International Journal of Sports, Yoga, and Physical Activity (IJSYPA), ISSN: 3005-5083
Volume 5, Issue 1, January-June, 2026, Available online at: internationalsportsjournal.com

Effects of Sport-Specific Circuit Training on Agility and Power among Adolescent Female Volleyball Players: A Comparative Study with Traditional Conditioning

Dr. Manu Singh Pawar[1], Sahil Kumar[2]

[1]Lecturer, (B.B.N Institute of Intellectual, Vijaypur, Samba)
[2]Research Scholar, MBSPSU, Patiala

ABSTRACT

This study compares sport-specific circuit training with traditional conditioning to see which one improves agility and power better in school-going girls who play volleyball. Volleyball requires quick direction changes, strong explosive power, and sport-specific movements, so it is important to find out which training method works best for these needs. A total of 45 school girls, aged 13 to 17 years, took part in this study. They were divided into three equal groups. One group did volleyball-specific circuit training, the second group followed a general conditioning program, and the third group (control group) did not undergo any training. The training programs for the first two groups continued for eight weeks. Before and after the training period, agility was measured using the Illinois Agility Test, and lower-body power was measured using the vertical jump test.

The data was analyzed using ANCOVA to adjust for any differences between groups at the start and to check improvements after training. The results showed that the sport-specific circuit training group improved significantly more in both agility and power, as compared to the traditional conditioning group. The study concludes that using sport-specific movements in circuit training is a more effective and targeted way to improve important performance skills needed in volleyball. Based on these findings, schools and sports programs should consider including customized, sport-specific training methods, especially for adolescent female athletes, to help them perform better.

Keywords: Sport-specific circuit training, Traditional conditioning, Agility, Power, Physical fitness, Adolescent athletes, Training effectiveness.

INTRODUCTION

Agility and power are two important qualities needed for good performance in volleyball, because this sport requires quick changes in direction, explosive movements, and fast decision-making. Agility means the ability to change direction quickly with control and balance. In volleyball, this helps players move fast for defensive digs, switch quickly to attack, and cover the court well. **Sheppard and Young (2006)** explain that agility in sports is not only about the body but also involves thinking and decision-making, especially in games like volleyball where situations change constantly. Power, on the other hand, comes from a combination of strength and speed. It helps players jump high, move fast, and perform strong actions like spiking. **Markovic et al. (2007)** found a close connection between how high a player can jump and their overall performance, showing why lower-body power is important to develop.

Also, **Cormie et al. (2011)** showed that power training methods, such as plyometrics and resistance exercises, help athletes perform much better in activities that need explosive strength. For female athletes, especially at the school level, training that improves both agility and power is important not only for better performance but also for preventing injuries. **Myer et al. (2005)** suggested that neuromuscular training can fix common movement-related problems in teenage girl athletes, improving agility and lowering injury risk. **Hoffman et al. (2009)** also showed that circuit-based training, which combines resistance, agility, and power exercises together, improves both stamina and performance. So, agility and power work together and are both necessary to make volleyball players faster, more responsive, and more explosive, forming the base of sport-specific physical training.

Conditioning plays a very important role in the overall development of young athletes. It helps build physical strength, prevents injuries, and supports long-term growth in sports. Through proper conditioning programs, young athletes improve important qualities like muscle strength, stamina, flexibility, speed, and coordination all needed for good sports performance. Starting conditioning at the right age also helps in developing basic motor skills and prepares the body for harder training later on. **Faigenbaum et al. (2009)** state that resistance and neuromuscular training, when done under proper supervision, can safely improve strength and performance in children and teenagers**. Lloyd and Oliver (2012)** also mention that combining strength, agility, balance, and power training together gives better results and reduces the chances of sports injuries in young athletes. Apart from physical benefits, conditioning also builds discipline, confidence, and healthy habits during important growing years. Using a Long-Term Athletic Development (LTAD) approach helps young athletes grow step-by-step with a strong physical base, avoiding burnout and overuse injuries. So, conditioning is not just an extra part of training it is a key foundation for developing strong, capable, and injury-free young athletes.

In recent years, there has been a clear shift in how athletes are trained, with more focus now on sport-specific training instead of general conditioning methods. Sport-specific training means designing exercises that closely match the movements and demands of a particular sport, so the benefits directly apply to that sport. Unlike general training, which works on overall fitness like endurance or strength without any specific sport in mind, sport-specific programs are designed to copy real game situations. This helps improve coordination, reaction time, and sport-related skills.

