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Concept of Plyometric Training and Its Effect on Physiological Parameters of Football Players

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Abstract

Background. Plyometric training, which consists of exercises that involve rapid and repetitive muscle stretching and contraction, has become increasingly popular for its potential in sports conditioning.

Objectives. The primary objective of this study was to examine the principles of plyometric training and to assess how it influences the physiological parameters of football players.

Materials and methods. This study involved 30 male football players aged 18 to 24, actively engaged in national-level competition. The participants were randomly divided into two groups: the experimental group (n = 15) and the control group (n = 15), with 15 players in each group. The selected physiological parameters for assessment included aerobic capacity, blood pressure, and pulse rate. Aerobic capacity was measured using Cooper's 12-minute run/walk test, blood pressure was assessed with a sphygmomanometer, and pulse rate was measured using the radial artery method. The six-week plyometric training program, conducted five days a week, involved 60-minute sessions. The experimental group underwent the plyometric training program, while the control group did not engage in any specific exercises. Pre- and post-test scores were analyzed statistically using descriptive statistics and analysis of covariance (ANCOVA). The significance level was set at a confidence level of 0.05.

Results. The findings indicate a notable enhancement in physiological parameters among participants in the experimental group as opposed to the control group. The implementation of the plyometric training program proved to be effective in elevating the aerobic capacity, blood pressure, and pulse rate of the football players.

Conclusions. The study concludes that a six-week plyometric training program significantly enhances the physiological parameters of football players, including aerobic capacity, blood pressure, and pulse rate. Further research should be conducted to examine the long-term effects and optimal duration of plyometric training, as well as the underlying physiological mechanisms, in order to gain a deeper understanding of its effectiveness and applications in sports conditioning.

Keywords: plyometric training, aerobic capacity, blood pressure, pulse rate, football.

Introduction

The term "plyometrics" originates from the Greek words "plythein" or "plyo," meaning "to increase," and "metric," meaning "to measure." Thus, plyometrics fundamentally implies "to increase the measurement." This often refers to improvements in sports performance metrics, such as throwing distance, serve velocity, jump height, or sprint speed, as measured during testing or competition (Davies et al., 1998). Plyometric training is typified by quick, strong motions that involve an explosive concentric contraction, which is a sudden, powerful shortening of the muscles after an initial lengthening (eccentric contraction). According to Bosco et al. (1982), this training technique can make use of either an eccentric-concentric coupling phase or a stretch-shortening cycle. The latter, sometimes referred to as the integrated performance paradigm, places emphasis on the necessity of precisely achieving movement by loading forces eccentrically, stabilizingisometrically, and then accelerating concentrically. Plyometric exercise, according to Voight and Brady (1992), uses the body's proprioceptive and elastic qualities to help generate maximum force in the shortest amount of time. By increasing the excitability, sensitivity, and reactivity of the neuromuscular system, this type of training not only increases motor learning but also neuromuscular efficiency. The overall impact includes an increase in the rate of force production (power), motor-unit recruitment, frequency (rate coding), and synchronization.

Plyometric exercises should be used for performance enhancement in sports because they incorporate principles essential to both lower extremity (LE) and upper extremity (UE) sports. Plyometric training leverages the stretch-shortening cycle (SSC), which involves a rapid transition from lengthening (eccentric) to shortening (concentric) movements (Ebben et al., 2008). This cycle enhances the efficiency and power of movements, leading to improved sports performance.

According to Chmielewski et al. (2006), plyometric training consists of three separate phases: the eccentric phase, the amortization phase, and the concentric phase. Muscles pre-extend before activating during the eccentric phase, which raises the activity of muscle spindles. The time between the end of the eccentric contraction (also known as the loading or deceleration phase) and the start of the concentric contraction (also known as the unloading or force production phase) is known as the amortization phase. Following the amortization phase, there is a concentric contraction during the concentric phase.

