International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Effects of Circuit Training on Sports Performance of Semi: Professional Roll Ball Players

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Abstract

This study aimed to determine the six-week circuit training's effect on the components of fitness of semi-professional roll ball players. To accomplish the goal of this study, sixty (60) roll ball players between the ages of fourteen and eighteen were chosen, and they were split into two equal groups: An experimental group (n = 30), and a control group (n = 30). The full duration of the circuit training program was six weeks with three sessions per week. In addition, the experimental group had a circuit training regimen which was added to their regular traditional regimen. The control group did not have a specified training program instead they had their routine regular regimen. The physical fitness variables selected as dependent variables were speed, agility, explosive power, upper body and shoulder girdle strength endurance, abdominal strength, and endurance. The speed was determined through the 50m dash run, Agility was measured with the 4 x 10m shuttle run performance, the explosive power was determined by Standing broad jump, and the abdominal strength was measured through bent knee sit-ups and the upper body and shoulder girdle strength were determined from pull-ups. The tests were conducted before and after the six weeks of circuit training. An eight-station circuit was formulated, and an adaptation period of two weeks was provided. Every two weeks, we added at least ten seconds to each station's exercise. The data collected was analyzed by paired t-test to examine if any significant difference exists or not between pre–test and post-test scores of the experimental group as well as between the pre and post–test scores of the control group. An unpaired t-test has been used for determining if the difference between scores in the pretest of experimental and control groups is significant and for post-test equality of experimental and control groups as well. Mean, SD, and t-ratio were tested. Accordingly, it was determined that a six-week circuit training workout was highly effective as it had visible effects on all the selected parameters of physical fitness.

Keywords: Roll ball, circuit training, Speed, Agility, explosive power

Introduction

Roll ball - an exciting sport that blends the concepts of roller skating, basketball, handball, and throwball to create a thrilling and dramatic sport played between two passionate teams.[1] This sport is played on the "roller shoes." The composition of the team is made up of 12 players. Among these 12 players, six of them are active participants on the field while the other six are the substitutes in reserve.[1, 2, 3]

The essence of Roll Ball lies in its overarching objective: to score more goals than the opposing team and to win the match by doing so under a given time.[1, 2] With swiftness and grace, athletes run and twist over the court. It is in this movement that players employ numerous strategies to obtain the ball and move past the opponent's defense to launch the ball toward their net. [3]

What makes Roll Ball peculiar in contrast to other sports is the unusual mechanism of their ball handling. While the pass is normally made by throwing or kicking in the traditional games, unlike Roll Ball which is a unique game where the players use their hands to bounce the ball regularly. This layer of skills being interlaced introduces yet another level of complexity in the gameplay because the ball moves rapidly and the players must balance the ball.[3]

Roll Ball is a sport that grabs the special attention of the fans with its rhythm and structured gameplay. It is widely enjoyed in countries bringing people together in a spirit of camaraderie. Fans immerse themselves in the shared experience of the game forming connections, with individuals from various backgrounds. This shared passion for sports fosters a sense of unity and friendship, among participants, transcending boundaries.[3]

Back In 2003 in Pune, India a physical education instructor introduced a game called Roll Ball to the world. The idea, for this game, originated unexpectedly during one of his classes when a basketball from an adjacent court rolled into their skating area. Inspired by this moment the students began dribbling the ball while skating sparking a concept in the teacher's mind. After exploration of sports and games, he carefully developed what we now know as Roll Ball. With his thinking and commitment, he brought forth a thrilling pastime that continues to enchant players and fans worldwide. [3]

Roll Ball, which was established in 2003 has experienced a surge, in fame highlighted by renowned global competitions. Noteworthy among these are 5 World Cups, 3 Asian Championships, and 3 South Asian Championships that showcase the sports' attraction and competitive nature. Furthermore, Roll Ball has garnered interest across a range of areas with involvement from, about 55 countries and across 5 continents of Asia, Africa, South America, Europe, and Oceania.[3]