Reilly et al. (2009) found that performance improves the most when training closely matches the actual movements and energy demands of the sport. Similarly, **Behm and Sale (1993)** found that the body adapts to resistance training in a very specific way, meaning athletes must train in ways similar to their actual sport movements to get the best results. This idea is especially important for youth and elite athletes, where training time is limited and needs to focus on improving skills, preventing injuries, and preparing for competition. Because of this, coaches and sports scientists are now focusing more on individual, sport-specific training programs to develop better and more specialized athletes.

A training approach that considers both age and gender is very important at the school level to make sure young athletes grow safely and effectively. Children and teenagers go through major physical, mental, and body-movement changes as they grow, and these changes are different for boys and girls. Designing training programs according to age and gender ensures that young athletes get the right type and amount of exercise suited to their body development, hormonal changes, and skill-learning stage. **Lloyd and Oliver (2012)** explain that age-appropriate training should focus on certain growth periods when the body responds best to building strength, speed, flexibility, and coordination.

Myer et al. (2005) also point out that female athletes, especially during their teenage years, are more likely to get injuries like ACL tears because of differences in body movement and muscle control, making gender-specific training very important for injury prevention. Boys and girls may also respond differently to strength, stamina, and agility training because of hormonal differences, especially after puberty. By understanding these differences, teachers and coaches can create better and more inclusive physical education and sports programs ones that not only improve performance but also encourage students to stay active for a longer time and reduce dropout from sports. So, being an age- and gender-specific approach is not just a good idea it is a scientifically proven need for the safe and proper development of young athletes at the school level.

There is a strong need for more research that directly compares different training methods, especially for youth and school-level sports, so that coaches and trainers can use proven, evidence-based methods. Even though training approaches like traditional conditioning and sport-specific training are commonly used, there is still no clear agreement on which method works best for specific goals like agility, power, stamina, or injury prevention. Comparative studies are important to understand how factors like age, gender, type of sport, and training duration affect the results of these methods. **Hoffman et al. (2009)** found that combining resistance and plyometric training gives better improvements in power and performance than using just one method alone, showing that a mixed approach may work better.

However, without proper comparison studies across different groups and settings, coaches may end up depending on guesswork or generalized programs that don't suit every athlete. **Faigenbaum et al. (2009)** also stress the importance of age-appropriate, research-based training methods, and call for more studies on how different training approaches affect young athletes differently depending on their stage of growth. Such comparative research would not only improve scientific understanding of training effects but also help coaches and teachers design safe, sport-relevant, and personalized training programs that improve both performance and long-term potential of young athletes.