Plyometric training leverages the elastic and proprioceptive attributes of muscles to achieve maximal force production, stimulating mechanoreceptors and promoting increased muscle recruitment in a condensed timeframe, as indicated by Wilk et al. (1993). The proprioceptive foundation for plyometric training is provided by muscle spindles and Golgi tendon organs (GTOs). The central nervous system utilizes this sensory input to influence muscle tone, motor execution, and kinesthetic awareness, as elucidated by Lundin (1985). Activation of these receptors facilitates, inhibits, and modulates both agonist and antagonist muscle activities, thereby enhancing neuromuscular efficiency and functional strength.

Exercises that involve plyometric stabilization, plyometric strength, and plyometric power have three main contraindications. Exercises for plyometric stabilization are designed to improve reactive neuromuscular efficiency, postural alignment, and ideal landing mechanics. The goals of plyometric-strength workouts are to improve the neuromuscular efficiency of the human movement system overall, eccentric strength, dynamic joint stabilization, and rate of force output (Mola & Adane, 2020). Markovic et al. (2007) found that maximal speed and explosiveness are used when performing plyometric power exercises.

The contractile component of the actin and myosin cross bridges with the sarcomere plays an important role in motor control and force development during plyometrics. The plyometric movement uses the pre-stretch of the muscle-tendon unit physiological length-tension curve in order to enhance the ability of the muscle fibers to generate more tension and resultant force production (Davies et al., 2001).

Football, or soccer, stands as the most widely embraced team sport globally, recognized for its dynamic and fast-paced nature, captivating both players and spectators. The evolution of football is marked by an increased emphasis on "high sports performance," wherein the game's essence involves the interplay of skill, technical and tactical prowess, motor component development, and physiological parameters. In addition to technical and physical advancements, there is a growing focus on enhancing the intellectual capacities of football players. Research by Singh et al. (2016; 2018) underscores the significance of various factors such as endurance, speed, agility, leg strength, upper body strength, power, muscular endurance, flexibility, coordination, and reaction time in optimizing football performance.

Football is acknowledged as one of the most intricate sports globally, demanding a synthesis of technical, tactical, and physical skills for success (Yi et al., 2018; Mola & Shaw, 2024). The collective performance of a team hinges on the cooperative dynamics among players in different positions, exemplified by midfielders orchestrating offense and defenders excelling in aerial duels and interceptions (Aquino et al., 2020; Modric et al., 2019). Understanding these position-specific demands becomes pivotal in evaluating player accomplishments (Dellal et al., 2010).

The contemporary landscape of football mandates elevated levels of endurance, speed, strength, and coordination skills, necessitating players to possess well-developed physical fitness (Chmura et al., 2015). Given that football primarily relies on aerobic metabolism for energy production (Silva et al., 2011), maintaining adequate aerobic fitness (AF) becomes crucial. A robust level of AF enables players to sustain high-intensity actions throughout a match, expedite recovery, and uphold peak physical condition throughout the season (Slimani et al., 2019).

Plyometric training, as highlighted by Patir et al. (2021), emerges as a training technique employed by athletes to enhance strength and explosiveness across various sports, including soccer. Recognizing soccer as a game demanding speed, agility, strength, power, endurance, and skill, the authors assert that plyometrics can contribute to improving soccer players' aerobic fitness. Soccer training is essentially a preparation process to enhance individual players' capabilities, enabling them to navigate the challenges of competitive matches successfully.

The physical demands of football encompass a variety of activities, from short sprints to recovery movements, necessitating both aerobic and anaerobic fitness (Williams et al., 2003; Reilly et al., 2000; Mola & Shaw, 2024; Singh et al., 2018, Fenta & Mola, 2023). Aerobic capacity, denoting a broad range of metabolic processes, plays a pivotal role in the total energy capacity of the human body. Maximal oxygen uptake (VO_2 max), a measure of aerobic intensity, signifies the organism's ability to utilize the maximum amount of oxygen at a given moment (Rankovi et al., 2010). Blood pressure, recorded as systolic and diastolic pressures, and pulse rate, measured in beats per minute (bpm), are additional physiological parameters assessed in soccer players. Notably, trained soccer players often exhibit lower resting heart rates than their counterparts (Singh et al., 2022) – a key indicator of cardiovascular health.

