intensity exercise training neither decreases heart rate and cardiac output nor attenuates high arterial blood pressure in SHR."

14, United States Sports Academy America's Sports University®The Sport Digest - ISSN: 1558-6448, Reducing High Blood Pressure through Exercise Submitted by: Sherldine Tomlinson, M.Sc., Department of Sport and Exercise Science, Health Science of Staffordshire University, England.

"The integration of a regular exercise program, including the F.I.T.T. principle with lifestyle modifications, provides many benefits to hypertensive patients which extend beyond a reduction in blood pressure."

"F.I.T.T- Means

Frequency - Four or more days per week

Intensity - Low to moderate

Time - 30-60 minutes

Type - Dynamic exercise (walking, jogging, cycling, non-competitive swimming)."

15, Exercise changes regional vascular control by commissural NTS in spontaneously hypertensive rats Cristiana A. Ogihara[1], Gerhardus H. M.

Schoorlemmer[1], Adriana C. Levada[2], Tania C. Pithon-Curi[2], Rui Curi[2], Oswaldo Ubriaco Lopes[1], Eduardo Colombari[1],[3], and Monica A. Sato[3].

"conclusion, our findings suggest the low-intensity exercise can induce changes on commNTS neurons, and the GABAergic inhibition of this subnucleus of the NTS is important for the enhanced hindlimb vasodilatation either in exercised SHR or WKY rats. This effect seems to be greater in WKY than in SHR rats."

16, Relationship of Running Intensity to Hypertension, Hypercholesterolemia, and Diabetes Paul T. Williams Authors and Disclosures , Posted: 10/28/2008; Medicine and Science in Sports and Exercise®. 2008;40(10):1740-1748. © 2008 American College of Sports Medicine.

"Exercise dose, intensity, and cardiorespiratory fitness may affect these conditions through both common and independent mechanisms."

17, Enhancement of Vasorelaxation in Hypertension following High-Intensity Exercise Ai-Lun Yang1, Chia-Wen Lo1, Jen-Ting Lee2, and Chia-Ting Su3 .1*Graduate Institute of Exercise Science, Taipei Physical Education College, Taipei*2*Department of Physical Therapy, College of Medicine, National Cheng Kung University, Tainan and* 3*Department of*

Occupational Therapy, College of Medicine, Fu Jen Catholic University,Taipei, Taiwan, Republic of China,

“In conclusion, our study demonstrated that the high-intensity exercise acutely enhanced vasorelaxant responses to insulin and IGF-1 in the endotheliumdependent manner, which was associated with the less superoxide production. Our findings provided parts of theoretical base for the improvements of hypertension-induced vascular impairments through the exercise intervention. Clinically, the high intensity of exercise intervention might be suggested and considered as one of therapeutic agents to ameliorate cardiovascular function in patients with hypertension. “

STATEMENT OF THE STUDY

AIM AND NEED FOR THE STUDY .

The aim of this study was to investigate whether the high intensity aerobic exercise on blood pressure during cycle ergo meter, previous many study demonstrate that mild to moderate intensity is having good result of bringing post exercise hypotension for mild to moderate hypertension patient.

NEED FOR THE STUDY:

It is proved that Endurance exercise training lowers BP between 5 and 10 mmHg in those with HTN with the greatest reductions seen in those with the highest preexercise BP. Although studies are limited in number and many lack adequate controls, moderate intensity aerobic exercise is professed to be at least as effective as vigorous intensity exercise in eliciting this response.

Isolated aerobic exercise sessions produce immediate
decreases in BP that can persist for 22 h after exercise. These BP reductions below control levels following acute exercise have been named, post exercise hypotension (PEH). The immediacy by which PEH occurs suggests some if not all of the BP benefit attributed to endurance

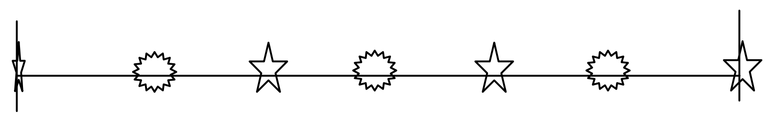
exercise training may actually be an acute phenomenon related to recent exercise. The reductions in BP resulting from isolated exercise sessions as with those produced by long term exercise training are greatest in people with the highest

Pre-exercise Blood pressure values. Preliminary evidence indicates PEH may be a low intensity threshold event, meaning the BP reductions occur after low levels of physical exertion. The present study examined the influence of high intensity exercise on PEH. Because PEH appears to be a low intensity threshold event, I tried to show the effectiveness of high intensity endurance exercise in eliciting PEH in men with stage 1Hypertension.

DESIGN AND METHODOLOGY

RESEARCH DESIGN

The study was quasi experimental in nature.



1 session of training for 3 days

Pre test BP Post test BP

Pre test and post test scores were recorded for, Ambulatory blood pressure monitor and analysed.