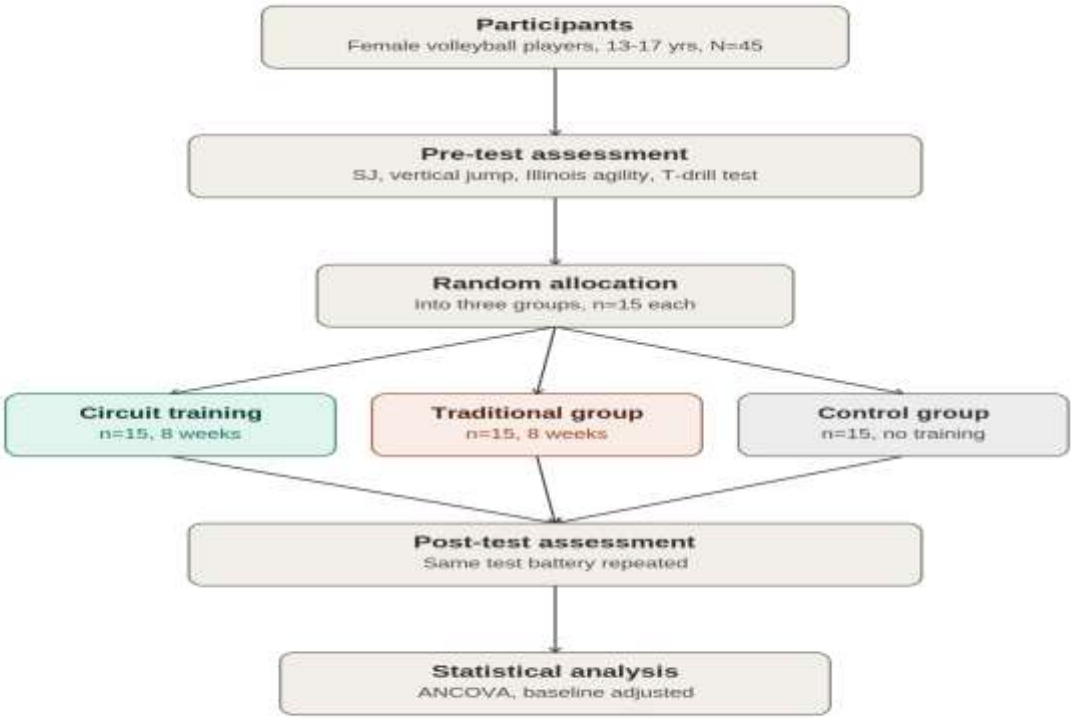
Objectives of the Study

- To compare the effects of traditional conditioning and sport-specific circuit training on agility and power.
- To propose an evidence-based training strategy for adolescent girls in school-level sports.

Hypotheses

H1: Sport-specific circuit training will result in greater improvement in agility and power than traditional conditioning.

METHODOLOGY



Participants

For the purpose of this study, forty-five female athletes from Jammu between the aged 13-17 years who competed in volleyball, participated. All of the individuals who were included in the sample were selected on the basis of their participation in school sports programs and the approval of their parents or guardians. The sample included 45 volleyball players. For the purpose of ensuring that the results seen were solely the result of the intervention, the participants in the study did not take part in any other structured training programs over the time of the scientific investigation.

Pre- and Post-Intervention Testing

Before and after the 08-week intervention with 04 sessions per week, all participants underwent physical assessments to measure key physical components related to athletic performance. The tests used in the study were as follows:

1. Standing Jump (SJ): This test assessed lower-body power and explosiveness.
2. Vertical jump test: This test evaluated power in vertical jump performance, which is critical for both volleyball and basketball players.
3. Illinois Agility Test: This test evaluated agility and the ability to change direction quickly, which is essential in both volleyball and basketball.
4. T- Drill Test: A standard agility test that measured the ability to change direction at speed.

Training Intervention

The individuals who took part in the activity were separated into three distinct groups: one undergoing circuit training, other into traditional training and third one is the control group. Each group contains 15-15 subjects. Following a planned sports specific circuit training program and traditional training that lasted for eight weeks, two groups participated in the program and the control group left free. A wide range of exercises were included in the circuit training, all of which were designed to improve speed, power, agility, and strength. Additionally, the training was tailored to meet the individual requirements of each discipline. The training sessions included four sessions per week, each of which lasted for fifteen minutes, and the athletes participated in all of them. Exercises included in the following:

Sports Specific Circuit training group

Exercises like jump serves, blocking drills, lateral shuffles, passing under fatigue, dribble & shoot circuits, agility ladder, spike simulation. The circuit training program was developed to provide the athletes with a program that would gradually challenge them by increasing the intensity of the exercises over the course of the program. This would ensure that the players were continually strengthening their physical skills.

Traditional training group
Jogging, sprinting, general resistance training, static stretching, basic plyometrics.

Data Analysis
Analysis of Variance (ANCOVA) with repeated measures was utilized in order to examine the data that was gathered from the pre- and post-intervention examinations. For the purpose of comparing the levels of improvement in physical performance between all the groups of volleyball, before and after the intervention, this statistical method was utilized. For the purpose of determining if there were any instances of statistically significant variations in performance outcomes, the significance level was established at 0.05 ($p < 0.05$).

Ethical Considerations
The study was carried out with complete ethical permission, and all of the participants gave their agreement after considering the information. Through the entirety of the research project, the anonymity of the data collected from the participants was protected, and the training program was developed to guarantee the participants' safety and well-being without exception.

