OPEN ACCESS
https://dergipark.org.tr/en/pub/turkjkin

ORIGINAL RESEARCH

Effect of an eight-week plyometric exercise training on athletes' muscular strength in selected ball games in Nigeria

Oluwabusayo Odunayo Akinbiola, Adewale Mathew Yekini

Department of Kinesiology, Health Education and Recreation, Obafemi Awolowo University, Ile-Ife, Nigeria.

Abstract. This study investigated how an eight-week plyometric exercise training program modifies the muscular strength characteristic of ball game athletes in Obafemi Awolowo University, Ile-Ife, and also determined differences in training effect by sports. The study adopted a pretest-posttest quasi-experimental design. Pre-test (baseline) data were recorded before the plyometric training intervention was administered. Post-test data were recorded within 24hrs of the completion of the intervention. The study population was the ball game athletes of Obafemi Awolowo University, Ile-Ife. One hundred active ball game athletes were drawn from four ball games; football (n=25), volleyball (n=25), basketball (n=25), and handball (n=25), using the purposive sampling technique. Six instruments were used for data collection. Participants' weight, height, and BMI were estimated with a digital BMI scale, blood pressure was recorded with an aneroid sphygmomanometer and skinfold thickness was measured with a Lange skinfold caliper, plyometric exercise training was conducted using a Plyo-Box, weight training exercises were performed using a multi-station weight training machine, the 8-week plyometric training intervention was guided by a structured training program. Data were analyzed using mean and standard deviation, Student t-Test, and Two-way ANOVA were used to compare pre-test and post-test data and the effect of training among ball game athletes, with significance set at $P < 0.05$. The results showed that ball game athletes in Obafemi Awolowo University possessed a mean 1RM of 67.36 ± 8.31kg, and the mean of their upper-torso muscle was 32.68 ± 13.46kg and their lower-torso muscle was 160.45 ± 170.01kg strong. There were marked improvements in the strength of the targeted muscles after the eight-week plyometric training as significant gains were noticed in the post-test 1RM $t= -3.59$, $p< 0.05$, muscles of the upper torso $t=-18.2$, $p<0.05$, muscles of the lower-torso, calf muscle ($t= -35.77$, $p<0.05$), and the hip flexors, ($t= -17.01$, $p<0.05$). When the effect of the plyometric training program was compared among ball game athletes by sport, the result showed that volleyball players gained significantly more than other ball game athletes in the strength of upper-torso and lower-torso muscles ($F= 503.96$, $p<0.05$). The study concluded that eight-week plyometric exercise training produced a significant increase in the muscular strength of ball game athletes.

Key Words. Athletes, ball games, muscular strength, plyometric exercise.

Introduction

Ball games are typically high-intensity, fast-paced, and dynamic sports in which performers require specific fundamental skills such as kicking, tackling, jumping, sprinting, turning, repetitive explosive bursts, agility, stamina, and changing speed for successful performance. Though the object "ball" (which comes in different sizes) is the common denominator for this class of sports, their performance is always guided by varied codes and laws which specify among other things the nature of the game, number of players making up a team, the degree of bodily contact allowed in each, the duration of play, the size of the play area and the length of intervals. Success in handball and volleyball alike depends on the ability to perform explosive intermittent anaerobic activities such as leaping vertically as is required in performing the jump shot, spiking, and jump attack from the attack

✉ O. O. Akinbiola, e-mail: akinbiolao@oauife.edu.ng
Received: Febraury 21, 2022 - ***Accepted:*** April 02, 2022 - ***Published:*** April 04, 2022
To Cite: Akinbiola, O.O., & Yekini, A.M. (2022). Effect of an eight-week plyometric exercise training on athletes' muscular strength in selected ball games in Nigeria. *Turk J Kinesiol*, 8(1), 9-14. **DOI:** 10.31459/turkjkin.1076794

line, blocking, and defending against the opponent. Physical characteristics typical of ball game athletes are speed, muscular strength, agility, endurance, balance, coordination and vertical jump ability, thus, athletes and coaches have continued to explore training modalities that best develops these traits within minimum time frame. Until recently, training and conditioning for ball games have followed the traditional strength training approach, with development of muscular strength and endurance being the focus.

