



IMPACT OF TERRACE TRAINING ON SELECTED PHYSIOLOGICAL VARIABLES AMONG MEN VARSITY STUDENTS

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Abstract:

This study investigates the effects of terrace training on VO₂ max and vital capacity among male varsity students, emphasizing its potential to enhance respiratory efficiency. Utilizing a quasi-experimental design, 30 male participants underwent a structured 12-week terrace training program, resulting in significant improvements in both VO₂ max and vital capacity compared to a control group, as confirmed by ANCOVA analysis. The findings suggest that terrace training is an effective and accessible intervention for optimizing the physiological capacities of varsity athletes, contributing valuable insights to sports conditioning practices.

Key Words: Terrace Training, VO₂ Max, Vital Capacity, Interval Training and Cardiopulmonary Fitness.

Introduction:

Another name of the interval training method is terrace training, which consists of a series of high-intensity workouts interspersed with rest or recovery periods. During these recovery intervals, lower-intensity activities are typically performed, while the high-intensity segments are conducted at or close to anaerobic levels (4). Terrace training, which incorporates repeated bouts of intense exercise followed by recovery, has shown significant potential in improving key physiological parameters such as VO₂ max and vital capacity. VO₂ maximal oxygen uptake is a crucial indicator of aerobic endurance and the body's ability to utilize oxygen during intense exercise (5). It is commonly measured through the treadmill test, which allows for precise evaluation of cardiovascular fitness. Similarly, vital capacity, the maximum amount of air the lungs can hold, is another essential measure of respiratory function, often assessed using a wet spirometer (6).

The quest for optimal physical fitness and performance enhancement has led to the exploration of various training methods, with interval training emerging as one of the most effective (7). Terrace training offers a unique and engaging approach, utilizing alternating periods of high-intensity exercise and rest, designed to maximize cardiovascular and respiratory capacity (8). For varsity athletes, who are often required to maintain peak physiological performance, the ability to increase endurance, stamina, and overall fitness is crucial for success both on and off the field (9).

The integration of terrace training is focused on enhancing these physiological attributes among men varsity students (10). With the increased physical demands placed on athletes, understanding the impact of terrace training on VO₂ max and vital capacity can offer valuable insights into optimizing training protocols for improved athlete performance (11). This study, therefore, aims to explore the effectiveness of terrace training in modifying selected physiological variables, providing a deeper understanding of its role in conditioning varsity-level athletes.

The pursuit of enhanced athletic performance and overall physical fitness is an ongoing priority for student-athletes, particularly at the varsity level, where competition is intense. To meet these demands, training programs must be effective in developing key physiological capacities such as cardiovascular endurance and lung function, terrace training presents a promising approach, but there is a need for further research to understand its specific benefits for university athletes. The critical reason for this study is the growing recognition of vo₂ max and vital capacity as essential indicators of athletic performance. VO₂ max reflects the body's ability to utilize oxygen during prolonged physical activity, directly influencing endurance and stamina. Vital capacity measures lung function, impacting an athlete's ability to sustain high-intensity exercise. Despite the importance of these variables, there is a gap in research exploring the impact of terrace training is relatively simple to implement and can be done in limited spaces, making it highly accessible for athletes who may not always have access to specialized equipment or facilities. By investigating the specific effect of terrace training on VO₂ Max and vital capacity, this research can provide valuable guidance methods. With the increasing popularity of interval training in sports conditioning, it is vital to evaluate the specific effect of terrace training to ensure that it is a viable option for student-athletes aiming to improve their physiological capacities. This study seeks to

fill that knowledge gap, providing evidence-based insights that can help inform training regimens and contribute to the broader fields of sports science.

Objectives:

- To evaluate the effects of terrace training on VO_2 max among men varsity students, assessing improvements in aerobic capacity and endurance.
- To examine the impact of terrace training on vital capacity measured through a wet spirometer, determining changes in respiratory function and overall lung efficiency in men varsity students.

Hypotheses:

- Terrace training will significantly increase VO_2 max levels among men varsity students compared to those who do not participate in terrace training.
- Terrace training will lead to a significant improvement in vital capacity, as measured by the wet spirometer, among men varsity students compared to their baseline measurements prior to the training.

Methodology:

This study employed a quasi-experimental design, specifically a pre-test and post-test approach, to assess the impact of terrace training on selected physiological variables among men varsity students. The design allowed for comparisons between the participants' physiological measurements before and after the intervention.

Selection of Subject:

A total of 30 male varsity students will be recruited for the study. Participants will be aged between 18 and 25 years and will be selected based on their willingness to participate and their regular involvement in physical activities. Prior to the commencement of the study, informed consent will be obtained from all participants. Male students aged 18-25, currently participate in regular physical activity. Students with cardiovascular or respiratory conditions, previous injuries that may affect performance, or any contraindications to high-intensity exercise.

