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Original Article

Physiotherapy Section

A Comparative Study of Circuit Training and Plyometric Training on Strength, Speed and Agility in State Level Lawn Tennis Players

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ABSTRACT

Introduction: Lawn tennis is one of the most admired racquet sports worldwide which is played either individually or in doubles. Circuit training is a simple method of giving a player a variety of exercises that will improve the three main functions i.e. speed, strength and agility, related to performance on the field. Plyometric training involves lengthening of muscle followed by quick shortening contraction that enhances capability of muscle to produce large amount of force.

Aim: To compare the effectiveness of circuit training and plyometric training on speed, strength and agility in aspiring state level Lawn tennis players.

Materials and Methods: The present study had an experimental study design. Forty male lawn tennis players in the age group of 18-25 years were included in this comparative study and randomly divided into two groups: Circuit training (Group A) and Plyometric training (Group B) with 20 players in each group. All players were evaluated for lower limb strength, upper limb strength, agility, running speed with Vertical Jump Test, Chest press test, agility-T-Test and 50 meter Dash test. Circuit training group performed 5 minutes warm up, 5 minutes sports specific training, Circuit training 28 to 42 minutes and cool down for 5 minutes. Plyometric group performed warm up 5 minutes, Plyometric training 30 to 60 minutes, 5 minutes sports specific training, cool down for 5 minutes. Paired t-test was used to compare the differences within the group and unpaired t-test was used to compare the difference between groups. Data was collected for all variables at baseline, 4th and end of 8th week.

Results: Both groups improved significantly after 8th week but circuit training group showed highly significant difference for upper limb strength, lower limb strength, running speed and agility compared to plyometric training group ($p<0.05$).

Conclusion: Circuit training is an important method for improving upper limb and lower limb strength, running speed and agility in lawn tennis players.

Keywords: Muscular power, Reaction time, Stretch shortening cycle, 1 Repetition maximum, 50 Meter dash test

INTRODUCTION

Lawn tennis is a racket sport that can be played discretely counter to a single opponent or amongst two squads of two players respectively. In lawn tennis, repeated high intensity effort (i.e., acceleration, deceleration, changes of direction) is required during variable period of time [1].

To be competitive and successful, lawn tennis players need a combination of speed, agility, and strength. Players ability to react to the opponent's actions needs good initial acceleration and the ability to rapidly change direction [2].

In Lawn tennis, service begins with 90 degree shoulder abduction and external rotation in the cocking phase. The shoulder then moves rapidly from external to internal rotation and from abduction to forward flexion. The deceleration phase is controlled by the external rotators. Over 50% of the total kinetic energy and total force generated in the tennis serve is created by the lower leg, hip, and trunk [3].

Speed can be defined as "displacement per unit time regardless of direction". As running speed is important component for tennis players, they must have the ability to rapidly accelerate and decelerate in court. Lawn tennis players can, however, develop speed by improving muscular power and strength. The 50 meter run test is used to measure the running speed [4].

Agility is defined as the ability to change direction accurately and quickly at the presentation of a stimulus such as movement of a ball or movement of opposing players. For tennis agility skills is imperative for victory. Agility is an important fitness component that effects performance in different types of sports that demand running and change of directions [5].

To improve their ability to rapidly move around in the court and to react to opponent's strokes, tennis players needs to have good neuromuscular coordination which is a combination of neural and muscular training [6].

Strength is the ability of the muscles to generate force with single maximal effort and is crucial component of fitness and performance for lawn tennis players as the game involves rapid and sudden change in directions while moving in and around the court during the game [7].

Circuit training is a type of training that work on body conditioning by developing strength, endurance, flexibility and coordination all in one workout. It consists of series of exercises that are performed in a row one after the other with minimal rest period in between. All these exercises form one circuit. Circuit training is used in sports to develop strength and cardiopulmonary fitness in same exercise session [7].

A variety of exercises are included in a circuit that target different components of fitness like strength, speed and agility required by a sportsman to enhance his performance in the game. Horizontal and vertical are two types of circuit trainings [7,8].

Varied amounts of weights can be used during circuit training session, starting from lighter weights progressing to higher weights or vice versa. A small period of rest is generally taken in between sets [9]. Since circuit training involves a combination of cardiovascular and strength training, a lot of beneficial effects are seen in terms of enhanced cardio-pulmonary fitness and muscle strength. It is also a good way to burn calories especially during high exertion periods of sets [10]. Circuit training not only maximises volume of exercises but also reduces the amount of time spent while performing exercises as varied exercises are performed in row [11].

