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Original Research Article

Effects of Home Based Graduated Aerobic Exercise Programme on Cardiovascular Disease Risk Factors in Sedentary Workers

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ABSTRACT

Background: Peoples today tend to be more sedentary than in past eras for a variety of reasons. Modern technology has replaced many of the physically exerting jobs of the past, and in today's market, most wage-earners are sitting at a desk for the majority of their work days.
Cardiovascular Diseases(CVD), type 2 diabetes, metabolic syndrome & cancer are the leader killer in westernized society and are increasing dramatically in developing countriesz.10 Sedentary lifestyle and Obesity are the important lifestyle related public health problems in the world. Despite the positive impact of physical fitness on CVD people become more sedentary in both occupation and leisure time and the burden of the CVD have increased in developing country. It has been observed that sedentary jobs have less physically active in their workplace. Physical inactivity is a major risk factor for CVD.
Objective: To investigate the efficacy of home based graduated aerobic exercise training programme on modifying CVD risk factor in sedentary workers.
Methodology: 40 (Male-24, Female-16, Ages between 30-50 years) Participants from Rajeev Gandhi college & Hospital account department, Medical record room, Purchase, stores and personnel department who spend multiple hours per day seated for their work. All subjects are defined sedentary from self reported physical activity levels of less than two hours organized physical activity per week. Subjects who are physically fit for aerobic exercises selected on the basis of PAR-Q screening. All subjects were evaluated for initial baseline measurements of dependent variables i.e. Resting Heart rate, Systolic blood pressure, Diastolic blood pressure and Body mass Index. Subjects were asked to walk on treadmill using progressive walk test (Modified Bruce Protocol) to volitional fatigue to evaluate Peak heart rate and Time of exhaustion. RPE scale was used for prescription intensity of aerobic exercise at home. On the basis of progressive walk test on treadmill subjects were given exercise program at home for a period of 12 weeks. All the outcomes (parameters) were reassessed at each 4 week interval that is baseline (preintervention) assessment, 4th week assessment, 8th week assessment and 12th week assessment.
Results: For 12th week of assessment, After applying paired 't' test there is highly significant ($p<0.01$) reduction in resting heart rate, peak heart rate, systolic blood pressure from its baseline value. There is significant ($p <0.05$) reduction in diastolic blood pressure and body mass index from its baseline value. There is highly significantly improvement ($p<0.01$) in time to exhaustion from its baseline value.
Conclusion: Our study provides randomized control trial data demonstrating that home based graduated aerobic exercise increases physical activity for healthy individuals and improves exercise capacity with a concomitant cardio-protective benefit.

Key Words: Coronary Artery Disease, Physical Activity, Risk Factor, aerobic exercise.

INTRODUCTION

Peoples today tend to be more sedentary than in past eras for a variety of reasons. Modern technology has replaced many of the physically exerting jobs of the past, and in today's market, most wage-

earners are sitting at a desk for the majority of their work days.

In the 1990 Ischemic Heart Disease (IHD) was the leading cause of mortality and the fifth leading cause of morbidity in the world. At end of 20th century more than 60% of global burden of IHD already occur in the developing country. [1] The burden of Cardiovascular Diseases (CVD) has increased in developing country. In 1990 46.7% of CVD death in developing countries occurs, before the age of 70 years compare with 26.5% in the developed countries. [2] Men are more likely to have CVD at an early age than women. [2] Recent studies have highlighted the importance of regular physical activity in the decreasing risk of CVD. Physical activity includes both aerobic and resistance training. Aerobic exercise training is an augmentation of the energy capacity of the muscle by means of an exercise programme. [3]

The relative risk of CVD has been estimated to be about twofold higher for inactive subjects compared with physical active person.

Despite the positive impact of physical fitness on CVD, developed and developing societies have become more sedentary in both occupation and leisure time.

Mortality data were obtained from Register General of India in 1998 the annual death rate for India was 840/1, 00,000 population and cardiovascular disease contribute to 27% of these death and its crude rate was 227/1, 00,000 population. [4] The morbidity and mortality related to CVD is may be preventable if risk factor robust and sustained action against risk factor is taken at an individual community and population (WHO). As much as 70% CVD can be preventable or delayed with dietary choices, lifestyle modifications and physical activity like brisk walking, jogging(aerobic exercise) for an hour. [5]

To prevent the rise in BMI and sedentary activity an effective educational programme is needed along with working on reducing in the illiteracy in population may help in better fitness.

