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WHOLE BODY VIBRATION TRAINING ON SELECTED PERFORMANCE-RELATED PHYSICAL FITNESS COMPONENTS OF PLAYERS IN THE UNIVERSITY OF IBADAN FOOTBALL TEAM, IBADAN, NIGERIA

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Abstract:
Several studies have attempted to identify adequate recovery strategies for athletes. But only paucity or none of such studies has been accessed which investigated long term effects of whole body vibration (WBV) as a recovery technique regimen before, during and after performance. This study was carried out to investigate the effect of whole body vibration training on selected performance-related physical fitness components of players in the University of Ibadan football team, Ibadan, Nigeria. The study was carried out using pretest/posttest/control group experimental research design. The sample size for this study was twenty participants. The participants were placed into experimental groups, who undertook eight weeks of whole body vibration training, and a control group who involved in their normal daily training regimen without the use of WBV for eight weeks. Two research questions were answered while four hypotheses were tested. Descriptive statistics of mean, percentages, chats and inferential statistics of analysis of covariance (ANCOVA) were used to test all hypotheses at 0.05 alpha levels of significance.

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The results of the study showed a significant difference in the pretest and posttest scores of players in leg power ($F(1, 18) = 10.047$; $p<0.05$; $\eta 2=.137$) and balance ($F(1, 18) = 19.317$; $p<0.05$; $\eta 2=.327$) but no significant difference in agility($F(1, 18) = 1.3923$; $p>0.05$; $\eta 2=.031$) and speed ($F(1, 18) = 1.006$; $p>0.05$; $\eta 2=.062$). Two hypotheses were rejected and two were not rejected. The results of this study help to conclude that whole body vibration training significantly improved the leg power and balance recovery of the participants but did not significantly improve agility and speed of the participants. It was therefore recommended that football coaches should incorporate whole body vibration training into their training programme as leg power and balance are essential fitness components needed to play the game of football.

Keywords: whole body vibration training, performance, participants, Ibadan, components of physical fitness

1. Introduction

One of the greatest objectives of most games is to outscore the opponent. No matter how tactically sound, fluidic, pattern-oriented and aesthetical a team plays what matters is to score goals and win the game. But before goals can be scored, or matches are won, there are some major qualities football team players must possess. Players need skills to enable them score goals but more importantly apart from skills is the need to have optimum performance-related physical fitness components referred to as performance components. There is no compromising having these components if a team wants to go far in competitions. Lack of these components will not allow players in a team to be skillful and so they will not be able to score goals. Therefore, it is of great important for a team to acquire quality fitness level so as to achieving consistent high quality performance.

Many authors have established physical fitness indices in several ways leading to the same concept, as the core necessity for performance. Physical fitness can be referred to as the capacity to carry out every day activities without excessive fatigue and with enough energy in reserve for emergencies. Colfer (2004) refers to skill-related physical fitness as essential for sports success. Components of physical fitness are grouped into health related components and skill/performance related components (Fahey, Roth and Insel, 2010).

Performance-related components of physical fitness have a relationship with enhanced performance in sports and motor skills. Skill related components of fitness, also called performance related components, enhance athleticism and improve efficiency at everyday tasks. These components are agility, speed, power, balance, coordination and reaction time (Fahey, Roth and Insel, 2010). Agility is the ability to change the body's position efficiently, and requires the integration of isolated movement skills using a combination of balance, coordination, speed reflexes, strength, and endurance. It is the ability to move and change direction and position of the body quickly and effectively while under control.

Balance is an ability to maintain the line of gravity (vertical line from centre of mass) of a body within the base of support with minimal postural sway. Balance can also be referred to as the ability to stay upright or stay in control of body movement (Shumway-Cook, Anson and Haller, 1988). Sway is the horizontal movement of the center of gravity even when a person is standing still. A certain amount of sway is essential and inevitable due to small perturbations within the body (for example: breathing, shifting body weight from one foot to the other or from forefoot to rear foot) or from external triggers (they include; visual distortions, floor translations). An increase in sway is not necessarily an indicator of dysfunctional balance so much as it is an indicator of decreased sensorimotor control (Davidson, Madigan and Nussbaum, 2004). There are two types of balance: static and dynamic. Static balance is maintaining equilibrium when stationary, while dynamic balance is maintaining equilibrium when moving. Maintaining balance requires coordination of input from multiple sensory systems including the vestibular, somatosensory, and visual systems (Gribble and Hertel, 2003).

