# EFFECT OF UPHILL RUNNING TRAINING AND STAIRCASE TRAINING ON LEAN BODY MASS, FAT MASS, VITAL CAPACITY AND RESTING HEART RATE OF MALE SPORTSMEN

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**ABSTRACT:**

The purpose of the study was to investigate the effect of uphill running and staircase training on selected physiological variable (resting heart rate, body composition (fat free mass & fat %) and vital capacity on undergraduate male students. The subjects were sixty male, all subjects were BPEd second year student of Lakshmibai National Institute of Physical Education, North East Regional Center, Guwahati. The age of subject ranged between 18-25 years. All test for body composition , resting heart rate and vital capacity were administered in exercise physiological laboratory of LNIPE, NERC to obtain the data. The data pertaining to each body composition (fat free mass & fat %), resting heart rate and vital capacity were examined by one way analysis of covariance (ANCOVA) in order to determine the difference, if any. The level of significant was set at 0.05 level for testing the hypothesis. In the selected variable vital capacity (F ratio 4.67), Resting Heart Rate (F ratio 4.05), Fat Percentage (F ratio 18.93), & Fat Free Mass (F ratio 21.55) was significant which was higher than tabulated value (3.18) at 0.05 level of significance.

**Keywords:** Uphill running training and Staircase training, Lean body mass, Fat mass, Vital capacity and Resting heart rate,

## Introduction

Sports training is a systematic process extending over a long period. For best result the system of training has to be based and conducted on scientific facts and lines where it is not possible to do that, the training has to be based on the results Successful practice which has withstood the test of time sport. Sports training aims at improving the performance of a sports person. The sports performance depends on several factors. The performance of sports primarily depends on his performance capacity, such as speed, strength and endurance. All these factors therefore are the principle aims of physical training.

Today the preparation of an athlete for achievement is a complex dynamic state, characterized by high level of physical, physiological and psychological efficiency and the degree of perfection of the necessary skill and knowledge, techniques and tactical preparation. Many other factors are also brought

into action in this preparation means of rehabilitating strength after loads. So, as to influence the development of an athlete and ensure the necessary level of preparation.

Physical fitness is an inseparable part of sports performance and achievements. The quality of its utilization value is directly proportional to the level of performance. That means the greater level of fitness, the greater the ability of a person to attain higher levels of performance.

Body composition is a method to gain insight into your physical health. It gives a broad range of information about the state of your body. This gives you valuable insight into how you can set goals for risk prevention matters and/or keep your body in balance. In measuring the body composition, the total body weight is divided into two component; lean body weight and body fat percentage %. Lean body weight includes muscles, bone and vital organs. The total amount of body fat stored in the marrow of bones and in the heart, lungs, liver, spleen, kidneys, intestine, muscles and lipid rich limner through the central nervous system. This fat is required for normal physiological functioning.

Muscle mass includes the skeletal muscles, smooth muscles such as cardiac and digestive muscles and the water contained in these muscles. Muscles act as an engine in consuming energy. As muscle mass increases, the rate at which we burn energy (calories) increases which accelerates your basel metabolic rate (BMR) and helps us reduce body fat levels and lose weight in a healthy way.

Resting Heart Rate is a considered in the context of other markers, such as blood pressure and cholesterol, can help identify potential health problems as well as gauge current heart health.

The vital capacity of the lungs is the expression applied to the volume of air that can be expired after the deepest possible inspiration. Among the factors affecting the vital capacity are the age, sex, height, weight, the size and flexibility of the thorax, and the state of physical training of the individual.

## Hypothesis

1. It was hypothesized that there would be no significant effect of uphill running training on selected physiological variables.

2. It was hypothesized that there would be no significant effect of staircase training on selected physiological variable.

## Selection of subjects

The age level of subject ranged from 18 to 21 years. All the subjects residing residential campus of LNIPE, NERC Guwahati and training was organized within the institute campus. All the selected subjects divided into three group by adopting random sampling.