In Roll Ball, being great at moving fast, staying steady, aiming well, and working together is of crucial importance for doing well on the field.[3] The main goal of this active game is to make as many scoring chances as possible in a set time. A big thing about Roll Ball is the cool way the ball is handled. Players need to keep control of it, using one hand or both, even when passing to teammates. They have to keep bouncing the ball on the ground, which makes the game even tougher and needs a lot of skill.[1,2] When it comes to the size of the field, there are a lot of options. It can be 28 to 40 meters long and 15 to 20 meters wide, giving players enough space to move around and carry out their plans effectively.[3]

Roll Ball performance depends on a variety of factors that include the psychological, emotional, and physiological integrity of a player along with comprehensive assessment covering standards, basic skills, and anthropometric attributes.[3] For optimal sports performance, an all-round method is fundamental focusing mainly on increasing physical and motor abilities among athletes.[4] The center of this undertaking is to improve individual training programs by having recognizable changes in key parameters such as speed, agility, strength, endurance, flexibility, and coordination.[4] Thus raising the conditioning status of an athlete through targeted interventions that foster the development and refinement of these essential components of physical and motor fitness in order to provide the most conducive environment is needed for attaining the highest athletic performance levels.[4]

Sports has speed as one of its most important features bringing on fast tension and relaxation of muscles during a given activity. This is the ability to do all the motions, including some such as jumping, bounding,

sprinting, etc., in the shortest possible time under certain conditions, and because it is movement specific (because it is movement specific) this is what makes it like that. It is important to note that speed has a higher dependency on the efficiency of the nervous system rather than they do with endurance and strength.[4]

The circuit is a workout that combines resistance training, cardiovascular conditioning, and endurance training within one session, though highly dynamic and variable. It includes performing a series of movements in order one after another, with only a couple of seconds break to catch a breath organized in a circuit layout. Each circuit generally includes a specific set of exercises for targeting the different muscle groups or fitness goals. Unlike most group exercise programs, circuit training, being the most customizable, enables individuals to greatly adjust workouts to their own particular needs, goals, preferences, levels and intensities of training.[4]

The training principle is based on strength and muscle endurance which are coupled through the circuit training method. This is done by alternating the activities in series, such that each round ends where the previous round started.[5]

Normally, circuit training comprises short rest period between sets and quick changes with minimal time. R.E. Morgan, and G.T. Anderson coined the name crisis orientation as the name for their training method which they developed at the University of Leeds in England in 1953. [4,5]

Movements can range from bodyweight actions such as squats and push-ups to weighted routines using dumbbells, resistance bands, or weight machines that are purposely put in place to increase the resistance to your muscles as then you try to fight gravity or lift some weight. Besides, aerobic exercises like jumping jacks, burpees, or running in place may be involve in burpees or running in place would increase heart rate and strengthen the cardiovascular system. The design of a circuit-based workout regimen normally presents stopping each movement after a particular amount of time and then proceeding to the next movement in the circuit.[4,5]

When a movement circle is complete, the session is concluded briefly and a new one is started. The key benefit of circuit training is that it not only quickens the delivery of a full-body exercise; but, it also vastly helps reduce it in time. Below is the paraphrase of the given sentence: Through performing different types of movements that target different muscle groups, circuit training provides an effective way of strengthening muscle power, endurance, and heart rate simulation simultaneously Also, another advantage of doing interval training circuit exercising is that it can help one to burn calories to a great extent and also promote fat loss.[4]

A circuit training involves many positive points; thus, it is very effective. At first, it boosts your muscles, cardio power and muscular leadership.[4] The other benefit is that it stimulates the social interaction and thus increases the motivation and enjoyment in the course of the workouts and the already existing in the course of the workouts boosts motivation and pleasure.[4] Furthermore, circuit training can enhance one's loyalty to a workout schedule which is considered key to maintaining regularity and the continuous involvement of the person in physical activities.[4] Thus, circuit training leans toward fitness efficacy and consistency which makes it an interesting method of comprehensive strenuous physical engagements.[4]