Need For the Study

It has been observed that workers in account department, medical record room, store department and personnel department have a sitting job. They are less physically active in their workplace. Physical inactivity is a major risk factor for CVD. [6]

The study undertaken to take in mind that CVD may be preventable if avoid the occurrence of major risk factor by doing aerobic exercises every day.

Aims and Objective

To investigate the efficacy of home based graduated aerobic exercise training programme on modifying CVD risk factor in sedentary workers.

RESEARCH DESIGN AND METHODOLOGY

Study Design- Comparative study.

Study Settings- Dept. of Physiotherapy, Rajeev Gandhi College, Bhopal.

Study Duration- Study was conducted for 9 months (Sept 2007-May 2008)

Study Population- Participants are both male and female personnel from Rajeev Gandhi College & Hospital account department, Medical record room, Purchase, stores and personnel department who spend multiple hours per day seated for their work. All subjects are defined sedentary from self reported physical activity levels of less than two hours organized physical activity per week.

Sample Size-40 (Male-24, Female-16).

Inclusion Criteria

- Ages between 30-50 years
- Subject who are sedentary from work related activity
- Subject who are physically fit for aerobic exercises on the basis on PAR-Q screening.
- Subject who satisfies 12 min walk test

Exclusion Criteria

- Known cardiac disease
- Uncontrolled hypertension

- Thyroid disease
- Diabetes
- Mental illness
- Immune or endocrine abnormality
- Contraindication to exercise on the basis of exercise stress test

METHOD OF SELECTION AND PROCEDURE

Explain general guideline about the study to all participants. All participants were request to complete a medical screening questionnaire (PAR-Q) before entering the study. All subjects are defined sedentary from self reported physical activity levels of less than two hours organized physical activity per week. Godin Leisure Time Questionnaire was provided to all participants.

To test aerobic fitness level 12 min walk/run test is performed by each participant. After fulfilling the inclusion and exclusion criteria, after medical screening questionnaire 40 participants were assigned into study. Then the subjects were taught stretching exercise and aerobic exercises.

All participants assigned a consent form to participate in study. Ethical committee of Rajeev Gandhi College & Hospital had approved the protocol of present study.

Baseline Evaluation and Measurements

Before starting exercise programme all subjects were evaluated for initial baseline measurements of dependent variables that is Heart rate, Systolic blood pressure, Diastolic blood pressure, Body mass index, cardiopulmonary outcomes by measuring Peak Heart Rate and Time to Exhaustion (TE)

Exercise Program

On the basis of progressive walk test on treadmill subjects were given exercise program at home as follows.

RPE scale was used for prescription intensity of aerobic exercise at home.

Week 1 to week 4

- Warm up-for 3 min
  Gentle stretching of arms overhead, Hamstring, Quadriceps and slow walking
- Aerobic exercise-
  Intensity-13 RPE
  Frequency-Four times a week
  Duration-22.5 minute
  And progressed every week by 2.5 min
- Mode of exercises-Brisk walking/light jogging
- Cool down-Slow walking for 3 minute

Week 4 to week 8

- Warm up-same as week 1-4
- Aerobic exercise-
  Intensity-Progressed 15 RPE +2.5 beats every week up to 8 week
  Frequency-Four times in a week
  Duration-30 minute
- Mode of exercise-Brisk walking/light jogging
- Cool down-same as week 1-4

Week 8-12

- Warm up-same as week 1-4
- Aerobic exercise-
  Intensity and frequency was same as 8^{th} week.
  Duration- 45 min
- Mode of exercise-Brisk walking/light jogging
- Cool down-same as week 1-4

Weekly Data Collection and Reassessment

All the outcomes (parameters) were reassessed at each 4 week interval that is baseline (preintervention) assessment, 4th week assessment, 8th week assessment and 12^{th} week assessment.

Data Analysis

All participants completed their exercise programme. Mean and standard deviation were calculated for all parameters that is resting heart rate (RHR), peak heart rate (PHR), systolic blood pressure (SBP), diastolic blood pressure (DBP), time to exhaustion (TE) and body mass index (BMI). Data were analyzed by using paired 't' test to find out the difference between

Pre and Post intervention at 4th ,8th and 12th week for all parameters .

