Effect of Low and High Intensity with Progressive Training on Selected Physiological Variables among Volleyball Players

R. Perumal[1*], B. Akbar Ali[2] and C. Ramesh[3]

[1]*PhD Scholar, Department of Physical Education, Madurai Kamaraj University, Madurai, Tamil Nadu, India*

[2]*Director of Physical Education, Hajee Karutha Rowther Howdia College, Uthamapalayam Tamil Nadu, India*

[3]*Assistant Professor & Head, Department of Physical Education, Madurai Kamaraj University, Madurai, Tamil Nadu, India*

[*]*Corresponding Author Email: perumalanu1022@gmail.com*

Abstract

Background: *The study focuses on the growing need to optimize volleyball performance through scientifically planned low- and high-intensity progressive training, as such approaches significantly influence key physiological variables and overall athletic efficiency.*

Aim*: The aim of this study was to investigate the effect of low and high intensity with progressive training on selected physiological variables among volleyball players.*

Material and Methods*: A total of forty five (N=45) college men volleyball players from the SVN College, PMT College and AAC Madurai, Tamil Nadu, participated in this study. These participants, aged between 18 and 22 years, were selected as subjects for the research. The participants were randomly divided into three groups (n=15).*

Statistical Applications*: The Statistical Package for the Jamovi Software was utilized to perform all analyses. Collected data's will be analysed by ANCOVA. The level of confidence 0.05 was fixed. The analysis of covariance (ANCOVA) was applied to find out the variance in each criterion variable (the process through which pre-test mean difference between the groups can be adjusted Post Test means). Whenever the 'F' ratio for adjusted Post Test means was found significant, Scheffe's post hoc test was applied. The significance level for hypothesis testing was established at 0.05.*

Results*: The results revealed significant differences in the low-intensity progressive training Group (resting heart rate: t-2.47*), High-intensity progressive training Group* *(resting heart rate: t-4.72*) and Control group (resting heart rate: t-0.50), F ratio (Pre F-0.01, Post F-9.33*, Aduj F- 9.23*) among volleyball players.*

***Conclusions**: High-intensity progressive training program (6 weeks) has been shown to be significant improvements on selected physiological variables than the low-intensity progressive training group and control group.*

***Keywords**: low- and high-intensity progressive training, volleyball and resting heart rate.*

Introduction

Volleyball is a dynamic sport requiring agility, endurance and cardiovascular efficiency, making structured training essential for improving physiological performance. Progressive training defined as gradually increasing exercise intensity, duration or frequency helps athletes achieve adaptations and enhance fitness outcomes (Science Direct, 2024). Evidence also indicates that higher-intensity training can improve cardio respiratory fitness compared with moderate exercise, supporting its application in sports conditioning (Tjønna et al., 2016). Therefore, combining low and high intensity with progressive overload is vital for optimizing physiological variables among volleyball players. Volleyball remains highly relevant today because it promotes cardiovascular fitness and overall physical health. Target exercise zones typically range from 50–70% of maximum heart rate for moderate activity and 70–85% for vigorous intensity, helping condition the heart effectively (Mayo Clinic, 2024). Resting heart rate is an important physiological marker, as endurance training can significantly reduce it by improving stroke volume and muscular efficiency (Hottenrott et al., 2013). A lower resting heart rate allows volleyball players to sustain rallies longer, recover faster between points and maintain performance during repeated high-effort movements. Energy expenditure in volleyball varies according to intensity, body weight and playing style, but most participants burn approximately 180–540 calories per hour with competitive play often reaching the higher range (Fit Health Regimen, 2025). Some estimates suggest players may expend about 230–800 kcal per hour depending on conditions such as pace and surface (Calories Fit, 2024). These values are commonly calculated using metabolic equivalents (METs), which compare the energy cost of activity to resting metabolism. Because volleyball demands repeated jumps, rapid directional changes and short bursts of effort, incorporating both low- and high-intensity progressive training is necessary. Progressive overload ensures that exercise workload increases gradually to stimulate adaptation. Moreover, high-intensity training has been associated with greater improvements in cardio respiratory fitness and aerobic capacity than moderate training alone (Tjønna *et al*., 2016). Consequently, structured intensity progression enhances energy utilization, cardiovascular efficiency and long-term athletic performance.

Aim of the Study

The aim of the study was to find out the effect of low and high intensity with progressive training on selected physiological variables among volleyball players.