Ethical Considerations:

In this study, ethical considerations were carefully observed to ensure the well-being and rights of all participants. Informed consent was obtained, providing participants with clear details about the study's purpose, procedures, risks, and benefits. Confidentiality was maintained by securing personal data, and no identifying information was shared publicly. The training regimen was designed to minimize physical strain, with proper monitoring to safeguard participants' health. Participation was entirely voluntary, and participants' autonomy was respected throughout the process, ensuring they felt comfortable and informed at every stage of the study.

Terrace Training Programme:

The intervention will consist of a structured terrace training program implemented for 12 weeks, with sessions held three times per week. The terrace training group participated in a 12-week program focused on improving cardiopulmonary fitness. The exercises included downhill running, wind sprints, sand running, interval running over varying distances, stair running, jump rope exercises, and shuttle sprints. These cardio-pulmonary exercises were performed three times a week on alternate days (Monday, Wednesday, and Friday). Each session lasted between 70-90 minutes, consisting of a structured warm-up, main cardio-focused workout, and a cool-down period. The intensity was set between 60-85% of the maximum heart rate, with the training load progressively increased throughout the program. Adequate recovery periods were included to optimise cardiovascular and pulmonary adaptations, following sports training principles.

Criterion Measures:

- VO_2 Max: VO_2 max was measured using the treadmill test, where the participant's oxygen consumption was recorded as they ran at progressively increasing speeds until exhaustion. This test provided an accurate reflection of cardiovascular efficiency and endurance capacity.
- Vital Capacity: Vital capacity was assessed using a wet spirometer, where participants exhaled forcefully after a deep breath. This test was crucial in evaluating respiratory efficiency and lung function improvements following the interval training program.

Collection of Data:

Data was collected at two key time points. Initially, measurements of VO_2 max and vital capacity were taken as a pre-test before the commencement of the twelve-week terrace training program. After completing the twelve weeks of training, post-test measurements were conducted immediately following the training.

Statistical Analysis:

Statistical analysis is conducted using the appropriate software SPSS. Descriptive statistics will summarize the data, while inferential statistics ANCOVA will be used to compare pre-test and post-test measurements for VO_2 max and vital capacity. The significance level will be set at $p < 0.05$.

Table 1: The Analysis of Covariance on VO₂ Max of the Pre And Post Test Scores of the Terrace Training Group and Control Group Have Been Analyzed and Presented

Test	Terrace Training Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained 'F' Ratio
Pre Test							
Mean	49.2	48.4	Between	4.8	1	4.8	0.21
S.D.	4.37	5.02	Within	22.21	28	22.21	
Post Test							
Mean	55.13	50.13	Between	187.5	1	187.5	6.37*
S.D.	5.61	5.22	Within	823.46	28	29.41	
Adjusted Post Test							
Mean	54.73	50.53	Between	131.22	1	131.22	17.72*
			Within	199.86	27	7.4	

* Significant at .05 level of confidence.

(The table values required for significance at .05 level of confidence for 2 and 28 and 2 and 27 are 3.34 and 3.35 respectively).

Table 1 presents the analysis of covariance (ANCOVA) on the VO₂ max scores for both the terrace training group and the control group, comparing their pre-test and post-test results. In the pre-test, the terrace training group had a mean VO₂ max of 49.20, while the control group had a mean of 48.40, with no significant difference between the groups (F = 0.21). After the training, the post-test mean VO₂ max for the terrace training group increased to 55.13, while the control group only improved to 50.13. The obtained F ratio of 6.37, exceeding the table value of 3.34, indicates a significant difference between the two groups at the 0.05 level of confidence. In the adjusted post-test analysis, after accounting for pre-test differences, the terrace training group's mean was 54.73, while the control group's was 50.53. The obtained F ratio of 17.72, well above the required value, confirms a significant improvement in VO₂ max for the terrace training group compared to the control group, demonstrating the effectiveness of the training intervention.

