OPEN ACCESS JOURNALS
Indiana Journal of Multidisciplinary Research
Abbreviate Tittle- Ind J Multi Res
ISSN *(Online)*- 2583-3820
Journal Homepage Link- https://indianapublications.com/Journals/IJMR
DOI: https://doi.org/10.5281/zenodo.18109113

INDIANA PUBLICATIONS
PRODUCTIVE AND QUALITY RESEARCH

Research Article

Volume-05|Issue-06|2025

Comparative Analysis of Body Weight, Body Fat, and Basal Metabolic Rate before and after Strength Training

Dr. Satish Kumar[1], Dr. Bidyarani Yumnam[2], Dr. Basanti Naik[3], Dr. Subhashis Biswas[4]

[1]Assistant Professor, Department of Physical Education & Director of sports, The ICFAI University Tripura.
[2]Assistant Professor, Department of Physical Education, The ICFAI University Tripura.
[3]HOD (Physical Education), Mayoor PVT school, Abu Dhabi, UAE.
[4]Assistant Professor, Department of Physical Education, The ICFAI University Tripura.

Article History
Received: 19.11.2025
Accepted: 24.12.2025
Published: 31.12.2025

Citation
Kumar, S., Yumnam, B., Naik, B., Biswas, S. (2025). Comparative Analysis of Body Weight, Body Fat, and Basal Metabolic Rate before and after Strength Training. *Indiana Journal of Multidisciplinary Research, 5*(6), 199-203.

Abstract: The purpose of the present study was to examine the effect of a six-week strength training programme on body weight, body fat, and basal metabolic rate (BMR) among obese adults aged 30–40 years from Raipur, Chhattisgarh, India. Two hundred obese male and female subjects were selected after obtaining informed consent and equally divided into an experimental group (n = 100) and a control group (n = 100). The experimental group participated in a structured strength training programme, while the control group did not undergo any systematic training. Body weight (kg), body fat (kg), and basal metabolic rate were measured before and after the intervention. Data were analyzed using descriptive statistics (Mean ± SE) and inferential statistics through Analysis of Variance (ANOVA), with statistical significance set at the 0.05 level. The results revealed that mean body weight decreased from 60.68 ± 0.64 kg (pre-training) to 59.52 ± 0.49 kg (post-training); however, this reduction was statistically insignificant ($p > 0.05$). In contrast, body fat showed a significant decrease from 15.52 ± 0.34 kg to 12.32 ± 0.31 kg following the strength training intervention ($p < 0.05$). Furthermore, basal metabolic rate increased significantly from 1414.31 ± 8.68 kcal/day at pre-training to 1460.36 ± 12.24 kcal/day at post-training ($p < 0.05$). The findings demonstrate that a six-week strength training programme produces significant improvements in body fat reduction and basal metabolic rate, despite no statistically significant change in overall body weight. These results suggest that strength training is an effective intervention for improving body composition and metabolic function in obese adults, supporting existing evidence that resistance training enhances metabolic health independent of marked body weight loss.

Keywords: Strength Training, Obesity, Body Weight, Body Fat, Basal Metabolic Rate, Resistance Exercise.

INTRODUCTION

Ageing is associated with a progressive decline in physical activity, which has important consequences for health and functional capacity. Epidemiological data from the United States indicate that adherence to recommended aerobic activity decreases from about 55% in earlier adulthood to nearly 33% by the age of 65 years. Participation in resistance training declines even more sharply, with only around 17% of older adults engaging in resistance exercise at least twice per week (Schoenborn *et al.*, 2013). This marked reduction in physical activity constitutes a significant public health concern in ageing populations.

Lower levels of physical activity in older adults are linked to unfavourable changes in body composition, including increased fat mass and reduced skeletal muscle mass, along with declines in aerobic fitness and muscular strength (Chumlea *et al.*, 2002; Häkkinen *et al.*, 1998; Sardeli *et al.*, 2018). These changes contribute to metabolic dysfunction, low-grade systemic inflammation, and an increased risk of metabolic syndrome, which is characterized by central obesity, dyslipidemia, hypertension, and elevated fasting glucose levels.