Materials and Methods

Selection of Subjects

The study involved the participation of thirty male football players hailing from the Imphal East district of

Manipur, India. These individuals competed in the national competition, with their ages falling within the range of 18 to 24 years.

Selection of the Test

The study employed Cooper's 12-minute run/walk test to evaluate aerobic capacity, while blood pressure was measured using the sphygmomanometer method. Additionally, pulse rate was assessed using the radial artery method. These specific tests were selected as they provide accurate measures of the physiological parameters under investigation in this study.

Criterion Measures

The testing protocol for evaluating aerobic capacity, blood pressure, and pulse rate adheres to specific criteria. The assessment involves the utilization of Cooper's 12-minute run/walk test to gauge aerobic capacity, with results measured in minutes. Blood pressure is determined through the sphygmomanometer method, providing measurements in millimeters of mercury (mmHg). Pulse rate is recorded using the radial artery method, expressed in counts per minute. Adherence to these criteria is crucial to maintain precision in measurements and to ensure the reliability of the obtained results.

Design of the Study

The primary aim of this study was to examine the impact of a plyometric training program on the aerobic capacity, blood pressure, and pulse rate of football players. The research involved two groups of participants, randomly assigned for the investigation: an experimental group comprising 15 players and a control group consisting of 15 players. Prior to the implementation of the plyometric training program, baseline measurements were taken for the selected parameters in both groups. Aerobic capacity was assessed using Cooper's 12-minute run/walk test, while blood pressure and pulse rate were measured utilizing the sphygmomanometer method and the radial artery method, respectively. The plyometric training program spanned six weeks, with five training sessions per week, each lasting for 60 minutes. The experimental group adhered to the prescribed plyometric training regimen, while the control group continued with their regular match practice. The intervention period encompassed the timeframe from August 10 to October 10, 2023.

Inclusive and Exclusive Criteria

Participants were selected based on physical preparedness and health history questionnaires. Only those free from acute or chronic illnesses and without physical or psychological damage were included. The study ensured participant privacy and addressed ethical concerns, such as potential harm and data confidentiality. Those not meeting these criteria were excluded from the intervention.

Training Program

Training was carried out for the study's goal, and then a six-week plyometric training programmed. This training regimen adhered to Thompson et al. (2013)'s prescribed allotment for exercise. Five times a week, the programmed comprised 60 minutes of exercise, consisting of a 10-minute warm-up, a 40-minute main activity, and a 10-minute warm-down. Five times a week for six weeks, the workout was done. By increasing the size and quantity of exercise motions, we have developed a programmed that remains within the bounds of the peak performance exercise intensity that was previously established (Singh, 2018). Furthermore, we prioritized safety over accuracy when rehearsing each man oeuvre, therefore we proposed slightly altering the movement in portions that were challenging to execute. The specifics of the weekly training schedule for the plyometric training programmed are outlined in Tables 1 and 2.

Table 1. Plyometric Training Program Design

No	Particulars	Duration
1.	Total program length	6 weeks
2.	Training frequency per week	5 days
3.	Duration of each training Session	45 minutes
4.	Rest interval between repetition	3 minutes
5.	Rest interval between exercises	1 minute
6.	Warm up and cooling down	15 minutes

Intensity

Intensity is the actual percentage of effort required by the footbllers to perform the activity. In plyometrics, the type of exercise performed controls the intensity. Plyometric exercises can come in many forms and intensities. Some activities such as bilateral jumping to a box are lower level plyometrics while others such as single leg jumps from a box are intense.

Volume

Volume is the total work performed in a single work session or cycle (periodization). In the case of plyometric training, volume is often measured by calculating the load, counting the number of repetitions, sets, etc. of the specific activity. Volume should be increased in a progressive manner to decrease risk of injury or overtraining.

Frequency

Frequency is the number of exercise sessions that take place during the training.

Recovery

Recovery is important to prevent injuries, overtraining and to determine the primary emphasis of the plyometric program. Because of the intense demands on the body with plyometric training, longer recovery periods between sets may be appropriate.

