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# Comparison of Effects of Resistance Exercise and Endurance Exercise on Body Weight and Body Mass Index (BMI)

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## ABSTRACT

**Background**: Regular endurance exercise decreases obesity, improves BMI, reduces the level of inflammatory markers and chronic diseases; while the regular resistance exercise prevents the development of chronic diseases such as stroke, heart failure and other cardiovascular diseases.
**Objective**: The present study was designed to compare the effects of resistance and endurance exercise training on body weight and BMI of medical students at our institution.
**Materials and Methods:** This study was performed on male subjects who were apparently healthy with normal daily physical activity. There were sixty male participants, aged between 18-25yrs with normal BMI (18.5-24.9 kg/m2). Subjects were grouped into endurance (n=30) and resistance training (n=30). Endurance training and Resistance training was given for five days a week at 60-70% of maximum heart rate (HR) for 8 weeks. HR was measured before and after the exercise.
**Results**: The findings of the study indicate statistically significant differences in body weight & BMI before and after Endurance training as well as Resistance training. There is statistically significant decrease in body weight and BMI after both types of exercise. But endurance exercise training was found more effective in decreasing body weight and BMI.
**Conclusion**: Endurance exercise training is more effective in decreasing body weight and BMI.

***Keywords:*** Endurance exercise; Heart rate; Resistance training; Body weight; BMI.

## INTRODUCTION

Physical exercise in any form is necessary for everyone to be healthy and be free from diseases. Chronic diseases are result of reduced physical activity. Obesity has been related to development of chronic inflammation and chronic diseases such as diabetes, hypertension and myocardial infarction etc.[1,2] Obesity is related to high BMI which is related to diabetes mellitus, coronary artery disease, hypertension and metabolic syndrome.[3]

Regular endurance exercise decreases obesity, improves BMI and body fat composition.[4,5] Regular endurance exercise reduces the level of inflammatory markers and chronic diseases.[6] Regular resistance exercise prevents the development of chronic diseases such as stroke, heart failure and other cardiovascular diseases.[7] Therefore the aims of present study were first to find out and second to compare, the effects of resistance and endurance exercise on body weight and BMI.

## OBJECTIVE

The present study was designed to compare the effects of resistance and endurance exercise training on body weight and BMI of medical students at our institution.

## MATERIALs AND METHODS

The study was performed at Autonomous State Medical College, Kaushambi, UP. Sixty male subjects were enrolled from the MBBS students studying in the college and their age group was between 18-25 years. Subjects selected were apparently healthy with normal daily physical activity and belong to normal BMI (18.5-24.9 kg/m$^2$).[8] A written informed consent was taken by subjects on prescribed consent form. Institutional ethical committee approved the ethical clearance for study. Two groups were created depending on the type of exercise, Group I - Resistance exercise training and Group II - endurance exercise training. Subjects were equally divided in each group (n=30). Subjects were performing exercise of moderate intensity (based on maximum heart rate) for 30 minutes daily. The Resistance group performed push-up, pull-up, and squats whereas the Endurance group performed jogging. Subjects were involved in the exercise training five days a week for eight weeks. In moderate intensity of exercise target heart rate was 64-76% of maximum heart rate. Heart rate assessment was done before the start of exercise and after five minutes of exercise when it reached 64-76% of maximum heart rate. It was measured by help of pulse oximeter. Follow-up was done after eight weeks of exercise in both the groups. Assessment of training program was done by comparison of changes in body weight and BMI. **Body mass index** (**BMI**) is calculated as the body mass, in kilograms (kg), divided by the square of the body height, in square meters (m$^2$). [9]

**Classification of intensity of exercise based on maximum heart rate[10]**

| Intensity of exercise | HRmax% |
|---|---|
| Very light | 57 |
| Light | 57-63 |
| Moderate | 64-76 |
| Vigorous | 77-95 |
| Maximal | 96-100 |

**According to American college of sports medicine guidelines 2018**

**Heart rate maximum:**

HRmax = 220 – age in years (beats per minutes) [11]

**Statistical analysis:** The data was assessed by using Statistical Package for Social Science (SPSS) version 21.0. All qualitative variables were mentioned in form of frequency (%). All the quantitative variables were mentioned in form of Mean±SD. The data was assessed using student t-test and paired t-test. Student t-test was used for comparing body weight and BMI between the two groups. Paired t-test was used for intragroup comparison. The p value less than 0.05 was considered significant.