Coordination is the ability to perform complex motor skills. Fahey, Roth and Insel, (2010) define coordination as the ability to perform a motor task accurately and smoothly using body movements and senses. It means working of all the muscle groups of the body in union. It is of utmost importance in executing any movement with a predetermined objective. Between the muscles groups, coordination are divided into inter muscular coordination and intra muscular coordination. It means coordination between different muscle groups as well as between muscle fibres of the same muscle. Coordination is necessary to execute movements requiring speed and strength and more efficiently, therefore, with less expenditure of energy, showing a better performance over a longer time.

Coordination is particularly important at the initial stages of the sports development of a competitor (Raczek, Mynarski and Ljach, (2002). A high level of coordination improvement since the earliest years makes it possible to make an effective use of technical and tactical skills during a sports competition (Sadovski, 2003, Starosta, 2003, Gierczuk, 2004). A well-formed basis of coordination in young sportsmen is maintained at a later age and is an important reason for faster and more accurate teaching of other, more difficult movement tasks (Raczek et al., 2002)

Power is defined as the amount of work performed per unit of time. It is the combination of strength and speed (Donatelli, 2015). According to Syatt (2012), power is an element of skill-related fitness that is needed to excel in athletic performance. Increased strength does not always translate into increased power. For example, a strong upper body lifts a high amount of weight. However, a strong upper body does not always have the ability to throw a shot put very far if enough speed cannot be generated. Powerful legs will allow pressing a huge amount of weight in a short amount of time bringing about a great amount of force and generating that force quickly (Johnstyles, 2015). This is especially important for football players.

Reaction time is the duration between applications of a stimulus to onset of response. Reaction time is the ability to respond quickly to a stimulus (Fahey, Roth and

Insel 2010). Visual Reaction Time (VRT) is time required to response to visual stimuli. Sound Reaction Time (SRT) is time required to response to sound stimuli. Reaction time acts as a reliable indicator of rate of processing of sensory stimuli by central nervous system and its execution in the form of motor response (Solanki, Joshi, Shah, Mehta and Gokhle, 2012). Reaction time can be divided into three parts. The first is perception time, which is time for the application and perception of the stimulus and giving the necessary reaction to it. Second is decision time, which signifies time for giving a suitable response to the stimulus. The third is motor time which is the time for compliance to the order received (Welford, 1980).

Speed is the ability of a person to execute motor movements with high speed in the shortest period of time. It is equal to the distance covered per unit of time. It is succinctly defined by Fahey, Roth and Insel, (2010) as the ability to perform a movement in a short amount of time. Speed is not just how fast someone can run (or cycle, swim etc.), but is dependent on their acceleration (how quickly they can accelerate from a stationary position), maximal speed of movement, and also speed maintenance (minimizing deceleration).

Movement speed requires good strength and power, but also too much body weight and air resistance can act to slow the person down. Speed is necessary in many sports and the ability to generate it quickly is a coveted skill especially in sports like track and field, swimming, speed cycling or speed skating. Speed is also an important factor in other sports such as boxing, soccer, American football, basketball and hockey. Speed is an integral part of every sport and can be expressed as - maximum speed, elastic strength (power) and speed endurance. Speed is influenced by the athlete's mobility, special strength, strength endurance and technique.

Whole body vibration (WBV) comprises the transfer of relatively low-frequency environmental vibration to the human body through a broad contact area. These frequencies are in the range of 0.5 to 80 Hz (ANSI, 2002). Transmission occurs through the feet when standing, the buttocks when sitting or the reclining body when in contact with the vibrating surface. There has been an increasing scientific interest in whole body vibration exercise (WBVE) where mechanical vibrations are transmitted when a subject is in contact with an oscillating/vibratory platform (OVP). WBVE has been used as a safe and accessible exercise and important reviews have been published about the use of this exercise to manage diseases and to improve physical conditions of athletes (Kurt and Pekünlü, 2015). It has also been seen to be effective in preventing muscle atrophy and osteoporosis (Rittweger, 2002; Roelants, 2004 and Verschueren, 2004).