Kumar M in his study on Physiological effect of circuit training on strength, speed and flexibility among fast bowlers in cricket found that there was a significant effect of circuit training on the development of strength, speed and flexibility among fast bowlers [12].

Plyometric is a form of resistance training that combines a rapid eccentric muscle contraction followed by a rapid concentric contraction to produce a fast forceful movement. It must be performed in conjunction with a resistance training program as athlete need to have minimum basic strength levels before commencing Plyometric [13].

Plyometric training is one of the training programs that work on strength and conditioning of athlete. It plays a crucial role in terminal phase of rehabilitation program as it aims to enhance athletic performance. It involves three phases. First phase known as preload or facilitatory phase which involves stretching of the muscle at the musculo-tendinous junction. The energy stored during this phase is released in the concentric phase. The second phase known as amortisation phase, which involves the small delay between 1st phase to the concentric shortening phase which is the third and the last stage. The concentric phase involves rapid power production which utilises the biomechanical properties of pre-stretched muscles. The interaction of these three phases results in enhanced muscle performance [9,13-15].

This study hypothesised that there will be a significant difference between both the groups in improving strength, running speed and agility in lawn tennis players.

Studies have found that both plyometric and circuit training has positive effect on various parameters related to sports performance. No study till date has compared the effects of these two techniques on performance parameters in Lawn Tennis players. So the purpose of current study was to compare the effect of two training program on running speed, agility, upper limb and lower limb strength in Lawn tennis players. The result of this study can be utilised as evidence based approach for enhancing performance in lawn tennis players.

MATERIALS AND METHODS

This experimental study was carried out at Delhi Lawn Tennis Academy. The duration of the study was 10 months i.e. March 2018 to December 2018. Ethics committee of Faculty of Physiotherapy, SGT University approved the study (Ref. No. SGTU/FOP/2018/37).

A sample size of 40 was calculated by using G-Power software. Power of the study was 0.95. Players who fulfilled the inclusion and exclusion criteria participated in the study. The inclusion criterion for the study was: age group between 18-25 years, players who were playing lawn tennis for more than two years with no history of any injury in past six months. Players who were excluded from the study were those having any musculo-skeletal problem that decreased the compliance of the players to participate in the study and any medical condition that would impair their playing activities. The whole procedure of the training program was explained to the players and written informed consent was taken from all the players.

Details like name, age, number of playing years, history of any previous injuries, and any medical condition of the player was recorded in the evaluation proforma. Forty players who participated in the study were divided into two groups by simple random sampling method i.e., 20 players who received circuit training (Group A) and 20 players that received plyometric training (Group B). Demographic characteristics like age, height weight and Body Mass Index was measured for all subjects. Baseline assessment of all players was done for agility, lower limb strength, upper limb strength, running speed.

1. Agility was Measured by Agility T-Test

The objective of this test was to assess the athlete's speed with the changes in direction which includes forward, lateral and backward running. This test uses set of four cones. Cone A is for starting/finishing, cone B is for forward sprinting and cone C and D are for left and right shuffling. The test was started with both feet behind the starting line at cone A. On the command of timer, subject sprinted forward to cone B and touched the base of it with his right hand. Then subject turned left and shuffled sideways to cone C touched its base with the left hand. Then they moved sideways towards right side to touch base of cone D with right hand. After that subject shuffled back to the left to cone B and touched its base. Finally, subjects ran backward as quickly as possible and returned to cone A [16].

2. Running Speed was Measured by 50 meter Dash Test

The objective of this test was to determine acceleration and speed. The test subject ran a single maximum sprint over 50 meters, with the time recorded. All players did some practice starts and acceleration as warm-up. Commenced from a static standing point (hands cannot touch the ground), with one foot in facing forward of the other and the front foot should be behind the starting line. Once the subject was ready and still, the starter gave the commands "set" then "go." The tester delivered intimations for maximising speed (such as keeping low, driving hard with the arms and legs) and the participant was cheered to not decelerate before crossing the finish line [17].

3. Upper Limb Strength was Measured by 1 Repetition Maximum (1 RM) Chest Press Test

1 RM was calculated as the weight that can be lifted for one repetition. To start with, subjects were asked to perform 6-10 lifts with lesser load progressing to 3-5 lifts with heavier load. Then subjects performed single repetition with increasing loads. Finally single repetition was performed with load increased by approximately 0.5-2.3 kg. The increment in load during analysis of 1 RM depended on the effort needed to lift the weight [18].

