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EFFECT OF 9-WEEK PLYOMETRIC TRAINING PROGRMME ON PHYSICAL EFFICIENCY INDEX OF MALE AMATUER BASKETBALL PLAYERS OF UNIVERSITY OF MAIDUGURI, BORNO STATE, NIGERIA

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Abstract

Introduction: physical efficiency index (PEI) is a score that can be used to measures cardiorespiratory fitness of amateur basketball players, it specifically measures how quickly the athlete's heart rate recovers after strenuous exercise. PEI is calculated using the Harvard Step Test, which involves stepping up and down on a platform for a giving period of time (5 minutes). A higher PEI score indicates better cardiovascular fitness, as it shows the athlete's body is more efficient at returning the heart rate to a normal state after physical exertion.

Objective: *The study investigates the effect of plyometric training programme on physical efficiency index (PEI) of male amateur basketball players of University of Maiduguri by exploring its optimization effects on heart rate recovery after exercise.*

Methods: *The pre-test post-test quasi experimental control group research design was used for this study. Simple random sampling technique was used to select thirty (30) participants (Male students of University of Maiduguri who play basketball). The fish bowl simple random sampling technique was used to randomly assign participants to experimental and control groups (n1=15, n2=15). The experimental group participated in 9-week plyometric training programme on physical efficacy index,(Modified Harvard Step Test) 3 times per week, (Mondays, Wednesdays and Fridays), while the control group were engaged in interactive sessions 3 times per week(Tuesdays, Thursdays and Saturdays) ,covering various topics on the history of basketball, the rules and regulation of basketball, officials of basketball both officiating and table officials and measurements of basketball courts. Data were analysed using descriptive statistics of mean and standard deviation to analyse the demographic characteristics of the participants while the inferential statistics of paired t-test was used to analyse hypothesis*

Results: *The findings of the study showed that, the weight and height of both the experimental and control group were similar at the base line (88.6 ±5.01 vs 86.5±5.06 kg and 1.94±4.32 and 1.82±4.50 meters) respectively. The results of the study showed significant difference (increase) ($P<0.05$) PEI of the experimental group before and after 9-week plyometric training programme on physical efficiency index. The mean of resting heart rate values for the experimental group improved from 59.0± 4.85 at pretest to 62.7± 4.81, at post-test, classifying the participants in the experimental group as average athletes. The mean of resting heart rate (PEI) values of the control group in the absence of plyometric training programme improved slightly by 0.01% from 60.0± 4.75 at pre-test to 61.1± 4.75 at post-test, suggesting no significant changes in the resting heart rate values (PEI) of the participants in the absence of plyometric training programme and physical efficiency index (Harvard Step Test) test after 9-week.*

Conclusion: *Plyometric training programme can significantly increase(improve)PEI of male amateur basketball players.*

Keywords*: 9-weekPlyometric Training programme: Physical Efficiency Index (PEI); Amateur*

Basketball Players

Introduction:

The main objective of every basketball player is to score points during a game. In an attempt to do so, the player might perform a jump shot, set shot, layup shot, or free throw. As the discipline has evolved and more athletic players have practiced this sport discipline, the defense has become increasingly efficient. As a result, coaches focus more on developing the cardiorespiratory endurance of their athletes in other to cope with the vigorous demands of the game of basketball.

Physical Efficiency Index (The Harvard Step Test)

The physical Efficiency Index of the participants was measured using the Harvard Step Test. The Harvard Step Test is a test that is used to measure physical efficiency index (PEI). The test measures aerobic fitness and the participant's ability to recover from physical exhaustion. The Harvard Step Test is a field test that is used to determine aerobic capacity and physical efficiency index (PEI), which is the ability of the heart to return to resting rate following a physical exercise that is of 5 (five) minutes of Harvard Step Test. The Physical Efficiency Index (PEI) is calculated using the Harvard Step Test Fitness Index = (100 x test duration in seconds) divided Fitness Index = (100 x test duration in seconds) divided by (2 x sum of heartbeats in the recovery periods).for example if the total test time is 300 seconds (if the athlete completes the whole 5 minutes), and his number of heartbeats between 1-1½ minutes is 90, between 2-2½ is 80 and between 3-3½ is 70, then the physical fitness index score will be: (100 x 300) / (240 x 2) = 62.5%. The test measures cardiovascular fitness and endurance, and the PEI is based on the participant's pulse rate recovery during the recovery period, (Sandstedt *et al* 2013).

