

THE EFFECT OF PERIODIZED RESISTANCE TRAINING ON SPRINTING SPEED, AGILITY AND POWER OF DOMESTIC FEMALE CRICKET PLAYERS

Saamia Sunble¹, Muhammad Faheem Afzal², Adeela Arif³, Lal Gul Khan¹, Zaheer Qadir⁴, Muhammad Sanaullah³

ABSTRACT

Introduction: It has been well documented that there is great difference between male and female according to body shape and other characteristics like ability to perform work, muscular power and strength. There is almost no study conducted on female cricket participants under the age of twenty. This study was designed to determine effects of periodized resistance training on sprinting speed, agility, power in domestic young female cricketers.

Material & Methods: This was a parallel group randomized control trial that utilized purposive sampling to recruit 46 participants. Data was collected from Abdul-Qadeer cricket academy, Kinnaird College for women. 46 young female cricketers completed the study, of which 23 were in experimental group and 23 were in control group. In experimental group, 8 week of resistance training program had been introduced in addition to their regular training sessions, while control group only followed their regular training sessions. To evaluate the speed, agility and power tests such as (run a three test, Illinois agility test, sergeant jump test and seated medicine ball throw) were performed before and after the experimental or control training.

Results: Periodized resistance training significantly increase ($p = 0.01$) sprinting speed measured by run a three test. Post intervention mean \pm SD of Illinois agility test was 19.817 ± 1.579 that shows significant effect of periodized resistance training on agility ($p=0.001$). Post intervention mean \pm SD of sergeant jump test was 7.782 ± 2.448 which shows significant effect of periodized resistance training on power of lower limb ($p=0.001$). Post intervention mean \pm SD of seated medicine ball throw was 28.194 ± 3.878 that shows that there is no significant effect of periodized resistance training on power of upper limb ($p=0.89$).

Conclusion: This study concluded that sprinting speed, agility and power of lower limb is improved by periodized resistance training.

Key Words: agility, periodized resistance training.

Authors' Declaration: The authors declared no conflict of interest and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed substantially to the planning of research, question designing, data collection, data analysis and write-up of the article.

Authors' Affiliation

¹ Riphah International University, Islamabad

² Lahore Medical and Dental College

³ Riphah International University, Lahore

⁴ Shifa International Hospital Islamabad

Corresponding Author

Saamia Sunble

Riphah International University, Islamabad

Email: sunblesamia@gmail.com

This article may be cited as: Sunble S, Afzal MF, Arif A, Khan LG, Qadir Z, Sanaullah M. The effect of periodized resistance training on sprinting speed, agility and power of domestic female cricket players. *Rehman J Health Sci.* 2022;4(1). 31-35

Submitted: June 19, 2021

Revisions Submitted: August 15, 2021.

Accepted: October 04, 2021

INTRODUCTION

Cricket is very famous and specially designed game that requires group of 11 participants (team) and is a well-known game at international level. Cricket is similar to baseball because it is also played in open grounds. At beginning the cricket was known to be the game only played by men.^{1,2} But few years earlier, world has been recognized to female cricket game as it is spreading and succeeding all over the world.^{2,3} It has been seen that media and commentators are not as interested in female cricket matches as in male matches. Therefore, most female matches have no record in history. That is why there is large research gap on female cricket game.⁴ Females playing style is also different from males that is why they show different reaction time during game and pregame season.⁵ The average speed of ball throw is 27m/s in females and running speed of bowler is 4.9m/s . The running speed of male and female is same, but females are slower than males in ball delivery.⁶

World leading organization recommended different regimen of RT exercises for gaining profitable training modifications so that it improves the fitness and performance during game and avoid fatigue.⁷

Agility is defined as the ability to dynamic start, slack up, repeal, speed up again while controlling body position and minimizing speed reduction.⁸ Sudden movement or change of direction may be required either during chasing a participant of opposite team or chasing a moving ball while playing team sport. That's why constituent of performance of agility is defined as reaction to a specific impulse.⁹ Response time, sport specific performance, body communion during repeal and sprinting are the main properties of agility in sports and competition. Nowadays the agility has become one of the most important factors for any sports of the world.¹⁰ For a good performance, streamline sprinting is an important component of training. Leg extensor

muscles such as extensor digitorum longus, tibialis anterior and extensor hallucis longus are the main muscles that drag the body during fast running. There is a strong relationship between peak strength of knee extensors (quads tendon and muscles) and increasing sprint performance. According to some studies, after RT program sprint time has been reduced.¹¹ While some studies shows that RT program has no effect on sprint speed and sprint time.¹²