According to Rittweger, (2002), Whole Body Vibration (WBV) was researched upon for potential therapeutic and sport performance benefits. It is assumed that whole body vibration with amplitude of 2mm to 6mm and frequency of 20 Hz to 30 Hz evokes muscle contractions which are probably induced via the monosynaptic stretch reflex. Some studies conducted on well-trained/elite athletes showed an acute performance-enhancing effect of WBVE on vertical jump height, mechanical power (Wyon, Guinan and Hawkey, 2010; Kurt and Pekünlü, 2015), flexibility (Osawa and Oguma, 2013; Dallas, Paradisis, Kirialanis, Mellos, Argitaki, and Smirniotou, 2015) and muscular activity (Cochrane, 2011; Marín and Rhea, 2010). Acute WBV has also been investigated as a potential ergogenic aid amongst coaches to induce immediate performance benefits prior to performance (Bullock, Martin, Ross, Rosemond, Jordan and Marino, 2008) or during half-time rest periods in soccer to help prepare for the second half performance (Lovell, Midgley, Barrett, Carter and Small, 2013).

A study suggested that WBV training can be an alternative to resistance training (Lorenzen, Maschette, Koh, and Wilson, 2009). This was further proven by researches which established the fact that a vertically oscillating platform (frequency [hz] x amplitude [mm]) elicits reflexive muscle contractions, increasing skeletal muscle activity, and improving strength (Bissonnette, Weir, Leigh, and Kenno, 2010; Cardinale and Wakeling, 2005; Roelants, Delecluse, and Verschueren, 2004).

Furthermore, the practical appeal of WBV training is that research reports that WBV is as effective as conventional resistance training, but it takes less time (Bissonnette et al., 2010, Signorile, 2006). For example, using a randomized sample of 43 seniors (66-85 years), Rees, Murphy and Watsford (2007) investigated the extent to which WBV training enhanced standard resistance training outcomes and muscle performance. After training 3 times a week for 2 months, they reported significant improvements in the sit-to-stand (12.4%, 10.2%), the knee- extension strength (8.1%, 7.2%), and the 5-meter walk (3.0%, 2.7%) tests in both WBV and resistance training groups, respectively. However, no significant differences were found when comparing WBV and resistance training.

2. Statement of the Problem

Football players need leg power to kick the ball, quickly burst into quick movements or to jump above opponents to head the ball; agility and efficiently to receive passes or evade opponents. They also need speed for breakaways, flank runs or defense recovery; balance to keep the body under control and stable with obstacles and unstable surfaces or handling perturbations from opponents. Singh (2015) and Dolan (2013) affirm that there is high correlation between power, agility, speed, balance. Lack of these necessities will lead to bad performance. In other to forestall bad performance in players, football coaches should dedicate a lot of time for drills and training programmes to enhance the fitness level of their players. Having these qualities will also forestall the common incidences of muscle damage, pains of overreaching, upper and lower limb injuries. It is for this reason that Rowsell, Coutts, Reaburn, and Hill-Haas, (2009) advised in his study that coaches should implement effective recovery strategies to enhance performance.

Researchers have attempted to identify adequate recovery strategies for athletes. Barnett (2006) investigated the efficacy of contrast temperature water immersion, hyperbaric oxygen, electrical current techniques and massage. Cheung, Hume, and Maxwell, (2003) also worked on stretching, ultrasound, homeopathy, compression, moderate-intensity exercise (active recovery) and anti-inflammatory drugs. These researchers reported that anti-inflammatory drugs have potential negative health outcomes and may negatively affect muscle repair and adaptation to training. No many studies have actually assessed the long term effects of whole-body vibration (WBV) as a recovery technique on performance. It is in this direction that this study investigated the effect of whole body vibration training on selected performance-related physical fitness components of players in the University of Ibadan football team, Ibadan, Nigeria.

3. Research Questions

The study provided answers to the following questions:

1) Do players in University of Ibadan football team possess adequate leg power?
2) Will players in University of Ibadan football team possess adequate agility?

3.1 Hypotheses

The following hypotheses were tested in the study

1) There will be no significant whole body vibration training effect on leg power of players in the University of Ibadan football team.
2) There will be no significant whole body vibration training effect on agility of players in the University of Ibadan football team.
3) There will be no significant whole body vibration training effect on speed of players in the University of Ibadan football team.
4) There will be no significant whole body vibration training effect on balance of players in the University of Ibadan football team.

4. Methodology

The pretest posttest control group experimental research design was employed for this study. The population for this study included male players in the University of Ibadan football team. Twenty (20) participants were used for this study. These players were randomly selected into two groups (experimental and control group) of ten players each. Players were subjected to series of leg power, agility, speed and balance tests to determine pre-test measures. The experimental group was made to undergo eight weeks of whole body vibration training (three sessions a week) while the control group was left with their regular training regimen which was devoid of WBV training. Post-test assessment was done after intervention had been concluded.

