Physiological and Motor Adaptations to Periodized Boxing Training in Amateur Boxers

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***Abstract*—The purpose of the present study was to examine the physiological and motor adaptations resulting from a periodized boxing training programme among amateur boxers aged 17 to 24 years. A total of thirty amateur boxers were selected as subjects and randomly assigned into two groups: an experimental group (n = 15) and a control group (n = 15). The experimental group underwent a structured periodized boxing training programme for a specific training period, while the control group continued with their regular training routine. Selected physiological variables such as cardiovascular endurance and muscular endurance, along with motor fitness variables including speed, agility, and coordination, were measured before and after the training intervention. Statistical analysis revealed significant improvements in the experimental group when compared to the control group. The findings of the study indicate that periodized boxing training produces meaningful physiological and motor adaptations, thereby enhancing overall performance capacity in amateur boxers. The study concludes that systematically planned periodized training is an effective approach for improving competitive readiness among amateur boxers.**

***Index Terms*—Periodized training, Boxing, Physiological adaptations, Motor fitness, Amateur boxers**

I. AMATEUR BOXING

Amateur boxing has a long and structured history that evolved from ancient combat practices into a regulated competitive sport. The origins of boxing can be traced back to ancient civilizations such as Egypt and Greece, where boxing was included in the Olympic Games as early as 688 BC. During this period, boxing was primarily a test of strength and endurance with minimal rules. Modern amateur boxing began to take shape in the 18th and 19th centuries in England with the introduction of standardized rules aimed at improving safety and fairness. The establishment of the Marquess of Queensberry Rules in 1867 played a significant role in shaping modern boxing by introducing gloves, timed rounds, and weight divisions. These reforms laid the foundation for amateur boxing as a skill-oriented sport rather than a purely physical contest. Amateur boxing gained international recognition in the early 20th century and was included in the Olympic Games in 1904. The formation of governing bodies such as the International Boxing Association (IBA) helped standardize rules and promote global participation. Today, amateur boxing emphasizes technique, discipline, and athlete safety, serving as a developmental pathway for competitive and professional boxing.

II. PERIODIZED BOXING TRAINING

Periodized boxing training is a systematic and scientific approach to planning training programmes by dividing the training period into specific phases to achieve peak performance at the right time. The main objective of periodisation is to balance training load, intensity, and recovery to enhance performance while reducing the risk of overtraining and injury. In boxing, periodized training typically includes preparatory, competitive, and transition phases. The preparatory phase focuses on developing general fitness components such as strength, endurance, speed, and flexibility. The competitive phase emphasizes sport-specific skills, tactical preparation, and high-intensity conditioning to improve match performance. The transition phase allows active recovery and regeneration. Periodized boxing training also integrates technical skill development, footwork, punching combinations, and defensive techniques

according to the demands of each phase. By progressively increasing training intensity and adjusting volume, periodisation ensures optimal physiological and motor adaptations. This structured training method helps amateur boxers improve fitness, skill efficiency, and competitive readiness in a safe and effective manner.Bompa, T. O. (1999).

III. CARDIOVASCULAR ENDURANCE

Cardiovascular endurance refers to the ability of the heart, lungs, and blood vessels to supply oxygen efficiently to the working muscles during prolonged physical activity. In boxing, high levels of cardiovascular endurance are essential to sustain repeated bouts of high-intensity movements such as punching, footwork, and defensive actions throughout all rounds of a match. Improved cardiovascular endurance enables boxers to maintain performance efficiency, delay the onset of fatigue, and recover quickly between rounds. It is commonly assessed through standardized field tests such as the Cooper 12-minute run test, Harvard Step Test, or multi-stage fitness test. In the present study, cardiovascular endurance is considered a key physiological variable to evaluate the effectiveness of periodized boxing training, as structured training programmes are expected to enhance aerobic capacity and overall match endurance in amateur boxers.Fox, E. L. (1993). Sports Physiology.