Speed is the bio motor component of a sport that allows a sportsman to move quickly at his peak effort against a particular intensity of load.¹³ Quick movement of a body is called speed.¹⁴ Hand/arm movement, step frequency and length of steps are very important factor for top speed. Running with different weights can also be helpful in increasing step length.¹⁵ Medicine ball and cable pulley are mostly used for development of power. They are also helpful in measuring power in all directions because medicine ball and cable pulley allow movement in all planes i.e. transverse, frontal and oblique.¹⁶ Periodization is a technique used in strength training that is described as the variation in duration, intensity and frequency of exercise after a regular time period. The main aim of periodization in strength training is to gain the maximum efficiency of training in days, weeks or months as a short period, and a year, whole career or lifetime training of an athlete as long period.¹⁷ RT has very important role in improving the speed and explosive power of an athlete. In most sports especially in football, RT plays an important role for development of agility, speed and power. All of these variables are very important for running sports as well as team sports because they all are important components of performance. For an athlete to be successful and for a coach to design a better coaching program, RT and plyometric training can be a basic requirement.^{18,19,20} The effect of RT program has been noticed in male soccer participant. According to this study RT helps in development of speed, jump height and power.²¹ According to another study RT program have positive effect on agility and power. RT enhances the explosive power and agility in post-assessment results as compared to pre-assessment results.²²

There are various changes which occurs in female athletes at their young age, so the effect of any training program can be measured easily which covers their drawbacks related to agility, power and speed at the start of their professional career²³ Previous studies mainly focused on the effect of resistance training on agility, power and speed in soccer participant²² and other games whereas up to our knowledge and literature searching very few studies are conducted about effects of periodized resistance training in cricketers²⁴ and almost no study is conducted on female cricket participants under the age of twenty.

There were two types of hypotheses according to this research i.e no effects of periodized resistance training on sprinting speed, agility, power in domestic young female cricketers or there were effects of periodized resistance training on sprinting speed, agility and power in domestic young female cricketers.

MATERIAL AND METHODS

The study design was parallel group, randomized controlled trial (RCT) and was conducted at the Abdul

Qadeer cricket academy Lahore and Kinnaird College for women Lahore, Pakistan from July 2019 to February 2020. The Ethical Review Committee of Riphah international University, Pakistan, approved the study. Participants were recruited from Abdul Qadeer cricket academy Lahore and Kinnaird College for women Lahore using purposive sampling. Participants were included if they were 14-20 years old and were involved in only sports specific training. The participants were excluded if they had any history of surgery or any injury in the last six months and had participated in any off seasons periodized resistance training session. Males and athletes from any game other than cricket were also excluded from the study. Sample size was calculated by open epi tool.

The eligible participants were randomly divided by sealed envelope method into experimental and control groups. To perform the study, the research topic, purpose, as well as the method of execution was explained to the subjects. Then the subjects voluntarily consented to participate in the study and signed a written consent form. The correct way to perform the exercises (smith press, seated press, squat, lying dumbbell leg curls, leg extension, leg press, standing barbell, lying barbell and sit ups) was explained to the subjects at the preparatory meeting before the main test. Prior to the experimental or control training, speed, agility, and power were assessed using Run-a-Three test, Illinois agility test and Sargent jump test perform on pitch. In addition to regular fitness training, experimental group performed their group's specified exercises three times a week for 60 minutes per session in 8 weeks. After eight weeks, the tests to assess the power, agility and sprinting speed were performed again to measure the effect of training.