Resistance training (RT) has emerged as an effective non-pharmacological strategy to counteract these age-related adaptations. Evidence suggests that RT improves body composition by increasing lean muscle mass and reducing fat mass in older adults (Sallinen *et al.*, 2006; Walker *et al.*, 2014), which may positively influence metabolic risk factors and inflammatory status. Although intervention studies report mixed findings, greater benefits of RT appear to occur in individuals with conditions such as obesity, hypertension, and type II diabetes (Ibáñez *et al.*, 2005).

Low-grade inflammation is a key mechanism linking obesity and metabolic syndrome to cardiovascular disease and is also associated with muscle loss and functional decline in older adults (Schaap *et al.*, 2006, 2009). Given that RT interacts with adiposity, particularly abdominal fat, further investigation is warranted to clarify its role in reducing inflammation-related metabolic risk. Overall, systematic evaluation of

***Corresponding Author:** Dr. Satish Kumar

resistance training is essential to support its use in promoting metabolic health and healthy ageing.

MATERIALS AND METHODS

Selection of subjects

In the present study, two hundred obese male and female subjects aged 30 to 40 years were selected from Raipur, Chhattisgarh, India, after obtaining their informed consent. The subjects were equally divided into two groups: a strength training experimental group consisting of one hundred subjects and a strength training control group consisting of one hundred subjects**.** All subjects in the experimental group regularly participated in the strength training program administered by the research scholar, while the control group did not undergo any structured training during the study period.

Sampling design

The present study adopted a randomized controlled experimental sampling design. A total of two hundred subjects were selected from Raipur, Chhattisgarh, India, after obtaining informed consent. The selected subjects were randomly assigned into two groups: an experimental group (n = 100), which participated in a structured strength training program administered by the research scholar, and a control group (n = 100), which did not undergo any systematic training during the experimental period. Random allocation ensured homogeneity between the groups at baseline and minimized selection bias, thereby enhancing the internal validity of the study.

Selection of variables

- **Independent Variable:** Six Week Strength Training Program
- **Dependent Variables:** Body Weight (kg), Body Fat (kg), Basal Metabolic Rate (BMR)

Null Hypotheses:

- There is no significant effect of strength training on **body weight (kg)** of obese subjects.
- There is no significant effect of strength training on **body fat (kg)** of obese subjects.
- There is no significant effect of strength training on **basal metabolic rate** of obese subjects.

Research Design

The study adopted a randomized pre-test–post-test control group experimental research design

Statistical Procedure

The data were analyzed using descriptive statistics (Mean ± SE) and inferential statistics. Analysis of Variance (ANOVA) was employed to compare the groups and draw meaningful conclusions. For this purpose, Microsoft Excel and SPSS (Version 27) were used for statistical analysis.

Level of Significance:

To test the hypotheses, the level of significance was set at 0.05, which was considered adequate for the purpose of this study.

Cumulative Day-Wise Strength Training Description (Six Weeks)

1. **Monday – Lower Body Strength Training**
   On Mondays, the training sessions focused on lower body strength development. The exercises included squats, lunges, leg press, and calf raises, performed at approximately 60% of one-repetition maximum (1RM). Emphasis was placed on correct technique, controlled movement patterns, and progressive overload to enhance muscular strength and improve energy expenditure in obese subjects.

2. **Tuesday – Upper Body Strength Training (Chest and Arms)**
   Tuesdays were dedicated to upper body exercises targeting the chest and arm muscles. The training program comprised bench press, push-ups, chest fly, biceps curls, and triceps extensions at moderate intensity. This session aimed to increase upper body muscular endurance and contribute to favorable changes in body composition through increased lean muscle mass.

