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Physiology

A STUDY ON PHYSICAL EXERCISE AND THEIR EFFECT ON PHYSICAL FITNESS AND THE $VO_{2MAX.}$

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ABSTRACT There are many studies associating physical exercise and their effect on physical finess. Our purpose was to study the physical exercise and their effect on physical fitness. Physical exercise is the most important and well documented preventive measure for most of the life style diseases. Physical exercise is important not only to gain the state of complete physical, mental, and emotional health but also to maintain physical fitness which includes strengthening of muscles and immune system, improving cardio-respiratory efficiency, increasing bone density and so on. **The result of this study showed that there is definite difference between two groups in most of the cardio-respiratory variables. Many studies have been conducted all over the world on beneficial effects of exercise on the cardio-respiratory variables.**

KEYWORDS :

INTRODUCTION :

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons including strengthening of muscles and cardiovascular system, sharpening athletic skills, weight loss or maintenance, as well as for the purpose of enjoyment. Frequent and regular physical exercise boosts the immune system, and helps prevent the "diseases of affluence" such as heart disease, cardiovascular disease, Type 2 diabetes and obesity(1)(2). Physical fitness is considered a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations.

This combination of unhealthy diet and lifestyle is having a significant impact on the health and nutritional status of population, particularly in developing countries and countries in transition (3). Cardiovascular diseases (CVD) continue to be the major cause of mortality representing about 30 per cent of all deaths worldwide. Lifestyle diseases like hypertension, diabetes mellitus, dyslipidaemia and overweight/obesity are the major risk factors for the development of CVD. With rapid economic development and increasing westernization of lifestyle in the past few decades prevalence of these diseases has reached alarming proportions among Indians in the recent years (4).

Physical exercise is the most important and well documented preventive measure for most of the life style diseases. Physical exercise is important not only to gain the state of complete physical, mental, and emotional health but also to maintain physical fitness which includes strengthening of muscles and immune system, improving cardio-respiratory efficiency, increasing bone density and so on. Many of these wonderful effects of exercise are mediated mainly by a hormone named as Irisin (5).

Exercise benefits a variety of organ systems in mammals, and some of the best-recognized effects of exercise on muscle are mediated by the transcriptional co-activator PPAR-γ co-activator-1 α (PGC1-α). It has been observed in mice that PGC1-α expression in muscles stimulates an increase in expression of FNDC5, a membrane protein that is cleaved and secreted as a newly identified hormone, Irisin. Irisin acts on white adipose cells in culture and in vivo to stimulate UCP1 expression and a broad program of brown-fat-like development. Irisin can be of therapeutic use for human metabolic diseases and other disorders that are improved with exercise (5).

Long-Term Respiratory Adaptations

The major changes in the respiratory system from endurance training are an increase in the pulmonary ventilation as a result of increases in both tidal volume and respiration rate, and an increase in pulmonary diffusion at maximal level of work primarily due to increases in pulmonary blood flow particularly to the upper regions of the lungs.

Vo_2max and exercise

These changes in muscle and in cardio-respiratory function are responsible for increases in Vo_2max. Thus the trained person can perform at considerably higher level of work than the untrained person. Increases in Vo_2max generally range from 15 to 20 % following a 6-month training period (6). However, individual variations in this response are considerable. In one study of 60-71 year-old men and women who were trained for 9 to 12 months, the improvement in Vo_2max varied from 0 to 43% with the mean increase of 24 % (7). This variation in response may be due in part to genetic factors and initial levels of fitness.

Vo_2max testing measures how efficiently the body consumes oxygen during exercise. Vo_2max is a relative measure of the rate at which the body deliver oxygen to active muscles. It is measured in ml/ kg body wt./min means maximum volume of oxygen consumed per minute. The amount of oxygen consumed depends upon physical fitness of the person within the physiological limits.

The physical fitness of a person improves with the training. There are two components of Vo_2max:

OBJECTIVE :

To find out a correlation between level of exercise and physical fitness.

METHODOLOGY :

This is a cross-sectional study in which we have selected 69 moderately exercising males of age group 25-40 years from Bhopal City. The participants were divided into two groups:

Group-1:- Moderately exercising males performing the aerobic exercises for not more than six weeks i.e. the group of beginners.

Group-2:- Moderately exercising males performing same exercises for more than six months up to 5years i.e. the group of regular exercising people.

Only those participants were taken into the study who fulfilled our inclusion criteria.

Inclusion Criteria:

- Persons doing regular exercise
- Males of 25-40 years age
- Moderately exercising male beginners
- Moderately exercising males doing aerobic exercises for variable duration up to 5 years
- Individuals giving consent for the study

Criteria for exclusion:

- Males less than 25 years of age
- Males more than 40 years of age
- Females
- Males suffering from any endocrinal disorder, hypertension , coronary artery disease and asthma
- Individuals not giving consent for the study.

On the **Day 1** after obtaining permission from the Head of the Department of Physiology, the subjects were explained the study procedure and written consent was obtained from them. Then all the participants were subjected to a self-made questionnaire to get information regarding their personal, present, past, family, socioeconomic and medical history in detail. Special information about their exercise schedule was also obtained through the questionnaire regarding type, duration and length of time of exercise
After taking detailed history, the physical examination including general as well as systemic examination particularly the Respiratory system and Cardiovascular system was done.