Periodized resistance training exercises were performed by sports physiotherapists in gym setting. Training exercises were performed three days a week during the eight-week period in experimental group. The periodized resistance training program started with warm up, and continued by some exercises such as smith press, seated press, squat, lying dumbbell leg curl, leg extension, leg press, standing barbell curl, lying burble extension, sit up and finally the subjects cooled down. At the beginning of the study, the exercises were conducted with one maximum repetition, 60% intensity while one maximum repetition and 10% intensity were added after every week. Each exercise was performed individually by each participant in a group activity.²² Regular fitness training was performed in control group that included their regular game training sessions such as net practice, fielding drills, throwing and catching practice, wicket keeping drills, warm up and cool down sessions. Statistical analysis was performed using SPSS version 21. Data normality was investigated using the Kolmogorov- Smirnov test. Paired t-test was used for within-group comparison and independent t-test was used for between-groups comparison. The significance level of the test was considered $p \leq 0.05$.

RESULTS

There were 54 participants underage group of 14 to 20. Out of 54, 25 were allocated to experimental group and 29 to control group. 2 participants were dropped from

experimental group and the data from 23 participants was analysed. In control group, 6 participants were dropped and as result total 46 participants were analysed.

The demographics of this study show that mean \pm standard deviation of athlete age is 17.34 ± 1.26 years with minimum age of 14 and maximum age of 20. The mean \pm SD of weight is 58.92 ± 9.2 Kg and mean value, and SD of height is 162.2 ± 6.04 with mean \pm SD of BMI 22.26 ± 3.7 . Mean value and SD of experience of players in game is 3.78 ± 2.48 . The mean \pm SD of group of participants is 1.50 ± 0.50 . The mean value \pm SD of run a three test in control group pre intervention is 15.755 ± 2.508 and in experimental group is 15.375 ± 2.26 . The mean value and standard deviation of Illinois agility test of control group pre intervention was 21.797 ± 2.356 and experimental group is 21.613 ± 2.124 .

DISCUSSION

This study was based on four tests, run a three test, Illinois agility test, sergeant jump test and seated medicine ball throw test that were performed on interventional based two groups. Experimental group with 8 weeks of periodized resistance training and control group without periodized resistance training.

Taheri reported that agility test time was reduced by eight weeks of resistance training.²² Resistance training is not a single factor that effects the agility, but equilibrium, tempo, harmonization, latency and strength also affects the agility of an athlete. All these factors have direct and indirect influence on agility. However, it has been reported that resistance training has indirect effect on agility by directly increasing the growth of muscle cells. These factors effect on developing agility skills without losing any balance.

Previous study showed that resistance training exercises decreases the sprint time of male participants. This effect is gained by lower limb weightlifting exercises. Resistance exercises has a direct effect on leg extensor muscles (Tibialis Anterior, Extensor Digitorum Longus, Extensor Hulleicis Longus, Fibularis Tertius).

A study reported the difference between gain in strength and sprinting speed after 8 week of resistance training and revealed that the sprint time was not increased as a result of 8-week resistance training. The tests were performed immediately after 8 weeks of resistance training program. Light dose of resistance training (30% 1RM) has positive effects on 10m sprint time. Sprint has been divided into different phases. Different regimen of resistance training affect differently on every phase of sprinting. Low regimen during light days has no effect on improving dynamic phase of sprint.

The pattern generating factors of step length and step frequency are responsible for variations in time during accelerating initial phase of sprint. These factors produce coordination in body during sprinting. Strength of motor system improved after resisted training program while initial phase of acceleration showed no improvement. Participants needs time in order to accommodate the changes in motor system to be integrated into other activities like sprint speed immediately after RT.²⁵

The result of this study shows that eight week of resistance training has positive effect on strength and power of lower limb. Gain in strength and power

depends on the number of weeks an athlete trains.²² After 3-4 weeks (30 days) of training, muscle spindles receive enlarged supply of motor unites. The pattern of neural recruitment and firing rate changes. Gain in muscle mass and changing in growth of muscle cell has been accomplished within 8-12 weeks. It was thought that resistance training was the main cause of adaptations.²²

A study on sergeant jump height noticed that there was great difference in values before and after the intervention applied.²⁷ When plyometric and resistance training was compared, so the results showed that both trainings had positive effects in 35 female basketball participants.²⁶