Traditional strength training exercise programs are commonly thought to involve exercises that targets specific muscles and with greater potentials to increase strength (Suresh et al. 2018). In the views of Suresh and colleagues, traditional strength training is a form of exercise in which the body's musculature is forced to move against an opposing force such as high-intensity interval training (HIIT), free weight training, and functional training. They however opined that the focus of a traditional exercise program is to increase the strength of particular muscle or muscle group without regard to movements that are related to specific activities found in respective sports. Whitehurst et al. (2005) opined that traditional, machine-based and free weight exercise programs that restrict movement along one plane of motion (usually sagittal) may elicit poorer carry-over effects on activities that occur in multiple planes. The limitation of the traditional strength training model when applied to ball games seem to lie in its inability to provide all-round conditioning for the athletes, who may be required to expediently perform dynamic movements ranging from running, leaping, jumping, pivoting, and bounding while performing. Thus, a more robust training approach such as the plyometric training method has been touted severally in the works of authors like Rezaimanesh et al. (2011), Michailidis (2015), and Kayantas & Soyler (2020).

Plyometric consists of a rapid muscle extension (eccentric action) followed by a shortening (concentric action) of the same muscle and connective tissue, aimed at maximizing strength in the shortest time (Rezaimanesh et al., 2011; Michailidis, 2015; Kayantas & Soyler, 2020). Plyometric training involved active muscle lengthening followed by active muscle shortening, changing directions, stopping, and starting. These concentric contractions and eccentric contractions are paramount to muscle activity during a movement called a stretch-shortening cycle, a reflex action that prevents the muscle from tearing and an integral part of muscle function that is responsible for many basic ball game movements including acceleration, vertical jump, and sudden changes of direction. Plyometric enhance muscular speed or strength and contractions that allow for various specific sports training explosiveness. Researchers have found that combining plyometric training with a strength training program improves vertical jump performance, foot strength, and muscular strength (Slimani et al., 2016; Suresh et al., 2018)

Traditional training program seems to be deficient in providing all-around development of the micro-component of the muscle, which contributes to strength and speed (Behm et al., 2017). Coaches and trainers have therefore continued to search for more rewarding training alternatives. Studies have confirmed that plyometric training targets the stretch contraction sequence of muscle to generate strength and many others have established its effectiveness in athletic conditioning, few studies have however delineated the effectiveness of plyometric training among collegiate ball-games athletes.. This study therefore sought to investigate the effect of an 8-week plyometric training program on athlete's muscular strength in selected ball games and to compare training effect by sports among athletes in Obafemi Awolowo University Ile-Ife, Nigeria.

Methods

Participants

Participants were 100 ball game athletes purposively selected from four ball games; football (n=25), basketball (n=25), handball (n=25) and volleyball (n=25) in Obafemi Awolowo University, Ile-Ife Nigeria.

Data collection

The research was cleared by the Ethics and Research Committee (ERC) of the Obafemi Awolowo University Teaching Hospitals Complex with protocol number ERC/2016/06/17. Participants were briefed on the test protocols and they gave their consent via an informed consent form. The study adopted a pre-test-post-test experimental design. Baseline data of participants were recorded before the 8-week training intervention was administered and post-test data were collected after the 8-week plyometric training program. Height, weight, and BMI were recorded with an electronic BMI scale (SECA220), resting blood pressure was recorded with a digital sphygmomanometer

(OMRON M6 Comfort), a 21inch truck tire was used for plyometric jump training, a multi-station weight training machine was used to test muscle strength, a non-elastic fiber tape was used to measure jump heights and distances, an Olympic weight lifting bar, sets of free weights and weight-lifting bench were used to measure the 1RM of participants, cones and agility ladder were used for conducting the plyometric exercise program, the structured 8-week Plyometric exercise program was used to administer the training intervention. All instruments were validated using standard procedures. The training was conducted on 3 alternate days for 8 weeks. Participants did stretching and warm-up exercises for between 5 to 10 minutes before performing 8 plyometric exercise drills in sequence as follows; standing jump and reach, one leg squat jump, depth jump, split squat jump, burpee, countermovement vertical jump, bench press with free weights and knee extension with free weights. Exercises are performed in sets and reps which were increased from week 2 through to week 8. The structured 8-week Plyometric exercise program is presented in Appendix 1.