Objective of the Study

To determine the effectiveness of low and high intensity with progressive training on selected physiological variables among volleyball players.

Hypothesis

It was hypothesized that the six weeks of low and high intensity with progressive training on selected physiological variables among volleyball players.

Methodology

The purpose of the study was to find out the effect of low and high intensity with progressive training on selected physiological variables among volleyball players. To achieve the purpose of the present study forty five college men volleyball players from randomly was selected from SVN College, PMT College and AAC Madurai, Tamil Nadu, India were selected as a subjects at random and Their age ranged between 18 to 22 years have participating in this research. The subjects were divided into three groups of fifteen each students. Group -A acted as Experimental (low intensity with progressive training) Group -B as (high intensity with progressive training) Group C as Control Group (Regular training). Training taught to be given on morning season of 6 weeks. Low intensity with progressive training would have doing on Monday, Wednesday, Friday and high intensity with progressive training on Tuesday, Thursday, Saturday of six weeks. Pre Data was gathered before the six weeks Post Data was collected after the finish of 6 weeks. The resting heart rate was measured by Digital blood pressure monitor. The data of pre and post was measurably examined by utilizing investigation of covariance (ANCOVA) in case the significance, scheffe's post-hoc to identified contrasts between gatherings. The confidence level maintained 0.05.

Statistical Interpretation

Analysis of covariance was used to determine the differences, if any, among the adjusted post test means on selected criterion variables separately. The Statistical Package for the Jamovi Software was utilized to perform all analyses. Whenever the *'F'* ratio for adjusted post test mean was found to be significant, the Scheffe's test was applied as post- hoc test. The level of significance was fixed at .05 level of confidence to test the *'F'* ratio obtained by analysis of covariance.

Table 1 Analysis of 't' Ratio for the Pre and Post-tests of low and high intensity with progressive training group on Resting Heart Rate

Mean	LIPT	HIPT	CG
Pre Test ± SD	71.06±2.34	71.13±1.40	71.20±1.69
Post Test ± SD	69.20±1.61	68.20±1.78	70.86±1.72
t Test	**2.47***	**4.72***	0.50

Table 1 shows the pre- and post-test mean values of resting heart rate for the Low-Intensity Progressive Training (LIPT), High-Intensity Progressive Training (HIPT), and Control Group (CG). Both the LIPT and HIPT groups exhibited a significant reduction in resting heart rate from pre-test to post-test, as their calculated *t* values (2.47 and 4.72) exceeded the required level of significance. This indicates that progressive training effectively improved cardiovascular efficiency. In contrast, the control group showed no significant change in resting heart rate, as reflected by the low *t* value (0.50). Overall, high-intensity progressive training produced a greater improvement compared to low-intensity training.

Table 2 Computation of Analysis of Covariance of Pre-Test, Post-Test and Adjusted Post Test on Resting Heart Rate of Experimental Groups and Control Group

Test	Source of Variance	Sum of Square	df	Mean Square	F
MEAN (PRE TEST)	B/G	0.13	2	0.06	0.01
	W/G	145.06	42	3.45	

MEAN (POST TEST)	B/G	54.44	2	27.22	**9.33***
	W/G	122.53	42	2.91	
MEAN (ADJUSTED POST TEST)	B/G	54.70	2	27.35	**9.23***
	W/G	121.50	41	2.96	

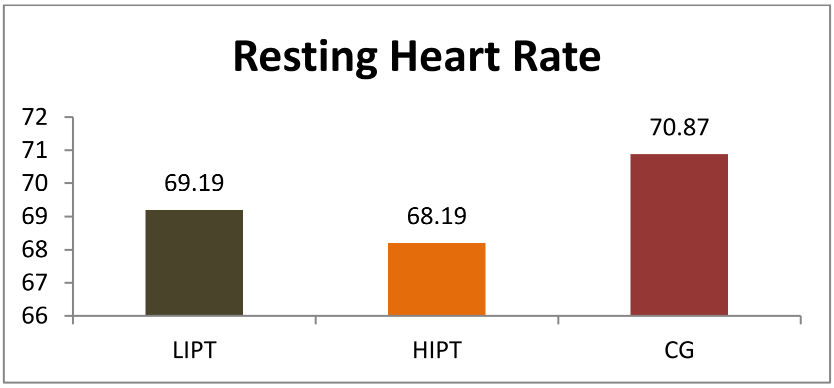
Table 2 presents the Analysis of Covariance (ANCOVA) results for resting heart rate among the Low-Intensity Progressive Training, High-Intensity Progressive Training, and Control groups. The pre-test F value (0.01) was not significant, indicating that all groups were homogeneous before the training program. However, the post-test F value (9.33) showed a significant difference among the groups, suggesting that the training had a measurable effect on resting heart rate. Similarly, the adjusted post-test F value (9.23) remained significant even after controlling for pre-test differences. This confirms that progressive training, particularly at varying intensities, effectively improved cardiovascular efficiency compared to the control group.

