

Impact of Step-Up Exercises on Specific Physiological Parameters of Basketball Players

¹Sourabh, ²Mr. Gurdeep Singh, ³Dr. Ravi Kumar

¹M.P.Ed. Student, Department of Physical Education, Guru Kashi University

²Assistant Professor, Department of Physical Education, Guru Kashi University

³Professor, Department of Physical Education, Guru Kashi University

Email id: ²gurdeep8488@gmail.com, ³ravikumargahalawat@gmail.com

Accepted: 08.06.2026

Published: 30.06.2026

Page No. 118 – 121

DOI: 10.5281/zenodo.21523479

Abstract— A research study was done on the effect of step-up exercises on selected physiological parameters of 20 junior male basketball players (12-14 years). The players were randomly assigned to the control group, which received regular training, and to the experimental group, which underwent a six-week step-up exercise program. Before and after intervention, assessments were made with respect to vital capacity, resting heart rate, and cardiorespiratory endurance. Statistical analysis utilized independent and dependent samples t-tests. The experimental group showed significant changes in resting heart rate and cardiorespiratory endurance before and after the test, but no significant change in vital capacity. Results suggest that a step-up exercise program for six weeks may improve selected cardiovascular and endurance-related parameters in junior basketball players.

Keywords—basketball, cardiorespiratory endurance, resting heart rate, step-up exercise, vital capacity.

I. INTRODUCTION

Basketball is a fast, intermittent team sport that requires strength, speed, agility, balance, flexibility, coordination, and cardiorespiratory endurance. Optimal physical conditioning is therefore essential for repeated sprinting, jumping, dribbling, passing, and shooting throughout a game. Step and bench exercises provide a practical mode

of lower-body aerobic conditioning and have been reported to produce measurable physiological responses [2]. Step-aerobic and related exercise programmes may influence cardiac function [1], while aerobic training has also been associated with changes in resting heart rate and vascular fitness [4]. Evidence from different exercise modes further indicates that cardiorespiratory endurance and flexibility respond to systematic training [3], and exercise training may produce adaptations in the respiratory system [5]. Accordingly, the present study investigated whether a six-week step-up exercise programme affected resting heart rate, vital capacity, and cardiorespiratory endurance in junior male basketball players.

II. METHODOLOGY

A. Selection of Subjects

Twenty (N = 20) junior male basketball players from D.C.P.E., Amravati, were selected for the study. The participants were 12–14 years of age and were divided into experimental and control groups of ten players each.

B. Selection of Tools and Criterion Measures

The following procedures were used to measure the selected physiological variables:

1) Resting Heart Rate: Resting heart rate was measured in the participants' hostel rooms immediately after waking in the morning. A digital

heart-rate monitor was used, and the value was recorded in beats per minute.

2) Vital Capacity: After several normal breaths, each participant inhaled deeply and exhaled as forcefully as possible into a dry spirometer. The best of three consecutive trials was recorded.

3) Cardiorespiratory Endurance: A nine-minute run/walk test was administered. Participants were instructed to cover the maximum possible distance within nine minutes; walking was permitted when necessary. The total distance was recorded in metres.

C. Collection of Data: Before data collection, the purpose, method, and procedure for each test were explained and demonstrated to the participants. Pre-test data were collected before the six-week programme, and post-test data were collected after completion of the intervention.

D. Statistical Analysis: The data were analysed using the Statistical Package for the Social Sciences (SPSS). Independent-samples t-tests were used to compare the experimental and control groups, while dependent-samples t-tests were applied to compare pre- and post-test means within each group. Statistical significance was assessed at the 0.05 level using the critical values reported in the original analysis.

III. RESULTS

The descriptive statistics and t-ratios for the selected physiological variables are presented in Tables I-IV. The symbols “*” and “@” indicate statistically significant and non-significant results, respectively, according to the critical t-values reported in the study.