4. Lower Limb Strength was Measured by Vertical Jump Test

The objective of this test was to determine strength of leg muscles. Before the execution of vertical jump test, the subject performed 8-10 minute dynamic warm-up which included squats, lunges, quad stretches and 20, 30, and 40 yard progressive jogging exercises. Players were instructed to stand side onto the wall. They were then asked to chalk their finger tips. With both feet on the ground they were asked to jump as high as possible and make a mark on the wall with their finger tips Then players from a static position attempted vertical jump to touch the wall as high as possible and marked the wall with the chalk on his fingers (M2). The therapist estimated the difference between M1 and M2. The therapist recorded the best of the 3 distances and used this value to evaluate the player's performance [19].

Procedure: Circuit training group performed 5 minutes warm-up, 5 minutes sports specific training, circuit training 28 to 42 minutes and cool down for 5 minutes. Plyometric group performed warm-up for 5 minutes, plyometric training 30 to 60 minutes, 5 minutes sports specific training, cool down for 5 minutes.

Group A protocol: Circuit training group was given 3 sessions on alternate days in a week. Training protocol included 5 minutes of warm-up followed by 30 minutes session of circuit training which had 8 stations. Each exercise lasted for 30 seconds with 60 seconds of rest between each station in a circuit [Table/Fig-1].

1. Seated row
2. Chest press
3. Lateral pull
4. Sit-up-toss
5. Planks
6. Crunches

7. Footwork pattern
8. Depth jump

Weeks	Cycles	Exercise duration (seconds)	Rest period between stations (seconds)	Rest period between cycles (seconds)	Total duration (minutes)
1-4	2	30	60	2	28
5-8	3	60	90	2	42

[Table/Fig-1]: Number of cycles, exercise duration, rest period between stations, rest periods between cycles and total duration of the circuit training program.

Group B protocol: The Plyometric training program consisted of combination of upper body and lower body exercise. A program of 4-8 exercises was performed at maximal intensity with 2-4 sets and 10-15 repetitions each was applied. Depending on the exercise and number of sets performed during trial rest period varied between 15-19 seconds. Proper technique was explained by demonstration. Plyometric session lasted for 30-60 minutes and was followed by 5 min cool down protocol. Plyometric group was trained twice weekly [Table/Fig-2].

Sports Specific Training (for both groups)

1. Monster walk
2. Elastic band kick
3. Lunge
4. Hamstring curl
5. Diagonal leg tug
6. Prone fly
7. Shoulder Shrug
8. Biceps curl
9. Standing over head triceps extension
10. Partial squat
11. Russian twist
12. Drawing in

STATISTICAL ANALYSIS

Readings were collected on day one of intervention, last day of 4th and 8th week. The data was analysed by using the software package SPSS 24 for window version. Mean and standard deviation of all the variables were calculated. The level of significance was set at $p<0.05$. Paired t-test was used to compare the differences within the group and unpaired t-test used to compare the difference between groups.

RESULTS

Mean comparison of age, height, weight and BMI was done for players in both the groups. Inter-group comparison showed that there was no significant difference in means of age, height, weight and BMI of the players in both groups ($p>0.05$) [Table/Fig-3].

The result of the study revealed that Agility in group A showed 40% improvement at the end of 8th week and group B showed 13% improvement at the end of 8th week. Group A (Circuit training group) showed highly significant improvement by 27% as compared to group B (Plyometric group) $p< 0.001$ [Table/Fig-4,5].

Analysis of the 50 Meter Dash test showed 39% improvement in group A at the end of 8th week and 12% improvement in group B at the end of 8th week. But Group A (Circuit training group) showed highly significant improvement by 27% as compared group B (Plyometric group) $p< 0.001$ [Table/Fig-6,7].

Result of this study revealed that upper limb strength improved by 29% in group A and 10 % in group B as measured by chest press test at the end of 8th week. Group A (Circuit training group showed highly significant improvement by 19% as compared to group B (Plyometric group) $p< 0.001$ [Table/Fig-8,9].

Result of the study revealed that leg muscles strength improved by 75% in group A and 22% in group B as measured by vertical jump test at the end of 8th week. But group A (Circuit training group showed highly significant improvement by 53% as compared to group B (Plyometric group) $p<0.001$ [Table/Fig-10,11].