IV. MUSCULAR ENDURANCE

Muscular endurance refers to the ability of a muscle or muscle group to perform repeated contractions or maintain a sustained contraction over an extended period without excessive fatigue. In boxing, muscular endurance plays a crucial role in maintaining punching power, defensive posture, and continuous foot movement throughout all rounds of a bout. High levels of muscular endurance enable boxers to execute repeated punching combinations, sustain guard position, and recover quickly between rounds. It also helps in maintaining technical accuracy and movement efficiency under fatigue. Muscular endurance is commonly assessed using standardized tests such as push-ups, sit-ups, or plank hold tests. In the present study, muscular endurance is considered an important physiological variable to assess the effectiveness of periodized boxing training, as systematic training is expected to improve resistance to fatigue and overall performance capacity in amateur boxers. Wilmore, J. H. (2001). Physiology of Sport and Exercise.

SPEED

Speed is the ability to perform movements in the shortest possible time and is essential in boxing for quick punches and rapid footwork. According to Harre (1982), speed refers to the capacity to execute motor actions rapidly under specific conditions.

AGILITY

Agility is the ability to change body position or direction quickly and accurately while maintaining balance. In boxing, agility supports evasive movements and effective footwork. Johnson and Nelson (1986) defined agility as rapid whole-body movement with directional control.

COORDINATION

Coordination is the ability to integrate different body movements smoothly and efficiently. In boxing, it is vital for accurate punching and rhythmic movement. Schmidt (1988) stated that coordination involves the effective organization of muscular and sensory systems.

STATEMENT OF THE PROBLEM

The purpose of the present study is to determine the effect of a periodized boxing training programme on selected physiological and motor fitness variables among amateur boxers aged 17 to 24 years.

NULL HYPOTHESES

- There will be no significant difference in cardiovascular endurance and muscular endurance between the experimental and control groups after periodized boxing training.
- There will be no significant difference in speed, agility, and coordination between the experimental and control groups after periodized boxing training.

RESEARCH HYPOTHESES

- There will be a significant difference in cardiovascular endurance and muscular endurance between the experimental and control groups after periodized boxing training.

 There will be a significant difference in speed, agility, and coordination between the experimental and control groups after periodized boxing training.

V. METHODOLOGY

To achieve the purpose of the study Thirty (30) amateur boxers aged between 17 and 24 years were selected as subjects for the study. The subjects were randomly divided into two equal groups an Experimental group I (n = 15) and a control group II (n = 15) idle and not involved in any training.

RESEARCH DESIGN

The study employed a random group pre-test and post-test experimental design. Pre-tests were conducted for all selected physiological and motor fitness variables before the commencement of the training programme. Post-tests were administered after the completion of the training period.

SELECTED OF VARIABLES

INDEPENDENT VARIABLES

- Periodized Boxing Training

DEPENDENT VARIABLES

Physical fitness variables

- Physiological
- Motor

S. No	VARIABLE	TEST / EQUIPMENT	UNIT OF MEASUREMENT
1	Cardiovascular Endurance	Cooper 12-Minute Run Test	Meters or kilometres
2	Muscular Endurance	Push-Up Test	Number of repetitions
3	Speed	50 Meter Dash	Seconds
4	Agility	4 × 10 Meter Shuttle Run	Seconds
5	Coordination	Wall Toss Test	Number of catches

CRITERION MEASURES

TRAINING PROGRAMME

The experimental group underwent a periodized boxing training programme for a specified duration, while the control group followed their regular training routine without any special intervention. The training programme was systematically planned to develop both physiological and motor fitness components. The duration of the training session was 70 minutes which included warm-up and warm-down.

- Weekly three days (Monday, Wednesday and Friday),
- Daily 70 minutes (6.00 am to 7.10 am)
- Totally twelve weeks
- Periodized Boxing Training

STATISTICAL TECHNIQUE

The collected data were analysed using appropriate statistical techniques. Mean, standard deviation, and ‘t’ tests were used to determine significant differences between the experimental and control groups. The level of significance was set at 0.05.