TABLE I
PRE-TEST COMPARISON OF THE
EXPERIMENTAL AND CONTROL GROUPS

variable	exp. mean	cont. mean	exp. sd	cont. sd	m.d.	s.e. of m.d.	t-ratio
resting heart rate	91.8	90.8	2.740	3.425	1.00	1.300	0.769@
vital capacity	1.22	1.21	0.162	0.166	0.01	0.077	0.129@
cardiorespiratory endurance	1190	1190	159.513	110.05	0	6.128	0.000@

@ Not significant at 0.05 level; N = 20; critical t (18) = 2.101.

As shown in Table I, the calculated t-values for resting heart rate (0.769), vital capacity (0.129), and cardiorespiratory endurance (0.000) were lower than the reported critical value of 2.101. Therefore, the experimental and control groups did not differ significantly at pre-test on any of the three variables.

TABLE II
POST-TEST COMPARISON OF THE
EXPERIMENTAL AND CONTROL
GROUPS

Variable	Exp. Mean	Cont. Mean	Exp. SD	Cont. SD	M.D	S.E. of M.D.	t-ratio
Resting Heart Rate	83.0	87.5	4.109	4.007	4.50	1.185	2.479*
Vital Capacity	1.49	1.24	0.202	0.1075	0.25	0.071	3.52*
Cardiorespiratory Endurance	1370	1280	105.934	168.65	90	62.98	1.43@

* Significant; @ not significant at 0.05 level; N = 20; critical t (18) = 2.101.

Table II indicates that the reported t-values for resting heart rate (2.479) and vital capacity (3.52) exceeded the critical value of 2.101, indicating significant post-test differences between the groups. The t-value for cardiorespiratory endurance (1.43) was below the critical value and was therefore not significant.

TABLE III
PRE- AND POST-TEST COMPARISON
WITHIN THE EXPERIMENTAL GROUP

Variable	Pre Mean	Post Mean	Pre SD	Post SD	M.D.	S.E. of M.D.	t-ratio
Resting Heart Rate	91.8	83.0	2.740	4.109	8.8	1.171	7.50*
Vital Capacity	1.22	1.49	0.162	0.202	0.27	0.220	1.227@
Cardio-Respiratory Endurance	1190	1370	110.050	105.934	180	21.09	8.53*

* Significant; @ not significant at 0.05 level; $N = 10$; critical $t(9) = 1.833$.

Within the experimental group, the reported t-values for resting heart rate (7.50) and cardiorespiratory endurance (8.53) exceeded the critical value of 1.833, indicating significant pre- to post-test changes. The t-value for vital capacity (1.227) was lower than the critical value and was not statistically significant.

TABLE IV
PRE- AND POST-TEST COMPARISON
WITHIN THE CONTROL GROUP

Variable	Pre Mean	Post Mean	Pre SD	Post SD	M.D.	S.E. of M.D.	t-ratio
Resting Heart Rate	90.8	87.5	3.425	4.007	3.3	1.612	2.06*
Vital Capacity	1.21	1.24	0.166	0.1075	0.03	0.628	0.48@
Cardiorespiratory Endurance	1190	1280	159.513	168.650	90	18.86	4.77*

* Significant; @ not significant at 0.05 level; $N = 10$; critical $t(9) = 1.833$.

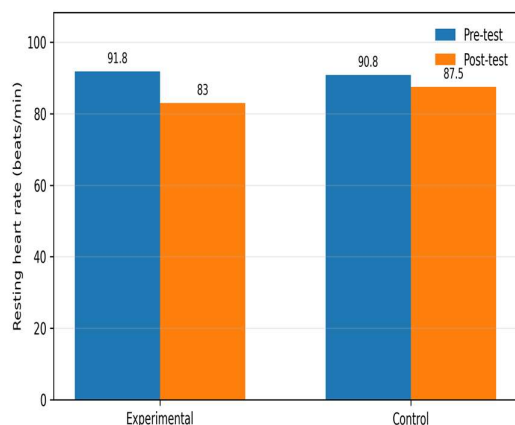


Fig. 1. Pre- and post-test resting heart rate in the experimental and control groups.