DISCUSSION

Circuit training is an excellent method of fitness training that is a combination of resistance and high intensity aerobic exercises that helps to improve all aspects of fitness [20]. It is a flexible training method in which exercises can be performed in different patterns like circular, star, square etc., [21].

Plyometric training is extensively used in sports to generate explosive power and strength of muscles translating into better sports performance. It consist of a pre-stretch phase (eccentric contraction) followed by a rapid shortening of muscle with a very short rest interval in between. Plyometric drills involve stopping, starting, and changing directions in a rapid manner which are essential for agility in sports [22].

This study compared the effectiveness of two techniques that is circuit training and plyometric training exercises on upper and

Week	Exercises (n)	Sets (n)	Repetitions (n)	Rest (s) (Exercises/sets)	Lower body exercises	Upper body exercises
1	6	2	15	15/90	2- foot ankle hop forward, 2-leg box hopping, counter movement jump (cmj)*	Chest throw, overhead throw, close stance throw
2	6	3	15	15/90	Cmj, 2- leg multidirectional hurdle jumps, 2 leg zigzag over lines	Overhead throw, open-stance throw, 2 hand overhead throw with rotation
3	6	3	15	15/90	2 – leg zigzag over lines, lateral bounds+ stabilisation, 1- leg box hopping	2 hand overhead throw with rotation. Overhead slam, close stance throw
4	6	3	15	15/90	Cmj, 2/1- leg multidirectional hurdle jumps, 2/1 leg zigzag over lines	Chest throw, open-stance throw, 2 hand overhead throw with rotation
5	8	4	12/15	15/90	2/1- foot ankle hop lateral, lateral bounds+stabilisation, 2- leg box hopping, cmj	Push-ups, overhead throw, open stance throw, 2 hand overhead throw with rotation
6	8	4	12/15	15/90	2/1 leg zigzag over lines, lateral bounds+stabilisation lateral bound, 2/1- leg box hopping, 1 foot ankle hop forward	Chest throw, open-stance throw, 2 hand overhead throw with rotation. Overhead slam
7	8	4	10/12	15/90	2/1 foot ankle hop lateral, lateral bounds+stabilisation, 2/1 leg multidirectional hurdle jumps, cmj	Push-ups (clapping hands), overhead throw, open/close-stance throw, 2 hand overhead throw with rotation.
8	8	4	10/12	15/90	Cmj, 2/1 leg multidirectional hurdle jump, 2/1 leg zigzag overlines, 2/1 foot ankle hop forward/ lateral	Chest throw, push-ups (clapping hands), 2- hand overhead throw with rotation, overhead slam

[Table/Fig-2]: Description of Plyometric training program.
*cmj-standing vertical jump with maximum arm swing to gain maximum height

Circuit group and plyometric	Mean±SD	t-value	p-value
Age-circuit Plyometric	21.95±2.89 21.10±2.25	1.04	0.306^{NS}
Height-circuit Plyometric	174.25±9.85 173.70±6.96	0.204	0.839^{NS}
Weight-circuit Plyometric	67.45±8.65 66.40±6.72	0.429	0.671^{NS}
BMI-circuit Plyometric	22.16±1.55 21.97±1.29	0.420	0.677^{NS}

[Table/Fig-3]: Mean comparison of Age, Weight, Height and BMI.
NS: Non significant

Agility t-test	Circuit training group	Mean±SD	t-value	p-value
Pair 1 Group A	Baseline 4th week	19.25±1.33 17.72±1.79	6.56	0.023*
Pair 2 Group A	Baseline 8th week	19.25±1.33 11.58±0.80	24.53	0.010**
Plyometric training group				
Pair 1 Group B	Baseline 4th week	18.02±1.99 17.80±2.01	3.49	0.057*
Pair 2 Group B	Baseline 8th week	18.02±1.99 15.71±1.86	14.63	0.002**

[Table/Fig-4]: Comparison of change in agility with in Group A and B.
Pair 1- Difference of mean agility from baseline to 4th Week; Pair 2- Difference of mean agility from baseline to 8th week; *- Significant; **- Highly significant

Agility t-test	Groups	Mean±SD	t-value	p-value
Baseline	Circuit Plyometric	19.25±1.33 18.02±1.99	2.29	0.128^{NS}
4th week	Circuit Plyometric	17.72±1.79 17.80±2.01	2.89	0.056^{NS}
8th week	Circuit Plyometric	11.58±0.80 15.71±1.86	9.12	<0.001**

[Table/Fig-5]: Comparison of means between the groups for agility.
NS; Non significant; **- Highly significant