Group I – Uphill running training

Group II- Staircase training

Group III- Control group

## Selection of variables

The research scholar went through scientific literature reviewed and in accordance with views of professional physical educators, the following dependent variable (physiological) and independent variable (group) were selected.

(i) Physiological Variables

1. Fat free mass
2. Fat percentage
3. Vital capacity
4. Resting Heart Rate

(ii) Groups

Group I – Uphill running training (20 Students)

Group II- Staircase training (20 Students)

Group III- Control group (20 Students)

## Design of the study

Random sample technique was applied to find out the effect of six week of training on selected physiological variable. Total two time data was collected before and after the duration of training.

## Statistical Analysis

To find out the effect of 6 week of uphill and staircase training on selected physiological variable analysis of covariance (ANCOVA) was used to analysis. Further the significant F-ratio was examined with the help of LSD post hoc test. The level of significant was set at 0.05.

## Result of the study

## Finding

Various descriptive measure like mean, standard deviation for the selected variable were calculated and presented in Table 4.The result pertaining to the analysis of covariance for the selected variable is presented from Table 4 to 12.

## Table – 4

**Descriptive statistic of selected physiological variables**

| Variable | Group | N | Mean | Standard Deviation |
|---|---|---|---|---|
| **Vital Capacity** | • Staircase<br>• Uphill<br>• Control group | 20<br>20<br>20 | 5.17<br>5.17<br>4.92 | .48<br>.84<br>.76 |
| **Resting Heart Rate** | • Staircase<br>• Uphill<br>• Control group | 20<br>20<br>20 | 54.55<br>54.30<br>55.70 | 4.39<br>3.70<br>4.13 |
| **Fat Free Mass** | • Staircase<br>• Uphill<br>• Control group | 20<br>20<br>20 | 59.27<br>61.48<br>57.38 | 6.95<br>8.68<br>6.68 |
| **Fat Percentage** | • Staircase<br>• Uphill<br>• Control group | 20<br>20<br>20 | 11.66<br>9.66<br>8.95 | 2.74<br>2.49<br>1.79 |

## Table - 5

**Analysis of covariance of different treatment in relation to vital capacity**

| Source of Variance | d.f | SS | MSS | F Ratio | Remark |
|---|---|---|---|---|---|
| Treatment | 2 | 1.76 | 0.88 | 4.67 | p<0.05 |
| Error | 56 | 10.58 | 0.19 | | |
| Total | 60 | | | | |

**Significant, $F_{0.05}$ (2, 57) = 3.18**

It is evident from table-5 that the adjusted F-Value for Treatment is 4.67 which is significant at 0.05 level with d.f =2/56. It indicates that the adjusted mean scores of Vital Capacity of Players belonging to Uphill Training, Stair Case Training and Control Groups differ significantly. So there was a significant effect of Training on Vital Capacity of Players. Thus the null hypothesis that there is no significant effect of Training on Vital Capacity of Players is rejected. To find out which of the paired means had a significant difference, the Least Significant Difference (LSD) post –hoc test was applied and the results are in Table 6.

## Table-6

**Least significant difference Post Hoc Test of the adjusted mean score of vital capacity by considering pre vital capacity as covariate**

| Training | Adj. M | Adj. SE |
|---|---|---|
| Stair Case Training | 5.28 | 0.10 |
| Uphill Training | 5.14 | 0.10 |
| Control Group | 4.86 | 0.10 |

Table 6 shows that the adjusted mean scores of Vital Capacity of players belonging to Uphill Training and Stair Case Training Groups did not differ significantly. It may, therefore, be said that both

Uphill Training and Stair Case Training were found to be equally effective in improving Vital Capacity of Players.

Table 6 it indicates that the adjusted mean scores of Vital Capacity of players belonging to Uphill Training and Control Groups differ significantly. Further the adjusted mean score of Vital Capacity of Uphill Training Group is 5.14 which is significantly higher than that of Control Group whose adjusted mean score of Vital Capacity is 4.86. It may, therefore, be said that Uphill Training was found to be significantly superior to Traditional Training in terms of Vital Capacity of Players.