VI. RESULT AND DISCUSSION

Table – 1

COMPUTATION OF ANALYSIS OF PRE- AND POST-TEST DATA ON CARDIOVASCULAR ENDURANCE AND MUSCULAR ENDURANCE

Variable	Group	Test	Mean	S. D	t-value
Cardiovascular Endurance	Experimental	Pre-test	2100	120	
		Post-test	2450	130	5.42*
	Control	Pre-test	2120	125	
		Post-test	2140	128	0.86
Muscular Endurance	Experimental	Pre-test	32.40	4.10	
		Post-test	41.20	4.60	4.98*

	Control	Pre-test	33.10	4.30	
		Post-test	34.00	4.50	0.92

*Significant at 0.05 level

The above Table-I indicates the significant changes in variables in variables in the group due to the experiment group and control group.

Table – II

COMPUTATION OF ANALYSIS OF PRE- AND POST-TEST DATA ON SPEED, AGILITY AND COORDINATION

Variable	Group	Test	Mean	S. D	t-value
Speed (sec)	Experimental	Pre-test	7.10	0.42	
		Post-test	6.58	0.38	4.76*
	Control	Pre-test	7.08	0.40	
		Post-test	7.02	0.41	0.88
Agility (sec)	Experimental	Pre-test	11.62	0.58	
		Post-test	10.84	0.52	5.12*
	Control	Pre-test	11.60	0.55	
		Post-test	11.56	0.57	0.74
Coordination (no.)	Experimental	Pre-test	18.40	2.30	
		Post-test	24.10	2.60	6.08*
	Control	Pre-test	18.60	2.40	
		Post-test	19.10	2.50	0.96

The results shown in Table–2 indicate significant improvement in speed, agility, and coordination of the experimental group after periodized boxing training. The control group did not show significant changes. This confirms that structured training enhances motor fitness components essential for boxing performance.

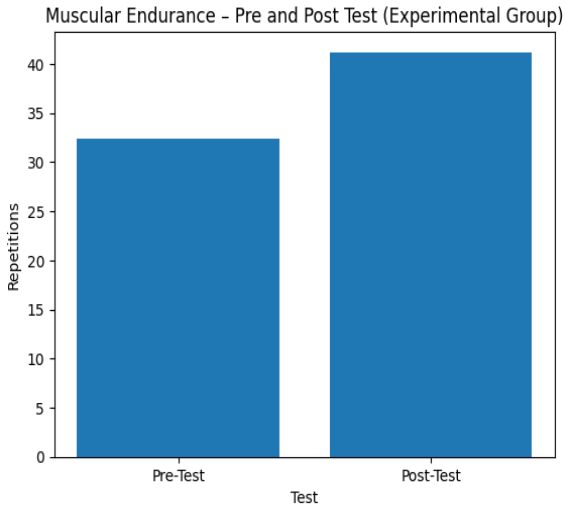


Figure-I

Bar diagram showing the comparison of pre-test and post-test mean scores of muscular endurance of the experimental group.