DATA ANALYSIS AND RESULTS

TABLE-1 Mean and Standard Deviation Values of Post Intervention for all Parameters

No	PARAMETERS	POSTINTERVENTION		
		At 4th week	At 8th week	At 12th week
1	RHR	74.12 ± 4.3	72 ± 4 .14	71 ± 4
2	PHR	172.7 ± 10.85	171 ± 11.39	170 ± 11
3	SBP	123 ± 4	121 ± 3.29	119 ± 2.79
4	DBP	82 ± 5	81 ± 4.5	81 ± 4.33
5	TE	10.8 ± 1.37	13.2 ± 1.51	15.7 ± 1.31
6	BMI	27.3 ± 3.31	29.29 ± 3.33	27.05 ± 3.25

TABLE-2 Mean and Standard Deviation of their Differences from Pre and Post intervention at 4th week for all parameters

No	PARAMETERS	Mean ± SD	't' value for wk1-4 (p value)
1	RHR	2.2 ± 2.5	5.94 (<0.01) Highly significant
2	PHR	2 ± 1.6	8 (<0.01) Highly significant
3	SBP	4 ± 4.2	6.06 (<0.01) Highly significant
4	DBP	1 ± 3.4	1.89 (>0.05) Not significant
5	TE	2 ± o.8	15.39 (<0.01) Highly significant
6	BMI	0.1 ± 0.5	1.25 (>0.05) Not significant

After applying paired 't' test there is highly significant (p<0.01) reduction in resting heart rate, peak heart rate, systolic blood pressure from its baseline value.

There is no significant (p >0.05) improvement in diastolic blood pressure and body mass index from its baseline value. There is highly significantly improvement (p<0.01) in time to exhaustion from its baseline value

TABLE-3 Mean and Standard Deviation of their Differences from Pre and Post intervention at 8th week for all parameters

No	Parameters	Mean ± SD	't' value for wk1-8 (p value)
1	RHR	4.3 ± 3.1	8.77(<0.01) Highly significant
2	PHR	3 ± 2.8	6.81(<0.01) Highly significant
3	SBP	6 ± 4.5	8.45(<0.01) Highly significant
4	DBP	1 ± 3.05	2.08(<0.05) Significant
5	TE	4.2 ± 1.1	24.70(<0.01) Highly significant
6	BMI	0.05 ± 0.5	0.625(>0.05) Not significant

After applying paired 't' test there is highly significant (p<0.01) reduction in resting heart rate, peak heart rate, systolic blood pressure from its baseline value. There is significant (p <0.05) reduction in diastolic blood pressure. No significant (p>0.05) improvement found in body mass index from its baseline value. There is highly significantly improvement (p<0.01) in time to exhaustion from its baseline value.

TABLE-4 Mean and Standard Deviation of their Differences from Pre and Post intervention at 12th week for all parameters

No	Parameters	Mean ± SD	't' value for wk 1-12(p value)
1	RHR	5.8 ± 3.9	9.35(<0.01) Highly significant
2	PHR	4 ± 3.9	6.45(<0.01) Highly significant
3	SBP	7 ± 4.9	9.09(<0.01) Highly significant
4	DBP	1 ± 3.3	1.97(<0.05) Significant
5	TE	6.7 ± 1.1	39.41(<0.01) Highly significant
6	BMI	0.2 ± 0.66	2(<0.05) Significant

After applying paired 't' test there is highly significant (p<0.01) reduction in resting heart rate, peak heart rate, systolic blood pressure from its baseline value. There is significant (p <0.05) reduction in diastolic blood pressure and body mass index from its baseline value. There is highly significantly improvement (p<0.01) in time to exhaustion from its baseline value.

DISCUSSION

The aim of the study was to find out the effect of home based graduated aerobic exercise on Cardiovascular Disease Risk factors in sedentary workers. Data from study confirmed that home based graduated aerobic exercises are effective in controlling Cardiovascular Disease Risk factors.