FINDINGS AND RESULTS

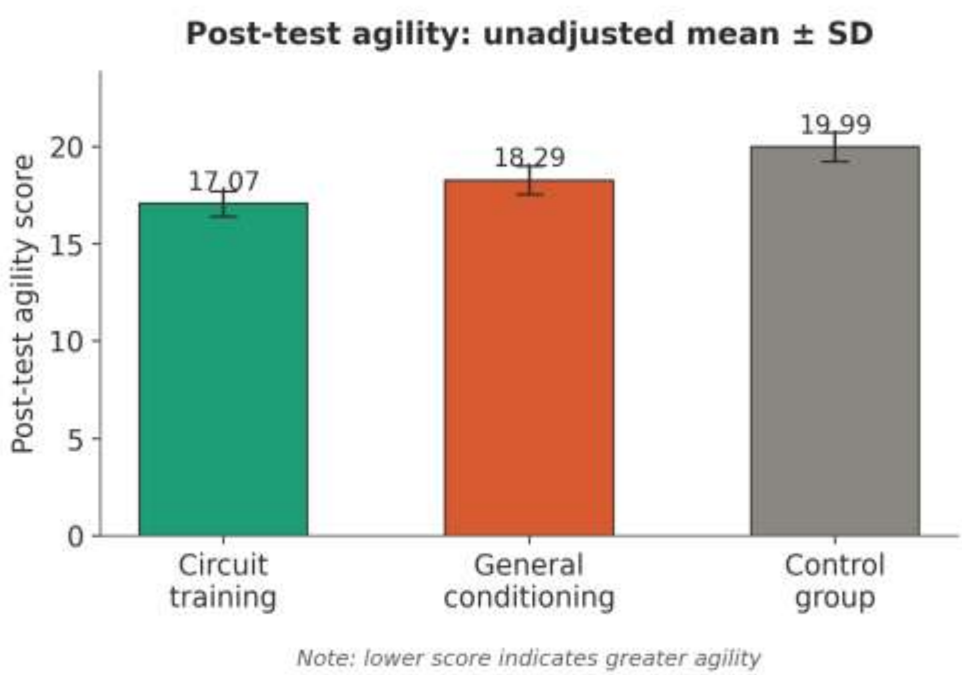
Table1.1: Mean and Standard Deviation of different groups of agility measured in post testing

Descriptive Statistics
Dependent Variable: post score

Agility	Mean	Std. Deviation	N
Circuit training	17.0733	.65843	15
General conditioning	18.2867	.72493	15
control group	19.9933	.74207	15
Total	18.4511	1.39555	45

The descriptive statistics for post-test agility scores showed mean scores of 17.07 for the circuit training group, 18.29 for the general conditioning group, and 19.99 for the control group.

GRAPHICAL REPRESENTATION OF TABLE 1.1



International Journal of Sports, Yoga, and Physical Activity (IJSYPA), ISSN: 3005-5083
Volume 5, Issue 1, January-June, 2026, Available online at: internationalsportsjournal.com

Table1.2: Adjusted mean and standard error of agility in post testing

Estimates
Dependent Variable: post score

Agility	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Circuit training	17.206[a]	.181	16.840	17.571
General conditioning	18.228[a]	.174	17.876	18.581
control group	19.919[a]	.175	19.565	20.274

a. Covariates appearing in the model are evaluated at the following values: pre score = 21.1067.

The estimated marginal means, adjusted for the covariate (pre score = 21.1067), showed that the control group had the highest adjusted mean post score (M = 19.92), followed by the general conditioning group (M = 18.23), and the circuit training group (M = 17.21). As lesser the value, greater the agility, so this indicates that, after adjusting for pre-existing differences, the circuit training group outperformed the two training groups in post scores.