Figure 1

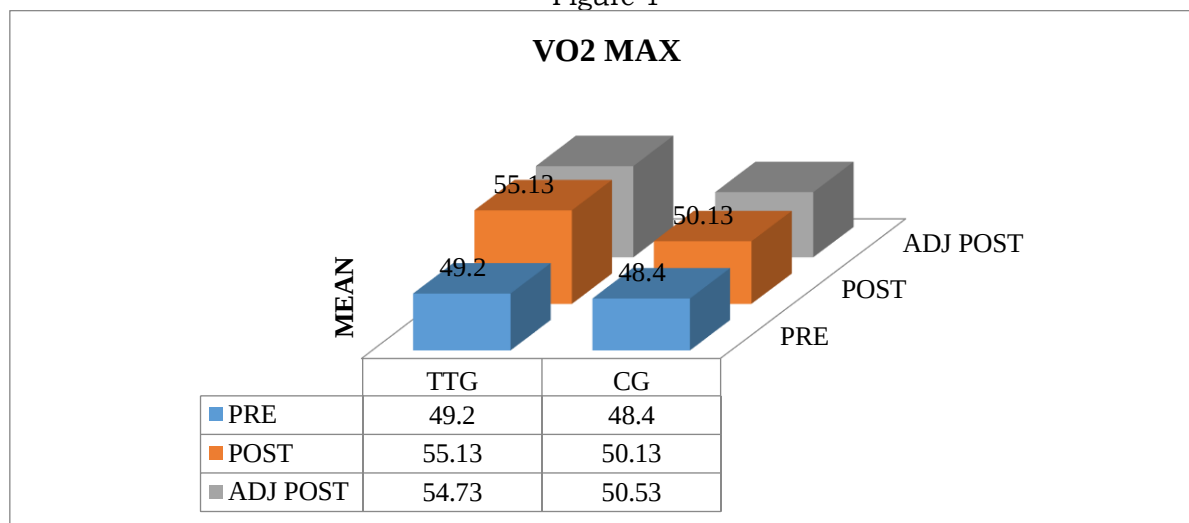


Table 2: The Analysis of Covariance on Vital Capacity of the Pre and Post Test Scores of the Terrace Training Group and Control Group Have Been Analyzed and Presented

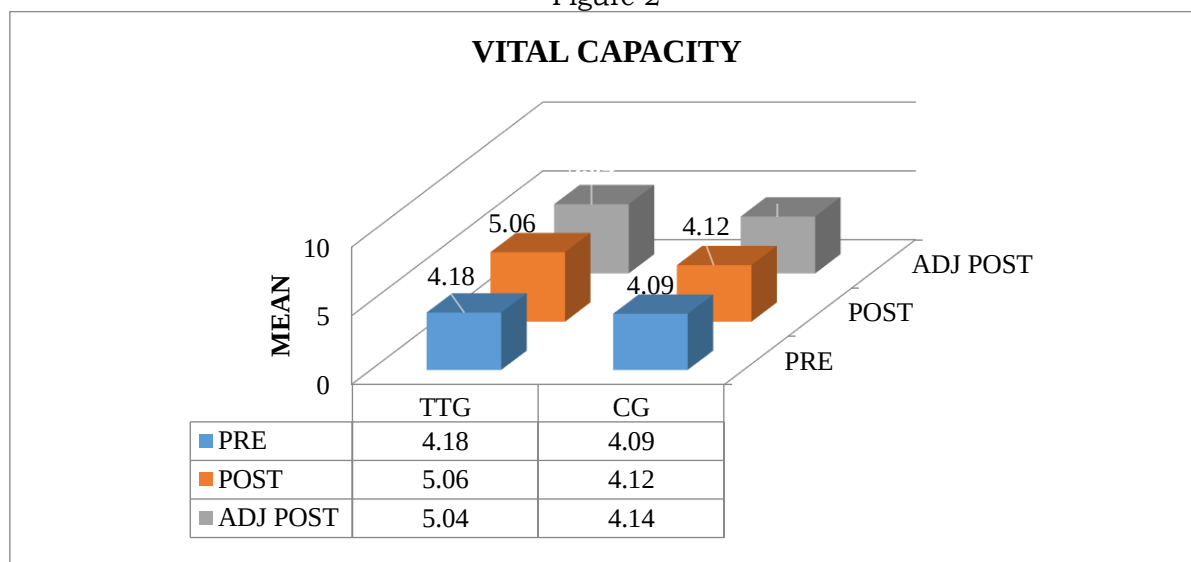
Test	Terrace Training Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained 'F' Ratio
Pre Test							
Mean	4.18	4.09	Between	0.05	1	0.05	0.28
S.D.	0.37	0.5	Within	5.48	28	0.196	
Post Test							
Mean	5.06	4.12	Between	6.72	1	6.72	21.28*
S.D.	0.5	0.61	Within	8.84	28	0.31	
Adjusted Post Test							
Mean	5.04	4.14	Between	6	1	6	22.61*
			Within	7.16	27	0.26	

* Significant at .05 level of confidence.

(The table values required for significance at .05 level of confidence for 2 and 28 and 2 and 27 are 3.34 and 3.35 respectively).

Table 2 presents the analysis of covariance (ANCOVA) results for vital capacity in the terrace training group and control group, comparing pre-test and post-test scores. In the pre-test, the terrace training group had a mean of 4.18, while the control group had a mean of 4.09, with no significant difference between the groups (F ratio = 0.28). Post-test results showed a significant increase in vital capacity for the terrace training group, with a mean of 5.06, compared to the control group's 4.12, as indicated by the F ratio of 21.28, which is higher than the required value of 3.34. After adjusting for pre-test scores, the terrace training group's adjusted mean was 5.04, while the control group's was 4.14, with a significant F ratio of 22.61, confirming the training's impact. Overall, the results demonstrate that the terrace training program significantly improved the vital capacity of the participants in the terrace training group compared to the control group, as shown by the post-test and adjusted post-test analyses.