Data Analysis

Data analysis was done using the IBM 20 version of the Statistical Package for Social Sciences (SPSS). Mean and standard deviation was used to describe data, and t-test and Analysis of Variance (ANOVA) were computed to compare pre-test and post-test data and to determine differences in the effect of plyometric training by sports.

Results

Demographic characteristics of ball game athletes are summarized in Table 1. The mean age of ball game athletes was 24.27±1.70yrs, while the means of their weight and height were 74.39±9.24kg and 5.65±0.42m respectively. With regard to body composition, ball game athletes possessed 25.24±4.42kg/cm^2, 12.50±3.00%, 1.08±0.07kg, and 62.32±18.32kg as means of BMI, % body fat, body density, and lean body mass respectively. The means of their resting systolic and diastolic blood pressures were 118.24±11.31 and 63.65±9.66 respectively. One of the objectives of this research was to determine the muscular strength characteristics of ball game athletes, a description of participants' strength characteristics is summarized in Table 2.

Results in Table 2 showed that ball game athletes had a mean 1RM of 67.36±8.31kg. Concerning the strength of the lower torso, athletes in the current study scored 32.68 ± 13.46rpm and 160.45 ± 170.01 rpm respectively in the squat Test and push-up Test used to test the strength of the lower torso muscles. With regards to the strength of the gluteus, quadriceps, hamstring, and calf muscles, ball game athletes scored 8.97±0.90cm and 5.13±1.68cm respectively in vertical jump and broad jump which were administered to test the targeted muscles. The mean of the torque of their hip flexor was 8.13 ± 1.68 kg, while that of their external and internal oblique muscles was 41.06±13.11kg. To investigate the effect of the 8-week plyometric training on the strengths of selected muscles of ball game athletes in the study, a t-Test statistic was computed to compare pre-training and post-training data. The results of the t-Test are summarized in Table 3.

Table 1
Demographic characteristics of ball game athletes.

Variables	Mean ± SD
Age of Athlete (yrs.)	24.27 ± 1.70
Weight (kg)	74.39 ± 9.24
Height (M)	5.65 ± 0.42
Body Mass Index (kg)	25.24 ± 4.42
Body fat (%)	12.50 ± 3.00
Body density (kg)	1.08 ± 0.07
Lean body mass (kg)	62.32 ± 18.32
Systolic Blood pressure (mmHg)	118.24 ± 11.31
Diastolic Blood pressure (mmHg)	63.65 ± 9.66

The t-Test results in table 3 revealed significant differences between pre-test and post-test muscular strength characteristics of ball game athletes. There were marked improvements in all strength parameters after the 8-week plyometric training. 1RM ($t = -3.59$; $p < 0.05$), upper torso muscles ($t = -18.21$; $p<0.05$), hip and upper leg muscles ($t = -11.20$; $p<0.05$), gluteus, quadriceps, hamstring and calf muscles ($t = -35.77$; $p<0.05$), hip flexor ($t = -17.01$; $p<0.05$) and external and internal oblique ($t = -22.58$; $p<0.05$). To compare the effect of the 8-week plyometric training program on the muscular strength of ball game athletes by sports, Analyses of Variance statistic was computed, and the results are summarized in Table 4.

Table 2
Muscular strength characteristics of ball game athletes.

Variables	Mean ± SD	Min	Max
Participant's 1RM kg	67.36 ± 8.31	52	97
Upper torso Muscle strength	32.68 ± 13.46	10	65
Hip and upper leg Strength	160.45 ± 170.01	39	901
Gluteus, Quad, Hamstring, and Calf strength	8.97 ± 0.90	7	12
Hip flexor strength	8.13 ± 1.68	5	12
External oblique, Internal oblique strength	41.06 ± 13.11	15	80

Table 3
Summary of the t-test comparing pre-intervention and post-intervention muscular strength characteristics of ball game athletes.

	Mean ± SD	t	df	p
Pre 1RM - Post 1RM	-1.89 ± 5.29	-3.57	99	.001*
Pre Upper torso - Post Upper torso	-18.55 ± 10.19	-18.21	99	.000*
Pre Hip & Upper Leg- Post Hip & Upper Leg	139.39 ± 124.49	-11.19	99	.000*
Pre GQHC - Post GQHC	-5.583 ± 1.56	-35.77	99	.000*
Pre HF - Post HF	-2.60 ± 1.53	-17.01	99	.000*
Pre EIO - Post EIO	-37.43 ± 16.58	-22.58	99	.000*

*1RM: 1 Repetition Maximum; GQHC: Gluteus, Quad, Hamstring, and Calf; HF: Hip Flexor; EIO: External, Internal Oblique; * p < .05*

Table 4
Summary of ANOVA comparing pre-intervention and post-intervention muscular strength characteristics of ball game athletes across sports.