3. **Wednesday – Core and Functional Strength Training**
   On Wednesdays, core stability and functional strength exercises were emphasized. The training included abdominal crunches, plank holds, leg raises, back extensions, and balance-oriented movements. These exercises were designed to improve postural control, trunk strength, and overall functional fitness, which are essential for obese individuals.
4. **Thursday – Upper Body Strength Training (Back and Shoulders)**
   Thursdays focused on strengthening the back and shoulder musculature. Exercises such as lat pull-downs, seated rows, shoulder press, lateral raises, and shoulder shrugs were performed at approximately 60% of 1RM. This session contributed to improved posture, enhanced upper body strength, and increased metabolic demand.
5. **Friday – Full Body Strength Training**
   On Fridays, a full-body strength training session was conducted incorporating compound movements such as squats, dead lifts, bench press, and shoulder press. These multi-joint exercises were selected to maximize muscle recruitment, promote caloric expenditure, and stimulate improvements in basal metabolic rate.
6. **Saturday – Circuit Strength Training**
   Saturdays involved circuit-based strength training, combining upper and lower body exercises performed sequentially with minimal rest. The circuit format increased cardiovascular involvement while maintaining muscular strength demands,

***Corresponding Author:** Dr. Satish Kumar

thereby enhancing fat metabolism and overall training efficiency.

7. **Sunday – Rest and Recovery** Sunday was designated as a rest and recovery day. No structured training was performed, allowing physiological recovery, muscle repair, and adaptation to the training stimulus. Light stretching or relaxation activities were permitted to facilitate recovery and prevent injury.

Table 1: Comparison of Body weight (kg) before and after Strength Training

Pre Test		Post Test		ANOVA	
Mean±SE	SD	Mean±SE	SD	F-value	P-value
60.68±0.64	6.47	59.52±0.49	4.88	2.068	*NS*

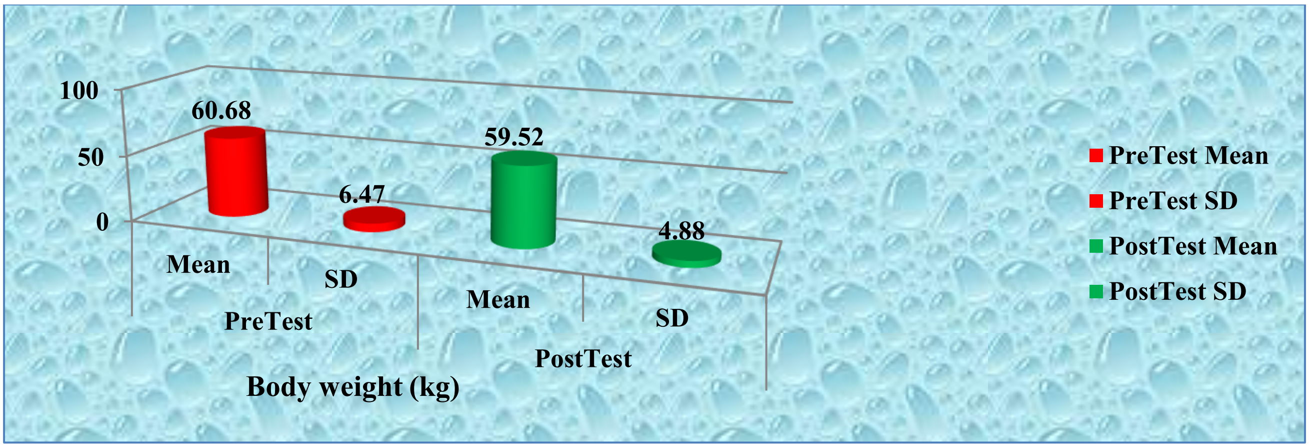

Figure 1: Showing the comparison (ANOVA) of body weight (kg) between the treatment i.e. pre strength training and post strength training of obese subjects. The body weight (kg) of post training was found to be insignificantly lighter than that of pre training.

The table 1 and figure 1 demonstrated the comparison of body weight (kg) between pre strength training and post strength training body weight (kg) of obese subjects. The mean value for body weight(kg)for pre training was found to be 60.68±0.64Kg and 59.52 ± 0.49 Kg for post training data for studied subjects. The inferential analysis (ANOVA) revealed statistically ($p >$ 0.05) insignificant difference amongst the studied groups i.e. pre strength training and post strength training body weight (kg) of obese subjects (table 1 and figure 1). The body weight (kg) of pre-training group were found in significantly heavier. The post strength training body weight (kg) is *found to be insignificantly* lighter as compare to that of pre strength training.