Statistical Analysis

The data collected were entered into an Excel spreadsheet, and statistical analyses were carried out using IBM SPSS

Table 2. Six-Week Plyometric Training Program

Weeks	Components of Plyometric Training	Repetition	Set	Intensity
1-2 Weeks	Squat jump & Tuck jump	2	2	40% to 50%
	Power skipping	2	2	40% to 50%
	Alternate leg bounding	2	2	40% to 50%
	Vertical depth jump: starting from the top of a box, jump down	2	2	40% to 50%
	Broad jump: Straddle jump, single and double leg hops up to 20 meters	2	2	40% to 50%
3-4 Weeks	Squat jump& Tuck jump	3	2	50% to 60%
	Power skipping	3	2	50% to 60%
	Alternate leg bounding	3	2	50% to 60%
	Vertical depth jump: starting from the top of a box, jump down	3	2	50% to 60%
	Broad jump: Straddle jump, single and double leg hops up to 20 meters	3	2	50% to 60%
5-6 Weeks	Squat jump& Tuck jump	4	2	60% to 70%
	Power skipping	4	2	60% to 70%
	Alternate leg bounding	4	2	60% to 70%
	Vertical depth jump: starting from the top of a box, jump down	4	2	60% to 70%
	Broad jump: Straddle jump, single and double leg hops up to 20 meters	4	2	60% to 70%

N.B.: – Low Intensity: 40% to 50%, Moderate intensity: 50% to 60% and High intensity: 60% to 70%

software (version 22.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics were employed to analyze pre- and post-test scores, and differences among groups were examined using the analysis of covariance test (ANCOVA). The significance level for the statistical analyses was set at 0.05.

Ethical Approval

This study received approval from the Institutional Human Ethical Committee of Manipur University, Canchipur, Imphal (India), with Reference Number MU/IHEC/2022/021. Additionally, informed consent was duly obtained from all participants, ensuring compliance with ethical standards and respect for the participants' autonomy.

Results

The results of the study showed a significant improvement in the aerobic capacity of selected subjects of the experimental and control groups. Table 3 presents the descriptive analysis of the data collected from the pre-test and post-test after six-weeks of plyometric training in the experimental and control groups.

Table 3 shows that the experimental group and control group achieved pre-test averages on aerobic capacity of 27.68 & 26.85. The obtained pre-test F-value of 1.780 and the necessary table F-value of 4.20 demonstrated that there was no statistically significant variation in the individuals' starting scores. The experimental group and control group achieved post-test averages on aerobic capacity of 29.82 & 28.25. The fact that the needed table F-value was 4.20 and the obtained post-test F-value was 15.730* demonstrated that there was a significant difference between the participants' post-test results. After determining the adjusted post-means tests for the pre-test and post-test means and performing an analysis of covariance, the obtained F-value of 52.24* was found to be greater than the required value of 4.20, indicating that there were significant differences between the treated groups. Additionally, Figure 1 displayed the mean aerobic capacity score for the experimental and control groups.

Table 3. Pre and post means score of aerobic capacity for experimental and control groups

Variable	Test	Experimental Group	Control Group	Source of Variance	Sum of Square	df	Mean Square	'F' Ratio
Aerobic Capacity	Pre test	27.68	26.85	Between	1.1483	2	1.1483	1.780
				Within	4.010	28	1.1220	
	Post test	29.82	28.25	Between	1.391	2	1.391	15.730*
				Within	4.627	28	4.627	
	Adjusted Post mean test	28.86	27.88	Between	63275.9	2	63275.9	52.24*
				Within	34642.4	27	2617.4	
	Mean Diff.	2.272	-2.272					

*Significant at .05 level, Table F-ratio at 0.05 level of confidence for 2 and 28 (df) = 4.20 and 27 (df) = 4.215

