# Effect Of Aerobic Training On Functional Endurance And Job Stress Among White Collar Office Individuals- A Simple Experimental Study

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## 1.1 INTRODUCTION

Physical activity has a positive effect on health and helps us to slow down the process of aging. The aim of the study was to evaluate the possible relationship between physical fitness, physical activity and type of work during occupational activity [(1)].

Occupational stress is one of the major health hazards of workplace. It accounts for much of the physical illness experienced by millions of White Collar Workers (WCW) who do the office work including managers. Work related stress is a matter of growing concern in developing countries as it will inevitably have future negative consequences for the health and safety of workers. Furthermore increasing globalisation, unhealthy work practices and unsafe technology make stress easily become a great challenge. Further WHO believes workers who are stressed are more likely to be unhealthy [(2)].

Among factors affecting cardiovascular diseases, especially mental or work stress is a key one deteriorating or inducing the diseases. Job stress can be defined as the harmful physical and emotional responses that occur when the requirements of the job do not meet the capabilities, needs or resources of the worker [(3)]. Health related quality of life reflects a person's perception of quality of their physical and mental health over time and it is closely related to perceived burden of person's self-report of chronic diseases[(4)]. Indians of white collar office personnel with low levels of activity in their work day, have higher average BMI an indicator of obesity is the significant risk factor of reduced cardiovascular fitness [(5)].

The physical and psychological job demands are differentially distributed among white and blue collar workers. White collar workers reported higher psychological demands than physical demands .White collar workers are often associated with office work, spending most of the their working hours especially in sitting at desk and at computer or conference calls representing an employee's class with lower physical demands and higher psychological stress. The classifications of employee as physically inactive are determined by their labor activity and not during leisure time. Traditionally accountant and administrative service manager are physically inactive and require higher job stress [(6)].

The administrative workers are likely performing more cognitively demanding work tasks, potentially with expectations that are difficult to meet without enough recovery between tasks. Also the posture during sitting can influence the respiratory function .Changes in body position can alter the length of respiratory muscle, the diaphragm thereby influencing its ability to generate tension. The poor posture significantly reduces lung capacity. Changes in head posture and dysfunction of local and global muscle systems are believed to lead to changes in force – length curves, muscle imbalances and segmental instability [(14)].In exploration of office work related health issues, cardiorespiratory fitness, stress management, nutrition are most important [(6)].However worldwide 31% of office workers do not meet the recommended physical activity guidelines and interventions to increase physical activity [(7)].

Being fit or active is associated with a greater than 50% reduction in risk of cardiovascular problem. An increase in physical fitness will reduce the risk of premature death and decrease in physical fitness will increase the risk. The effects appear to be graded, such that even small improvements in physical fitness are associated with the significant reduction in risk. Modest enhancements in physical fitness in previously sedentary people have been associated with large improvements in health status. For Example people who went from unfit to fit over a 5 – year period had a reduction of 44% in the relative risk of death compared with people who remained unfit [(41)].

According to WHO, in a 24 hour day, adults aged 18 to 64 years of age should

- ✓ Do at least 150 – 300 minutes of moderate intensity of aerobic physical activity.

✓ Should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity provides health benefits and reduces the detrimental effects of high levels of sedentary behaviour on health [(8)].

The workplace offers both captive audience and an arena to promote physical activity and reduce sedentary time [(9).] Workplace intervention has also been carried out to reduce overall sitting time which is an important domain of white collar office personnel. The intervention concentrates overall physical activity and sitting time [(10)].

Cardiovascular system, composed of heart, blood vessels and blood responds predictably to the increased demands of exercise. With few expectations, the cardiovascular response to exercise is directly proportional to the skeletal muscle oxygen demands for any given rate of work, and oxygen uptake ($vo_2$ ) increases linearly with increasing rates of work.