Figure 2



Result and Discussion:

The study results demonstrated that terrace training significantly improved key physiological variables, specifically VO₂ max and vital capacity, among male varsity students. Over the 12-week training period, participants in the terrace training group experienced notable increases in VO₂ max, reflecting enhanced cardiovascular efficiency and endurance. The vital capacity improvements indicated better lung function and respiratory health. The structured and progressive training program, including stair running, interval exercises, and other high-intensity activities, placed demands on the cardiopulmonary system, leading to these physiological improvements.

Analysis of covariance (ANCOVA) confirmed significant differences between the terrace training group and the control group in both VO₂ max and vital capacity, highlighting the effectiveness of this training method in optimizing aerobic and respiratory function. The findings align with previous research supporting the role of interval training in improving overall fitness, demonstrating that terrace training can be a valuable tool for enhancing cardiopulmonary health in athletes.

These results contribute to existing literature by reinforcing the effectiveness of terrace training as a practical and accessible method for improving essential physiological functions. This study fills a gap by providing evidence-based insights that can be used to design training regimens tailored to varsity athletes, particularly in settings where specialized equipment or facilities may not be available. The training's success in improving both VO₂ max and vital capacity suggests that it can effectively prepare athletes for the physical demands of competitive sports, fostering enhanced performance on and off the field.

(Moholdt et al., 2024): This study focuses on reproductive-aged females and explores the benefits of interval training on cardio metabolic health (2). It is highly relevant because it emphasizes the feasibility and effectiveness of interval training in improving health outcomes, particularly for females in different life stages, which may align with your population of interest, especially if your study involves a similar demographic.

(Bossi et al., 2024): This research investigates the individual variability in adaptive responses to different intensities of interval training in cyclists, highlighting how exercise intensity normalization affects training completion and adaptation. This study is pertinent if your research examines the variability in physical or physiological responses to interval training, as it provides insights into inter- and intra-individual variability in response to different training intensities (1).

(Zouhal et al., 2024): This systematic review evaluates the impact of active versus passive recovery during interval training on physical fitness and physiological parameters (3). It is directly applicable to your study if you are investigating the effectiveness of different recovery modes within interval training protocols, providing evidence on how recovery type influences training outcomes.

These studies support various aspects of interval training, including its effects on health, adaptive variability, and recovery, making them well-suited to provide a comprehensive context for your research.

Constraints and Prospects for Future Research:

The study faced several constraints, including a small sample size, which may limit the generalizability of the findings, and the exclusion of females and other demographic groups, reducing the applicability of the results across diverse populations. The duration of the training program, while showing significant changes, could be extended in future studies to explore long-term effects. Environmental factors such as weather and terrain, which were not controlled, may have influenced the outcomes. Future research could address these limitations by including a more diverse participant pool, such as athletes from various sports, different age groups, and both genders. It would also be beneficial to compare terrace training with other high-intensity interval training methods or integrate it with strength and flexibility exercises for a more comprehensive understanding of fitness improvements. Furthermore, investigating the psychological effects of terrace training, such as motivation and mental resilience, and incorporating advanced biometrics like heart rate variability (HRV) and lactate threshold could provide deeper insights into cardiopulmonary adaptations and recovery processes.

Conclusions:

The present study investigated the impact of terrace training on selected physiological variables, specifically VO₂ max and vital capacity, among male varsity students. The findings revealed significant improvements in both variables for participants who underwent a 12-week terrace training program compared to the control group. The terrace training group exhibited a marked increase in VO₂ max, indicating enhanced cardiovascular efficiency and aerobic endurance, as demonstrated by a statistically significant F-ratio in the post-test and adjusted post-test analyses. Similarly, the improvement in vital capacity among the terrace training participants suggests better respiratory function, confirmed by the significant difference in adjusted means between the experimental and control groups.

The results of this study underscore the efficacy of terrace training as a viable intervention for enhancing key physiological parameters associated with athletic performance. The structured program, incorporating interval-based high-intensity exercises interspersed with recovery periods, facilitated the development of both aerobic and respiratory capacities. The improvements observed align with previous research, affirming the benefits of interval training in improving overall fitness levels. These findings suggest that terrace training can be effectively integrated into training regimens for varsity athletes to optimize their physiological performance, particularly when traditional training facilities or equipment are limited.

Future studies could explore the long-term effects of terrace training across different athletic populations, including variations in training intensity and frequency, to better understand its potential applications in sports conditioning and general fitness.

Conflict of Interest Statement:

The authors declare that there are no conflicts of interest regarding the publication of this study.

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