The following research instruments was used for data collection;

1) **Vibration Machine:** the Bodytrain vibration plate was used.
2) **Weighing Scale:** A portable weighing scale was used to measure total body weight in kilograms.
3) **Stadiometer:** This was used to measure the height of participants.
4) **Stopwatch:** This was used in taking accurate measurement of time when necessary.
5) **Measuring tape:** A tape calibrated in metres was used to take all necessary distance measurements.

6) **Cones:** these were used to demarcate organization for participants.
7) **Landmarks:** Served as markers and was especially used during the Illinois agility and controlled speed dribbling tests.

4.1 Test Protocols

4.1.1 Test of Leg Power (Vertical Jump Test/ Sargent Jump)

Objective: The Sargent jump test is used to measure leg power. This test is designed to measure lower limb explosive power by measuring the height an individual is able to jump.
Equipment required: measuring tape or marked wall, chalk for marking wall (or 'Vertec' equipment).
Procedure: the participant stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach. The person puts chalk on their fingertips to mark the wall at the height of their jump. The person then stands away from the wall, and jumps vertically as high as possible using both arms and legs to assist in projecting the body upwards. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score.
Scoring: The jump height is usually recorded as a distance score. The best of three attempts is recorded.

4.1.2 Agility Test (Illinois Agility Test)

Objective: to test the running agility of the participants.
Equipment required: flat non-slip surface, marking cones, stopwatch, measuring tape
Procedure: The length of the course is 10 meters and the width (distance between the start and finish points) is 5 meters. Four cones are used to mark the start, finish and the two turning points. Another four cones are placed down the center an equal distance apart. Each cone in the center is spaced 3.3 meters apart. Participants should lie on their front (head to the start line) and hands by their shoulders. On the 'Go' command the stopwatch is started, and the athlete gets up as quickly as possible and runs around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing is stopped.
Scoring: An excellent score is under 15.2 seconds for a male, less than 17 seconds for a female.

4.1.3 Test of Speed (30m Dash)

Purpose: The aim of this test is to determine speed, and also a reliable indicator of acceleration, agility and quickness.
Equipment required: measuring tape or marked track, stopwatch or timing gates, cone markers, flat and clear surface of at least 50 yards.
Procedure: The test involves running a single maximum sprint over 30 metres, with the time recorded. A thorough warm up should be given, including some practice starts and

accelerations. The player to be tested starts from a stationary position, in a base-stealing stance that is most familiar to the individual and that which the individual thinks will yield the best time. The front foot must be on or behind the starting line. Shoulders should be perpendicular to the starting line. This starting position should be held for 2 seconds prior to starting, and no rocking movements are allowed. The tester should provide hints to maximizing speed and encouragement to continue running hard past the finish line.
Scoring: Two trials are allowed, and the best time is recorded to the nearest 2 decimal places. The timing starts from the first movement (if using a stopwatch) or when the timing system is triggered, and finishes when the chest crosses the finish line and/or the finishing timing gate is triggered.

4.1.4 Test of Balance (Standing Stork Test)

Purpose: To test the athlete's ability to maintain a state of equilibrium (balance) in a static position.
Equipment required: Warm dry location, Stopwatch.
Procedure: The athlete warms up for 10 minutes and then stands comfortably on both feet with their hands on their hips. The athlete lifts the right leg and places the sole of the right foot against the side of the left kneecap. The assistant gives the command "GO", starts the stopwatch and the athlete raises the heel of the left foot to stand on their toes and is told to hold this position for as long as possible. The assistant stops the stopwatch when the athlete's left heel touches the ground or the right foot moves away from the left knee. The assistance records the time. The athlete then rests for 3 minutes. The athlete stands comfortably on both feet with their hands on their hips and then lifts the left leg and places the sole of the left foot against the side of the right kneecap. The assistant gives the command "GO", starts the stopwatch and the athlete raises the heel of the right foot to stand on their toes and is told to hold this position for as long as possible. The assistant stops the stopwatch when the athlete's right heel touches the ground or the left foot moves away from the right kneecap and records the time.
Scoring: The two scores recorded are then added together to form one single score for the athlete.

4.2 Training Procedures

4.2.1 Whole Body Vibration Training (Experimental Group)

Vibration Machine: Bodytrain vibration plate was used. This machine functions in a one directional, oscillating pattern which stimulates muscles at frequencies of up to 50 Hz which in turn makes the muscles to contract and relax by natural reflex about 50 times per second. Participants were not allowed to wear shoes but wore cotton socks to avoid the dampening effect of the soles of the shoes.
Week: 1-2
Warm Up: 10 minutes

Participants had their warm up session to condition the body and prepare the muscles for the activities to be performed. The participants then stepped on to the vibrating machine in order to start the exercises.