Cardiac output at rest and during submaximal exercise is essentially unchanged following an endurance training program. At or near maximal rates of work, however, cardiac output is increased substantially upto 30 % or more. There are important differences in the responses of stroke volume and heart rate to training. After training, stroke volume is increased at rest, during submaximal exercise and during maximal exercise. Conversely, post training heart rate is decreased at rest and during submaximal exercise and is usually unchanged at maximum rates of work. The increase in stroke volume appears to be the dominant change and explains most of the changes observed in cardiac output. Several factors contribute to the increase in stroke volume following aerobic exercise training using treadmill protocol. Aerobic endurance training increases plasma volume by approximately the same percentage it increases the stroke volume. An increased plasma volume increases the volume of blood available to return to the right heart and subsequently to the left ventricle. There is also an increase in the end diastolic volume because of increased amount of blood and increased return of blood to the ventricle during exercise. This acute increase in the left ventricle's end diastolic volume stretches its walls, resulting in more elastic recoil. Long term adaptive responses include hypertrophy of cardiac muscle fibres (increase in size of each muscle fiber), this hypertrophy increases muscle mass of the ventricle, permitting greater forces to be exerted with each beat of the heart. The aerobic training also found to increase the amount of capillaries in the trained skeletal muscle, thereby allowing a greater capacity for blood flow in the active muscle. This enhanced capacity for blood flow is associated with reduction in total peripheral resistance thus left ventricle can exert a more forceful contraction against a lower resistance to flow out of the ventricle. The major changes in respiratory system from the training are an increase in the maximal rate of pulmonary ventilation which is the result of increase in both tidal volume and respiratory rate and increase in pulmonary diffusion at maximal rates of work primarily due to increase in pulmonary blood flow in the upper regions of the lung.[(43)]

Thus Aerobic exercise training improves physiological responses that have been shown to have a beneficial effect on maintaining or promoting mobility, cardiorespiratory fitness, enhances the sense of wellbeing and reduces the job stress. The components of cardiorespiratory fitness incudes lung function and cardiovascular endurance. This exercise training may constitute a valuable tool in attempting to implement more efficient therapeutic approaches that effectively improve functional capacity and quality of life in office personnel[(11)].

Cardiorespiratory fitness is an important marker of health which is an scientific statement from the American Heart Association. Cardiorespiratory fitness refers to the capacity of the circulatory and respiratory systems to supply oxygen to skeletal muscle mitochondria for energy production during physical activity. Cardiorespiratory fitness is an important marker of physical and mental health. Exercise induced improvements in cardiorespiratory fitness may be explained by structural and functional adaptation leading to a better oxygen transport system such as increased blood volume, myocardial contractibility, ventricular compliance, angiogenesis all of which lead to an increased cardiac output. According to fick principle, oxygen uptake is the product of cardiac output and arteriovenous oxygen difference. Thus $VO_2$ is dependent on cardiac function ,the ability of lungs to act as gas exchange organ, the binding of oxygen to blood that is primarily dependent on haemoglobin content, the ability of muscles to extract oxygen from the circulation for energy transfer.$VO_2$ max is the highest oxygen uptake attained during graded exercise to volitional exhaustion and it is considered as the best indicator of cardio respiratory fitness by World Health Organisation.$VO_2$ max remains the only index that integrates pulmonary, circulatory and muscular function into a single number[(12)].

There are so many laboratory and field tests are available to assess $vo_2$ max .The most common and widely used field test is 6 min walk test (6MWT). It provides a representative means of predicting aerobic fitness based on BMI and distance walked information. Timed walking tests are widely used to evaluate functional exercise performance, as they are likely to measure the ability to undertake the activities of day to day life. In 1960, balke developed a simple walk test with defined period of time which was later modified to 12 minute walk test. Since it was too exhausting 6 minute walk test was developed which is easy to administer, being tolerated and more reflective of daily activities of living. The 6 minute walk test was also found to be valuable instrument to assess progression of functional exercise capacity. The 6 MWT was originally described by