It indicates that the adjusted mean scores of Vital Capacity of players belonging to Stair Case Training and Control Groups differ significantly. Further the adjusted mean score of Vital Capacity of Stair Case Training Group is 5.28 which is significantly higher than that of Control Group whose adjusted mean score of Vital Capacity is 4.86. It may, therefore, be said that Stair Case Training was found to be significantly superior to Traditional Training in terms of Vital Capacity of Players.

Weather both the training are equally effective for developing the vital capacity but staircase training has more impact on the performance of vital capacity in comparison to uphill training.

## Figure - 1

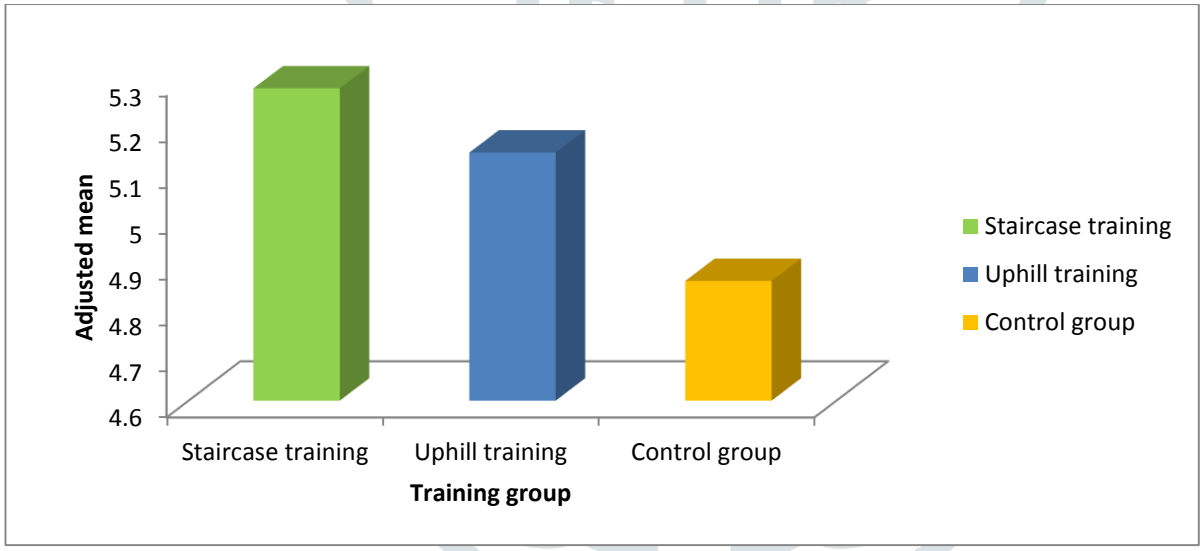


**Figure 1: Graphical representation of adjusted mean scores of vital capacity of various training**

## Table - 7

**Analysis of Covariance of Resting heart rate by considering pre-resting heart rate as covariate**

| Source of Variance | d.f | SS | MSS | F Ratio | Remark |
|---|---|---|---|---|---|
| Treatment | 2 | 12.26 | 6.13 | 4.05 | p<0.05 |
| Error | 56 | 84.72 | 1.51 | | |
| Total | 60 | | | | |

**Significant, $F_{0.05}$ (2, 57) = 3.18**

From Table 7 it can be seen that the adjusted F-Value for Treatment is 4.05 which is significant at 0.05 level with d,f=2/57. It indicates that the adjusted mean scores of resting heart rate of Players belonging to Uphill Training, Stair Case Training and Control Groups differ significantly. So there was a significant effect of Training on resting heart rate of Players. Thus the null hypothesis that there is no significant effect of Training on resting heart rate of Players is rejected. To find out which of the paired

means had a significant difference, the Least Significant Difference (LSD) post –hoc test was applied and the results are in Table 8.