CRITERIA FOR SELECTION

Inclusion criteria

1. Subjects with age group of 25-45 years
2. Male subjects only
3. Sedentary life style no participation in a regular exercise programme or intentional activities beyond normal daily habits, within the previous 12 months
4. All the patients were in clinically stable and have undergone medical examination excluding cardiovascular, hormonal and orthopaedic pathologies

5. Basal physiological characteristics of participants

   Weight (kg)**82.4+-13.9**

   Body Mass Index (kg·m-2) 24.24 (1.73)

   Systolic Blood Pressure (mm Hg) 129.6+-19.4

   Diastolic Blood Pressure (mm Hg) 69.0+-10.2

Exclusion criteria

1. Other age group
2. Known cardiac, pulmonary, neurological or hormonal problems
3. Smokers
4. Alcoholic with in 12 months

POPULATION

All the patients who fulfilled the selection criteria were taken as the population for the study.

SAMPLE SIZE AND METHOD OF SELECTION

Twenty samples from the population were selected using simple random sampling method.

VARIABLES

- Independent variable: Type of exercise –high intensity exercise in cycle ergo meter, age, baseline and orientation BP, Body
  Mass Index (BMI), waist circumference, and VO2max.
- Dependant variable : Systolic blood pressure and Diastolic blood pressure.

VALIDITY AND RELIABILITY OF THE TOOLS USED

- To calculate *exercise intensity* of the Karvonen's formula (1957). *Target HR = [(220 – age – restingHR) × exercise intensity] + resting HR.*
- Ambulatory blood pressures monitor its "white-coat hypertension." Will help the patient to find the need for emergency, and also it will help After 24 hours of monitoring,
- Borg scale is a valid and reliable tool to measure RPE that has been found to closely correlate with relative exercise intensity measured by VO2max (Robertson, 1982).

SETTING:

The study was conducted multispecialty arokya gym

• Mode: Dynamic cardio respiratory exercise;

• Frequency: 1 session

• Duration: 20–60 minutes;

• Intensity: 70% of maximal physical work capacity.

METHODOLOGY

A pilot study was conducted prior to the main study with subjects using maximal cycle stress test to observe the feasibility of study.

After this, samples of subjects were selected using simple random sampling method from the population.

All the participants were explained about the purpose and procedure of study and written consent was obtained from them before being included in the study.

Six minutes walk test was used to measure the exercise tolerance prior to the study. The patients were asked to walk on a hard surface for a period of six minutes as fast as he could. The distance covered by the patient was measured.

Modified Borg scale was used to measure the dyspnea patients were clearly instructed the 0 is the point where there was nothing at all and 10 is the point where there was the maximal dyspnea that the patients had experienced the patients themselves were asked to mark on this scale for their level of dyspnea.

PROCEDURE

Interview Subject

- Ask subject:
    - If they have been tested before
    - medications and drugs: medications that affect heart rate will render test invalid
    - Musculoskeletal limitations and recent injuries
    - Present physical condition (cold, infections)
    - Time of last meal or snack
- Explain purpose of stress test:
    - Predicts cardiorespiratory fitness
    - Customize design of exercise prescriptions
    - Evaluate the effectiveness of exercise program
    - Monitors heart rate and blood pressure responses
- Explain procedures of test:
    - Explain test only takes client just beyond 75% of predicted maximum heart rate
    - Stop the test if you feel faint, dizzy, or short of breath
    - They are free to stop test for ANY reason

- Subject's responsibility:
- Ride at 50 rpm
- Give tester a RPE when asked (1-10)
- Keep going until about 75-85% of heart rate max (70% of heart rate reserve)
- Tester's responsibility:
- Monitor blood pressure and heart rate responses during each 3 minute stage
- Change the resistance on the bike in accordance to heart rate
- Cool down after test
- Pretest

- Write down 75% of max heart rate on test form
- Take weight
- Take height
- Resting blood pressure
- Resting heart rate
- Adjust seat height and record for future tests

  - knee is almost straight (5°) in bottom stroke with ankle in neutral position
  - consider subject may sink into seat within the first few minutes

        - test results may be inaccurately low if seat is set too low
        - pedaling position should be comfortable for subject

    - Set metronome at 50 bpm
    - Subject practices pace during warm-up
- Test
    - Record blood pressure, heart rate, RPE, and workload for each stage
    - See Workload Guides (appendix 1)
    - Tension may slip on a mechanically braked cycle and may require attention between workloads
    - See samples below
- Post test
    - Cool down at work rate equivalent to first stage or lower
        - Tester continues to monitor heart rate, blood pressure, signs, and symptoms
    - Plug numbers in computer or graph heart rates and calculate predicted functional capacity
        - Stage A is second to last stage
        - Stage B is last stage completed
- Both heart rate measurements must be between 110 bpm and 85% of the age predicted heart rate
- Place information in client file.

- P*rior* to the study all 20 clint"s sistolic and diasdolic blood pressure where monitored during 10 waking hours of 1 day during their activities of daily life and where recorted in a pre test assessment form.

After the pre test assessment all the 20 clients were subjected to 20–60 minutes, 70% of maximal physical work capacity, cycle ergometer. Each subject wore a 24-hour ambulatory blood pressure monitor at the same time of day for 10 consecutive hours on 3 different days. To calculate the exercise intensity heart rates we use the Karvonen's formula (1957). Target HR = [(220 – age – resting HR) × exercise intensity] + resting HR. each individual were advised to keep their exertion level between 13-17 of Borg scale. On each of the 3 days, subjects either cycled for 30 minutes at 65% or 75% of maximum HR. followed by the subject were adviced to worn electronic blood pressure monitor for next 13 hours to monitor the BP for every one hour. It was recorded in a sheet provided to them and was submitted on the next day of exercise. Before the beginning of the session, I assign the program for each phase (i.e. warm-up, exercise and cool-down) by calculating the duration and the upper and lower values for working HR which is specific for each individual. This program allowed participants to keep HR in the assigned range by managing just one parameter (i.e. workload) instead of two (i.e. speed and workload).