Guyatt et al that can be used to document functional outcomes .there are equations in 6 MWT using which the distance walked can be converted into measure of functional capacity (vo2 max)[14] .
Physical activity is the ability to perform occupational, recreational and daily activities without becoming unduly fatigue. Cardiopulmonary endurance/ cardiopulmonary fitness is one of the health related components which refers to the dynamic exercise performance involving large muscles for prolonged periods which depends upon functional status of cardiovascular, respiratory as well as musculoskeletal symptoms. Hence determination of cardiorespiratory fitness gives an idea of overall fitness of an individual. The widely accepted criterion measure of CRF is maximal amount of oxygen that can be utilised by the body during strenuous exercise, termed as $vo_2$ max [15].
The occupational stress among white collar individuals are measured by using perceived stress score. Perceived stress score is the thoughts or feelings that an individual has or how much stress they are under at a given point of time or over a given time period[22]
Stress may be defined as a state of threatened homeostasis, which is counteracted by adaptive process involving affective, physiological, biochemical and cognitive behavioural responses in an attempt to regain homeostasis. Stress reactions are always followed by recovery processes, the adaptive capacity to deal with one stress is ones fitness. The study found that the individuals who expend more than 3.0 kcal/kg/day in physical activity during leisure time were 78% less likely to have moderate and high perceived stress. Thus exercise neutralises the effect of psychological stressors and dampens stressor evoked increases in stress hormones [17]. Thus it has also been found that aerobic exercise training is found to reduce the job stress which can be measured by using the perceived stress scale [22.]

## MATERIALS AND METHODOLOGY

### 3.1 STUDY DESIGN:
A simple experimental study design with pre- test and post- test evaluation.

### 3.2 STUDY POPULATION:
Male white collar office individuals were selected for this study.

### 3.3 SAMPLE SIZE:
Based on the selection criteria 25 members of both gender were enrolled for this study.

### 3.4 SAMPLING TECHNIQUE:
Purposive sampling technique.

### 3.5 STUDY SETTING:
The study was conducted at the workplace .

### 3.6 STUDY DURATION:
The duration of the study was 6 months.

### 3.7 TREATMENT DURATION:
6 weeks

### 3.8SELECTION CRITERIA:
- **INCLUSION CRITERIA :**

- Age group: 35- 45 years
- Gender: male
- BMI: 25 – 29 (overweight)

- **Occupation:**
  - Personal working on computers for more than 5 hrs in a day.
- Individuals with stress score between 27 to 40 (high stress level) according to the perceived stress scale.
- Participant with $vo_2$ max ranging from 25 – 30 ml/kg/min.
- Participants who signed the informed consent form.
- Participants with work experience of more than 8 years

- **EXCLUSION CRITERIA:**

- Individuals with cardiac diseases, respiratory problems, musculoskeletal problems, neurological problems.
- Pregnant women.
- Individuals who are working less than 4 hrs in a day

- Individuals with any drug intake.

**3.10 PARAMETERS**:
6 minute walk test – to measure functional endurance ($VO_2$MAX)
Perceived Stress Score – to measure job stress

**3.10 MATERIALS**:
- Informed consent form.
- Assessment form.
- Height scale.
- Weight scale.
- Smooth and level marked track.
- Stop watch.
- cone
- Pulse oximeter.
- Treadmill

**3.12PROCEDURE:**
The aim and objectives of the study was clearly explained to the private ethical sector and permission was obtained. About 40 office personnel were screened for this study, on that 25 subjects were selected based on the inclusion and exclusion criteria.
All the subjects were clearly explained in detail about the study. Procedure, training
Protocol, merits and demerits of the technique prior to the study. After that all the willing
Participants were asked to submit the written informed consent form.
The selected participants were asked to present on a prescribed date and time. Only 5 members were asked to report at a particular date and time .The subjects were asked not to ingest any food or caffeine before the treatment session .the entire session was performed either in the morning or evening.