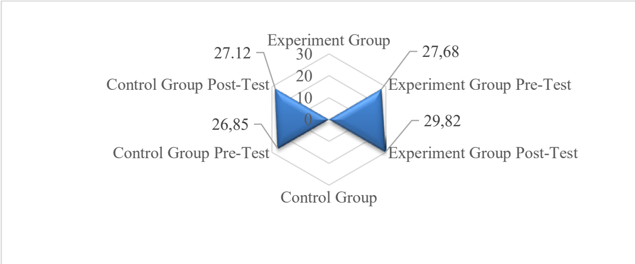

Fig. 1. Graphical presentation on pre and post means score of aerobic capacity for experimental and control group

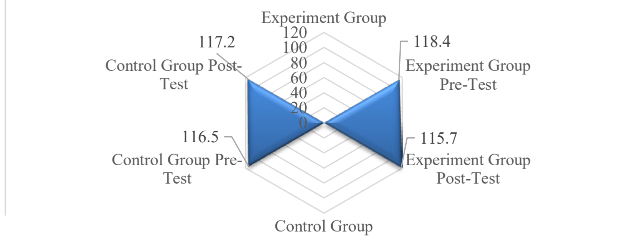

Fig. 2. Graphical presentation on pre and post means score of systolic blood pressure for experimental and control groups

Furthermore, the study's findings demonstrated that a subset of the experimental and control groups' systolic blood pressure significantly improved. Table 5 presents the descriptive analysis of the data obtained from the pre-test and post-test following six weeks of plyometric training for the experimental and control groups.

Table 5 shows that the experimental group and control group attained pre-test averages on Systolic Blood Pressure of 118.4 & 117.2. The fact that the needed table F-value was 4.20 and the achieved pre-test F-value of 4.00 demonstrated that there was no statistically significant difference between the individuals' starting scores. The experimental group and control group's post-test averages for Systolic Blood Pressure were 115.7 & 116.5. The fact that the needed table F-value was 4.20 and the obtained post-test F-value was 10.30* demonstrated that there was a significant difference between the participants' post-test results. After determining the adjusted post-means test and doing a covariance analysis, it was recognized that there were significant differences between the treated groups because the obtained F-value of 20.24* was higher than the necessary value of 4.20. Additionally, Figure 2 displayed the mean Systolic Blood Pressure score for both the experimental and control groups.

Additionally, the study's findings demonstrated that a subset of the experimental and control groups' diastolic blood pressure significantly improved. Table 7 displays the results of the descriptive analysis of the data gathered from the pre-test and post-test following six weeks of plyometric training for the experimental and control groups.

Table 7 shows that the experimental group and the control group obtained pre-test averages on diastolic blood pressure of 80.4 & 82.3. The obtained pre-test F-value of

Table 4. Pairwise comparisons of experimental and control group of aerobic capacity of football players

Variable	Group	Mean Difference	Std. Error	Sig.b	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Aerobic Capacity	Experimental Group	2.272	2.452	0.008	2.72	2.464
	Control Group	-2.272	2.452	0.008	-2.464	-2.72

Table 5. Pre and post means score of systolic blood pressure for experimental and control groups

Variable	Test	Experimental Group	Control Group	Source of Variance	Sum of Square	df	Mean Square	'F' Ratio
Systolic Blood Pressure	Pre test	118.4	117.2	Between	110.57	2	110.57	4.00
				Within	4.322	28	20.42	
	Post test	115.7	116.5	Between	116.453	2	116.453	10.30*
				Within	425.84	28	4.794	
	Adjusted Post mean test	117.96	115.88	Between	14151.9	2	14151.9	20.24*
				Within	2542.7	27	2312.8	
	Mean Diff.	5.648	-5.648					

*Significant at .05 level, Table F-ratio at 0.05 level of confidence for 2 and 28 (df) = 4.20 and 27 (df) = 4.215

Table 6. Pairwise comparisons of experimental and control groups of systolic blood pressure of football players

Variables	Group	Mean Difference	Std. Error	Sig.b	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Systolic Blood Pressure	Experimental Group	5.648	3.035	0.034	1.689	8.296
	Control Group	-5.648	3.035	0.034	-8.296	-1.689