## Table -8

**Least significant difference Post Hoc Test of resting heart rate of players by considering pre-resting heart rate as covariate**

| Training | Adj. M | Adj. SE |
|---|---|---|
| Control group | 55.34 | 0.28 |
| Uphill Training | 54.39 | 0.28 |
| Staircase training | 54.37 | 0.28 |

Table 8 revealed that the adjusted mean scores of Resting heart rate of players belonging to Uphill Training and Stair Case Training Groups differ significantly. It may, therefore, be said that both Uphill Training and Stair Case Training were found to be equally effective in improving Resting heart rate of Players.

Table 8 indicates that the adjusted mean scores of Resting heart rate of players belonging to Uphill Training and Control Groups differ significantly. Further the adjusted mean score of Resting heart rate of Uphill training is 54.39 which is significantly higher than that of control group whose adjusted mean score of Resting heart rate is 55.34. It may, therefore, be said that Uphill Training found to be significantly superior to Traditional Training in terms of Resting heart rate of Players.

Table 8 indicates that the adjusted mean scores of Resting heart rate of players belonging to Stair Case Training and Control Groups differ significantly. Further the adjusted mean score of Resting heart rate of staircase training is 54.37 which is significantly higher than that of control group whose adjusted mean score of Resting heart rate is 55.34. It may, therefore, be said that Stair Case Training was found to be significantly superior to Traditional Training in terms of Resting heart rate of Players.

It may, therefore, be said that both Uphill Training and Stair Case Training were found to improve Resting heart rate of Players.

## Figure - 2

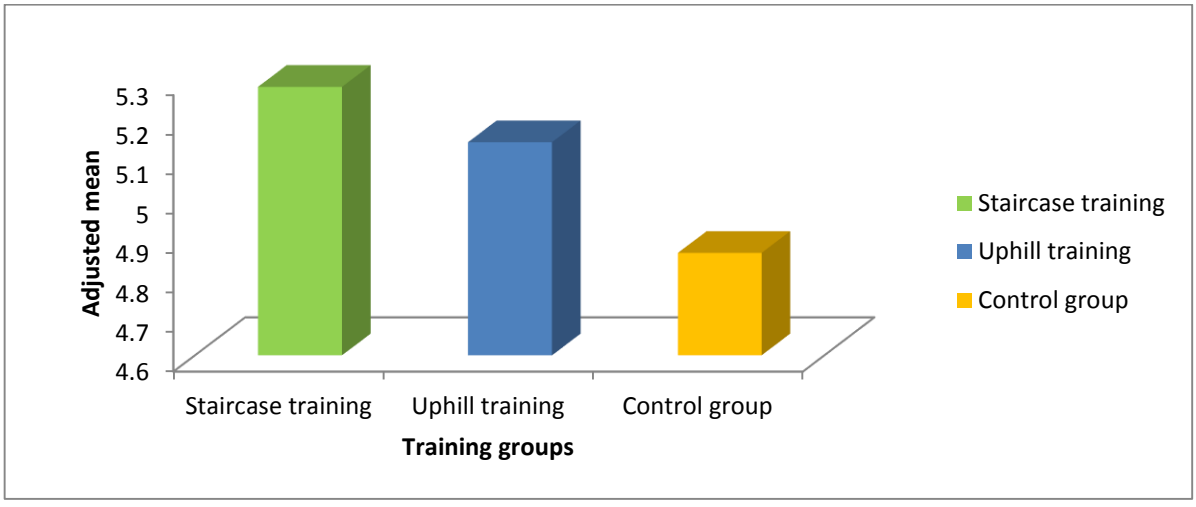


**Figure 2 : Graphical presentation of adjusted mean score difference of Resting Heart Rate of various training**

## Table -9

**Analysis of covariance of fat percentage by considering pre fat percentage as covariate**

| Source of Variance | d.f | SS | MSS | F Ratio | Remark |
|---|---|---|---|---|---|
| Treatment | 2 | 16.98 | 8.49 | 18.93 | p<0.05 |
| Error | 56 | 25.12 | 0.45 | | |
| Total | 60 | | | | |

**Significant, $F_{0.05}$ (2, 56) = 3.18**

From Table 9 it can be seen that the adjusted F-Value for Treatment is 18.93 which is significant at 0.05 level with d.f=2/57. It indicates that the adjusted mean scores of Fat percentage of Players belonging to Uphill Training, Stair Case Training and Control Groups differ significantly. So there was a significant effect of Training on Fat percentage of Players. Thus the null hypothesis that there is no significant effect of Training on Fat percentage of Players is rejected. To find out which of the paired means had a significant difference, the Least Significant Difference (LSD) post –hoc test was applied and the results are in Table 7.