**3.13TECHNIQUES:**
Cardiorespiratory fitness and job stress was assessed using the Six Minute Walk test and perceived stress score pre and post the intervention. Perceived Stress Scale consists of 10 questionnaire that assess the stress level during last one month and 6 MWT is being used to measure the $VO_2$ max. Equipment's required for the test includes an indoor area with flat, straight hard surface that is seldom travelled, stop watch, two small cones to mark turnaround points, pulse oximeter, a chair that can be easily moved along the walking course . The participant should sit at rest in a chair, located near the starting position for at least 10 minutes before the test starts. Check for contraindications and measure pulse rate, blood pressure and spo2 and the participants were asked to perform walking as fast as possible and not to jog or run for the period of six minutes. After walking for 6 minutes, the resting heart rate, distance walked (m) for the 6 min were calculated and $vo_2$ max can be calculated for each participant based on age, gender, BMI, resting heart rate and distance walked in 6 minutes.

**Scoring of $vo_2$ max:**
$VO_2$ max (ml/kg/min) = 70.161 + (0.023X 6MWT [M])- (0.276X weight [kg] ) – (6.79 X sex , where m = 0 and f = 1) – ( 0.193X Resting hear rate [BPM]) - 0.191x Age[y]
**Aerobic exercise training:**
Aerobic exercise training consists of the following session. According to the ACSM's guidelines the aerobic training programme was divided into four parts which included
1. Warm up period
2. Treadmill training
3. Cool down period
4. Stretching

**1. Warm up period**
The warm up was further divided into
- Warm up of the treadmill
- Warm up on the treadmill

❖ Warm up of the treadmill

1. It includes basic stretches of major muscle groups
- Biceps
- Triceps

- Hamstring
- Quadriceps
- Adductors
- Calf

2. Marching.
3. Lunges.

❖ Warm up on the treadmill

Before starting warm up on the treadmill, hearty rate monitor was attaches to the participant which gave a scientific guide for maintaining specific heart rate capacities during warm up on the treadmill. The warm up session lasts for 5 minutes.

**2. Treadmill training**

According to the American Heart Association (AHA), the healthiest people have the target exercise heart rate ranging from 50% to 60% of their maximum capacity and maximum heart rate is calculated by the formula,

**$HR_{max}$ = 220 – age**

The training intensity ranges from 60% to 80% and the target heart rate was calculated using Karvonan's formula

**Target heart rate (THR) = [(Maximum heart rate – Resting heart rate) x % Heart rate reserve]+ resting heart rate**

Then, according to the American College of Sports Medicine (ACSM) guidelines, FITT principle was set as follows,

Frequency: 5 days/week

Intensity: Moderate intensity i.e. 40 % to 60% THR

Time: warm up – 5 minutes

Treadmill training – 20 to 50 minutes (participants are allowed to take rest for a period of 5 minutes if necessary)

Cool down – 5 minutes

Type: **Treadmill training (Speed only $vo_2$ max)**

| S.NO | WEEK | SPEED | TRAINING INTENSITY | DURATION |
|---|---|---|---|---|
| 1 | WEEK 1 | 3.0mph | 40% | 20min |
| 2 | WEEK 2 | 3.0 mph | 60% | 30min |
| 3 | WEEK 3 | 4.5 mph | 40% | 30 min |
| 4 | WEEK 4 | 4.5 mph | 60% | 40 min |
| 5 | WEEK 5 | 6.0 mph | 40% | 45 min |
| 6 | WEEK 6 | 6.0 mph | 60% | 50 min |

**3. Cool down period**

The cool down phases keeps the bold flow throughout the body. Stopping suddenly can cause light headedness because your heart rate and blood pressure might drop rapidly. Winding down slowly allows them to fall gradually.

a) Initially in cool down phase, the speed gradient of the treadmill will be reduced to half of the peak training speed that was being run before and slowly the speed gradient will be reduced to zero.

b) This will help the muscles to cool down gradually and ease back to normal and vitals must also be assessed.