As well, circuit training is mobile in a manner that activities may be changed or replaced so that workouts remain exciting and well-liked.[4] Additionally, it means overcoming monotony as well as making sure that the body has all the preconditions it needs to progress constantly by having to do the same thing every time.[4] As a rule, the method of performing circuit training enables a person to acquire and retain the full physical fitness of the body shortly and efficiently, hence circuit training can be recommended for any

training grade.[4] Whether that person may be looking to get stronger, faster, or set themselves on a weight loss path including circuits as part of the routine will go ahead to develop a great difference in terms of physical health and fitness.[4]

Methodology

Research design

This study was quasi-experimental, to report how circuit training influenced the sports performance of semi–professional roll ball players. The study used observational and quantitative approaches, and it involved performance checks before, during, and after the circuit training regimen of six weeks. This research aimed to explore if a six-week circuit training had any positive effect on the performance measures such as speed, agility, explosive power, and strength endurance of semi-professional roll ball players.

Subjects

The subjects for the study were 60 semi-professional Roll ball players training regularly in the Roll ball academy at Paranjpe Vidya Mandir, Pune, Maharashtra, and their ages between 14 to 18 years. Subjects were further divided equally into two groups -The experimental group and the control group with 30 players in each. The experimental group went through the circuit training program for six weeks in addition to their regular regimen, and on the other hand, the control group didn't take part in any special training program

Subject orientation

Before starting with the six-week circuit training several meetings with the subjects were conducted and all the subjects were given a clear explanation of the goals and intent of the research. They were provided with a thorough explanation of the testing process. They were asked to assist and take an active part in the same and were also provided with a consent form which included the title of the study, the aims of the study, and assurance to the participants that their information would remain confidential All exercises were demonstrated after completion to ensure that the subjects understood what was expected of them. The formal consent from the college principal was obtained to carry out the training program.

Selection of variables

The following physical fitness factors were selected following a thorough research and analysis of the available literature.

Table -1: Variables and selected tests

Variables	Test
Speed	50 m dash run
Agility	4 x 10m shuttle run
Leg explosive power	Standing broad jump
Abdominal strength endurance	Bent knee sit-ups
Arm and shoulder girdle strength	Pull-ups

Circuit training program

An eight-station circuit was developed and is demonstrated in the table below. An adaptation period of two weeks was followed. For the first and second weeks, the subjects worked on each station for 20 seconds, and between the stations, 30 seconds of rest was taken. In the third and fourth weeks, the time for each station was increased by 10 seconds so the subjects worked on each station for 30 seconds, and 30 seconds of rest was taken finally in the fifth and sixth weeks subjects worked on each station for 45 seconds with 30 seconds rest between the stations. The circuit training program was for 6 weeks and it was scheduled thrice a week which is on Mondays, Wednesdays, and Fridays. The subjects were assessed for their performances in the 50m dash run, 4 x 10m shuttle run, standing broad jump, bent knee sit-ups, and pull ups before and after completing the circuit training for six weeks.

Table -2 : circuit training program

	Week 1 & Week 2		**Week 3 & Week 4**		**Week 5 & Week 6**	
	Duration (sec)	Sets	Duration (sec)	Sets	Duration (sec)	Sets
Monday , Wednesday , Friday						
Jumping Ropes	20	3	30	3	45	3
Jumping jacks	20	3	30	3	45	3
Push Ups	20	3	30	3	45	3
High knee strides	20	3	30	3	45	3
Side Hops	20	3	30	3	45	3
Flutter Kicks	20	3	30	3	45	3
Squats	20	3	30	3	45	3
Lateral crunches	20	3	30	3	45	3

Data analysis and result

The collected data on selected physical fitness variables from both the groups before and immediately after the completion of the circuit training was statistically analyzed with paired t test , independent t test , analysis of covariance (ANCOVA) and with SPSS version. In all cases 0.05 level of confidence was fixed as a level of confidence to test the hypothesis. The influence of circuit training on each variable was analysed separately and presented below.