Table 7. Pre and post means score of diastolic blood pressure for experimental and control groups

Variables	Test	Experimental Group	Control Group	Source of Variance	Sum of Square	df	Mean Square	'F' Ratio
Diastolic Blood Pressure	Pre test	80.4	82.3	Between	40.13	2	40.13	3.50
				Within	76.94	28	4.52	
	Post test	78.2	79.6	Between	38.60	2	38.60	6.20*
				Within	78.342	28	60.654	
	Adjusted Post mean test	80.2	78.5	Between	48.653	2	48.653	10.15*
				Within	54.437	27	65.127	
	Mean Diff.	-2.14	-0.04					

*Significant at .05 level, Table F-ratio at 0.05 level of confidence for 2 and 28 (df) = 4.20 and 27 (df) = 4.215

Table 8. Pairwise comparisons of experimental and control groups of diastolic blood pressure of football players

Variable	Group	Mean Difference	Std. Error	Sig.b	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Diastolic Blood Pressure	Experimental Group	3.252	1.868	0.501	1.183	5.263
	Control Group	-3.252	1.868	0.501	-5.263	-1.183

Table 9. Pre and post means score of pulse rate for experimental and control groups

Variables	Test	Experimental Group	Control Group	Source of Variance	Sum of Square	df	Mean Square	'F' Ratio
Pulse Rate	Pre test	72.4	74.3	Between	140.43	2	140.43	2.10
				Within	23.94	28	19.52	
	Post test	68.2	70.6	Between	267.46	2	267.46	8.40*
				Within	130.16	28	18.50	
	Adjusted Post mean test	70.6	72.4	Between	245.73	2	245.73	12.14*
				Within	187.77	27	169.64	
	Mean Diff.	-2.14	-0.04					

*Significant at .05 level, Table F-ratio at 0.05 level of confidence for 2 and 28 (df) = 4.20 and 27 (df) = 4.215

Table 10. Pairwise comparisons of experimental and control group of pulse rate of football players

Variable	Group	Mean Difference	Std. Error	Sig.b	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pulse Rate	Experimental Group	8.645	2.364	0.02	6.136	12.172
	Control Group	-8.645	2.364	0.02	-12.172	-6.136

3.50 and the necessary table F-value of 4.20 demonstrated that there was no statistically significant value was 6.20* demonstrated that the individuals' post-test scores differed significantly from one another. After doing an analysis of covariance and compelling the adjusted post-means test to be considered, it was agreed that there were significant differences variation in the individuals' starting scores. The experimental group and control group's attained post-test averages for diastolic blood pressure were 78.2 & 79.6. The fact that the needed table F-value was 4.20 and the obtained post-test F-between the treated groups because the obtained F-value of 10.15* was higher than the necessary value of 4.20.

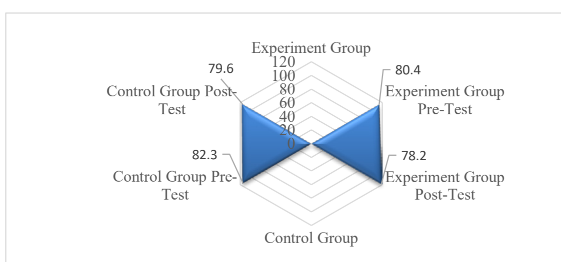

Fig. 3. Graphical presentation on pre and post means score of diastolic blood pressure for experimental and control groups

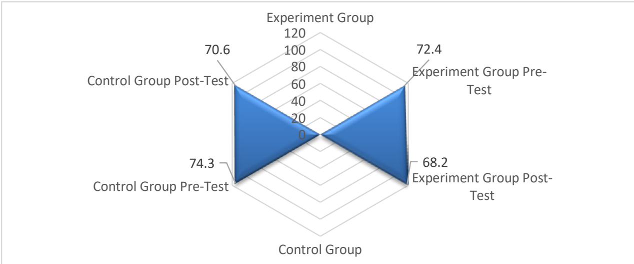

Fig. 4. Graphical presentation on pre and post means score of pulse rate for experimental and control group

Additionally, Figure 3 displayed the mean diastolic blood pressure score for both the experimental and control groups.