**4. Stretching**

After the on treadmill cool down period, major muscle stretching must be carried out. It is also added by

1. Slow jogging
2. Walking.

At the end of 6 weeks after the aerobic training program, the subjects will be reassessed and the post test result were compared with the pre-test results to find out the effects of aerobic exercise training on white collar office personnel.

**PHOTOGRAPHIC REPRESENATION**

**FIGURE 1: WARM OF THE TREADMILL (QUADRICEPS STRETCH)**

**FIGURE 2: WARM OF THE TREADMILL (HAMSTRING STRETCH**

**FIGURE 3: TREADMILL TRAINING (SPEED ONLY $VO_2$ MAX)**

**DATA ANALYSIS AND RESULTS**

**4.1 STATISTICAL TOOLS**

The statistical tool used in this study is paired' test

**Paired 't' test**

The paired t – test was used to find out the statistical significance between pre and post t test value of $VO_2$ max and Perceived Stress Score.

**4.2.1 DEMOGRAPHIC DATA:**

| S.NO | VARIABLES | GROUP | PERCENTAGE |
|---|---|---|---|
| 1 | AGE(years) | 35 – 39 = 13<br>40 – 45 = 12 | 52%<br>48% |
| 3 | BMI($kg/m^2$) | 25 – 27 = 14<br>28 – 29 = 11 | 48%<br>44% |

**4.3 GROUP ANALYSIS**

**4.3.1 WITHIN GROUP ANALYSIS:**

**FOR FUNCTIONAL ENDURANCE USING $VO_2$ MAX:**

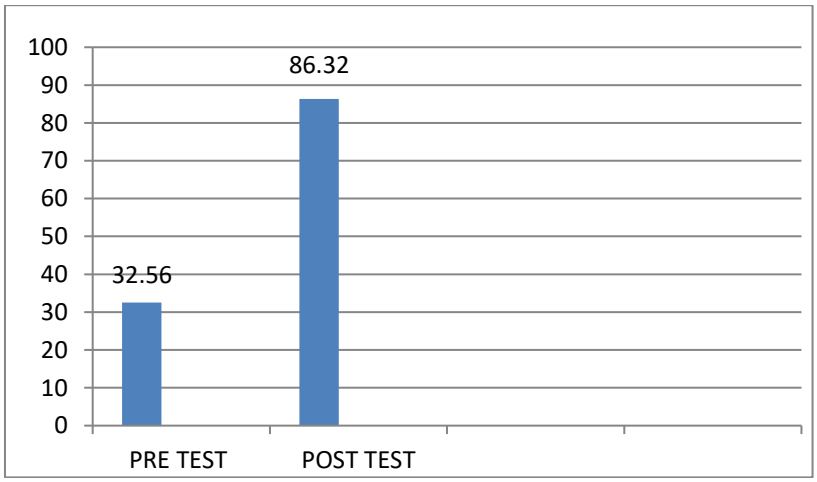
The table showing the difference between the pre-test and post-test values of experimental group regarding increased $vo_2$ max using six minute walk test in white collar office individuals.

| $VO_2$ MAX | MEAN | SD | t VALUE | P VALUE |
|---|---|---|---|---|
| PRETEST | 32.56 | 1.13 | 16.46 | <0.05 |
| POSTTEST | 86.32 | 1.85 | | |

**TABLE NO 1: DEMOGRAPHICAL DATA OF $VO_2$ MAX USING 6 MINUTE WALK TEST AS A MEASURE OF FUNCTIONAL ENDURANCE**

The pre mean and standard deviation values of $VO_2$ Max of the single experimental group were 32.56 and 1.13. The post mean and standard deviation values of $VO_2$ Max were 86.32 and 1.85.