GRAPHICAL REPRESENTATION OF TABLE 1.2

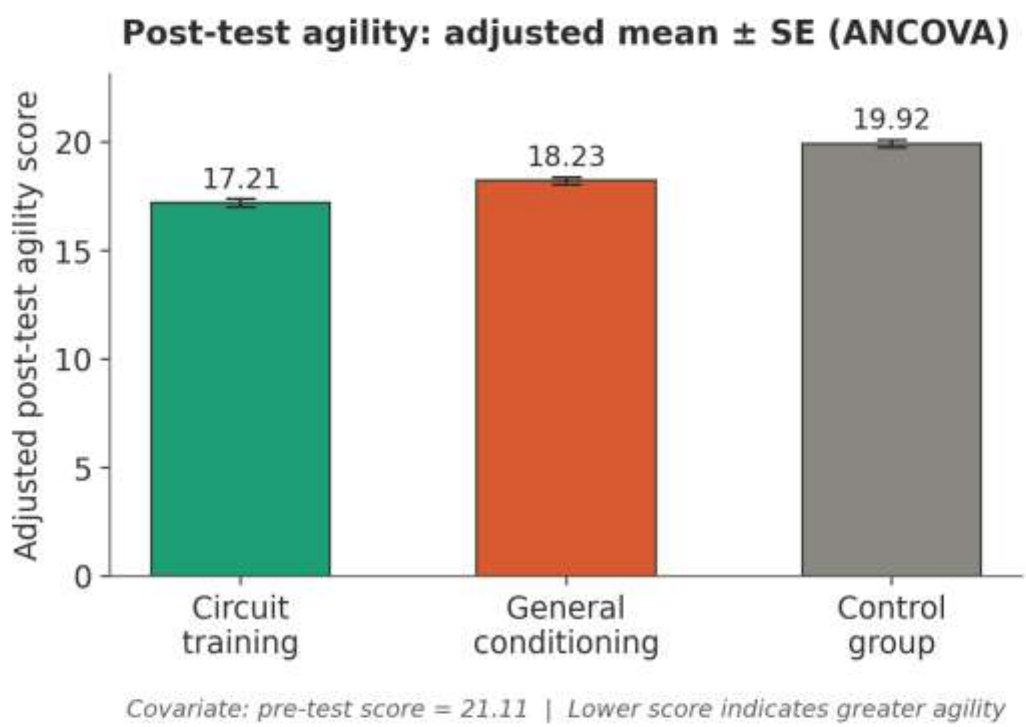


Table1.3: ANCOVA table for post test data

Tests of Between-Subjects Effects
Dependent Variable: post score

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
pre	15.798	1	15.798	35.229	.000
Agility	51.509	2	25.755	57.433	.000
Error	18.385	41	.448		
Corrected Total	85.692	44			

a. R Squared = .785 (Adjusted R Squared = .770)

The analysis revealed a significant effect of pre-test scores, F (1, 41) = 35.23, p < .001, and a significant effect of training group, F (2, 41) = 57.43, p < .001, on post-test scores. The model accounted for 78.5% of the variance in post scores (Adjusted $R^2 = 0.770$). This indicates that the type of agility training had a significant impact on performance, even after adjusting for initial differences.

GRAPHICAL REPRESENTATION OF TABLE 1.3

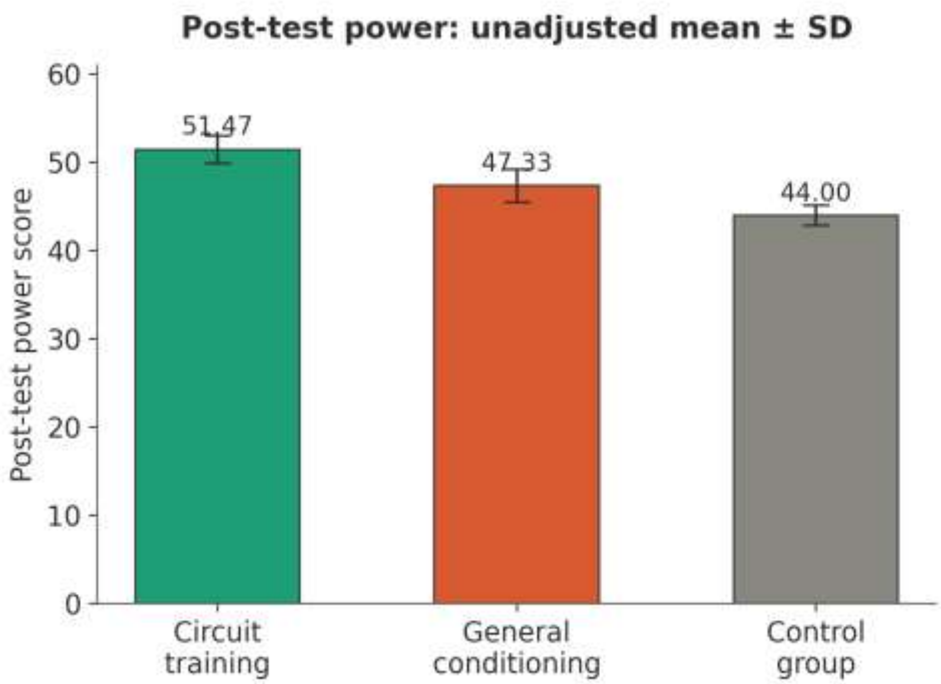


Table1.4: Pair Wise Comparison

Pairwise Comparisons

Dependent Variable: post score

(I) Agility	(J) Agility	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Circuit training	General conditioning	-1.023*	.256	.000	-1.541	-.505
	control group	-2.714*	.258	.000	-3.236	-2.192
General conditioning	Circuit training	1.023*	.256	.000	.505	1.541
	control group	-1.691*	.245	.000	-2.185	-1.197
control group	Circuit training	2.714*	.258	.000	2.192	3.236
	General conditioning	1.691*	.245	.000	1.197	2.185