50 meter dash test	Circuit training group	Mean±SD	t-value	p-value
Pair 1 Group A	Baseline 4th week	17.99±1.58 15.50±1.58	13.89	0.051*
Pair 2 Group A	Baseline 8th week	17.99±1.58 11.04±1.17	41.06	0.001**
Plyometric training group				
Pair 1 Group B	Baseline 4th week	17.55±1.34 17.10±1.34	5.63	0.055*
Pair 2 Group B	Baseline 8th week	17.55±1.34 15.47±1.38	15.75	0.011**

[Table/Fig-6]: Comparison of change in 50 meter dash test within the Group A and B.
Pair 1- Difference of mean 50 Meter Dash Test from baseline to 4th week; Pair 2 If p-value <.05 or .001 (significant or highly significant respectively); *- Significant; **- Highly significant

50 meter dash test	Groups	Mean±SD	t-value	p-value
Baseline	Circuit Plyometric	17.99±1.58 17.55±1.34	0.98	0.335^{NS}
4th week	Circuit Plyometric	15.50±1.58 17.10±1.34	3.04	0.004*
8th week	Circuit Plyometric	11.04±1.17 15.47±1.38	10.96	<0.001**

[Table/Fig-7]: Comparison of means between the groups for 50 meter dash test.
NS: Non significant; *- significant; **- Highly significant

lower limb strength, agility and running speed. The subject in this study had similar baseline values of all dependent variables suggesting that all groups had homogenous distribution of athletes.

The result of this study revealed that although circuit training group and plyometric training group improved significantly at the end of 8th week but circuit training group brought better results compared to plyometric training with respect to agility of subjects as measured by T- test running speed of subjects as measured by 50 meter dash

Chest press test	Circuit training group	Mean±SD	t-value	p-value
Pair 1 Group A	Baseline 4th week	31.85±4.96 35.35±5.04	11.87	0.021*
Pair 2 Group A	Baseline 8th week	31.85±4.96 41.00±5.10	41.41	<0.001**
Plyometric training group				
Pair 1 Group B	Baseline 4th week	31.70±4.13 32.38±4.16	5.44	0.041*
Pair 2 Group B	Baseline 8th week	31.70±4.13 34.80±4.21	19.30	0.029*

[Table/Fig-8]: Comparison of change in chest press test within Group A and B.
Pair 1- Difference of mean chest press test from baseline to 4th week; Pair 2- Difference of mean chest press test from baseline to 8th week; *- Significant; **- Highly significant

Chest press test	Groups	Mean±SD	t-value	p-value
Baseline	Circuit Plyometric	31.85±4.96 31.70±4.13	0.104	0.918^{NS}
4th week	Circuit Plyometric	35.35±5.04 32.38±4.16	1.92	0.043*
8th week	Circuit Plyometric	41.00±5.10 34.80±4.21	4.19	<0.001**

[Table/Fig-9]: Comparison of means between the groups for chest press test.
*- significant; NS: Non significant; **- Highly significant

Vertical jump test	Circuit training group	Mean±SD	t-value	p-value
Pair 1 Group A	Baseline 4th week	13.30±1.98 16.85±1.79	13.33	0.043*
Pair 2 Group B	Baseline 8th week	13.30±1.98 23.25±2.83	25.26	<0.001
Plyometric training group				
Pair 1 Group A	Baseline 4th week	12.65±2.03 13.17±2.07	4.27	0.045^{Ns}
Pair 2 Group B	Baseline 8th week	12.65±2.03 15.40±2.01	17.17	0.027*

[Table/Fig-10]: Comparison of change in vertical jump test within Group A and B.
Pair 1- Difference of mean Vertical Jump Test from baseline to 4th week; Pair 2- Difference of mean vertical jump test from baseline to 8th week; *- Significant; **- Highly significant

VJT-test	Groups	Mean±SD	t-value	p-value
Baseline	Circuit Plyometric	13.30±1.98 12.65±2.03	1.03	0.312^{NS}
4th week	Circuit Plyometric	16.85±1.79 13.17±2.07	5.96	0.067^{NS}
8th week	Circuit Plyometric	23.25±2.83 15.40±2.01	10.12	<0.001**

[Table/Fig-11]: Comparison of means between the groups for vertical jump test.
NS- Non significant; **- Highly significant

test, upper limb strength as measured by chest press test and lower limb strength as measured by vertical jump test.