## Table- 10

**Least significant difference post hoc test of fat percentage of players by considering pre fat percentage as covariate**

| Training | Adj. M | Adj. SE |
|---|---|---|
| Uphill Training | 9.86 | 0.17 |
| Staircase Training | 9.31 | 0.15 |
| Control Group | 10.74 | 0.17 |

Table 10 shows that the adjusted mean scores of Fat percentage of players belonging to Uphill Training and Stair Case Training Groups did not differ significantly. It may, therefore, be said that both Uphill Training and Stair Case Training were found to be equally effective in decreasing Fat percentage of Players.

The above table indicates that the adjusted mean scores of Fat percentage of players belonging to Uphill Training and Control Groups differ significantly. Further the adjusted mean score of Fat percentage of Uphill Training Group is 9.86 which is significantly better than that of Control Group whose adjusted mean score of Fat percentage is 10.74. It may, therefore, be said that Uphill Training was found to be significantly superior to Traditional Training in terms of Fat percentage of Players.

Table 10 indicates that the adjusted mean scores of Fat percentage of players belonging to Stair Case Training and Control Groups differ significantly. Further the adjusted mean score of Fat percentage of Stair Case Training Group is 9.31 which is significantly better than that of Control Group whose adjusted mean score of Fat percentage is 10.74. It may, therefore, be said that Stair Case Training was found to be significantly superior to Traditional Training in terms of Fat percentage of Players.