According to ACSM the greatest conditioning occur during first 6 to 8 weeks of the exercise program. Aerobic endurance may improve as much as 3% per week during the first month, 2% per week of second month & 1% per week or less thereafter (Sharkey 1979). In order to make continued improvement, the cardio

respiratory system must be overload by adjusting the intensity & duration of the exercise to the new level of fitness. In our study we progressed from 13 RPE to 16 RPE intensity & 22 min to 30 min of duration up to 12 weeks. One can use Rate of Perceived Exertion (RPE) to prescribe & monitor exercise intensity (Birk & Birk 1987). [7,8,9] Monitoring & adjusting RPE during exercise is relatively easy & effective mean to prescribe exercises on the basis of an individual's perception of effort that can nicely coincides with % HR max, % VO2 max. RPE 13(somewhat hard) to RPE 16 (hard) approximately coincides with 50% & 80% HRR respectively (Dunbar et al.1992).Individuals learn quickly to exercise at specific RPE.

At the end of 4th week resting heart rate decreased by averaged 2bpm from its baseline value that is from 76 ± 5 to 74 bpm & at the end of 12th week it decreased by averaged 6bpm from its baseline value that is up to 71bpm .Peak heart rate reduced by 2bpm at the end of 4th week & 4bpm at the end of 12th week from its baseline value.

Heart rate decreases after aerobic exercise because exercise training creates an imbalance between the tonic activity of sympathetic accelerator and parasympathetic depressor neurons in favor of vagal dominance, a response mediated primarily by increased parasympathetic activity and small decreased in sympathetic discharge. [10,11] Training also decreases the intrinsic firing rate of sinoatrial nodal pacemaker tissue. [12]

According to ACSM's risk stratification and recommended treatment for hypertension, subject with systolic blood pressure of 130-139 mmHg & diastolic blood pressure 85-89 mmHg are called in pre hypertensive stage and these patients required lifestyle modifications .Regular aerobic exercise as preventive therapy also helps to control the tendency for blood pressure to increase over time in individuals at risk for hypertension. [9,13] Bakx JC, van den Hoogen HJ, van den Bosch WJ, et al. (2005) studied Diastolic blood pressure and weight gain predicted future risk for hypertension their findings revealed that the risk for developing hypertension was associated with baseline diastolic BP weight gain. [14]

In present study baseline mean of systolic blood pressure were 127 ± 6.25mmHg & mean of diastolic blood pressure were 82 ± 4.65 mmHg, at the end of 4th week systolic blood pressure reduced by 4 ± 4.2 mmHg and at the end of 12th week it reduced by7 ± 4.9 from its base line value that is it decreased up to 119 ± 2.7mmHg.

Diastolic blood pressure at the end of 4th week decreased by 1 ± 3.4mmHg, and decreased .by 1±3.3 mmHg at the end of 12th week that is it decreased up to 81 ± 4.3 mmHg from its baseline value. Post intervention reduction in blood pressure may be because of reduced sympathetic nervous activity with training and normalization of arteriole morphology decrease resistance to blood flow and so lower blood pressure. [15-18] and may be altered renal function facilitate the kidney elimination of sodium with subsequently reduces fluid volume and hence reduces blood pressure. [19] The 20% decrease of PRA (plasma rennin activity) supports the involvement of the renin-angiotensin system.

In present study regarding body mass index (BMI) at the end of 4th and 8th week no improvement were found in BMI. Only at the 12th week we get slight improvement in BMI. It should be consider that aim of training program was not directly target weight loss for a reduction of cardiovascular disease risk, but instead to improve physical capacity, and lowers resting heart rate, systolic blood pressure and diastolic blood pressure in absence of dietary modifications.

The present study was successful in improving maximal and sub maximal aerobic capacity as Time to exhaustion mean value at baseline was 8.9 ± 0.96 min it improved at 4th week by 2 min, at 8th week by4.2 min and at 12th week by 6.7 min from

its baseline value that is it improved up to 15.7 ± 1.3min.

Exercise training enhances the ability to sustain exceptionally high level of sub maximal ventilation. Endurance training also stabilizes body's internal milieu during sub maximal exercise consequently exercises causes less disruption in whole body hormonal and acid-base balance that could negatively affect Inspiratory muscle function. Documented training induced increase in aerobic enzyme levels and oxidative capacity of the respiratory musculature probably enhance ventilatory muscle function.

Improved fitness often neutralizes increase mortality associated with elevated blood pressure. It remains prudent to recommend regular aerobic exercise and proper diet to induce weight loss (where necessary) is a first line of defense in managing borderline hypertension.

CONCLUSION

The result of the study accept alternative hypothesis.

Present study demonstrating that home based graduated aerobic exercise increases physical activity for healthy individuals and improves exercise capacity with a concomitant cardio-protective benefit.

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