	Sum of Squares	df	Mean Square	F	p
1-RM	1012.990	3	337.66	5.93	.001*
	5469.760	96	56.977		
	6482.750	99			
Upper torso	253.360	3	84.45	0.46	.712
	17666.640	96	184.03		
	17920.000	99			
Hip & Upper Leg	1654960.160	3	551653.39	8.83	.000*
	5997325.280	96	62472.14		
	7652285.440	99			
GQHC	2.059	3	.686	0.84	.473
	78.053	96	.813		
	80.112	99			
HF	41.684	3	13.89	6.82	.000*
	195.690	96	2.038		
	237.374	99			
EIO	1578.990	3	526.33	1.40	.249
	36184.000	96	376.92		
	37762.990	99			

*1RM: 1 Repetition Maximum; GQHC: Gluteus, Quad, Hamstring, and Calf; HF: Hip Flexor; EIO: External, Internal Oblique; * p < .05*

The summary of ANOVA in Table 4 revealed that there were significant differences in the effect of the 8-week plyometric training on muscular strength characteristics of ball game athletes in the study; 1RM $F=5.93$; $p<0.05$; Hip &Upper Leg $F=8.83$; $p<0.05$; and Hip flexor $F=6.82$; $p<0.05$ when they were compared across sports. Ball game athletes in the current study however did not manifest

significant differences in strength of the upper torso muscles F=0.46; p>0.05; gluteus maximus, quadriceps, hamstrings, and calf muscles F=0.84; p>0.05; and in external and internal oblique muscles F=1.40; p>0.05.

Discussion

This study investigated the effect of an 8-week plyometric training program on athletes' muscular strength in selected ball games and compared training effects by sports among athletes of a tertiary institution in Nigeria. Ball games are sports whose gameplay is often characterized by repetitive jumping, bounding, leaping, and hopping, interspersed with quick intermittent sprints. Markovic & Mikulic (2010) had conjectured that these activities entail the use of the stretch-shortening cycle (SSC) developed during the transition from a rapid eccentric contraction to a rapid concentric contraction of a muscle. Evidence abounds in the literature on the effectiveness of plyometric exercises in developing traits such as speed, explosive jump power, and strength among sportsmen. The finding of this current research with regards to plyometric exercise training and gains in muscle strength and speed corroborated what was reported by Markovic & Mikulic (2010) and Michailidis (2015). These authors were unanimous in their conclusion that plyometric training could improve sprint and jump performance of ballgame athletes at various levels. Soundara & Pushparajan (2010) had reported that plyometric training could enhance muscle strength and power. In a meta-analytical study of the effect of plyometric training on the strength of back and leg muscles, Kayantas & Soyler (2020) found that plyometric training is moderately effective in strengthening the back and leg muscles and that the force generation capacity of these muscles could be improved with plyometric training. In a similar study carried out by Demirci (2016) to investigate the effect of 8 weeks of plyometric training on physical parameters of female volleyball players, the author reported a significant difference in the strength of the back muscles of participants after the 8-week plyometric training program.

The current study found that volleyball athletes had better abdominal muscular strength than their counterparts in handball, football, and basketball after the training intervention. Suresh et al. (2018) reported that a combination of plyometric and weight training produced significant gains in jumps and speed of male volleyball players. Alam et al. (2012) had earlier reported significant changes in the vertical jumps and briskness of elite handball athletes after 6-week plyometric circuit training.