Based on estimated marginal means

- The mean difference is significant at the .05 level.
- Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

International Journal of Sports, Yoga, and Physical Activity (IJSYPA), ISSN: 3005-5083
Volume 5, Issue 1, January-June, 2026, Available online at: internationalsportsjournal.com

Pairwise comparisons using estimated marginal means revealed statistically significant differences between all groups. The control group outperformed both the general conditioning group (mean difference = 1.691, $p < .001$) and the circuit training group (mean difference = 2.714, $p < .001$). Additionally, the general conditioning group scored significantly higher than the circuit training group (mean difference = 1.023, $p < .001$). These results indicate a clear hierarchy in post-test scores: Control > General Conditioning > Circuit Training, even after adjusting for pre-test differences. But lower the value of agility, greater the effect. So, the circuit training has significantly greater effect.

GRAPHICAL REPRESENTATION OF TABLE 1.4

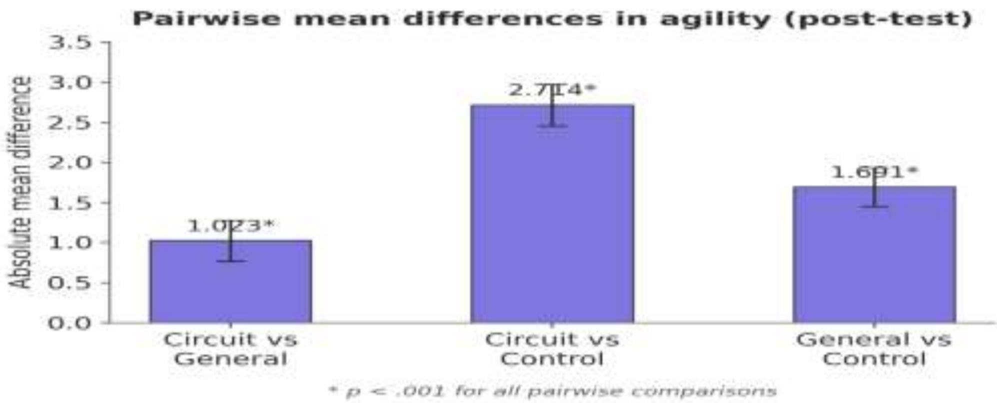


Table2.1: Mean and Standard Deviation of different groups of Power measured in post testing

Descriptive Statistics

Dependent Variable: post score

Power	Mean	Std. Deviation	N
Circuit Training	51.4667	1.55226	15
General Conditioning	47.3333	1.87718	15
Control Group	44.0000	1.13389	15
Total	47.6000	3.44040	45

The descriptive statistics for post-test power scores show that the circuit training group achieved the highest mean score (M = 51.47), followed by the general conditioning group (M = 47.33), and the control group (M = 44.00). These results suggest that circuit training may have been the most effective in enhancing power among the three groups. However, these are unadjusted means and should be further analyzed using ANCOVA to account for any pre-test differences.

GRAPHICAL REPRESENTATION OF TABLE 2.1

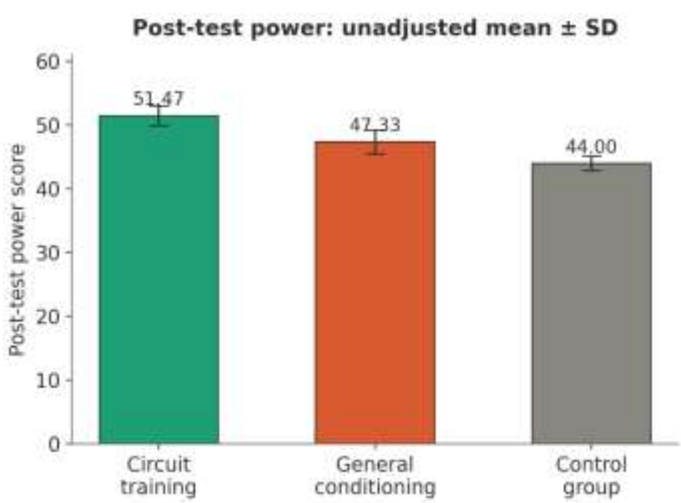


Table2.2: Adjusted mean and standard error of Power in post testing
Estimates
Dependent Variable: post score

Power	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Circuit Training	50.349[a]	.580	49.178	51.521
General Conditioning	47.460[a]	.380	46.692	48.228
Control Group	44.991[a]	.543	43.894	46.087

a. Covariates appearing in the model are evaluated at the following values: pre score = 44.6444.