Table 2: Comparison of Body fat(kg) before and after Strength Training

Pre Test		Post Test		ANOVA	
Mean ± SE	SD	Mean ± SE	SD	F-value	P-value
15.52±0.34	3.39	12.32±0.31	3.03	49.58	p<0.01

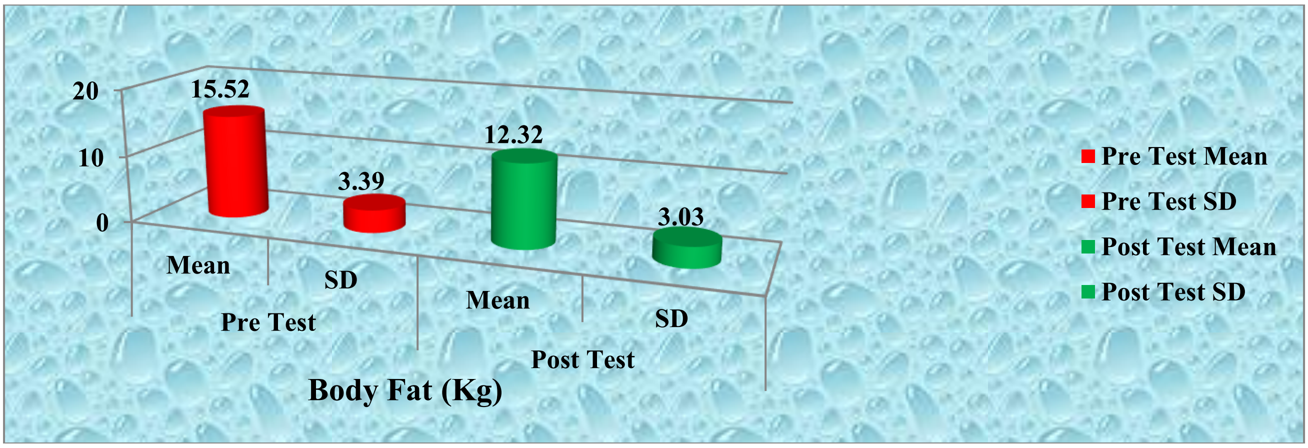

Figure 2: Showing the comparison (ANOVA) for body fat(kg) between the treatment i.e. pre strength training and post strength training of obese subjects. The body fat (kg) of post training were found to be significantly lighter than that of pre training.

***Corresponding Author:** Dr. Satish Kumar

The table 2 and figure 2 demonstrated the comparison of body fat (kg) between pre and post strength training body fat (kg) of obese subjects. The mean value for body fat (kg) for pre strength training was found to be 15.52 ± 0.34 Kg and 12.32 ±0.31 Kg for post strength training data for studied subjects. The inferential analysis (ANOVA) revealed statistically ($p < 0.05$) significant difference amongst the studied groups i.e. between pre strength training and post strength training body fat (kg) of obese subjects (table II and figure II). The body fat (kg) of pre-training group were found heavier. The post strength training body fat (kg) is found to be significantly lighter as compare to that of pre training (table 2 and figure 2).

Table 3: Comparison of Basal Metabolic Rate before and after Strength Training

Pre Test		Post Test		ANOVA	
Mean ± SE	SD	Mean ± SE	SD	F-value	P-value
1414.31±8.68	86.75	1460.36±12.24	122.38	9.425	p<0.01