Asadi et al. (2012) found significant improvement after plyometric exercise in squat jump performance of professional football athletes. The author reported positive changes in vertical jump height as well as an increase in squat jump (SJ) of elite male handball athletes after plyometric exercises. The superiority in post-intervention gains in jump height and squat jumps among volleyball athletes in this current study was in agreement with the submissions of Ronstadt et al. (2008) and Asadi et al. (2012) that volleyball athletes benefited most from plyometric training program when compared with other ballgame athletes. Concerning muscular strength of the lower body, this study found a significant improvement in muscular strength of ball game athletes, particularly after the 8-week plyometric training program, and more noticeably with the volleyball group. Ramirez-Campillo et al. (2021) had reported that plyometric training effectively improved muscle power and sprint speed in amateur and professional volleyball players and that it enhances volleyball-specific skills such as spike jump and countermovement jump.

The jump height of basketball athletes improved significantly after the plyometric training program in the current study. This finding is in tandem with Guruvupandian & Murugavel (2017), and Birtukan & Sisay (2018) who reported significant improvements in squat jump, push-up, and sit-up performances of athletes after plyometric training. In a recent meta-analytical study by Ramirez-Campillo et al. (2021) plyometric jump training was reported to significantly improve muscle power, sprint speed, balance, and muscle strength among basketball players.

Limitations

The study made use of field tests in its assessment, which provided estimates of the muscular strength characteristics of participants. Standardized testing apparatuses such as the Biodex® isokinetic testing machine and dynamometers may elicit more accurate data.

Conclusion

The study concluded that eight weeks of plyometric exercise training produces a significant increase in the strength of the upper and lower torso muscles of ball game athletes. It is thus recommended that a

blend of plyometric exercise training and the traditional strength training approaches would be more appropriate for the all-round conditioning of athlete's muscles particularly with regards to force, speed and endurance.

Authors' Contribution

Study Design: OOA, AMY; Data Collection: OOA, AMY; Statistical Analysis: OOA; Manuscript Preparation: OOA, AMY; Funds Collection: OOA, AMY.

Ethical approval

The study was approved by the Ethics and Research Committee (ERC) of the Obafemi Awolowo University Teaching Hospitals Complex with protocol number ERC/2016/06/17 and it was carried out in accordance with the Code of Ethics of the World Medical Association also known as a declaration of Helsinki.

Funding

The authors declare that the study received no funding.

Conflict of Interest

The authors hereby declare that there was no conflict of interest in conducting this research.

References

Alam, S., Pahlavani, H. A., Monazami, M., Vatandoust, M., & Nasirzade, A. (2012). The effect of plyometric circuit exercises on the physical preparation indices of elite handball players. *Adv Environ Biol,* 6(7), 2135-2140

Asadi, A., Arazi, H., Young, W. B., & De Villareal, E. S. (2016). The effects of plyometric training on change of direction ability: A meta-analysis. *Int J Sports Physiol Perform*, 11(5), 563-573.

Behm, D., Young, J., Whitten, J., Reid, J., Quigley, P., Low, J., Li, Y., Lima, C.D., Hodgson, D.D., Chaouachi, A., Prieske, O., & Granacher, U. (2017). Effectiveness of traditional strength vs. power training on muscle strength, power and speed with youth: A systematic review and meta-analysis. *Front Physiol*, 30(8), 423.

Birtukan, B., Sisay M. (2018). Effects of physical fitness exercises on muscular strength and endurance performance of male football athletes of Tabor secondary school. *IOSR Journal of Humanities and Social Science*, 23(2), 60-68.

Demirci, E. (2016). *The effect of plyometric training on physical parameters of 14-16 age female volleyball players*. Master Thesis, Dicle University, Institute of Health Sciences, Physical Education and Sports Department, Diyarbakır, Turkiye.

Guruvupandian, C., & Murugavel, K. (2017). Influence of high intensity plyometric training program on motor fitness variables of intercollegiate male handball players. *Int J Appl Res*, 3(6), 536-539.

Kayantas, I. & Soyler, M. (2020). Effect of plyometric training on back and leg muscle strength: A meta-analysis study. *Afr Educ Res J*, 8(2), 342-351.

Markovic, G., & Mikulic, P. (2010). Neuro-musculoskeletal and performance adaptations to lower-extremity plyometric training. *Sports Med*, 40(10), 859-896.

Michailidis, Y. (2015). Effect of plyometric training on athletic performance in preadolescent soccer players. J Hum Sport Exerc, 10(1), 15-23.

Razaimanesh, D., Amiri-Farsani, P., & Saidian, S. (2011). The effect of a 4-week plyometric training period on lower body muscle EMG changes in futsal players. *Procedia Soc Behav Sci,* 15, 3138-3142.