After adjusting for pre-test scores using ANCOVA, the Circuit Training group maintained the highest estimated post-test power score (M = 50.35), followed by the General Conditioning group (M = 47.46), and the Control group (M = 44.99). These findings suggest that circuit training was the most effective intervention for improving power performance, independent of baseline differences.

GRAPHICAL REPRESENTATION OF TABLE 2.2

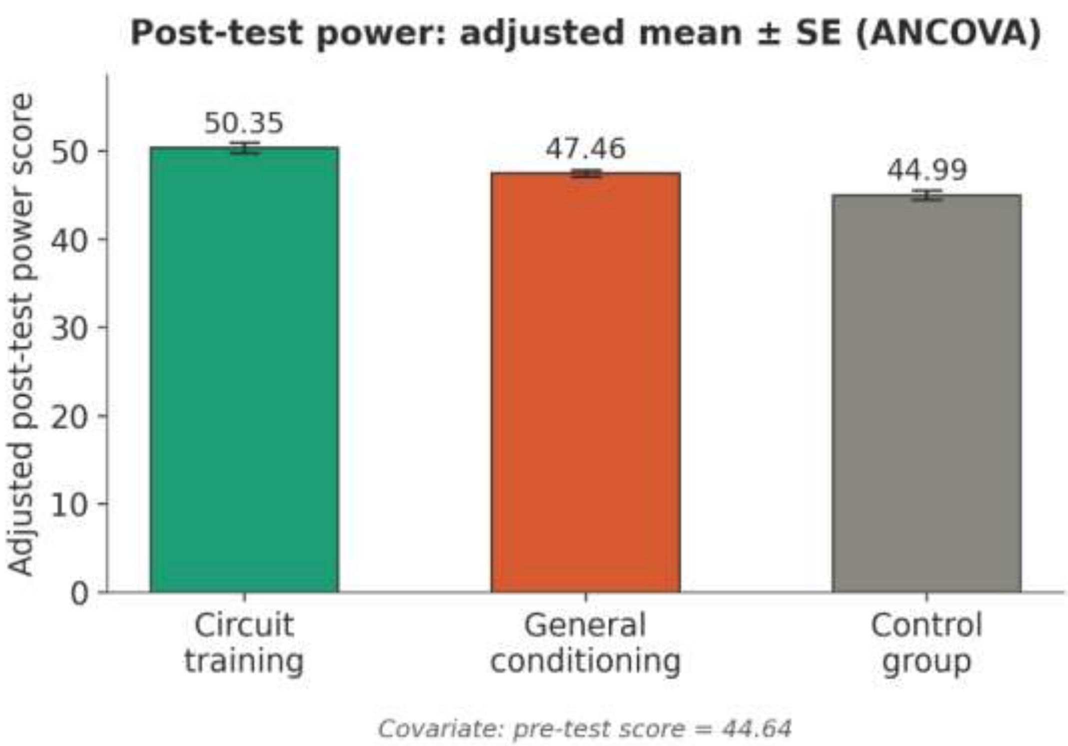


Table2.3: ANCOVA table for post test data

Tests of Between-Subjects Effects
Dependent Variable: post score

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
pre	370.546	1	370.546	173.860	.000
Power	62.871	2	31.436	14.750	.000
Error	87.383	41	2.131		
Corrected Total	520.800	44			

R Squared = .832 (Adjusted R Squared = .820)

An ANCOVA was conducted to assess the effect of different training methods on post-test power scores while controlling for pre-test scores. The results revealed a significant effect of pre-test scores, $F(1, 41) = 173.86$, $p < .001$, and a significant group effect, $F(2, 41) = 14.75$, $p < .001$. The model explained 83.2% of the variance in post-test power outcomes (Adjusted $R^2 = .820$), indicating a strong influence of both the initial performance level and the type of training received.