During each day systolic and diastolic pressure where monitored by those clint's for the next 10 working hours during there activities of daily life. blood pressure where recorded one each hour and where subjected to analysis.

The T-Test:

The t-test assesses whether the means of two groups are *statistically* different from each other. This analysis is appropriate whenever you want to compare the means of two groups, and especially appropriate as the analysis for the posttest-only two-group randomized experimental design.

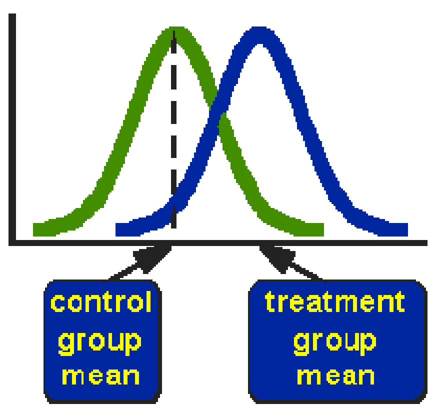


Figure 1. Idealized distributions for treated and comparison group posttest values.

Figure 1 shows the distributions for the treated (blue) and control (green) groups in a study. Actually, the figure shows the idealized distribution -- the actual distribution would usually be depicted with a histogram or bar graph. The figure indicates where the control and treatment group means are located. The question the t-test addresses is whether the means are statistically different.

What does it mean to say that the averages for two groups are statistically different? Consider the three situations shown in Figure 2. The first thing to notice about the three situations is that ***the difference between the means is the same in all three***. But, you should also notice that the three situations don't look the same -- they tell very different stories. The top example shows a case with moderate variability of scores within each group. The second situation shows the high variability case. the third shows the case with low variability. Clearly, we would conclude that the two groups appear most different or distinct in the bottom or low-variability case. Why? Because there is relatively little overlap between the two bell-shaped curves. In the high variability case, the group difference appears least striking because the two bell-shaped distributions overlap so much.

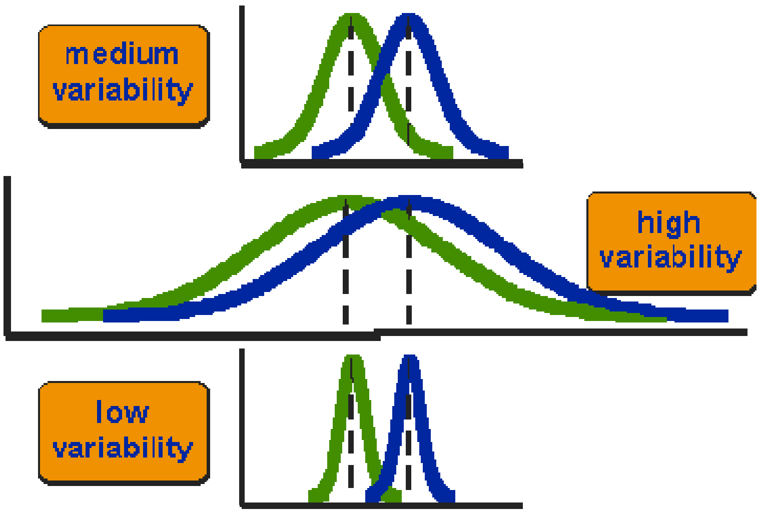


Figure 2. Three scenarios for differences between means.

This leads us to a very important conclusion: when we are looking at the differences between scores for two groups, we have to judge the difference between their means relative to the spread or variability of their scores. The t-test does just this.

Statistical Analysis of the t-test:

The formula for the t-test is a ratio. The top part of the ratio is just the difference between the two means or averages. The bottom part is a measure of the variability or dispersion of the scores. This formula is essentially another example of the signal-to-noise metaphor in research: the difference between the means is the signal that, in this case, we think our program or treatment introduced into the data; the bottom part of the formula is a measure of variability that is essentially noise that may make it harder to see the group difference. Figure 3 shows the formula for the t-test and how the numerator and denominator are related to the distributions.

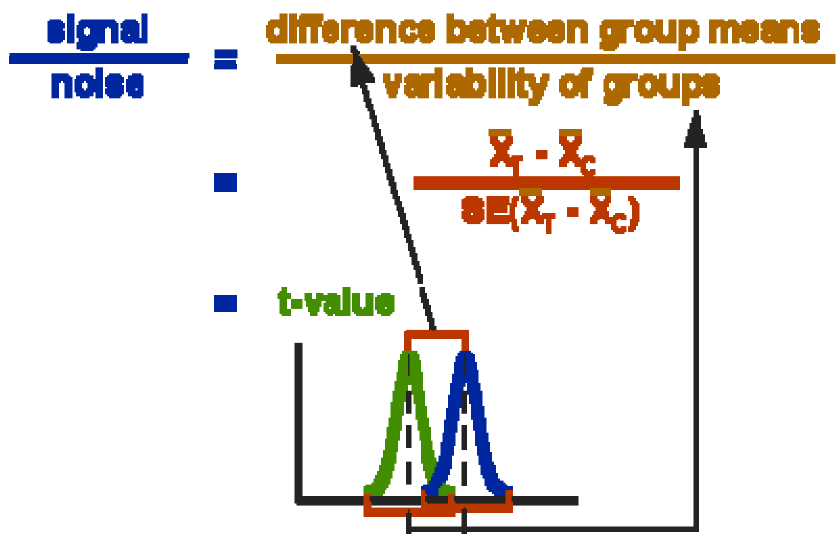


Figure 3. Formula for the t-test.