## Figure - 3

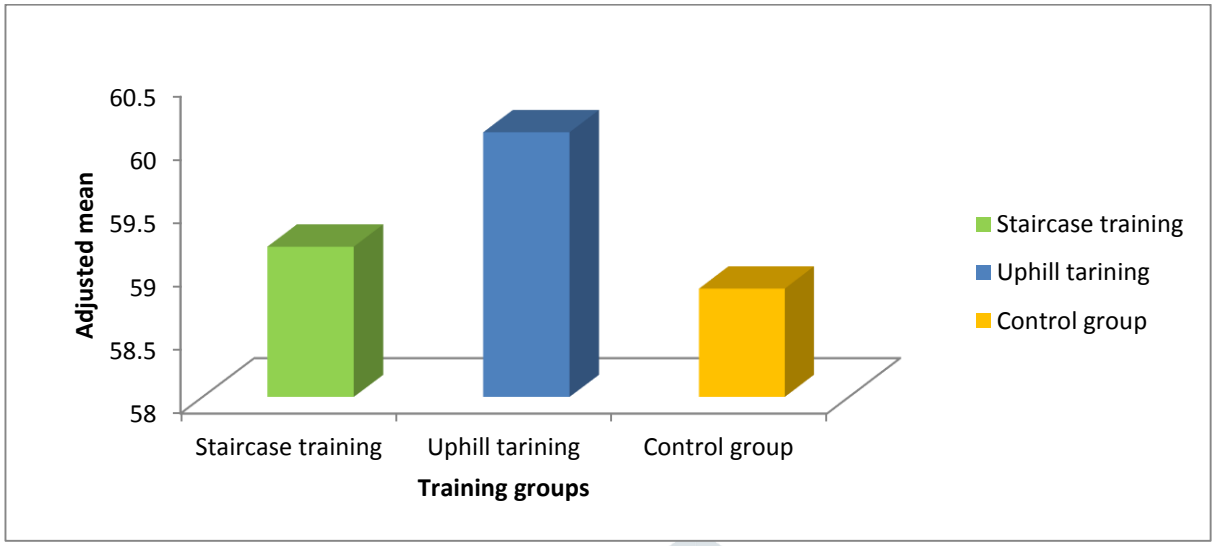


**Figure 3: Graphical presentation of adjusted mean scores of Fat Percentage of various training**

## Table- 11

**Analysis of coverience of fat free mass by considering pre- fat free mass as covariate**

| Source of Variance | d.f | SS | MSS | F Ratio | Remark |
|---|---|---|---|---|---|
| Treatment | 2 | 15.90 | 7.95 | 21.55 | p<0.05 |
| Error | 56 | 20.66 | 0.37 | | |
| Total | 60 | | | | |

**Significant, $F_{0.05}$ (2, 56) = 3.18**

From Table 11 it can be seen that the adjusted F-Value for Treatment is 21.55 which is significant at 0.05 level with d.f=2/56. It indicates that the adjusted mean scores of fat free mass of Players belonging to Uphill Training, Stair Case Training and Control Groups differ significantly. So there was a significant effect of Training on fat free mass of Players. Thus the null hypothesis that there is no significant effect of Training on fat free mass of Players is rejected. To find out which of the paired means had a significant difference, the Least Significant Difference (LSD) post –hoc test was applied and the results are Table 9.

**Table-12**

**Least significant difference post hoc test of fat free mass of players by considering pre- fat free mass as covariate**

| Training | Adj. M | Adj. SE |
|---|---|---|
| Uphill Training | 60.09 | 0.14 |
| Staircase Training | 59.19 | 0.14 |
| Control Group | 58.86 | 0.14 |

Table 12 revealed that the adjusted mean scores of fat free mass of players belonging to Uphill Training and Stair Case Training Groups did not differ significantly. It may, therefore, be said that both Uphill Training and Stair Case Training were found to be equally effective in improving fat free mass of Players.

Table 12 it indicates that the adjusted mean scores of fat free mass of players belonging to Uphill Training and Control Groups differ significantly. Further the adjusted mean score of fat free mass of Uphill Training Group is 60.09 which is significantly higher than that of Control Group whose adjusted mean score of fat free mass is 58.86. It may, therefore, be said that Uphill Training was found to be significantly superior to Traditional Training in terms of fat free mass of Players.

From Table 12 It indicates that the adjusted mean scores of fat free mass of players belonging to Stair Case Training and Control Groups differ significantly. Further the adjusted mean score of fat free mass of Stair Case Training Group is 59.19 which is significantly higher than that of Control Group whose adjusted mean score of fat free mass is 58.86. It may, therefore, be said that Stair Case Training was found to be significantly superior to Traditional Training in terms of Vital Capacity of Players.