The t value and P values were 16.46 and 2.064.The obtained t value is greater than the table t value at the significant level of 0.05. Hence the statistical reports states that there were statistically significant improvements in$VO_2$Max after the application of intervention in experimental group.




**GRAPH NO: 4.3.1 WITHIN GROUP ANALYSIS OF $VO_2$ MAX USING 6MWT (MEASURE OF FUNCTIONAL ENDURANCE)**

The graphical representations of vo2 max pre-test and post-test value were 32.56 and 86.32 and the level of significance p<0.05. This showed that there was a significant increased $vo_2$ max among white collar office individuals between pre-test and post-test value of experimental group

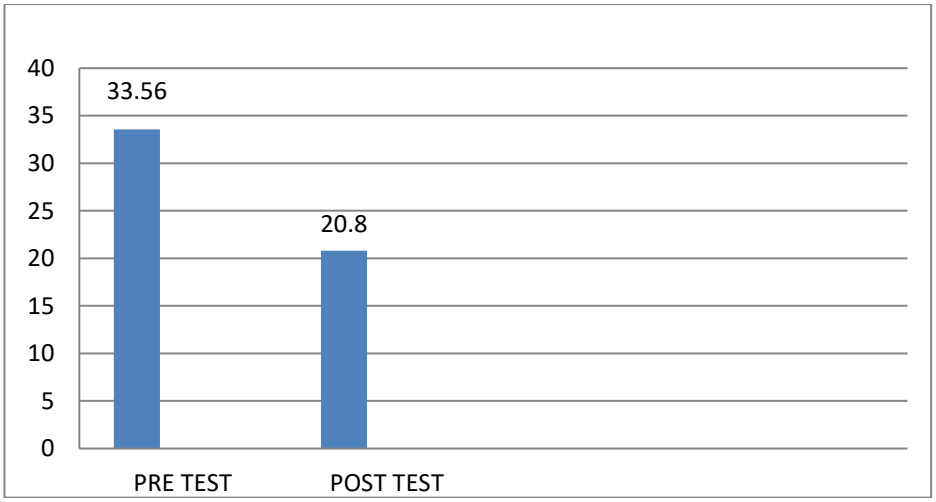
**4.3.2 FOR PERCEIVED STRESS SCALE (PSS):**

The table showing the difference between the pre-test and post-test values of experimental group regarding reduced job stress after the application of aerobic exercise training using perceived stress score among white collar office individuals.

| PSS SCORE | MEAN | SD | t VALUE | P VALUE |
|---|---|---|---|---|
| PRE TEST | 33.56 | 4.18 | | |
| POST TEST | 20.8 | 2.51 | 17.75 | <0.05 |

**TABLE NO 2: DEMOGRAPHIC DATA OF PERCEIVED STRESS SCALE SCORE (PSS)**

The pre mean and standard deviation value of perceived stress score 33.56 and 4.18. The post mean and standard deviation value of perceived stress score was 20.8 and 2.51
The t value and P value were 17.75 and 2.064. The obtained t value is greater than the table value at the significant level of 0.05. Hence the statistical report states that there were statistically significant reductions in job stress after the application of aerobic exercise training using treadmill among white collar office individuals.




**GRAPH NO 4.3.2: WITHIN GROUP ANALYSIS OF PERCEIVED STRESS SCALE SCORE (PSS)**

The graphical representations of perceived stress scale score pre-test and post-test value were 33.56 and 20.8 and the level of significance p<0.05. This showed that there was a significant decreased job stress among white collar office individuals between pre-test and post-test value of experimental group.

**DISCUSSIONS**

The physical and psychological demands are differentially distributed among white collar office individuals. They report higher psychological demands and less physical demands. Reduced physical demand shows negative impact on health

The aim of the study is to find out the efficacy of aerobic exercise training on functional endurance and job stress of white collar office individuals. The main findings of the present intervention has shown greater improvement in functional endurance and reduced the job stress to greater extent. Reducing the job stress results in improvement of cardiovascular health which can be measured through $vo_2$ max. For white collar office individuals, the $vo_2$ max falls between the range of 35 to 40ml/kg body weight /min for men.$vo_2$ max denotes the potential for work performance.