The top part of the formula is easy to compute -- just find the difference between the means. The bottom part is called the **standard error of the difference**. To compute it, we take the variance for each group and divide it by the number of people in that group. We add these two values and then take their square root. The specific formula is given in Figure 4:

$$SE(\bar{X}_T - \bar{X}_C) = \sqrt{\frac{var_T}{n_T} + \frac{var_C}{n_C}}$$

Figure 4. Formula for the Standard error of the difference between the means.

Remember, that the variance is simply the square of the standard deviation.The final formula for the t-test is shown in Figure 5:

$$t = \frac{\bar{X}_T - \bar{X}_C}{\sqrt{\frac{var_T}{n_T} + \frac{var_C}{n_C}}}$$

Figure 5. Formula for the t-test.

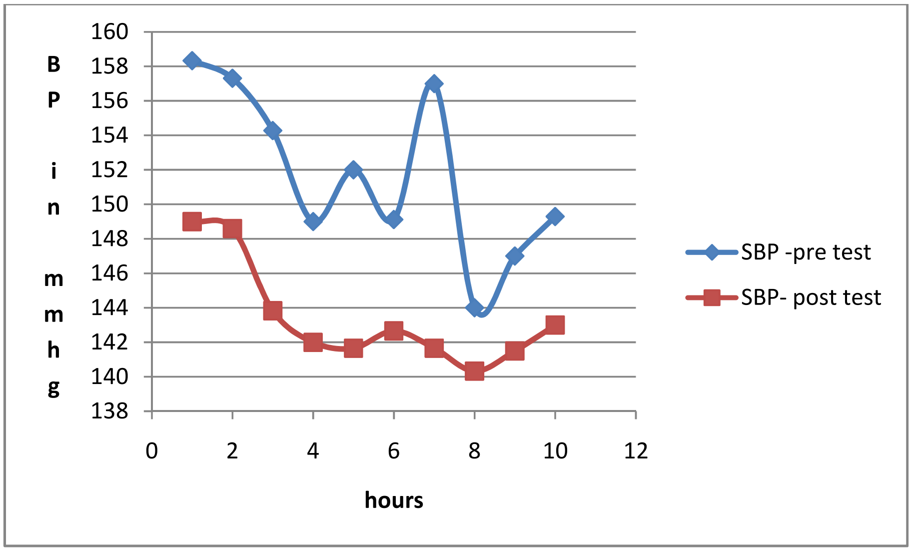
The t-value will be positive if the first mean is larger than the second and negative if it is smaller. Once you compute the t-value you have to look it up in a table of significance to test whether the ratio is large enough to say that the difference between the groups is not likely to have been a chance finding. To test the significance, you need to set a risk level (called the alpha level). In most social research, the "rule of thumb" is to set the alpha level at .05. This means that five times out of a hundred you would find a statistically significant difference between the means even if there was none (i.e., by "chance"). You also need to determine the degrees of freedom (df) for the test. In the t-test, the degrees of freedom is the sum of the persons in both groups minus 2. Given the alpha level, the df, and the t-value, you can look the t-value up in a standard table of significance (available as an appendix in the back of most statistics texts) to determine whether the t-value is large enough to be significant. If it is, you can conclude that the difference between the means for the two groups is different (even given the variability). Fortunately, statistical computer programs routinely print the significance test results and save you the trouble of looking them up in a table.

OBSERVATION AND ANALYSIS

The collected data were analyzed using paired t test to test the hypothesis and graph where blotted for systolic and diastolic blood pressure to show **correlation between pre test and post test systolic and diastolic blood pressure** .