Additionally, the study's findings demonstrated that a subset of the experimental and control groups' pulse rates significantly improved. Table 9 presents the descriptive analysis of the data obtained from the pre-test and post-test following six weeks of plyometric training for the experimental and control groups.

Table 9 shows that the experimental group and control group attained pre-test averages on the pulse rate of 72.4 & 74.3. The obtained pre-test F-value of 2.10 and the necessary table F-value of 4.20 demonstrated that there was no statistically significant variation in the individuals' starting scores. The experimental group and control group achieved post-test averages on the pulse rate of 68.2 & 70.6. The fact that the needed table F-value was 4.20 and the obtained post-test F-value was 8.40* demonstrated that the individuals' post-test scores differed significantly from one another. After conducting an analysis of covariance and compelling the modified post-means test, it was concluded that there were significant differences between the treated groups. The obtained F-value of 12.14* was higher than the necessary value of 4.20. Additionally, Figure 4 displayed the average pulse rate score for both the experimental and control groups.

Discussion

Plyometric training involves quick, strong movements characterized by explosive concentric contractions, which are rapid muscle shortening following an initial lengthening (Islam et al., 2024). This research aimed to examine the principles of plyometric training and its effects on the physiological parameters of football players. The plyometric program lasted six weeks, with training sessions held five days a week (Monday to Friday) for 60 minutes each. The study found that plyometric training significantly impacted heart rate, blood pressure, and aerobic capacity. In contrast, the control group, which did not follow any specific training regimen, showed no improvement in these parameters. These findings were supported by statistical analyses, including descriptive statistics and ANCOVA.

The current study's results suggested that the influence of the plyometric training programme greatly enhanced all of the dependent variables. Shunmuganathan (2018) conducted a study to examine the impact of plyometric training on selected physiological variables among 30 adolescent school boys aged 14 to 18 years. The participants were divided into two groups: Group A underwent six weeks of plyometric training, while Group B served as the control. The findings revealed a significant improvement in resting heart rate, systolic blood pressure, and diastolic blood pressure due to the six-week plyometric training program. Here's a paraphrased version: The study investigated how plyometrics, Pilates, and their combination impact vertical jump performance in basketball players. Dividing 45 subjects into plyometrics (Group A), Pilates (Group B), and combined training (Group C), the research found that after six weeks, Group C exhibited the most notable increases in vertical jump height and muscle endurance. This suggests that combining plyometrics with Pilates is more effective than either exercise alone for improving vertical jump performance (Chouhan et al., 2022).

Results indicated significant improvements in Pulse Rate and Vital Capacity for the Plyometric and Circuit training groups compared to the control, with no significant changes in Systolic and Diastolic Blood Pressure. Karuppasamy (2018) investigated the impact of plyometric and circuit training on physical and physiological variables in 24 male volleyball players aged 18 to 25 years. The study demonstrated significant improvements in speed, muscular endurance, flexibility, agility, explosive strength, vital capacity, and anaerobic capacity following both plyometric and circuit training (Mola & Bayeta, 2020). Sivakumar and Logeswaran (2017) studied the effects of plyometric training on resting heart rate and breath-holding time in thirty adolescent male tennis players aged 14 to 17 years. The results showed significant improvements in both resting heart rate and breath-holding time after twelve weeks of plyometric training, highlighting a notable difference between experimental and control groups.