Boosting up the energy source in musculature of lower limb during resisted training would be the main reason of increasing jump height in post intervention assessment. This boosting up of energy source could be the reason of increasing height in present study. The significance results of this study showed the increase power generations that is tested by vertical jump height may be due to increase in muscles cells of lower limb. It has been reported that resistance training enhances the ATP production in muscles, resulting in rapid breakdown of energy molecules which are used in short term activities like jumping as anaerobic energy power source.²⁶

As compared to control group, periodized resistance training had no significant effects on the power of upper limb. This may be explained by the fact that cricket is mainly a game of ball and bat in which the ball throwing action and hitting the ball from bat requires stronger forces to perform. For development of these forces, one must have greater strength of upper limb.²⁷ The strength and power of upper limb can be easily possessed by multiple training sessions related to game and cricketers also perform heavy warmups before every session which may have mitigated the difference between the groups. During practice and fitness training sessions of a game, neural adaptations are accompanied, and motor unites adopt the pattern.

The present study was the first to evaluate the effects of periodized resistance training on speed, agility, and power in female cricket participants in a randomized controlled trial. However, there were some limitations of the study. First, there was a lack of gym setting in cricket academies that is why it was difficult for participants to join an outdoor gym and follow 8 weeks of training. Secondly there was no injury control program (setting) during any type of resistance exercise, in case of any injury participant should be dropped from training session. Lastly, every participant had different 1RM, so starting weight is different for each participant so they were not similar at baseline, that is why every participant showed different response to training session.

CONCLUSION

The result of this investigation concluded that periodized resistance training has beneficial effects on sprinting speed, agility and power of lower limb in female cricketers. The power of upper limb is not much affected by periodized resistance training. So periodized resistance training can be added to fitness training

program of young female cricketers for increasing sprinting speed, agility and power of lower limb.