## RESULTS

Mean age of subjects of group I was found to be higher (19.98±1.26 years) as compared to group II (19.97±0.98 years). Mean pre intervention BMI of both the groups was found to be similar (21.97±1.78 kg/m$^2$).(Table-1)

Range of pre-intervention body weight in both the groups was 54-83 kg, though pre-intervention body weight of subjects in Group I (66.33±9.59 kg) was found to be higher as compared to Group II (65.87±9.47 kg) but this difference was not found to be significant statistically (p=0.850).Post-intervention body weight of overall population was 53-83 kg, body weight of Group I (65.67±9.23 kg) was still higher than that of Group II (63.53±9.10 kg) and difference in post-intervention body weight between two groups was not significant statistically.(Table-2).

After intervention statistically significant decline in pre-intervention body weight was observed in both the groups. In Group I decline of 0.67±0.80 kg was observed while in Group II decline of 2.33±0.80 kg was observed. Percentage post-intervention change in body weight was 1.01% in Group I and 3.54% in Group II. Group II (Endurance exercise) was more effective for losing body weight. (Table-3)

Range of pre-intervention BMI in overall as well as both the groups was 18.60 to 24.90 kg/m$^2$. Mean pre-intervention BMI of both the groups was found to be similar (21.97±1.78 kg/m$^2$). Range of post- intervention BMI in overall study population and in Group I was 18.50 to 24.60 kg/m$^2$ while same in Group II was 18.50 to 23.60 kg/m$^2$. Mean post-intervention BMI of Group I (21.49±1.51 kg/m$^2$) was found to be higher than that of Group II (20.66±1.42 kg/m$^2$). This difference was found to be significant statistically. (Table-4).

After intervention significant decline in pre-intervention body mass index was observed in both the groups. In Group I decline in BMI was 0.47±0.70 kg/m$^2$ while in Group II decline in BMI was 1.31±0.67. On evaluating the % post-intervention change in Group I (2.15%) and Group II (5.95%), it was observed that decline in BMI in Group II was higher as compared to Group I. (Table-5)

**Table-1: Socio-demographic characteristics**

| Parameter | Resistance exercise | Endurance exercise |
|---|---|---|
| **Age (Mean±SD) years** | 19.98±1.26 | 19.97±0.98 |

| | | |
|---|---|---|
| **Weight (Mean±SD) kg** | 66.33±9.59 | 65.87± 9.47 |
| **BMI (Mean±SD) kg/m²** | 21.97±1.78 | 21.97±1.78 |
| **Race** | Asian | Asian |
| **Type of exercise** | Push-ups, pull-ups, squats | Jogging |

**Table 2: Between Group Comparison of Pre and Post-intervention Body Weight (in kg)**

| Group | Range | | Mean | S.D. | 95% CI | |
|---|---|---|---|---|---|---|
| | Min. | Max. | | | Lower bound | Upper bound |
| **Pre-intervention** | | | | | | |
| Group I (n=30) | 54.00 | 83.00 | 66.33 | 9.59 | 62.75 | 69.91 |
| Group II (n=30) | 54.00 | 83.00 | 65.87 | 9.47 | 62.33 | 69.40 |
| Total (n=60) | 54.00 | 83.00 | 66.10 | 9.45 | 63.66 | 68.54 |
| Student 't' test | | | 't'=0.190; p=0.850 (NS) | | | |
| **Post-intervention** | | | | | | |
| Group I (n=30) | 55.00 | 83.00 | 65.67 | 9.23 | 62.22 | 69.11 |
| Group II (n=30) | 53.00 | 81.00 | 63.53 | 9.10 | 60.14 | 66.93 |
| Total (n=60) | 53.00 | 83.00 | 64.60 | 9.15 | 62.24 | 66.96 |
| Student 't' test | | | 't'=0.902; p=0.371 (NS) | | | |