Activity/Mode: Standing flat feet, Heel raise and Squatting.

Frequency: (15 Hz)

This has to do with the force generated by the vibration machines to provide loading on the musculoskeletal system. For the first two weeks, participants were exposed to a frequency of 15 Hz during training sessions.

Sessions: 3 days per week.

Duration: 50 seconds x2 (1:40s)

Each of the activity was performed on the vibration platform for 50 seconds, well supervised by the researcher and his assistants.

Set: 2

Participants were exposed to all activities twice after the required rest intervals have been observed.

Rest: 1 minute

Every participant had 1 minute rest session after first set before commencing the second set.

Cool down Phase: after the exercises on the vibrating platform had been concluded, the participants were exposed to a cool down session which lasted for 10 minutes. Exercises in low intensity were performed at this stage.

Week: 3-5

Warm Up: 10 minutes

Participants had their warm up session to condition the body and prepare the muscles for the activities to be performed. The participants then stepped on to the vibrating machine in order to start the exercises.

Activity/Mode: Squatting and Side lunges.

Frequency: (20 Hz)

For progressive loading, the frequency of the vibrating machine was increased to 20 Hz during training sessions.

Sessions: 3 days per week.

Duration: 50 seconds x2 (1:40s)

Each of the activity was performed on the vibration platform for 50 seconds, well supervised by the researcher and his assistants.

Set: 2

Participants were exposed to all activities twice after the required rest intervals have been observed.

Rest Between Set: 1 minute

Every participant had 1 minute rest session after first set before commencing the second set.

Cool down Phase: after the exercises on the vibrating platform had been concluded, the participants were exposed to a cool down session which lasted for 10 minutes. Exercises low in intensity were performed at this stage.

Week: 6-8

Warm Up: 10 minutes

Participants had their warm up session to condition the body and prepare the muscles for the activities to be performed. The participants then stepped on to the vibrating machine in order to start the exercises.

Activity/Mode: Side lunges and Squatting.

Frequency: (25 Hz)

This has to do with the force generated by the vibration machines to provide loading on the musculoskeletal system. For progressive loading, the frequency on the machine was increased to 25 Hz during training sessions.

Sessions: 3 days per week.

Duration: 50 seconds

Each of the activity was performed on the vibration platform for 50 seconds, well supervised by the researcher and his assistants.

Set: 2

Participants were exposed to all activities twice after the required rest intervals have been observed.

Rest Between Set: 1 minute

Every participant had 1 minute rest session after first set before commencing the second set.

Cool down Phase: after the exercises on the vibrating platform had been concluded, the participants were exposed to a cool down session which lasted for 10 minutes. Exercises, low in intensity were performed at this stage. (See Appendix XIX)

5. Results and Discussion of Findings

This study was designed to investigate the effect of whole body vibration as a recovery strategy on leg power, agility, speed and balance of players in the University of Ibadan football team. Descriptive statistics of mean, percentages, chats were used to test the demographic variables while inferential statistics of analysis of covariance (ANCOVA) were used to test all hypotheses at 0.05 alpha levels of significance.

5.1 Demographic Variables

Table 4.1: Frequency distribution of Participant's Height characteristics

Height	Frequency	Cumulative Frequency	Percentage	Cumulative Percentage
1.7m	12	12	60	60
1.8m	7	19	35	95
1.9m	1	20	5	100
Total	20		100	

The Table 4.1 above showing the height characteristics of participants which had the height of majority within the bracket of 1.7 (60%) and 1.8 (35%) respectively.

Table 4.2: Frequency distribution of Participant's Weight characteristics

Weight	Frequency	Cumulative Frequency	Percentage	Cumulative Percentage
60-64kg	2	2	10	10
65-69kg	8	10	40	50
70-74kg	7	17	35	85
75-79kg	3	20	15	100
Total	20		100	

Table 4.2 above shows the weight characteristics of the participant which had the weight of majority within the bracket of 65-69kg (40%) and 70-74kg (35%) respectively.

Question 1: Do players in University of Ibadan football team possess adequate leg power?