Higher $vo_2$ max denotes more performance potential.$vo_2$max is also affected by the age, gender, body composition, raining status and type of exercise. The follow up $vo_2$ max test can be used as a measure of progress. The treadmill aerobic exercise training results in an increase in the efficiency of oxygen transport within the body. By lowering the resting heart rate and the heart rate at submaximal loads, he heart pumps more blood with every heart beat which is likely due to volume overload induced left ventricular hypertrophy.

This increases the oxygen extraction ability and when an individual is tested before and after training by performing exercise at a same load , lower heart rate is shown after training because blood oxygen is delivered with each heart beat with increasing arterio venous oxygen difference .The effects of aerobic

training also increases in a dose dependent manner. Exercise intensity of high repetitions contributed to an improvement of $vo_2$ max. Treadmill is similar to road training. All aspects of workout can be controlled by the user – the speed, inclination, warm up period, cool down period and energy spent.
The mental benefits of aerobic exercise have a neurochemical basis. Exercise reduces the level of body stress hormones such as adrenaline and cortisol. It also simulates the production of endorphins, chemicals in the brain that are the body's natural pain killers and mood elevators. Endorphins are responsible for the "runner's high" and for the feelings of relaxation. Stress comes in many forms and produces any symptoms. Mental symptoms range from worry and irritability to restlessness and insomnia and even panic.
Many people find that using large muscle groups in a rhythmic, repetitive fashion works best; also called "muscular meditation". Walking, jogging and indoor aerobics – the treadmill are the primary examples.And same stretching exercise that help relax your muscles after a hard workout will help relax your mind as well. The aerobic exercise has the power to trigger the release of endorphins in a higher number than usual. Endorphins often called feel good chemicals are chemicals produced by our own body's to help us better deal with mental state. Aerobic exercise also helps us to reduce the level of stress hormones such as cortisol and adrenaline in body.
ZINAT MOHEBBI et al., conducted a study on the effect of aerobic exercise on occupational stress of female nurses which is a controlled clinical trial. It includes participation of 60 nurses working in a hospital a Iran. The nurses were assigned randomly into control group and experimental group. The intervention consisted in an aerobic exercise program lesion 3months with 3 weekly sessions 1 hour each. The stress score was measured prior to intervention upon registering, after finishing exercise program, weekly and 2 months after terminating the intervention.
HARSH PATEL et al., conducted a study on aerobic vs. anaerobic raining effects on cardiovascular system among the age group of 18 – 4 years. The study reveals that the individual should perform at least 150 minutes of moderate activity. The study reveals the importance of aerobic exercise and the measurement criterion is the $vo_2$ max and he study reveals that aerobic interval training has shown 46% increase in $vo_2$ max.

## SUMMARY AND CONCLUSION

### 6.1 SUMMARY

The aim of the study was to find out the effects of aerobic training on functional endurance and job stress among white collar office individuals. Based on selection criteria, 25 subjects were selected for the study. The experimental group consisting of 25 subjects were given aerobic exercise training using treadmill for 6 weeks. He treatment duration program lasts for 20 to 50 minutes for 5 days in a week with intensity ranging from 40% to 60% of target heart rate
The pre evaluation score of functional endurance and job stress was measured by 6 minute walk test (6MWT) and Perceived Stress Score after weeks of treatment program, post-test evaluation was done. Results of statistical analysis showed that the calculated values of $vo_2$ max was 16.46 and Perceived Stress Score for job stress was 17.75 which were greater than table t value at 0.05 level of significance

### 6.2 CONCLUSION

Thus the study concludes that the aerobic exercise improves the functional endurance and reduces job stress among white collar office individuals.

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