## Figure - 4

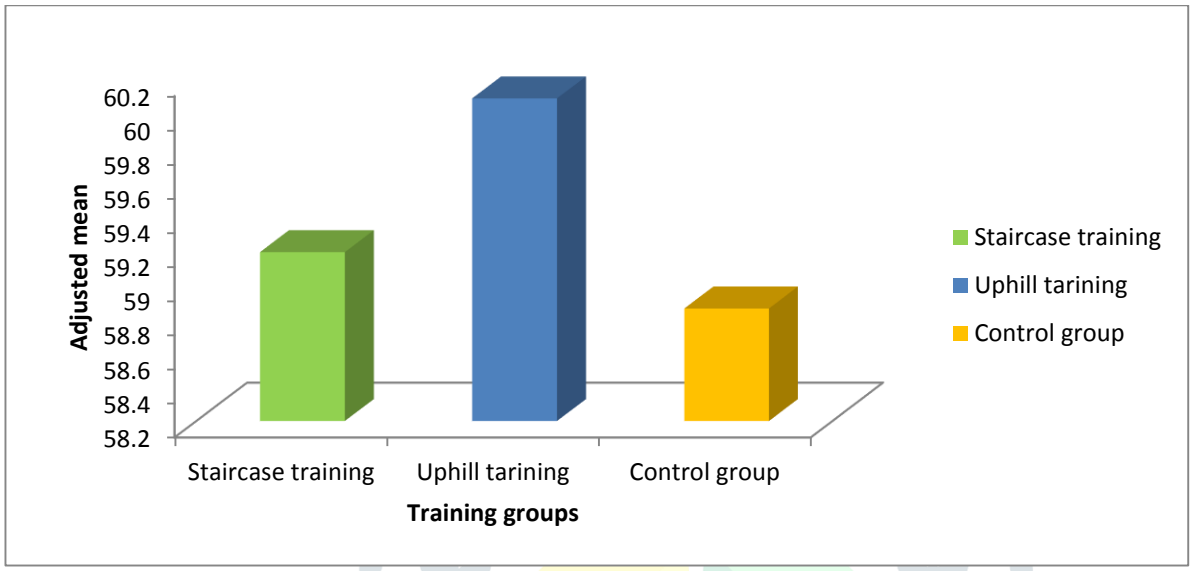


**Figure 4: Graphical presentation of adjusted mean scores of Fat Free Mass of various training**

## Finding

## Discussion of Hypothesis

The finding of the present study revealed significant effect of uphill training and staircase training on selected physiological variable i.e. Vital capacity, Fat percentage, Fat free mass and Resting heart rate. On the basis of the result, hypothesis has been rejected in case of all the selected variables.

The finding and results of the study highlight the two types of training and its effect on selected physiological variables. To pertain the effect of 6 week of training pre and post training data were collected. The results and finding of study clearly indicate that there was significant effect of 6 week of training on vital capacity, resting heart rate, fat free mass and fat percentage. Two type of training program were implemented i.e. staircase and uphill training program reveled significant effect on selected physiological variable.

The case of vital capacity finding improvement in vital capacity through both the training program but significantly staircase training program indicates more effective in improving vital capacity. It should be obvious that stair climb act as a type of stress test. Although there is a strong relationship to pulmonary function. This significant change in vital capacity may be attributed to fact that the graded exercise schedule resulted in higher capacity of lungs. The higher capability may be due to increase in the volume of lungs and increase in ventilator efficiency and lungs strength of respiratory muscle after training program. Vital capacity in general given indication of vitality of lungs of an individual.

We know that the lower the resting heart rate, better in the level of cardiovascular efficiency of an individual. It was revealed that there was positive on resting heart rate. Probably the reason was strenuous training might have given adequate load on cardiovascular system. At every week of training significantly reduce the resting heart rate of the subject. This may be due to the fact that the load experienced by the subject in the training phase was adequate, planned and progressive to produce significant improvement in resting heart rate from physiological point of view, the reduction of resting heart rate due to activated by (a) an increased parasympathetic tone, (b) a decrease sympathetic tone (c) good balance of (a) and (b).

As far as body composition concern, both the training program was found significantly effect on fat percentage and fat free mass but staircase training program looked more effective in reducing fat percentage and increase fat free mass of the subjects. These type of physical training normally effect these dimensional changes: firstly, the fat weight goes down, increase lean body mass and lastly decrease or no change in total body weight. From the investigation, it was observed that fat percentage was reduced, probably due to utilization of stored fat by individual and then such reduction has taken place. In support of the above finding similar study done by "EGANA DONNA B (2004) and they also found both training method has significant result.

The summery of entire discussion of finding it can be revealed that the finding & result revealed in this study in quite rational. The age of subjects ranged from 18 to 21 years. They had a very regulated and planned life during the BPED course. They also got a very good and nutritional diet. Which support during the entire course of training. Probably all these factors culminated into such development.

## Conclusion

On the basis of the analysis of data and the limitation of the present study, the following conclusion may be drawn-

1.) There is significant effect of both uphill and staircase training on vital capacity.

2.) There is significant effect of both uphill and staircase training on fat free mass.

3.) There is significant effect of both uphill and staircase training on fat percentage.

4.) There is significant effect of both uphill and staircase training on resting heart rate.

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