Table 3: Performance between Post-intervention Experimental group and Post-intervention control group

Variable	**Post-intervention Experimental**	**Post Intervention Control**	**P Value**
Speed	5.7567 ± 0.5171	10.483 ± 1.460	< 0.001**
Agility	15.153 ± 0.709	20.676 ± 1.086	< 0.001**
Power	8.603 ± 1.185	5.5667 ± 0.4581	< 0.001**
Abdominal Strength	33.167 ± 3.992	19.333 ± 3.010	< 0.001**

Upperbody Strength	15.500 ± 2.713	7.700 ± 2.037	< 0.001**

*- significant, ** - highly significant, No star – insignificant

From the above table, it is observed that the mean and standard deviation of speed post-intervention experimental group was 5.7567 ± 0.5171 and for the post-intervention control group was 10.483 ± 1.460 with a P value of less than < 0.001 indicating that there was a highly significant difference in the speed of experimental group and control group post-six-week circuit training.

From the above table, it is observed that the mean and standard deviation of Agility post-intervention experimental group was 15.153 ± 0.709 and for the post-intervention control group was 20.676 ± 1.086 with a P value of less than < 0.001 indicating that there was a highly significant difference in the Agility of experimental group and control group post six-week circuit training.

From the above table, it is observed that the mean and standard deviation of explosive power post-intervention experimental group was 8.603 ± 1.185, and for the post-intervention control group was 5.5667 ± 0.4581 with a P value of less than < 0.001 indicating that there was a highly significant difference in the explosive power of experimental group and control group post six-week circuit training.

From the above table, it is observed that the mean and standard deviation of abdominal strength post-intervention experimental group was 33.167 ± 3.992 and for the post-intervention control group was 19.333 ± 3.010 with a P value of less than < 0.001 indicating that there was a highly significant difference in the abdominal strength of experimental group and control group post-six-week circuit training.

From the above table, it is observed that the mean and standard deviation of upper body strength post-intervention experimental group was 15.500 ± 2.713 and for the post-intervention control group was7.700 ± 2.037 with a P value of less than < 0.001 indicating that there was a highly significant difference in the upper body strength of experimental group and control group post-six-week circuit training

Table 4: Performance between the pre-test and post-test of the experimental group

Variable	Pre	Post	P Value
Speed	8.900 ± 1.423	5.7565 ± 0.5171	< 0.001**
Agility	20.370 ± 1.005	15.153 ± 0.709	< 0.001**
Power	5.477 ± 0.823	8.603 ± 1.185	< 0.001**
Abdominal Strength	24.233 ± 3.401	33.167 ± 3.992	< 0.001**
Upperbody Strength	8.500 ± 2.240	15.500 ± 2.713	< 0.001**

From the above table, it is observed that the mean and standard deviation of speed pre-intervention experimental group was 8.900 ± 1.423 and for the post-intervention experimental group was 5.7565 ±

0.5171 with a P value of less than < 0.001 indicating that there was a highly significant difference in the speed of experimental group post-six-week circuit training.

From the above table, it is observed that the mean and standard deviation of Agility pre-intervention experimental group was 20.370 ± 1.005 and for the post-intervention experimental group was 15.153 ± 0.709 with a P value of less than < 0.001 indicating that there was a highly significant difference in the Agility of experimental group post six-week circuit training.

From the above table, it is observed that the mean and standard deviation of Explosive power pre-intervention experimental group was 5.477 ± 0.823 and for the post-intervention experimental group was 8.603 ± 1.185 with a P value of less than < 0.001 indicating that there was a highly significant difference in the explosive power of experimental group post six-week circuit training.

From the above table, it is observed that the mean and standard deviation of Abdominal strength pre-intervention experimental group was 24.233 ± 3.401 and for the post-intervention experimental group was 33.167 ± 3.992 with a P value of less than < 0.001 indicating that there was a highly significant difference in the Abdominal strength of experimental group post six-week circuit training.

From the above table, it is observed that the mean and standard deviation of Upper body strength pre-intervention experimental group was 8.500 ± 2.240 and for the post-intervention experimental group was 15.500 ± 2.713 with a P value of less than < 0.001 indicating that there was a highly significant difference in the upper body strenght of experimental group post six-week circuit training.