**Table 3: Intragroup Change in Pre and Post-intervention Body Weight (Paired 't' test)**

| Group | Mean change | S.D. | % Post-intervention Change | 't' | 'p' |
|---|---|---|---|---|---|
| Group I | -0.67 | 0.80 | -1.01 | -4.551 | <0.001 |
| Group II | -2.33 | 0.80 | -3.54 | -15.930 | <0.001 |
| **Total** | **-1.50** | **1.16** | **-2.27** | **-10.041** | **<0.001** |

**Table 4: Between Group Comparison of Pre and Post-intervention Body Mass Index (in kg/m²)**

| Group | Range | | Mean | S.D. | 95% CI | |
|---|---|---|---|---|---|---|
| | Min. | Max. | | | Lower bound | Upper bound |
| **Pre-intervention** | | | | | | |
| Group I (n=30) | 18.60 | 24.90 | 21.97 | 1.78 | 21.30 | 22.63 |
| Group II (n=30) | 18.60 | 24.90 | 21.97 | 1.78 | 21.30 | 22.63 |
| Total (n=60) | 18.60 | 24.90 | 21.97 | 1.77 | 21.51 | 22.42 |
| Student 't' test | | | 't'=<0.001 (Sig); p=0.1.000(NS) | | | |
| **Post-intervention** | | | | | | |
| Group I (n=30) | 18.50 | 24.60 | 21.49 | 1.51 | 20.93 | 22.06 |
| Group II (n=30) | 18.50 | 23.60 | 20.66 | 1.42 | 20.13 | 21.19 |
| Total (n=60) | 18.50 | 24.60 | 21.08 | 1.52 | 20.69 | 21.47 |
| Student 't' test | | | 't'=2.198; p=0.032 (Sig) | | | |

**Table 5: Intragroup Change in Pre- and Post-intervention Body Mass Index (Paired 't' test)**

| Group | Mean change | S.D. | % Post-intervention Change | 't' | 'p' |
|---|---|---|---|---|---|
| Group I | -0.47 | 0.70 | -2.15 | -3.708 | 0.001 |
| Group II | -1.31 | 0.67 | -5.95 | -10.748 | <0.001 |
| Total | -0.89 | 0.80 | -4.05 | -8.653 | <0.001 |

**DISCUSSION-**

Subjects who completed resistance exercise training also showed statistically significant decrease in body weight and BMI after exercise. Our findings are similar to Donges et al,[12] Chun-De Liao,[13] and Hee-Jae KIM et al,[14] who studied the effect of resistance exercise on body fat composition and observed that there is statistically significant decrease in body weight and BMI after exercise.

Subjects who performed endurance exercise training showed statistically significant decrease in body weight and BMI. There was statistically significant increase in lean mass after exercise. These findings are in accordance to Sayyed Mohammad Marandi et al,[15] Hee Jae KIM et al,[14] J. K. Song et al,[16] and Tugay Yilmaz et al,[17] who studied the effect of endurance exercise on body fat composition and observed that there is statistically significant decrease in body weight

and BMI after exercise. In the present study positive correlation of endurance and resistance exercise was found on body weight and BMI. But endurance exercise training was more effective in improving body weight and BMI.

## CONCLUSION

There is statistically significant decrease in weight and BMI after resistance exercise training as well as after endurance exercise training. However, the decrease in weight and BMI is more effective in endurance exercise group than in resistance group.


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