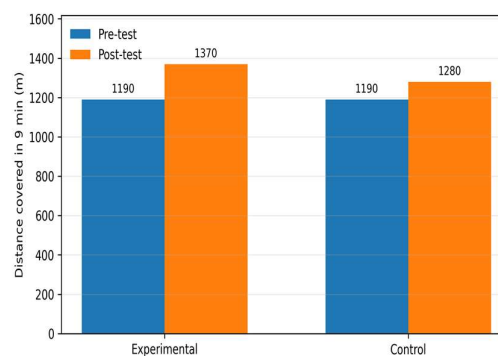


Fig. 2. Pre- and post-test vital capacity in the experimental and control groups.

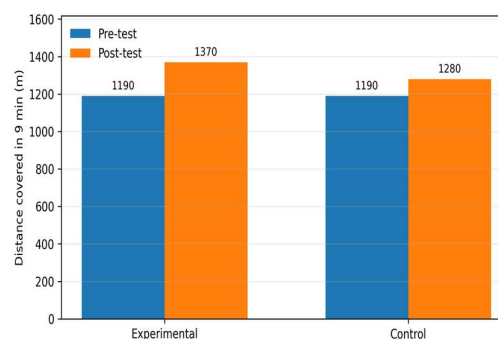


Fig. 3. Pre- and post-test cardiorespiratory endurance in the experimental and control groups.

For the control group, the reported t-values for resting heart rate (2.06) and cardiorespiratory endurance (4.77) were greater than the critical value of 1.833, whereas the t-value for vital capacity (0.48) was lower than the critical value. Thus, significant pre- to post-test differences were reported for resting heart rate and cardiorespiratory endurance, but not for vital capacity.

IV. DISCUSSION

Based on the findings, step-up exercise had a significant effect on resting heart rate and cardiorespiratory endurance of the student after six weeks of practice. However, it was not significant on vital capacity. Research also indicates that step or bench exercise can provide an effective aerobic stimulus [2] consistent with the cardiovascular response. Comparable exercise programmes have been associated with cardiovascular functional

adaptations [1] and alterations in resting heart rate, vascular fitness, and relaxation [4]. The development of cardiorespiratory endurance is compatible with earlier comparisons of endurance responses between different exercise modes [3]. As no significant change occurred in vital capacity, the duration, intensity and/or respiratory loading of the programme may not have been enough to produce a clear pulmonary adaptation. It has been reported that systematic training can produce an effect on respiratory function [5].

The results must be interpreted with caution. The sample was small and only comprised boys aged 12-14 years. Moreover, the control group significantly changed from pre- to post-test for two variables. Consequently, factors like growth, regular sporting involvement, variability in measurement, and lack of control over activities may cause the changes. A larger randomized study with detailed training-load monitoring and group-by-time analysis would provide a better estimate on intervention effect.

V. CONCLUSION

According to the confines of the study, there was a noteworthy improvement in the resting heart rate and cardiorespiratory endurance of the experimental-group basketball players in the six-week step-up exercise program. No statistically significant change was witnessed in vital capacity. The step-up exercise could thus be devised as a realistic supplementary conditioning activity for junior basketball players and future studies should use a larger sample size, a longer intervention duration, and stricter control of training exposure.

REFERENCES

- [1] G. Cicek, "The effect of exercises on left ventricular systolic and diastolic heart function in sedentary women: Step-aerobic vs. core exercises," *Journal of Exercise Science & Fitness*, vol. 15, no. 2, pp. 70–75, Dec. 2017.
- [2] M. Scharff-Olson, "The physiological effects of bench/step exercise," *Sports Medicine*, vol. 21, no. 3, pp. 164–175, Apr. 1996.
- [3] D. Allen and I. Young, "Cardiorespiratory endurance and flexibility: A comparison study of Taekwon-Do and aerobic exercise in adult males," *Dissertation Abstracts International*, vol. 53, p. 3143-A, Mar. 1973.
- [4] S. J. Kang, "Effects of aerobic exercise on the resting heart rate, physical fitness, and arterial stiffness of female patients with metabolic syndrome," *Journal of Physical Therapy Science*, vol. 28, no. 6, pp. 1764–1768, Jun. 2016.
- [5] S. P. Sharma, "Effect of training on respiratory system," *Indian Journal of Physical Education, Sports Medicine and Exercise Science*, vols. 3–4, pp. 69–76, Jan.–Jul. 2005.