Table 4.3: Leg power fitness level of players in University of Ibadan football team

Status	Frequency	Cumulative Frequency	Percentage	Cumulative Percentage
Average	15	15	75	75
Below Average	2	17	15	90
Poor	3	20	10	100
Total	20		100	

Table 4.3 shows leg power fitness level of players in University of Ibadan football team when compared with the vertical jump test norm values. It was observed that majority of the players (75%) had average leg power values of 41-55cm at the entry point of the study. 25% (5) of the players had below average (31-40cm) or poor (below 30cm) leg power values.

Question 2: Will players in University of Ibadan football team possess adequate agility?

Table 4.4: Agility fitness level of players in University of Ibadan football team

Status	Frequency	Cumulative Frequency	Percentage	Cumulative Percentage
Excellent	20	20	100	100

Table 4.4 shows agility fitness level of players in University of Ibadan football team when compared with the Illinois agility test norm values. It was observed that all 20 (100%) players had excellent agility values of below 15.2 seconds at the entry point of the study.

5.2 Hypotheses testing

Hypothesis 1: There will be no significant whole vibration training effect on leg power of players of University of Ibadan football team.

Table 4.9a: Vertical Jump Test Results (Leg Power)

	N	Pretest $\overline{X}$ Score	Posttest $\overline{X}$ Score
Experimental Group	10	45.73cm	47.53cm
Control Group	10	42.15cm	42.17cm

Table 4.9a above shows that the experimental group had a pretest mean score of 45.73cm and a posttest mean score of 47.53cm while the control group had a pretest mean score of 42.15cm and a posttest mean score of 42.17cm. When compared with the control group, the experimental group gained 1.80cm after treatment while the control group also had an increase of just 0.02cm.

Table 4.9b: ANCOVA showing main effect of whole vibration training on leg power

Source	Type II Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	32.431[a]	13	2.495	10.217	.000	.139
Intercept	87.916	1	87.916	22.164	.000	.171
Treatment	12.811	1	12.811	10.047	.000	.137
Error	7.946	18	.467			
Total	141.104	20				
Corrected Total	32.000	19				
a. R Squared = .342 (Adjusted R Squared = .331)						

Table 4.9b shows that the main effect of treatment (whole vibration training) is significant on leg power of players of University of Ibadan football team ($F_{(1, 18)}$ =10.047; $p<0.05$; η^2=.137). Therefore, the null hypothesis is rejected. The partial eta squared of 0.137 implies that treatment accounted for 13.7% of the observed variance on leg power of players of University of Ibadan football team.

Table 4.9c: Adjusted Marginal Mean showing
the direction of difference in leg power between the treatment groups

Dependent Variable	Treatment Groups	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Leg power	Experimental	49.280cm	.792	30.718	55.841
	Control	46.142cm	.781	26.3	53.682

Table 4.9c showed that participants in experimental group obtained a higher mean score ($\bar{x}$=49.280) while control had a mean score of ($\bar{x}$=46.142). This shows that participants in experimental group had better leg power ability than the control group. It then means that the treatment had better effect on leg power of the participants in experimental group than the participants in the control group.

Hypothesis 2: There will be no significant whole vibration training effect on agility of players of University of Ibadan football team.

Table 5.0a: Illinois Agility Test Results

	N	Pretest $\overline{X}$ Score	Posttest $\overline{X}$ Score
Experimental Group	10	11.964s	11.896s
Control Group	10	12.016s	12.063s

Table 5.0a above shows that the experimental group had a pretest mean score of 11.964s and a posttest mean score of 11.896s while the control group had a pretest mean score of 12.016s and a posttest mean score of 12.063s. The experimental group finished 0.068s faster after treatment while the control group finished 0.047s slower after treatment.

Table 5.0b: ANCOVA showing main effect of whole vibration training on agility

Source	Type II Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12.849[a]	7	1.834	1.392	.076	.032
Intercept	87.916	1	87.916	2.921	.071	.053
Treatment	12.894	1	12.894	1.3923	.074	.031
Error	18.093	18	1.005			
Total	131.752	20				
Corrected Total	32.000	19				
a. R Squared = .115 (Adjusted R Squared = .117)						

Table 5.0b shows that the main effect of treatment (whole vibration training) is not significant on agility of players of University of Ibadan football team ($F_{(1, 18)}$ =1.3923; $p>0.05$; η^2=.031). Therefore, the null hypothesis is accepted. The partial eta squared of 0.031 implies that treatment accounted for 3.1% of the observed variance on agility of players of University of Ibadan football team.