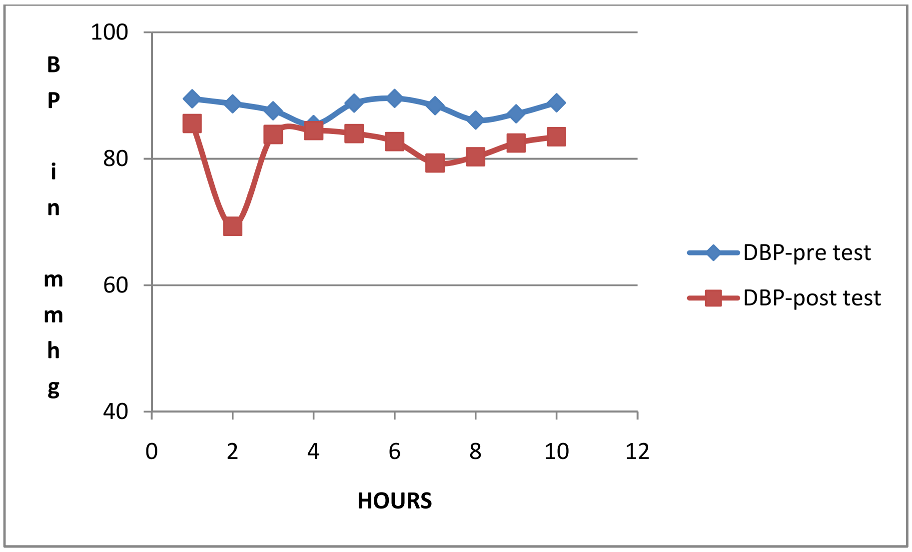
Graph -1

Showing pre and post test systolic blood pressure

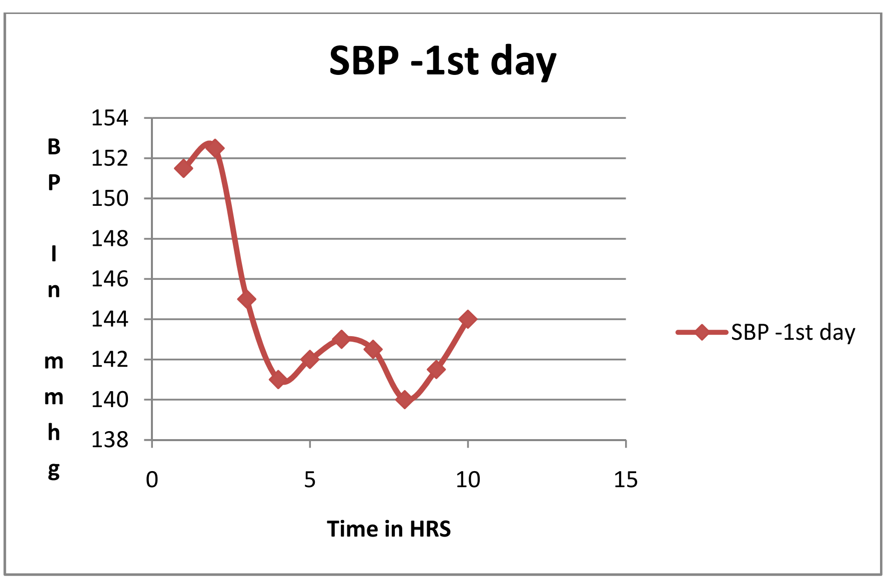


Graph 2

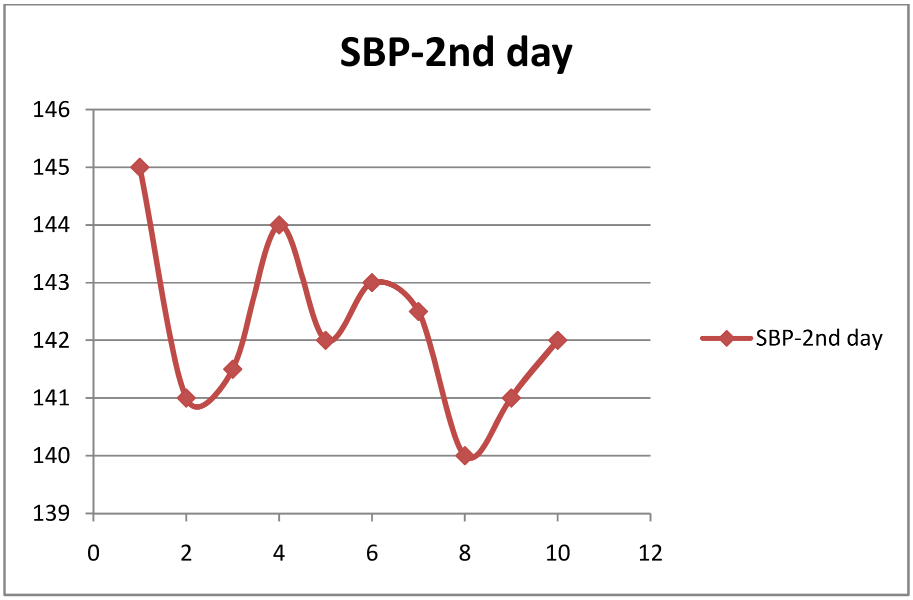
Showing pre and post test diastolic blood pressure