Variables-agility, running speed, upper limb strength, lower limb strength showed significant improvement from baseline to the end of 8th week in both groups p<0.005. Results of this study showed that improvement in agility was 28% and 23%, in Group A & B respectively. Improvement in speed was observed 30% and 25% in Group A and B. Strength of upper limb was improved by 20% and 17% and strength of lower limb was improved by 24% and 18% in Group A and B respectively.

On comparing two groups i.e., circuit training and plyometric training a significant difference was seen between both the groups for all the variables i.e., agility, running speed, upper limb and lower limb strength with better improvement seen in circuit training group compared to plyometric training group at the end of 8th week of intervention.

Result of this study are in the accordance with results of study by Rameshkannana. S and Chittibabu B. They studied the effects of plyometric on agility in male hand ball players. It was concluded that 8 week plyometric training program significantly improved agility of handball players. F=17.96, p<0.001 [23].

All types of sports involving both upper and lower extremity use concept of plyometric for performance enhancement. Plyometric training utilises the Stretch Shortening Cycle (SSC) in which stretching of a muscle is immediately followed by a shortening contraction. The pre-stretch phase which involves stretching of contractile as well as non-contractile components of the muscle prepares the muscle for the concentric contraction phase in which explosive strength and power is generated due to the release of stored energy in muscle. This response of muscle is resultant of neuro-physiological and biomechanical response to stretching [9,13,14].

Plyometric involves rapid start, stop and change in direction. Agility is the ability of the body to rapidly change its position and direction and needs a good neuro-muscular coordination for same [24].

Sangari VS et al., in his study on Effect of plyometric training on development of speed and agility on Basketball players concluded that plyometric training produce significant improvement in speed and agility in inter-collegiate basketball players [25].

Results of this study are similar with results of study by Babalola JF on the effects of 8-weeks Circuit Training Programme on Physiological and Performance Characteristics of University Racket Game Players. They found that leg muscular power, cardio-respiratory endurance, agility, flexibility, speed, greatly improved after 8th week's protocol $p<0.05$ [26].

Physiological fact is that the human need stimulating exercises. The physiological adaptations and functioning of the body improves when it is subjected to training programs that stresses cardio-pulmonary and musculo-skeletal systems of the body [27].

The enhancement of upper and lower limb muscle strength in Circuit training group is because of gradual increase in exercise intensity and frequency of resisted exercises. Increased strength and endurance of muscles played a crucial role in improving running speed as measured by 50 meter Dash test.

Abdullah SA in their study on the effects of High intensity interval training on some of the essential skills in young badminton players found that in experimental group abdominal muscle strength, jumping length, speed, forehand, backhand shot, increased greatly but there was no improvement seen in control group ($p<0.05$). It was found that in experimental group abdominal muscle strength, jumping length, speed of forehand and backhand shot, increased greatly but there was no improvement seen in control group ($p<0.05$). Control group performed regular training with coaches [28].

Sonchan W et al., studied the effects of a circuit training program on muscle strength, agility, anaerobic performance and cardio-vascular endurance. They found that muscle strength, agility increased greatly but there was no improvement seen in anaerobic performance $p<0.01$ [29].

Result of this study are in the accordance with results of study by Bhat AR et al., on the effect of circuit training on agility of college male students. They found that agility was greatly increased after 8 week circuit training program $p<0.005$ [30].

Result of this study are similar with results of study by Babu MS et al., on the effect of selected circuit training exercises on sprinters of High School Girls. It was found that sprinting ability was significantly improved after 6 weeks circuit training program $p<0.01$ [31].

To conclude, both groups were found to be effective in improving agility, running speed, upper limb and lower limb strength. Result of the study revealed that circuit training program brought better improvement compared to plyometric training program.

LIMITATION

The limitation of the study is small sample size and restricted age group. Also female lawn tennis players were not included in the study, so any gender specific differences in the results and associated factors could not be studied. Study could have been done on wider sample and on different age groups. Follow-up was not done in the study.

Relevance to Clinical Practice

This study showed a significant improvement in agility, running speed, upper limb and lower limb strength in both circuit training and plyometric training group but the circuit training group has shown highly significant result. Hence the result of the study provide the evidence that the circuit training may be useful and valuable tool in improving various fitness component of Lawn Tennis players.

CONCLUSION

The comparative study of circuit training and plyometric training on strength, speed, agility, in aspiring state level lawn tennis players concluded that although both the groups improved significantly with respect to variables upper and lower limb strength, agility and running speed but circuit training group showed better results compared to plyometric group for all the variables at the end of 8th week.

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