Table 5.0c: Adjusted Marginal Mean showing the direction of difference in agility between the treatment groups

Dependent Variable	Treatment Groups	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Agility	Experimental	11.835secs	1.264	11.743	13.726
	Control	11.481secs	1.049	11.213	13.549

Table 5.0c showed that participants in experimental group obtained a higher mean score ($\bar{x}$=11.835) while control had a mean score of ($\bar{x}$=11.481). This shows that participants in experimental group had better agility than the control group. It then means that the treatment had better effect on agility of the participants in experimental group than the participants in the control group.

Hypothesis 3: There will be no significant whole vibration training effect on speed of players of University of Ibadan football team.

Table 5.1a: 30 metre Speed Test Results

	N	Pretest $\overline{X}$ Score	Posttest $\overline{X}$ Score
Experimental Group	10	4.877s	4.761s
Control Group	10	5.076s	5.021s

Table 5.1a above shows that the experimental group had a pretest mean score of 4.877s and a posttest mean score of 4.761s while the control group had a pretest mean score of 5.076s and a posttest mean score of 5.021s. When compared with the control group, the experimental group gained 0.116s and finished faster after treatment but the control group also finished faster as they also gained 0.055s.

Table 5.1b: ANCOVA showing main effect of whole vibration training on speed

Source	Type II Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8.729[a]	1	8.729	1.201	.124	.081
Intercept	87.916	1	87.916	1.320	.110	.075
Treatment	18.261	1	18.261	1.006	.126	.062
Error	17.004	18	.945			
Total	131.91	20				
Corrected Total	32.000	19				
a. R Squared = .017 (Adjusted R Squared = .019)						

Table 5.1b shows that the main effect of treatment (whole vibration training) is not significant on speed of players of University of Ibadan football team ($F_{(1, 18)}$ =1.006; p>0.05; η^2=.062). Therefore the null hypothesis is accepted. The partial eta squared of 0.062 implies that treatment accounted for 6.2% of the observed variance on speed of players of University of Ibadan football team.

Table 5.1c: Adjusted Marginal Mean showing the direction of difference in speed between the treatment groups

Dependent Variable	Treatment Groups	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Speed	Experimental	4.321secs	.817	4.551	5.332
	Control	4.281secs	.678	4.344	5.961

Table 5.1c showed that participants in experimental group obtained a higher mean score ($\bar{x}$=4.321) while control had a mean score of ($\bar{x}$=4.281). This shows that participants in experimental group had better speed than the control group. It then means that the treatment had better effect on speed of the participants in experimental group than the participants in the control group.

Hypothesis 4: There will be no significant whole vibration training effect on balance of players of University of Ibadan football team.

Table 5.2a: Standing Stork Test (Balance)

	N	Pretest $\overline{X}$ Score	Posttest $\overline{X}$ Score
Experimental Group	10	45.997s	46.566s
Control Group	10	40.502s	40.570s

Table 5.2a above shows that the experimental group had a pretest mean score of 45.997s and a posttest mean score of 46.566s while the control group had a pretest mean score of 40.502s and a posttest mean score of 40.570s. WBV training had a bigger impact on the experimental group as they gained 0.569s after treatment compared to the control group that had an increase of just 0.068s.

Table 5.2b: ANCOVA showing main effect of whole vibration training on balance

Source	Type II Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	38.833[a]	6	6.472	19.907	.000	.329
Intercept	87.916	1	87.916	22.117	.000	.361
Treatment	33.333	1	33.333	19.317	.000	.327
Error	34.119	18	1.900			
Total	194.201	20				
Corrected Total	32.000	19				
a. R Squared = .437 (Adjusted R Squared = .442)						

Table 5.2b shows that the main effect of treatment (whole vibration training) is significant on balance of players of University of Ibadan football team ($F_{(1, 18)}$ =19.317; $p<0.05$; η^2=.327). Therefore, the null hypothesis is rejected. The partial eta squared of 0.327 implies that treatment accounted for 32.7% of the observed variance on balance of players of University of Ibadan football team.

Table 5.2c: Adjusted Marginal Mean showing the direction of difference in balance between the treatment groups

Dependent Variable	Treatment Group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Balance	Experimental	48.414secs	.756	31.923	60.904
	Control	43.789secs	.746	23.319	54.259

Table 5.2c showed that participants in experimental group obtained a higher mean score ($\bar{x}$=48.414) while control had a mean score of ($\bar{x}$=43.789). This shows that participants in experimental group had better balance than the control group. It then means that the treatment had better effect on balance of the participants in experimental group than the participants in the control group.