REFERENCES

- Goggins L, Warren A, Smart D, Dale S, Peirce N, McKay C, Stokes KA, Williams S. Injury and player availability in Women's International Pathway cricket from 2015 to 2019. *International journal of sports medicine*. 2020 Oct;41(13):944-50.
- Thompson G. Surfing, gender and politics: Identity and society in the history of South African surfing culture in the twentieth century (Doctoral dissertation, Stellenbosch: Stellenbosch University).
- Koley S and Kashyap K. An evaluation of anthropometric characteristics in Indian inter-university female cricketers. *Sport Sci Rev* 2010; 14: 121–130.
- Felton PJ, Lister SL, Worthington PJ, King MA. Comparison of biomechanical characteristics between male and female elite fast bowlers. *Journal of sports sciences*. 2019 Mar 19;37(6):665-70.
- Bagordo A, Ciletti K, Kemp-Smith K, Simas V, Climstein M, Furness J. Isokinetic dynamometry as a tool to predict shoulder injury in an overhead athlete population: a systematic review. *Sports*. 2020 Sep;8(9):124.
- Munro, Catherine & Christie, Candice. (2018). Research directions for the enhancement of women's cricket. *International Journal of Sports Science & Coaching*. 174795411876410. 10.1177/1747954118764102.
- Acar H, Eler N. The Effect of Balance Exercises on Speed and Agility in Physical Education Lessons. *Universal Journal of Educational Research*. 2019 Jan;7(1):74-9..
- CHELLADURAI, P. Manifestations of agility. *Can. Assoc. Health Phys. Educ. and Recreation J*. 42(3):36–41. 1976
- Rodríguez-Rosell D, Pareja-Blanco F, Aagaard P, González-Badillo JJ. Physiological and methodological aspects of rate of force development assessment in human skeletal muscle. *Clinical physiology and functional imaging*. 2018 Sep;38(5):743-62.
- Devaki D, Kumar MM, Bhuvanendhiran K, Rathinakamalan S, Abraham G. effect of circuit training on strength endurance among players of different team games. 2021 13(2): 364
- Moir G, Sanders R, Button C, Glaister M. The effect of periodized resistance training on accelerative sprint performance. *Sports Biomechanics*. 2007 Sep 1;6(3):285-300.
- Al kitani ms, sharaif b, al busafi ms. the effect of saq exercises on physical fitness level and performance of basketball players. volume 5, issue iv december 2018.:48.
- McBride JM, Triplett-McBride T, Davie A, Newton RU. The effect of heavy-vs. light-load jump squats on the development of strength, power, and speed. *The Journal of Strength & Conditioning Research*. 2002 Feb 1;16(1):75-82.
- Baechle, T.R. (ed.). *Essentials of Strength Training and Conditioning*. Champaign, IL: Human Kinetics, 1994.
- Earp JE, Kraemer WJ. Medicine ball training implications for rotational power sports. *Strength Cond J* 32: 20–25, 2010.
- Baker dg, wilson, and r. carlyon. Periodization: The effect on strength of manipulating volume and intensity. *J. Strength Cond. Res*. 8:235–242. 1994
- Talukdar K, Cronin J, Zois J, Sharp AP. The role of rotational mobility and power on throwing velocity. *The Journal of Strength & Conditioning Research*. 2015 Apr 1;29(4):905-11.
- Haghighi A, Moghadasi M, Nikseresht A, Torkfar A, Haghighi M, *Eur J Exp Biol*, 2012, 2, 2351.
- Celly SM, Ghenem AM, Abid K, Hermassi S, Tabka Z, Shephard JR, *J Strength Cond Res*, 2010, 24, 2676 Parry MA, Hayyat FS. Effect of 12 weeks of plyometric and resistance training on agility, speed and explosive power in kabbadi players.
- Bashir B, Suleh Hayyat F, Shafi S. The effect of 8 weeks of plyometric and resistance training on agility, Speed and explosive power in cricket players.
- Taheri E, Nikseresht A, Khoshnam E. The effect of 8 weeks of plyometric and resistance training on agility, speed and explosive power in soccer players. *European Journal of Experimental Biology*. 2014;4(1):383-6.
- Filipčič T, Filipčič A, Berendijaš T. Comparison of game characteristics of male and female tennis players at Roland Garros 2005.
- Dicle Ar, firat ak, güler ö, birol a, ertetik g, çetinkaya g, akalan c. Extreme altitude mountain climbing decreases sensation seeking score and increases the anxiety level. *Uluslararası İnsan Çalışmaları Dergisi*. 2018;1(2):222-34.
- Maker R. The effects of four-week resistance training on cricket bowling velocity (Doctoral dissertation, Cape Peninsula University of Technology)
- Moir G, Sanders R, Button C, Glaister M. The effect of periodized resistance training on accelerative sprint performance. *Sports Biomechanics*. 2007 Sep 1;6(3):285-300.
- Tirumala A, Motimath B. Effect of resistance tube exercises on kicking accuracy, vertical jump and 40-yard technical test in competitive football players—an experimental study. *Human Movement*. 2014 Sep 1;15(3):152-9.
- Hayath H, Spargoli G. The Immediate Effects Of Different Intensities Of Upper Limb Plyometric Warm-up On Bowling Speed In Cricketers. Preliminary Results. *Scienza Riabilitativa*. 2016 Jan 1;18.

Table 1: Mean±SD of demographics of all participants

Demographics	Mean	Standard Deviation
Age in years	17.34	1.268
Weight in kg	58.26	9.28
Height in cm	162.2	6.04
BMI	22.26	3.79
Experience of participants in years	3.78	2.48

Table 2: Pre and Post mean±SD of all four tests in control and experimental group with, p values

Variables	Group	Mean value	SD	P value	
Medicine ball throw (distance in feet's)	PRE	Control	28.643	3.09	0.159
		Exp.	27.252	3.48	
	POST	Control	28.329	3.18	0.898
		Exp.	28.194	3.87	
Run a three test (time in second)	PRE	Control	15.755	2.508	0.592
		Exp.	15.375	2.262	
	POST	Control	15.171	1.700	0.016
		Exp.	13.845	1.868	
Illinois agility test (time in seconds)	PRE	Control	21.797	2.35	0.782
		Exp.	21.613	2.12	
	POST	Control	21.309	1.93	0.006
		Exp.	19.817	1.57	
Sergeant jump height (height in inches)	PRE	Control	5.347	1.640	0.50
		Exp.	6.652	2.621	
	POST	Control	5.534	1.996	0.001
		Exp.	7.782	2.448	