Ramirez-Campillo, R., Garcia-Hermoso, A., Moran, J., Chaabene, H., Negra, Y., & Scanlan, A.T. (2020). The effects of plyometric jump training on physical fitness attributes in basketball players: A meta-analysis. *J Sport Health Sci*, 24, S2095-2546(20)30169-1.

Ramirez-Campillo, R., Garcia-de-Alcaraz, A., Chaabene, H., Moran, J., Negra, Y., & Granacher, U. (2021). Effects of plyometric jump training on physical fitness in amateur and professional volleyball: A meta-analysis. *Front Physiol,* 12, 636140.

Ronstadt, B.R., Kvamme, N.H., Sunde, A., & Raastad, T. (2008). Short-term effects of strength and plyometric training on sprint and jump performance in professional football players. *J Strength Cond Res*, 22(3), 773–780.

Slimani, M., Chamari, K., Miarka, B., Del Vecchio, F. B. & Chéour, F. (2016). Effects of plyometric training on physical fitness in team sport athletes: A systematic review. *J Hum Kinet*, 53, 231-247.

Soundara, R., & Pushparajan, A. (2010). Effect of plyometric training on the development of the vertical jump in volleyball athletes. *Journal of Physical Education & Sport,* 28(3), 65–69.

Suresh, T.N., Veeragoudhaman, T.S., Vijayananth, V., & Kumar, S.D. (2018). Effects of plyometric-weight training and plyometric training on anaerobic power and muscle strength in male volleyball players. *Int J Res Sci Innov,* 5(4), 90-96

Whitehurst, M.A., Johnson, B.L., Parker, C.M. (2005). The benefits of functional exercise circuit for older adults. J Strength Cond Res, 19, 647-651.

Appendix: Structured 8-week Plyometric Exercise Training Program

Days / Weeks	Day 1	Sets / Reps	Day 2	Sets / Reps	Day 3	Sets / Reps
Week 1	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	1x15	Standing jump and reach	1x15	Standing jump and reach	1x15
	One leg squat jump	1x10	One leg squat jump	1x10	One leg squat jump	1x10
	Depth jump	3x10	Depth jump	3x10	Depth jump	3x10
	Split Squat Jump	3x10	Split Squat Jump	3x10	Split Squat Jump	3x10
	Burpee	1x10	Burpee	1x10	Burpee	1x10
	Counter Movt, V J.	3x10	Counter Movt, V J.	3x10	Counter Movt, V J.	3x10
	Bench press (80% of 1-RM)	5 sets	Bench press (80% of 1-RM)	5 sets	Bench press (80% of 1-RM)	5 sets
	knee Extension 20kg	2x20	knee Extension 20kg	2x20	knee Extension 20kg	2x20
Week 2	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	2x15	Standing jump and reach	2x15	Standing jump and reach	2x15
	One leg squat jump	2x10	One leg squat jump	2x10	One leg squat jump	2x10
	Depth jump	3x13	Depth jump	3x13	Depth jump	3x13
	Split Squat Jump	3x13	Split Squat Jump	3x13	Split Squat Jump	3x13
	Burpee	2x10	Burpee	2x10	Burpee	2x10
	Counter Movt, V J.	3x10	Counter Movt, V J.	3x10	Counter Movt, V J.	3x10
	Bench press (80% of 1-RM)	7 sets	Bench press (80% of 1-RM)	7 sets	Bench press (80% of 1-RM)	7 sets
	knee Extension 20kg	2x20	knee Extension 20kg	2x20	knee Extension 20kg	2x20
Week 3	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	3x15	Standing jump and reach	3x15	Standing jump and reach	3x15
	One leg squat jump	3x10	One leg squat jump	3x10	One leg squat jump	3x10
	Depth jump	3x15	Depth jump	3x15	Depth jump	3x15
	Split Squat Jump	3x15	Split Squat Jump	3x15	Split Squat Jump	3x15
	Burpee	2x10	Burpee	2x10	Burpee	2x10
	Counter Movt, V J.	3x10	Counter Movt, V J.	3x10	Counter Movt, V J.	3x10
	Bench press (80% of 1-RM)	7 sets	Bench press (80% of 1-RM)	7 sets	Bench press (80% of 1-RM)	7 sets
	knee Extension 20kg	3x20	knee Extension 20kg	3x20	knee Extension 20kg	3x20