6. Discussion of Findings

The average height of the participants was 1.76m and an average weight of around 69kg. It was also revealed that 15 (75%) of the players had average leg power values at the entry point of the study when compared with leg power norm values. 5 (25%) of the players had below average or poor leg power values. Further breakdown shows that none of the players had excellent leg power values with 2 (10%) of the players in the below average category and 3 (15%) having poor leg power values.

All the 20 participants used for this study had excellent agility values prior to the training programme when compared with agility norm values. But only 4 (20%) of the players had excellent speed values when compared with speed norm values with 11 (55%) of the players being in the good category. 2 (10%) of the players having average speed values and just 3 (15%) were in the fair category. This meant that 17 (85%) of the players had average or better speed values when compared with the speed norm values prior to the training programme.

Furthermore, 5 (25%) of the players had excellent balance values with 8 (40%) of the players being in the above average category. 4 (20%) of the players also had average balance values with 3 (15%) being in the below average category. This meant that 13 (65%) of the players had better than average balance values when compared to the balance norm values prior to the training programme. Findings in this study also revealed that there was significant effect of treatment on leg power of participants under study. This is in line with the position of Rittweger, (2002); Delecluse, Roelants and Verschueren, (2003), that indications exists that better results may be achieved with whole body vibration in the area of explosive power. Also, Cochrane and Stannard (2005) discovered acute effects of WBV on leg power compared with active controls. The increase in leg power was 3% after WBV and the change in leg power after active control was 0.4%. For example, leg power measured in the form of countermovement vertical jump height increased 8% in 18 female elite field hockey players ($p < 0.05$) and decreased 3% in the same athletes after cycling as an active control. Findings from this study have now shown that whole body vibration training can also have chronic effects on leg power of athletes.

It was also revealed that there was no significant effect of WBV training on agility of participants under the study. This has confirmed the assertions of Cochrane, Legg and Hooker (2004) who concluded that WBV training did not enhance agility in non-elite athletes. Although, participants in the experimental group had a slightly better posttest performance than the pretest, the difference was not statically significant. Also, findings from this study had shown no significant effect of WBV training on speed of participants under the study. This is not surprising as a previous study carried out by Delecluse, et al., (2005) came to a similar conclusion. In that study, elite sprinters trained for five weeks with and without WBV (35 Hz, 2mm), the start time for 30 m sprint did not change (364.3 ms both pre and post with WBV; pre: 374.2 ms, post: 375.2 ms without WBV).

It was also discovered that the treatment had a significant effect on balance of participants under study as participants in experimental group obtained a higher mean score ($\bar{x}$=48.414) while control had a mean score of ($\bar{x}$=43.789). This is in line with the study carried out by Despina et al. (2014) whose measurements revealed a 7% increase ($p < 0.05$) in rhythmic gymnasts' balancing ability 15 minutes after squat type of exercises performed with WBV compared with the -1.0% change when the athletes performed the same exercises without WBV. Similarly, Nina and Ewald (2012) discovered that sports students had improved one leg balance after a bout of whole body vibration exercise.

7. Conclusion

The ANCOVA results showed a significant difference in the pretest and posttest scores of players in leg power and balance but no significant difference in agility, speed, coordination and reaction time. Hence, two hypotheses were rejected, and four hypotheses were accepted. Based on the findings of this study, it was concluded that whole body vibration training improved the leg power of participants. It was also discovered that WBV training improved balance of participants. But WBV training did not significantly improve the speed, agility, coordination and reaction time of the participants.

7.1 Research implications, Justification and Novelty of the Study

Over the years, WVB has been used as a means of massaging parts of the body to easy and tone muscles. This study however, sought to investigate the effect of whole body vibration training on selected performance-related physical fitness components of players in the university of Ibadan football team, Ibadan, Nigeria**.** The study poked further and discovered novelty of this study that whole body vibration (WBV) can rather be used as a recovery technique regimen before, during and after performance in sports. The training and tests were included in the study for consultation.

7.2 Recommendations

Based on the findings of this study, the following recommendations were made:

1. Whole body vibration training should be adopted as a viable alternative to other conventional recovery methods to improve leg power recovery of individuals.
2. Whole body vibration training should also be introduced by experts as an avenue to improve body balance recovery due to its potency along other existing training protocols available.
3. Football coaches should incorporate whole body vibration training into their training programme as leg power and balance are essential fitness components needed to play the game of football. More so, as whole body vibration training is time economical and places minimal stress on the body, this may lead to lower rate of injury occurrence.

Conflict of Interest Statement

There is no conflict of interest.

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