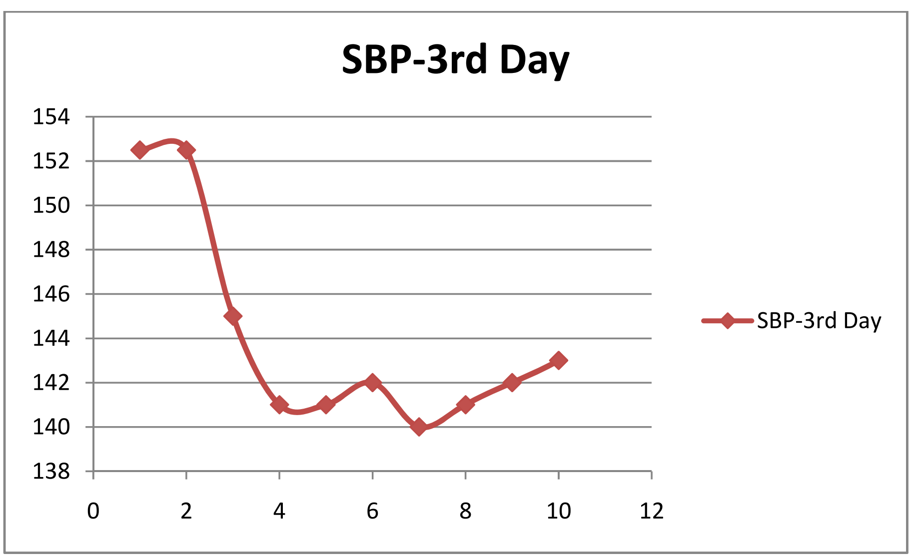
Graph-3



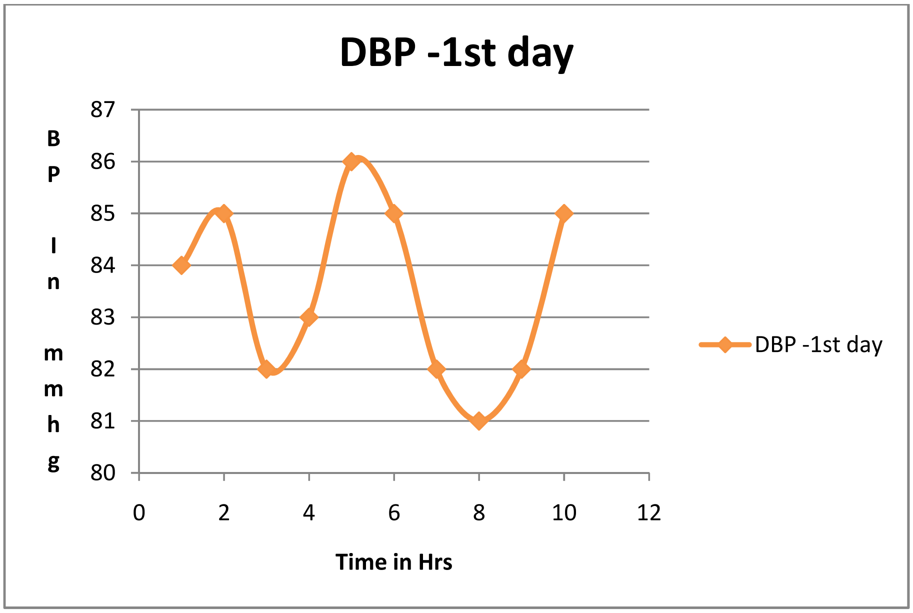
Graph-4



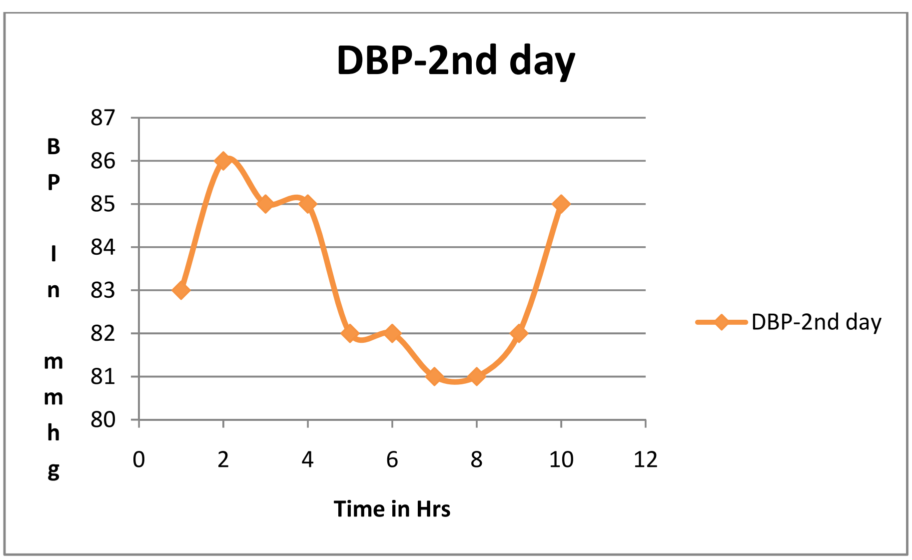
Graph-5



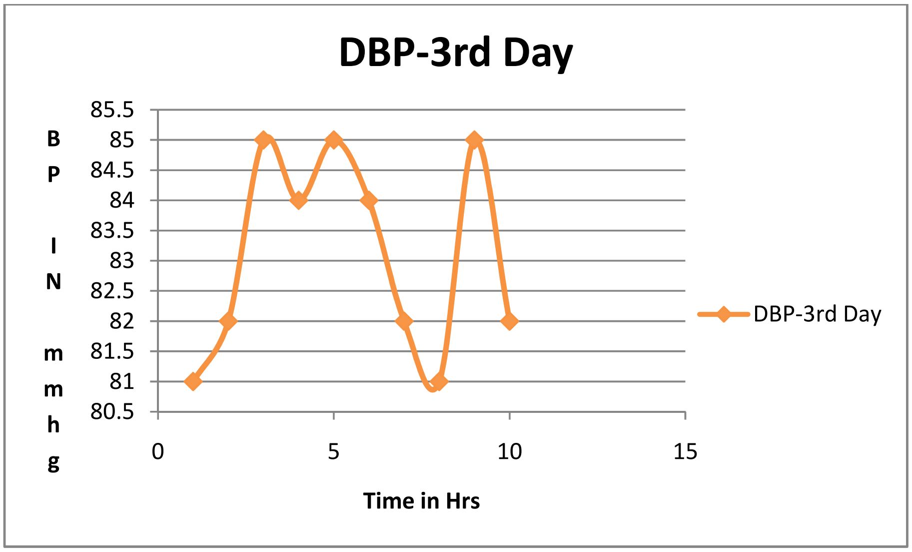
Graph-6



Graph-7



Graph-8



DBP-3rd Day
B P I N mmhg
85.5
85
84.5
84
83.5
83
82.5
82
81.5
81
80.5
0
5
10
15
Time in Hrs
DBP-3rd Day

STATISTICAL VALUE:

t – Test for SBP

	Variable 1	*Variable 2*
Mean	151.733	143.424
Variance	23.48767	8.926316
Observations	10	10
Pooled Variance	16.20699	
Hypothesized Mean Difference	0	
df	18	
t Stat	4.615115	
P(T<=t) one-tail	0.000107	
t Critical one-tail	1.734064	
P(T<=t) two-tail	0.000215	
t Critical two-tail	2.100922	

t – Test for DBP

	Variable 1	*Variable 2*
Mean	88.006	81.564
Variance	1.993516	22.00554
Observations	10	10
Pooled Variance	11.99953	
Hypothesized Mean Difference	0	
Df	18	
t Stat	4.158375	
P(T<=t) one-tail	0.000295	
t Critical one-tail	1.734064	
P(T<=t) two-tail	0.00059	
t Critical two-tail	2.100922	

Average score of SBP and DBP during pre and post test during each hr of 10 hrs

S N	Pretest Average of		Posttest Average of	
	SBP	DBP	SBP	DBP
1st Hr	158.33	89.5	149	85.6
2nd Hr	157.31	88.7	148.6	69.33
3rd Hr	154.28	87.6	143.83	83.86
4th Hr	149	85.4	142	84.46
5th Hr	152	88.8	141.66	84
6th Hr	149.12	89.56	142.66	82.73
7th Hr	157	88.4	141.66	79.33

8th Hr	144	86.12	140.33	80.33
9th Hr	147	87.12	141.5	82.5
10th Hr	149.29	88.86	143	83.5

RESULTS AND DISCUSSION

RESULTS

The data was subjected to analysis and the following results were obtained.

By analysing the the graph one and two there was a significant reduction in systolic blood pressure and diastolic blood pressure between pre and post group so there is an exercise induced hypotension is evitent by calculating the averages of systalic blood pressure of per test and post test result it is using t test two sample affuming equal variance of the t calculated value (2.1009) is smaller than t statistical value (4.6151).

When calculating the diastolic blood pressure value the t calculated value (2.1009) is with in t statistical value (4.1583) so ther is a significant changes between systolic and diastolic blood pressers of pre and post test results . so we can reject the nall hypothesis,Ther is a main reduction of systolic blood pressure 8.309 mm hg between pre and post test and there is a reduction of diastolic blood pressure of 6.44mm hg following high intensity exercise.