Anitha (2014) examined the effect of plyometric training on physiological variables in 30 inter-collegiate male volleyball players, demonstrating significant improvements in Breath Holding Time and Resting Heart Rate compared to the control group. Chandra et al. (2023) found that a 3-week plyometric training program significantly improved agility, speed, and explosive strength in badminton players compared to a control group, demonstrating the program's effectiveness. Kryeziu et al. (2023) found that a 12-week plyometric training program significantly improved speed and explosive strength in adolescent males compared to a control group. These improvements were evident in various speed and jumping tests, highlighting the effectiveness of plyometric exercises for enhancing athletic performance. Anitha et al. (2018) found that six weeks of plyometric and circuit training significantly improved speed, muscular endurance, flexibility, agility, explosive strength, vital capacity, and anaerobic capacity in male volleyball players aged 18-25, demonstrating the effectiveness of both training methods (Anitha et al., 2018). Singh L et al. (2018) explored the effects of twelve weeks of plyometric and weight training on physiological variables in 60 male football players, indicating reductions in resting pulse rate for both the plyometric and weight training groups compared to the control group. Patir et al. (2021) studied the effectiveness of a plyometric training program in increasing the muscular endurance of football players. Therefore, the six-week plyometric training program significantly impacts the physiological parameters of football players. This study focused on male football players, so future research should include female football players and utilize larger sample sizes for better generalizability. Additionally, similar studies are recommended for other sports to enhance player performance.

Conclusion

The study concludes that a six-week plyometric training program positively influences the aerobic capacity, blood pressure, and pulse rate of football players. The findings highlight the importance of integrating plyometric training into football training regimens to enhance overall fitness. Coaches and trainers can gain valuable insights from this study for designing effective training programs. Future research should investigate the long-term effects and optimal duration of plyometric training for sustained benefits, as well as the underlying physiological mechanisms to better understand its effectiveness in sports conditioning.

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Conflicts of interest

The authors declare no conflicts of interest.

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Концепція пліометричного тренування та вплив застосування даної методики на фізіологічні показники футболістів

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 10 с., 10 табл., 4 рис., 42 джерела.

Історія питання. Пліометричні тренування, які включають в себе комплекс вправ, що передбачають швидкісне та повторюване розтягування та скорочення м’язів, набувають дедалі більшої популярності завдяки своєму потенціалу в контексті спортивної підготовки.

Мета дослідження. Головною метою цього дослідження було вивчити принципи пліометричного тренування та оцінити, як застосування цього методу впливає на фізіологічні показники футболістів.

Матеріали та методи. До проведення дослідження було залучено 30 футболістів-чоловіків віком від 18 до 24 років, які беруть активну участь у змаганнях на національному рівні. Учасників було розподілено за методом рандомізації на дві групи: експериментальну (n = 15) та контрольну (n = 15), з кількістю 15 гравців у кожній. Обрані фізіологічні параметри з метою оцінки результатів включали аеробну продуктивність, артеріальний тиск та частоту пульсу. Рівень аеробної продуктивності вимірювали за допомогою 12-хвилинного тесту бігу/ходьби Купера, артеріальний тиск оцінювали з використанням сфігмоманометра, а частоту пульсу — за методикою вимірювання на променевій артерії. Шеститижнева програма пліометричних тренувань, що проводилася п’ять днів на тиждень, включала 60-хвилинні заняття. Експериментальна група проходила програму пліометричних тренувань, тоді як контрольна група не виконувала жодних спеціальних вправ. Показники результатів перед початком і після завершення тестування було проаналізовано статистично з використанням методів описової статистики та коваріаційного аналізу (ANCOVA). Рівень значущості був встановлений на довірчому рівні 0,05.

Результати. Отримані дані свідчать про суттєве покращення фізіологічних показників учасників експериментальної групи порівняно з контрольною групою. Впровадження пліометричної програми тренувань підтвердило свою ефективність щодо підвищення аеробної продуктивності, артеріального тиску та частоти пульсу футболістів.

Висновки. Дослідження встановило, що програма пліометричних тренувань, яка тривала шість тижнів, сприяє значному поліпшенню фізіологічних показників футболістів, зокрема аеробної продуктивності, артеріального тиску та частоти пульсу. Проведення подальших досліджень потребує вивчення довгострокових ефектів та оптимальної тривалості пліометричних тренувань, а також фізіологічних механізмів, що лежать в їх основі, з метою глибшого розуміння ефективності таких тренувань та їх застосування у спортивній підготовці.

Ключові слова: пліометричне тренування, аеробна продуктивність, артеріальний тиск, частота пульсу, футбол.

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