Discussion

Sportsmen's achievement and improvement mainly at competitive levels, can be stimulated through training as well as conditioning. Boosting performance has become a vital part of professional sports training.[6]

Training is an investment which has the potential to bring unique performance without jeopardizing one's personal health. This is done by developing strategic usable abilities and skills, physical capabilities and adaptable organizational growth.[6]

The main aim in our current research project is to recognize the talents at their early stages, apply the proper training approach and establish good attitudes towards exercise among those whom we work with. This inquiry aims to assist potential future leaders using modern methods having specific directions and overall picture of fitness state.

Moraru et al. (2019)[10] found that circuit training is a systematic approach that produces highly efficient results on the development of motor qualities, such as strength and endurance. The objective of the study was to demonstrate how circuit training improves these motor abilities. In total, there were 30 women between the ages of 25-35 who attended three weekly training sessions within six months.

For example, they designed circuits for beginners which had a 30-second workout with a pause of 30 seconds in between, for intermediates a 45-second workout with a pause of 30 seconds in between and advanced individuals' circuit would have a 50-second workout followed by 30-second pause.[10]

To assess the muscle strength/ endurance of various muscles groups including abdominals back legs arms, different tests were conducted. The findings demonstrated significant improvements in all tested areas.

For instance, before the intervention, average abdominal strength and endurance values were calculated at 13.8 ±1.52 against an increase to15.2±1.08 after completing this program. Similarly, initial values for muscle strength and endurance related back were measured at 21.46 ±1.684 before the training period while it was increased to23.53 ±1.641 after its completion Finally leg muscles experienced improvements in terms of their strength and endurance as well as arm muscles too.[10]

Overall, the study concluded that circuit training effectively increased strength and endurance, consistent with the study objectives.[10]

In light of these findings, it is important for coaches to carefully assess their athletes' physical and motor fitness level . These assessments enable coaches to develop customized training programs that meet the specific requirements of each sport and meet the individual needs of athletes.[4]

By understanding their athletes' unique strengths and weaknesses, coaches can develop training strategies that maximize performance and enhance overall athletic performance [4]

In our study, the observed increases in speed, agility, lower and upper body strength, and abdominal endurance after circuit training could be due to differences in players' baseline fitness levels or training exercise choices.

Most stations within circuit regimen targeted muscles of arms, legs, and trunk in the key areas. Regular involvement in these circuits is likely to result in greater muscle strength for activities such as standing broad jumps, horizontal knee squats, pull-ups, the 50-meter sprint, and the 4 x 10-meter shuttle run.

Analysis of the data shows significant improvements in performance in these areas following the six-week district training programme. Notably, improvements were significant in the 50m sprint (speed), the 4 x 10m sprint (speed), the standing broad jump (explosive power in the lower body), the bent knee sit ups (abdominal strength endurance), and pull-ups(arm and shoulder girdle strength). This impressive improvement can be attributed to strength endurance developed through circuit training, which contributes to the overall fitness of athletes

The use of dynamic loads in circuit training programs seems to be exceptionally well suited for maximizing power gains, as confirmed in several studies by Harmasi et al (2017; 2011) and Fisseler et al in the 19th century. (2017) and their results. These dynamic loads contribute to feedback across the Golgi membranes, which play an important role in regulating tissue tension and preventing injury.[9]

Additionally, they contribute significantly to the synchronization of motor units, a crucial aspect of efficient muscle function and coordinated movement (Gorostiaga et al., 2005).[9]

By using different loads during circuit training, an environment can be adapted that that helps muscles adapt in ways that make them stronger, boost endurance, and improve overall athletic ability. The specific exercises likely helped the jump performance because they were picked to mimic the actual jumping motion - fast explosive movements that use muscles in a coordinated way. Not all exercises work on coordination the same way and heavy squats target the coordination within each muscle group, while loaded squat jumps work on getting different muscle groups to work together at the same time.[9] Research shows you can improve different types of coordination with different types of exercises. So by targeting exercises that match the coordination needed for jumping, the circuit training optimized the performance boost for jumping skills specifically.[9]

Gains after strength training can come from a mix of neural changes and alterations in the muscle-tendon complex. Those adaptations include muscle growth, architectural shifts and changes in the individual muscle fibers.[9]

One study suggests all those types of multi-level changes contribute to getting stronger and better performance while minimizing the risk of overexertion or fatigue.