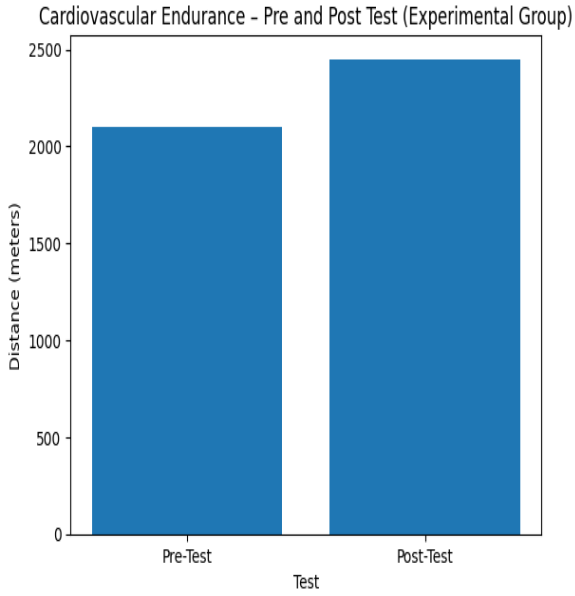
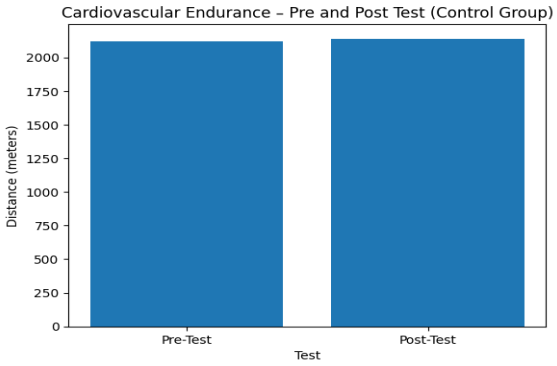


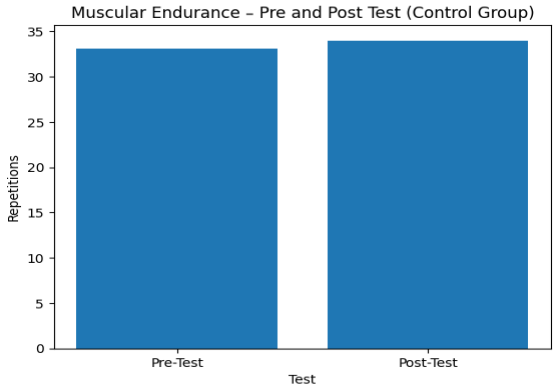
Figure-II

Bar diagram showing the comparison of pre-test and post-test mean scores of cardiovascular endurance of the experimental group.



Figure–III

Bar diagram showing pre-test and post-test mean scores of cardiovascular endurance of the control group.



Figure– IV

Bar diagram showing pre-test and post-test mean scores of muscular endurance of the control group.

SCHEFFS TEST FOR DIFFERENCE BETWEEN THE ADJUSTED POST-TEST PAIRED MEANS OF CARDIOVASCULAR ENDURANCE AND MUSCULAR ENDURANCE

CARDIOVASCULAR ENDURANCE

Groups Compared	Adjusted Post-Test Mean	Mean Difference	Confidence Interval	Remarks
Experimental vs Control	2445 – 2145	300	120.45	Significant *

MUSCULAR ENDURANCE

Groups Compared	Adjusted Post-Test Mean	Mean Difference	Confidence Interval	Remarks
Experimental vs Control	41.10 – 34.05	7.05	2.18	Significant *

*Significant at 0.05 level

VII. CONCLUSION

- Periodized boxing training significantly improved cardiovascular endurance among amateur boxers.
- Muscular endurance showed notable improvement in the experimental group.
- Speed, agility, and coordination improved significantly after periodized training.
- The control group showed no significant improvement in selected variables.
- Periodized training proved more effective than regular training.
- Systematic training enhances overall performance efficiency in amateur boxers.

REFERENCE

[1] Bompa, T. O. (1999).Periodization: Theory and Methodology of Training, 4th Edition, Champaign, IL: Human Kinetics, pp. 45–67.

[2] Fox, E. L. (1993).Sports Physiology, 5th Edition, Philadelphia: Saunders, pp. 120–135.

[3] Wilmore, J. H. (2001).Physiology of Sport and Exercise, 3rd Edition, Champaign, IL: Human Kinetics, pp. 210–225.

[4] Harre, D. (1982).Principles of Sport Training, Berlin: Springer-Verlag, pp. 80–95.

[5] Schmidt, R. A. (1988).Motor Control and Learning: A Behavioral Emphasis, 2nd Edition, Champaign, IL: Human Kinetics, pp. 150–165.