Week 4	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	3x20	Standing jump and reach	3x20	Standing jump and reach	3x20
	One leg squat jump	3x15	One leg squat jump	3x15	One leg squat jump	3x15
	Depth jump	3x15	Depth jump	3x15	Depth jump	3x15
	Split Squat Jump	3x15	Split Squat Jump	3x15	Split Squat Jump	3x15
	Burpee	2x20	Burpee	2x20	Burpee	2x20
	Counter Movt, V J.	3x20	Counter Movt, V J.	3x20	Counter Movt, V J.	3x20
	Bench press (90% of 1-RM)	7 sets	Bench press (90% of 1-RM)	7 sets	Bench press (90% of 1-RM)	7 sets
	knee Extension 20kg	3x25	knee Extension 20kg	3x25	knee Extension 20kg	3x25
Week 5	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	3x30	Standing jump and reach	3x30	Standing jump and reach	3x30
	One leg squat jump	3x20	One leg squat jump	3x20	One leg squat jump	3x20
	Depth jump	3x20	Depth jump	3x20	Depth jump	3x20
	Split Squat Jump	3x20	Split Squat Jump	3x20	Split Squat Jump	3x20
	Burpee	2x20	Burpee	2x20	Burpee	2x20
	Counter Movt, V J.	3x20	Counter Movt, V J.	3x20	Counter Movt, V J.	3x20
	Bench press (100% of 1-RM)	5 sets	Bench press (100% of 1-RM)	5 sets	Bench press (100% of 1-RM)	5 sets
	knee Extension 20kg	3x30	knee Extension 20kg	3x30	knee Extension 20kg	3x30
Week 6	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	3x35	Standing jump and reach	3x35	Standing jump and reach	3x35
	One leg squat jump	3x25	One leg squat jump	3x25	One leg squat jump	3x25
	Depth jump	3x25	Depth jump	3x25	Depth jump	3x25
	Split Squat Jump	4x25	Split Squat Jump	4x25	Split Squat Jump	4x25
	Burpee	2x25	Burpee	2x25	Burpee	2x25
	Counter Movt, V J.	3x25	Counter Movt, V J.	3x25	Counter Movt, V J.	3x25
	Bench press (100% of 1-RM)	7 sets	Bench press (100% of 1-RM)	7 sets	Bench press (100% of 1-RM)	7 sets
	knee Extension 20kg	4x40	knee Extension 20kg	4x40	knee Extension 20kg	4x40

Week 7	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	3x40	Standing jump and reach	3x40	Standing jump and reach	3x40
	One leg squat jump	3x40	One leg squat jump	3x40	One leg squat jump	3x40
	Depth jump	3x30	Depth jump	3x30	Depth jump	3x30
	Split Squat Jump	4x30	Split Squat Jump	4x30	Split Squat Jump	4x30
	Burpee	2x40	Burpee	2x40	Burpee	2x40
	Counter Movt, V J.	3x30	Counter Movt, V J.	3x30	Counter Movt, V J.	3x30
	Bench press (100% of 1-RM)	8 sets	Bench press (100% of 1-RM)	8 sets	Bench press (100% of 1-RM)	8 sets
	knee Extension 20kg	4x40	knee Extension 20kg	4x40	knee Extension 20kg	4x40
Week 8	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min	Stretching/low intensity warm-up	5-10min
	Standing jump and reach	3x40	Standing jump and reach	3x40	Standing jump and reach	3x40
	One leg squat jump	3x40	One leg squat jump	3x40	One leg squat jump	3x40
	Depth jump	3x35	Depth jump	3x35	Depth jump	3x35
	Split Squat Jump	4x35	Split Squat Jump	4x35	Split Squat Jump	4x35
	Burpee	2x40	Burpee	2x40	Burpee	2x40
	Counter Movt, V J.	3x35	Counter Movt, V J.	3x35	Counter Movt, V J.	3x35
	Parallel squats (80% of 1-RM)	11 sets	Parallel squats (80% of 1-RM)	11 sets	Parallel squats (80% of 1-RM)	11 sets
	knee Extension 20kg	4x40	knee Extension 20kg	4x40	knee Extension 20kg	4x40