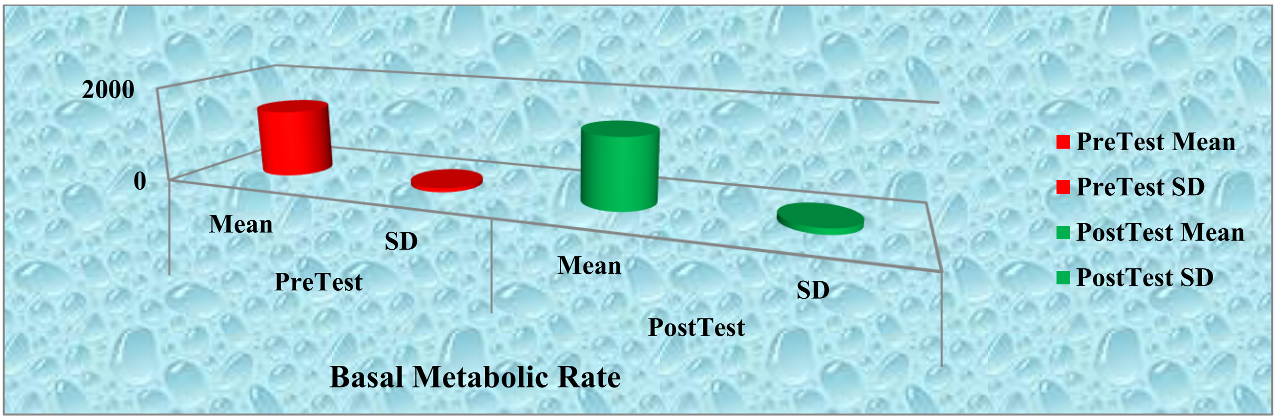

Figure 3: Showing the comparison (ANOVA) for basal metabolic rate between the treatment i.e. pre strength training and post strength training of obese subjects. The basal metabolic rate of post training were found to be significantly higher than that of pre strength training.

The table 3 and figure 3 demonstrated the comparison of basal metabolic rate between pre and post strength training basal metabolic rate of obese subjects. The mean value for basal metabolic rate for pre training was found to be 1414.31 ± 8.68 and 1460.36 ± 12.24 for post training data for studied subjects. The inferential analysis (ANOVA) revealed statistically (p<0.05) significant difference amongst the studied groups i.e. pre strength training and post training basal metabolic rate of obese subjects (table III and figure III). The basal metabolic rate of pre-training group were found lower. The post strength training basal metabolic rate is found to be significantly higher as compare to that of pre strength training (table 3 and figure 3).

DISCUSSION

The findings of the present study provide important insights into the effects of a structured strength training program on body weight, body fat, and basal metabolic rate among obese subjects. The results indicate differential adaptations in these variables following the training intervention, highlighting the specific physiological benefits of resistance-based exercise.

With regard to body weight, the results revealed a marginal reduction in mean body weight from pre-training to post-training; however, this change was not statistically significant (p > 0.05). This finding suggests that strength training alone may not lead to a substantial reduction in total body weight within the duration of the intervention. Similar observations have been reported in earlier studies, which indicate that resistance training often produces minimal changes in overall body weight due to the simultaneous reduction in fat mass and increase or maintenance of lean muscle mass (Kraemer & Ratamess, 2004; Westcott, 2012). Therefore, the insignificant change in body weight observed in the present study may reflect favourable body recomposition rather than an absence of training effect.

In contrast, a significant reduction in body fat was observed following the strength training programme (p < 0.05). The decrease in body fat among the post-training group demonstrates the effectiveness of strength training in reducing adiposity in obese individuals. This finding is consistent with previous research indicating that resistance training enhances fat oxidation and promotes reductions in fat mass through increased energy expenditure and improved metabolic efficiency (Sallinen *et al.*, 2006; Walker *et al.*, 2014). The significant decline in body fat, despite the non-significant change in body weight, further supports the role of strength training in improving body composition rather than merely reducing scale weight.

Furthermore, the results of the study showed a significant increase in basal metabolic rate (BMR)

***Corresponding Author:** Dr. Satish Kumar

following the strength training intervention ($p < 0.05$). The observed elevation in BMR in the post-training group may be attributed to increases in lean muscle mass, which is metabolically more active than fat tissue. Earlier studies have reported similar increases in resting energy expenditure following resistance training, emphasizing its role in enhancing metabolic rate and long-term weight management (Häkkinen *et al.*, 1998; Strasser *et al.*, 2012). The increase in BMR is particularly important for obese individuals, as it may facilitate sustained fat loss and reduce the risk of weight regain.

Collectively, the findings of the present study suggest that strength training is an effective intervention for improving body composition and metabolic health in obese subjects. Although total body weight did not change significantly, the significant reduction in body fat and increase in basal metabolic rate indicate positive physiological adaptations. These results underscore the importance of including strength training in exercise programmes aimed at obesity management, as it promotes favourable changes in fat mass and metabolic function that may not be fully captured by body weight measurements alone.