The Modified Harvard Step Test:

The Modified Harvard Step Test is a simple cardiorespiratory fitness test that measures the participant's aerobic capacity by assessing their heart rate recovery after a set of physical exertion. Participants are instructed to repeatedly step up and down a platform, and their pulse is measured after the test is completed to determine their fitness level.

Objectives of the Modified Harvard Step Test:

I. To asses aerobic fitness: The test is primarily used to evaluate an athlete's cardiovascular system's ability to deliver oxygen to the working muscles during exercise.
II. To predict VO2max: The test is used as a predictive test of VO2max, (volume oxygen consumption) which is the maximum amount of oxygen an athlete can use during exercise.
III. To monitor progress**:** It is used to monitor improvements in fitness level of the athlete over a period of time.

Equipment:

A step or platform (40.6 centimetre high), a stopwatch, and a means of measuring pulse (e.g., fingertips or a heart rate monitor) are needed. The researcher instructed the participants as follows:

I. **Step Height:** 16 inches (40.6 cm) plyo box was utilized
II. **Stepping Rate:** 15 steps per alternate leg per minute for 5 minutes or until exhaustion
III. **Duration:** Until the participant is exhausted or on completion of the set time (for example,5 minutes or 15 set per alternate leg per minute). To maintain the same rhythm for as long as possible
IV. **Exhaustion:** is the point where the participant cannot maintain the stepping rate for

15 seconds, the researcher then asked the participant to step down.

V. **Heart Rate Measurement:** Heartbeats were measured at specific intervals (e.g., 1-1.5 minutes, 2-2.5 minutes, 3-3.5 minutes) after the stepping phase was concluded

Recovery period

After the stepping was completed, the participants were instructed to rest for a set of time (1minute) before the commencement of pulse measurements were taken.

Pulse Measurement and Calculation

Pulse rate was measured at approximately 1.5 minute, 2.5 minutes, and 3.5 minutes after the test is completed. The participants fitness index score was calculated based on the pulse measurements taken after the test.

Benefits:

Simple and easy to administer**,** minimal equipment was required for the test and it can be performed by individuals with limited experience.it is Predictive of VO2max Since it cannot be considered as a direct measurement of VO2max, it can reliably provide a reasonable estimate of an athlete's aerobic capacity.

Limitations:

I. **Not Suitable for Everyone:** participants who are diagnosed with certain medical conditions or aged may not be able to safely participate in the test.

II. **Exhaustion Factor:** The test can be physically demanding and may cause fatigue, easily especially for participants with lower fitness levels, or participants with lower strength at the lower extremities muscles responsible for jumping or beginners.

Table 4.6: Summary of paired t-test on Physical Efficiency Index of male amateur basketball players of University of Maiduguri before and after 9-week plyometric training programme on physical efficiency index of the participants

Groups	D	SD	t	df	P-value	Decision
Experimental Group						
-13.8	± 8.64	-8.75	29	0.000		Rejected
Control group						
-16.6	± 15.75	-5.76	29	0.007		Retained

Key=D=Mean difference between pre-test and post-test on physical efficiency index expressed in percentage (%)

Table 4.6 showed mean difference of -13.8 in resting heart rate recovery after exercise (Harvard Step Test {5 min}) between the pre-test and post-test values for the experimental group, with a standard deviation of ± 8.64 and paired t-test value of -8.75 and p-value of 0.000, ($P<0.05$). Hence null hypothesis 2 is rejected, and it is concluded that ,9-week plyometric training programme on lower limb explosive strength and Physical efficiency index (PEI) (Harvard Step Test) had a significant effect on the PEI of the participants after 9-week plyometric training programme.

The paired t-test summary on table 4.6 showed mean difference of -16.6 in resting heart rate recovery after exercise (Harvard Step Test {5 min}) between the pre-test and post-test values for the control group, with a standard deviation of ± 15.75 and paired t-test value of -5.76 and p-value of 0. 007. This indicates that there is no significant difference between the means of the pre-test and post-test values of the participants in the control group. (heart rate recovery period after exercise {PEI}) in the absence of 9-week plyometric training programme and PEI. Hence null hypothesis 2 is retained. (P =0.07>0.05).

Summary of findings:

The resting heart rate recovery period (PEI) of the experimental group significantly improved (Increased) by 3.7% (from 59% at pre-test-to-62.7% at post-test) after 9-week plyometric training programme on lower limb explosive strength and physical efficiency index, while the resting heart rate recovery period of the control group increased slightly by 1.1%(from 60% at pre-test- to-61.1% at post-test) in the absence of plyometric training programme and physical efficiency index .**Conclusion:** 9-week Plyometric training programme have significant effect on Physical Efficiency index of male amateur basketball players of University of Maiduguri

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