Then the subjects were explained and trained to record the basal body temperature from electronic digital thermometer, at the same time the subjects were also explained about the fasting status (overnight fasting) for fasting blood sugar to be measured on Day 2. Subjects were provided the digital thermometer to record the basal body temperature on day 2 and then come for examination between 7am-9 am.

Basal Body Temperature (Recorded by subject)
Basal Body Temperature was taken by subjects with electronic digital thermometer early in the morning in the bed when they arouse before any activity, gargling or ingestion of any liquid. The subjects followed the following procedure to record basal body temperature.

Procedure:
- The thermometer was taken out of its holder.
- Its probe was then cleaned with soap and warm water or rubbing alcohol and then rinsed with cold water.
- With mouth open the tip of the thermometer was put under the tongue and then lips were closed gently keeping the thermometer in place till it beeps.
- Then the thermometer is removed when numbers show in the "window" which gives directly the temperature reading.

Vo_2max :
Measured by Queen's college step test : The participant steps up and down on the platform (Height-16.25 inches / 41.3 cm) at a rate of 24 steps per minute. The subjects stepped using a four-step cadence, 'up-up-down-down' for 3 minutes. The participant stops immediately on completion of the test, and the heart beats were counted for 15 seconds from 5-20 seconds of recovery. This 15 second reading was multiplied by 4 to get beats per minute (bpm). The VO2max can be calculated from the test results, using this formula:
VO_2max (ml/kg/min) = 111.33 - 0.42 x heart rate (bpm)

Statistical Analysis:-
Data thus obtained were analyzed by t-test with the help of SPSS-20 (Software Package used for Statistical Analysis) software for statistical analysis.

OBSERVATIONS
Initially 69 participants of 25-40 years age group were enrolled but out of them 9 participants dropped out due to non compliance. So, finally 60 participants completed the study and data thus collected were tabulated and analyzed statistically. In this study the subjects were divided into following two groups:-

Group-1:- Moderately exercising males performing the aerobic exercises not more than six weeks i.e. the group of beginners.

Group-2:- Moderately exercising males performing same exercises for more than six months i.e. the group of regular exercising.

Table-1. Group wise number of subjects

S. No.	Groups	No. of Subjects
1.	Group-1	30
2.	Group-2	30

Table-2: Comparision of age between Group 1 and 2

Groups	Sample size (N)	Mean Age in years	Standard Deviation (SD)	t - Value	P - Value
1	30	30.73	4.74	0.551	0.584
2	30	30.10	4.15		

Table-2 and Graph shows:
- Ø Group-1 having the mean age of 30.73 ±4.74 years.
- Group-2 having the mean age of 30.10 ±4.15 years.
- No statistically significant difference was observed in age of both the groups. So, both the groups can be compared and the studying parameters are not influenced by the age.

- **Table-3: Comparision of VO2max of Obese (A) and Non-Obese (B)**

Group	Sample size (N)	Mean VO2max ml/kg/min	Standard Deviation	t -Value	p -Value
A	34	45.61	4.49	-.730	.469
B	26	46.39	3.52	-.753	.454

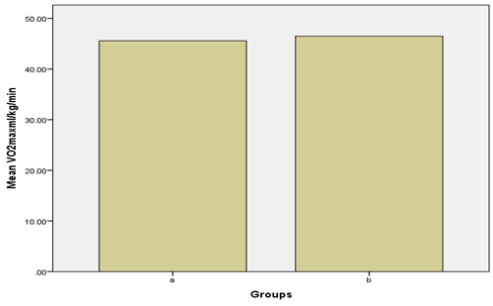

Table-3 and Graph shows:
- Group-A having the mean VO_2max of 45.61±4.49 ml/kg/minute.
- Group-B having the mean VO_2max of 46.39±3.52 ml/kg/minute.
- No Statistically significant difference was observed in VO_2max of both the groups.

Discussion
Regular physical activity, fitness, and exercise are critically important for the health and well being of people of all ages. Researchers have demonstrated that virtually all individuals can benefit from regular physical activity, whether they participate in vigorous exercise or some type of moderate health-enhancing physical activity. Even among frail and very old adults, mobility and functioning can be improved through physical activity. Therefore; physical fitness should be a priority for individuals of all ages.

The result of this study showed that there is definite difference between two groups in most of the cardio-respiratory variables. Many studies have been conducted all over the world on beneficial effects of exercise on the cardio-respiratory variables.

The expected effect of exercise on the body is decrease in body weight (8) which is due to decrease in total body fat. As the body mass index depends upon the body weight, a change produced in the body weight will result in change in body mass index. Exercise increases weight/BMI ratio of underweight (borderline low) individuals (9) while decreases weight/ BMI ratio of overweight or obese indivi Z. Nikolic and N. Ilic (1992) reported similar findings in some trained and untrained swimmers. Maximal aerobic power i.e. VO_2max (overall, relative and in relation to lean body mass) in absolute values, and expressed per kilogram of body mass and lean body mass, was 31.5%, 21.2% and 20.6%, respectively, higher in the trained than in the untrained group (P less than 0.05). These data suggest that physical training significantly increases maximal aerobic power (VO_2max) in young subjects (10).

In the table-23 VO_2 max of Group-A was compared with Group-B and no statistically significant difference observed. But when the same subjects were compared for VO_2 max with fat free mass (table-24) Group-A (Obese) showed a higher value as compared to Group-B (Non-obese), this might be due to consumption of more oxygen in obese people who are fit and doing regular exercise.

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