CONCLUSION

Based on the findings of the present study, it can be concluded that the structured strength training programme produced beneficial adaptations in obese subjects. Although the reduction in body weight following the training period was not statistically significant, a significant decrease in body fat and a significant increase in basal metabolic rate were observed. These results indicate that strength training is effective in improving body composition and enhancing metabolic function, even in the absence of marked changes in overall body weight.

The findings highlight that body weight alone may not be a sensitive indicator of training-induced adaptations, as strength training promotes fat loss while preserving or increasing lean muscle mass. The significant improvement in basal metabolic rate further suggests that regular strength training can contribute to long-term energy expenditure and may support sustained weight management in obese individuals.

Therefore, the study supports the inclusion of strength training as an essential component of exercise interventions aimed at obesity management and metabolic health improvement. Incorporating structured resistance training may help reduce body fat, enhance metabolic efficiency, and improve overall health outcomes in obese populations.

REFERENCES

1. Schoenborn, C. A., Adams, P. F., & Peregoy, J. A. (2013). *Health behaviors of adults: United States, 2008–2010* (Vital and Health Statistics, Series 10, No. 257). National Center for Health Statistics.
2. Chumlea, W. C., Guo, S. S., Kuczmarski, R. J., Flegal, K. M., Johnson, C. L., Heymsfield, S. B., Lukaski, H. C., & Vellas, B. (2002). Body composition estimates from NHANES III bioelectrical impedance data. *International Journal of Obesity*, *26*(12), 1596–1609. https://doi.org/10.1038/sj.ijo.0802167
3. Häkkinen, K., Newton, R. U., Gordon, S. E., McCormick, M., Volek, J. S., Nindl, B. C., Gotshalk, L. A., Campbell, W. W., Evans, W. J., Häkkinen, A., Humphries, B. J., & Kraemer, W. J. (1998). Changes in muscle morphology, electromyographic activity, and force production characteristics during progressive strength training in young and older men. *Journal of Gerontology: Series A, Biological Sciences and Medical Sciences*, *53*(6), B415–B423. https://doi.org/10.1093/gerona/53A.6.B415
4. Sardeli, A. V., Tomeleri, C. M., Cyrino, E. S., Fernhall, B., Cavaglieri, C. R., & Chacon-Mikahil, M. P. T. (2018). Effect of resistance training on inflammatory markers of older adults: A meta-analysis. *Experimental Gerontology*, *111*, 188–196. https://doi.org/10.1016/j.exger.2018.07.021
5. Sallinen, J., Pakarinen, A., Fogelholm, M., Sillanpää, E., Alén, M., Volek, J. S., Kraemer, W. J., & Häkkinen, K. (2006). Serum basal hormone concentrations and muscle mass in aging women: Effects of strength training and diet. *International Journal of Sport Nutrition and Exercise Metabolism*, *16*(3), 316–331. https://doi.org/10.1123/ijsnem.16.3.316
6. Walker, S., Peltonen, H., Sautel, J., Scaramella, C., Kraemer, W. J., & Avela, J. (2014). Neuromuscular adaptations to constant versus variable resistance training in older men. *International Journal of Sports Medicine*, *35*(1), 69–74. https://doi.org/10.1055/s-0033-1343404
7. Ibáñez, J., Izquierdo, M., Argüelles, I., Forga, L., Larrión, J. L., García-Unciti, M., Idoate, F., & Gorostiaga, E. M. (2005). Twice-weekly progressive resistance training decreases abdominal fat and improves insulin sensitivity in older men with type 2 diabetes. *Diabetes Care*, *28*(3), 662–667. https://doi.org/10.2337/diacare.28.3.662
8. Schaap, L. A., Pluijm, S. M. F., Deeg, D. J. H., & Visser, M. (2006). Inflammatory markers and loss of muscle mass (sarcopenia) and strength. *The American Journal of Medicine*, *119*(6), 526.e9–526.e17. https://doi.org/10.1016/j.amjmed.2005.10.049

***Corresponding Author:** Dr. Satish Kumar