Table III: Adjusted Means, Differences between means and Scheffe's Post Hoc Test on Resting Heart Rate of Experimental groups and Control group

LIPT	HIPT	CG	MD	Sig
69.19	68.20		0.99	0.12
	68.20	70.87	2.67	**0.00***
69.19		70.87	1.68	**0.01***

Table III presents the adjusted mean values and Scheffe's post hoc test results for resting heart rate among the Low-Intensity Progressive Training (LIPT), High-Intensity Progressive Training (HIPT), and Control Group (CG). The comparison between LIPT and HIPT showed no significant difference (MD = 0.99, p = 0.12), indicating that both training intensities were similarly effective. However, significant differences were observed between HIPT and CG (MD = 2.67, p = 0.00) and between LIPT and CG (MD = 1.68, p = 0.01). These findings suggest that both progressive training methods significantly reduced resting heart rate compared to the control group, with high-intensity training demonstrating slightly greater improvement.

Figure 1: Bar Diagram shows that Scheffe's Post Hoc on Resting Heart Rate Test of Experimental groups and Control group



Discussion of Findings

Discussion on Findings

The findings of the present study revealed that both low- and high-intensity progressive training produced favourable changes in resting heart rate, with the high-intensity group demonstrating greater improvement than the low-intensity and control groups. Regular exercise is widely recognized for enhancing cardiovascular efficiency, and structured aerobic training has been shown to significantly decrease resting heart rate in experimental groups while no meaningful change occurs in control conditions (Alqantara Journal, 2023). Furthermore, evidence suggests that consistent aerobic exercise promotes better cardiovascular health by reducing resting heart rate over time, thereby supporting improved endurance performance (Gendemeh et al., 2025). Higher training intensity may produce more pronounced heart rate adaptations, indicating the effectiveness of progressive overload in conditioning programs (Nature, 2009). Overall, the results align with previous research confirming that systematic training enhances physiological function and athletic readiness.

Conclusion

The study concludes that both low- and high-intensity progressive training significantly improved resting heart rate among volleyball players, indicating enhanced cardiovascular efficiency. High-intensity progressive training produced comparatively greater reductions, demonstrating its effectiveness in developing physiological fitness. The absence of significant improvement in the control group confirms that systematic training is essential for positive adaptation. Therefore, incorporating progressive overload with appropriate intensity levels can help athletes improve endurance, recovery ability and overall sports performance, making it an important component of modern volleyball conditioning programs.

References

1. *TopEndSports. (2025). MET calculator and energy expenditure. MET Calculator – Energy Expenditure.*
2. *Hottenrott, K., et al. (2013). High-intensity and endurance training effects on resting heart rate. Effects of High Intensity Training on Aerobic Capacity.*
3. *Gendemeh, C., Kumar, P., & Bah, M. B. (2025). Impact of regular aerobic exercise on cardiovascular efficiency.*
4. *Alqantara Journal. (2023). Effects of aerobic training on resting heart rate among college students.*
5. *Nature. (2009). Effects of aerobic training intensity on heart rate.*
6. *Mayo Clinic. (2024).* Exercise intensity: How to measure it. *Exercise intensity: How to measure it.*
7. *ScienceDirect. (2024).* Progressive overload in cardiorespiratory exercise training. *Progressive overload in cardiorespiratory exercise training.*
8. *Tjønna, A. E., et al. (2016).* Effects of high-intensity vs. moderate-intensity training on VO_2max. *Study on high-intensity interval training and VO_2max.*
9. *FitHealthRegimen. (2025).* Volleyball calories burned calculator. *Volleyball Calories Burned Calculator.*
10. *CaloriesFit. (2024).* How many calories burned playing volleyball. *How Many Calories Burned Playing Volleyball.*