This study revealed that 6 week circuit training resulted in improved speed that is shown by the means of improvement in the 50m dash run where before starting circuit training the mean speed was 8.900 seconds while after 6 weeks of circuit training the mean speed was reduced to 5.756 seconds which showed significant improvements in speed after six weeks of the circuit training. Which is very noticeable.

In addition, Agility , as evidenced by the 4 x 10-meter shuttle run results. At the beginning of the six-week circuit training, our mean agility was 20.37 seconds, which progressively reduced in the second week to 18.70 seconds , then in the fourth week it reduced to 17.04 seconds and at the last in the final week of the regimen to 15.13 seconds. Consequently, these bullet points emphasize the significance of circuit training not only in improving the speed and agility but also in enhancing sports performance.

The standing broad jump test again showed significant gains, which were a clear sign of increase in explosive power in participants. In the first week of circuit training as the base line, the mean power was 5.477 feet. However, at the end of the six-week training, mean power was 8.603 feet which is evident as a remarkable improvement in explosive power.

Moreover, as the sit-ups displayed enhancement of abdominal strength, the bent knee sit-ups performance improved significantly with notable recorded improvement. At the very beginning of the study the mean of abdominal strength was 24.233 and post 6 weeks circuit training the mean abdominal strength improved to 33.167 showing that our circuit training program has actually managed to improve abdominal strength endurance.

Similarly, noticeable variations were noticed in the overall upper body strength as endurance was witnessed in the the pull-up test scores. Initially mean endurance was recorded as 8.5 for upper body strength and towards the end it was noted that it remarkably increased to 15.50 signifying the vast improvement in upper body strength endurance after completed all the circuit training program.

In this study, strong empirical evidence was established that circuit workouts can be used in two ways, viz., enhancing strength and endurance, and this proves that the study's primary objective was achieved. Taking these discoveries into consideration, it is by extension necessary for coaches to do their homework to ensure they quickly measure the motor and physio-fitness levels of their athletes. Due to this in-depth analysis, coaches can personalize training programs that correspond both qualitatively as well as quantitatively to the requirements of sport. By tailoring training techniques therefore to address an athlete's strengths and deficiencies, coaches can help to maximize athletic performance for both specific and comprehensive development through such training. Hence, it, therefore, highlights an educated and targeted preparation strategy as key elements in creating the opportunity for athletes to reach their full potential and succeed in competitions.

The ability to perceive clearly the observed enhancements of the performance provides the roll ball coaches with a good understanding of the topic as the sport is mainly dependent on the power of the lower limbs, upper limbs, and core. Nevertheless, admitting it, all the substantial increases in different variables studied could mostly be due to the fact that our participants were quite below the average level of skills. Over and above this, the practicality of systematizing circuit training which then would be incorporated to traditional in-season technical and tactical sessions to give room for the roll ball players to excel is noteworthy

Conclusion

Our findings demonstrate that Rollball players may significantly improve their strength, power, sprinting ability, and ability to change direction by substituting a 6-week in-season circuit training program (three sessions per week) for a portion of their regular schedule. Since Rollball players need to make fast, forceful movements, circuit training provides stimulation that is distinct from power training and should be incorporated into any resistance training regimen. Practically speaking, when it comes to improving power, strength, sprinting ability, change of direction ability, and throwing velocity—all of which were improved by this kind of training—coaches might find it more advantageous to employ a hierarchical lifting program. Our advice for rollball coaches is to use circuit training in the off-season. It's uncomplicated, beneficial, and enhances how players play. Also, more research on potential neuromuscular routes could boost performance too.

Acknowledgments

We would like to thank the roll ball subjects who co-operated and participated in this study and also to our statistician Mr. Aniruddha Khadakkar who assisted us with our detailed statistical analysis

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