High intensity exercise in cycle ergo meter shows reduced post exercise Blood Pressure responses of mild to moderate hypertensive patient.

There was a changes in Blood Pressure followed by High intensity exercise in cycle ergo meter on each day. So we can use high intensity exercise as an adjunct treatment to reduce the blood pressure in mild to moderate hypertension response.

DISCUSSION

Since exercise intensity and volume plays a role in hemodynamic, thermoregulatory and neural responses during exercise (UMPIERRE et al., 2007; WILKINS et al., 2004), it is expect that different exercise intensities and volume would determine distinct postexercise blood pressure responses. However, this was not the case in the present study, in which exercise performed at intensity 60-75 % of HRR provoked hypotensive response during the recovery period. Exercise training may were provoke changes in vasodilator capacity (MARTIN et al., 1991) and regulation of arterial pressure (PESCATELLO et al., 2004) which may influence the recovery blood pressure. Also, Mediano et al. (2005) studied older hypertensive humans, while we investigated young normotensive humans, It is well understood that older and hypertension subjects have vascular musculature alterations and decreased aroreceptor sensitivity (PESCATELLO et al., 2004; EBERT et al., 1992) which may modify postexercise hemodynamic responses. Halliwil et al. (1996) have shown that vascular responsiveness to a-adrenergic stimulation is blunted after acute exercise. This response alone would facilitate vasodilatation and reductions in peripheral resistance. Thus the final outcome of this mechanism is a reduction in post-exercise blood pressure. Moreover, the vasodilatory response, the decrease in blood volume, the release of nitric oxide, prostaglandins, adenosine, and ATP augmented during exercise and would also facilitate peripheral vasodilatation after acute exercise (MACDONALD, 2002; PESCATELLO et al., 2004; SANG et al., 2009), and may play a role in the fall of post-exercise blood pressure. There is evidence that the hypotensive response lasts up to 17 hours following endurance exercise (PESCATELLO et al., 2004; JONES et al., 2008). it is apparent from our study is that low intensity exercise is a sufficient stimulus to evoke the neural and vascular Faraji et al.: Resistance exercise and hypotensive responses changes that have been postulated to result in PEH.

Acute Moderate-Intensity Exercise Induces Vasodilation Through an Increase in Nitric Oxide Bioavailiability in Humans[*] (Chikara Goto[1], Kenji Nishioka[1], Takashi Umemura[1], Daisuke Jitsuiki[1], Akihiro Sakagutchi[3], Mitsutoshi Kawamura[3], Kazuaki Chayama[2], Masao Yoshizumi[1] and Yukihito Higashi) ,

After exercise began, moderate-intensity exercise, but not mild-intensity exercise, promptly increased FBF(forearm blood flow) from 2.8 ± 1.1 mL/min/100 mL to a plateau at 5.4 ± 1.6 mL/min/100 mL at 5 min ($P < .01$) and increased mean arterial pressure from 84.7 ± 11.8 mm Hg to a plateau at 125.7 ± 14.3 mm Hg at 5 min ($P < .01$). Moderate-intensity exercise decreased forearm vascular resistance (FVR) from 29.2 ± 5.4 to 16.8 ± 3.2 mm Hg/mL/min/100 mL tissue ($P < .01$). The administration of N^G-monomethyl-L-arginine, an NO synthase inhibitor, abolished moderate exercise–induced augmentation of vasodilation. Although we were not able to measure FBF during high-intensity exercise because of large body motion, high-intensity exercise markedly increased mean arterial pressure from 82.6 ± 12.2 to 146.8 ± 19.8 mm Hg. High-intensity exercise, but not mild-intensity or moderate-intensity exercise, increased plasma concentration of 8-isoprostane, an index of oxidative stress, from 24.1 ± 10.8 to 40.2 ± 16.7 pg/mL ($P < .05$) at 10 min after the end of exercise. These findings suggest that acute moderate-intensity exercise induces vasodilation through an increase in NO bioavailability in humans and that high-intensity exercise increases oxidative stress.

While the current research base is not strong enough to draw a firm conclusion, studies published to date suggest that moderateintensity activity (40 to 75 percent of the maximum oxygen uptake) may be most effective in lowering blood pressure. The current intensity recommendation for hypertensive individuals is to use low to moderate intensity exercise. Regular physical activity has also been shown to be effective in reducing the relative risk of developing hypertension by 19 to 30 percent. Similarly, a low cardio-respiratory fitness in middle age is associated with a 50 percent greater risk of developing hypertension. Results have been similar in both men and women. Prior to starting a new exercise program, individuals with known hypertension should obtain clearance from their primary care physician.

It is important to remember that the key to a successful exercise program is consistency over time. Don't try to conquer the world the first time out. Be patient, start slowly and gradually increase frequency and duration. During the planning phase carefully consider what barriers might stand in the way of consistency; then develop strategies and accountabilities to assist in eliminating these barriers.

CONCLUSION

In fact, when sedentary people monitor their physical exercise intensity with predetermined Heart Rate could elicit undesired physiological responses and may end with up fatal incidence.

When a sedentary person under going hygh intensity workout exercises on cycle ergonometer, without a specific stress test to provide the maximal HR and monitor the blood pressure response it would be safer and healthier to monitor him/her according to the RPE scale, assigning a task of working at an exercise intensity lower than 12, instead of using the indirectly determined HR method.

Limitations of this study:

The study has been limited to adult normal population and the tools used to measure parameters are palpation technique for pulse rate and sphygmomanometer and stethoscope for BP measurement. The main study limitations are the small sample size.

RECOMMENDATIONS FOR FURTHER STUDY

However, further research is needed before we can be completely sure that exercise practice under the high intensity method elicits a unsafe cardiac response to some people with pathological conditions and also in normal sedentary people.

- A similar study can be conducted for other low intensity exercises.
- A similar study can be conducted for sedentary normal tensive people.
- A similar study can be conducted for sedentary adults between Elliptical ergometer and stationary bikes exercises.
- A similar study can be conducted between smokers and non smokers to compare the Blood pressure changes.
- We shall compare RPE with Blood pressure for different exercise.
- A similar study can be conducted for children with neuromuscular diseases if medically safe.

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APPENDICES

APPENDIX - I

MASTER CHART:

Sn	Day 1		Day 2		Day 3	
	SBP	DBP	SBP	DBP	SBP	DBP
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

APPENDIX -II

INFORMED CONSULT FORM

TILTLE: EFFECT OF HIGH INTENSITY EXERCISE IN

REDUSING THE BLOOD PRESSURE

IN MILD TO MODERATE HYPERTESIVE PATIENT.

FULL NAME OF THE PATIENT:---

The nature and purpose of research to object describe and explain to me.

[I].I understand it and agree to take part in the same,

[II].I understand ,I may not directly benefit by taking part in the study,

[III].I understand ,while information gained the study may be published , I will Not be indentified and information will be confidential ,

[IV].I understand ,I can withdraw from the study at any stage,

[V]. I'am aware I should repaint a copy of the consult form when completed,

[VI].I understand that the privacy and confidentiality of any information I will provide will be safeguarded.

Signature of the subject