Table2.4: Pair Wise Comparison

Pairwise Comparisons

Dependent Variable: post score

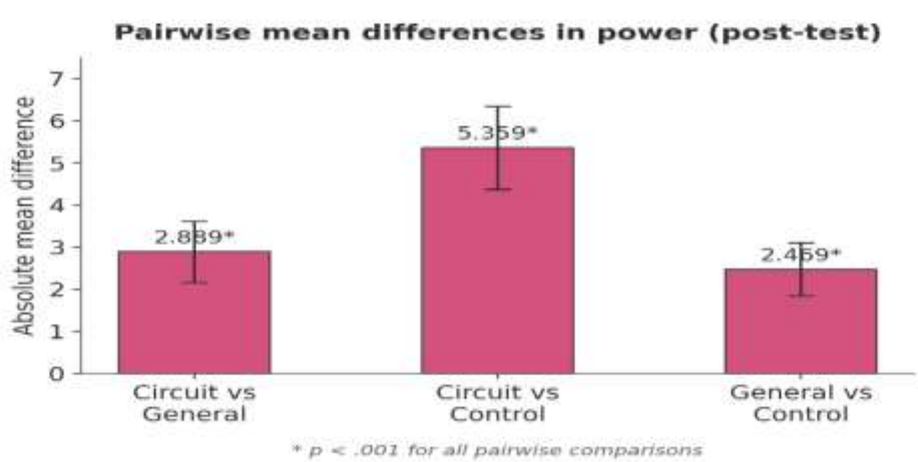
(I) Power	(J) Power	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Circuit Training	General Conditioning	2.889*	.725	.000	1.426	4.353
	Control Group	5.359*	.988	.000	3.363	7.354
General Conditioning	Circuit Training	-2.889*	.725	.000	-4.353	-1.426
	Control Group	2.469*	.633	.000	1.192	3.747
Control Group	Circuit Training	-5.359*	.988	.000	-7.354	-3.363
	General Conditioning	-2.469*	.633	.000	-3.747	-1.192

Based on estimated marginal means

- **The mean difference is significant at the .05 level.**
- **Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).**

Pairwise comparisons of adjusted post-test power scores revealed statistically significant differences between all groups. The Circuit Training group outperformed the General Conditioning group (Mean Difference = 2.89, $p < .001$) and the Control group (Mean Difference = 5.36, $p < .001$). Additionally, the General Conditioning group scored significantly higher than the Control group (Mean Difference = 2.47, $p < .001$). These findings confirm that Circuit Training was the most effective method for enhancing power, followed by General Conditioning, with the Control group performing the lowest.

GRAPHICAL REPRESENTATION OF TABLE 2.4



CONCLUSION

A systematic circuit training program was shown to considerably increase vertical jump performance, power and agility in volleyball (VB) players, according to the findings of the study. The findings suggest that there are adaptations that are specific to the sport, with volleyball players demonstrating superior improvements in explosive power, multidirectional quickness. This is reflected in greater gains in the Standing Jump (SJ), vertical jump and agility tests such as the Illinois jump and T test.

These findings provide further evidence that the training program is effective in meeting the specific physical requirements of each sport at the individual level. In accordance with the jump-intensive character of volleyball, the program appears to provide an emphasis on explosive strength and plyometric activities, as evidenced by the improved performance of female volleyball players. In a similar vein, the improvements in lateral agility that the volleyball players have made are in line with the dynamic and multidirectional movement patterns that are required in volleyball.

Previous research, such as that conducted by **Markovic and Mikulic (2010) and Asadi et al. (2017),** has consistently demonstrated the significance of plyometric and agility training in enhancing performance metrics that are specific to a particular sport. These findings are in agreement with those findings. In the future, research could concentrate on long-term adaptations and the comparative benefits of tailored training regimens in order to further improve the outcomes that are specific to the sport.

REFERENCES

1. Behm, D. G., & Sale, D. G. (1993). Velocity specificity of resistance training. *Sports Medicine, 15*(6), 374–388.
2. Faigenbaum, A. D., et al. (2009). Youth resistance training: Updated position statement paper from the National Strength and Conditioning Association. *Journal of Strength and Conditioning Research*, *23*(Supplement 5), S60–S79.
3. Hoffman, J. (2014). *Physiological aspects of sport training and performance*. Human Kinetics.
4. Hoffman, J. R., et al. (2009). The effect of combined resistance and plyometric training on athletic performance in adolescent athletes. *Journal of Strength and Conditioning Research, 23*(3), 793–801.
5. Lloyd, R. S., & Oliver, J. L. (2012). The youth physical development model: A new approach to long-term athletic development. *Strength and Conditioning Journal, 34*(3), 61–72.
6. Markovic, G. (2007). Does plyometric training improve vertical jump height? A meta-analytical review. *British Journal of Sports Medicine, 41*(6), 349–355.
7. Markovic, G., Jukic, I., Milanovic, D., & Metikos, D. (2007). Effects of sprint and plyometric training on muscle function and athletic performance. *Journal of Strength and Conditioning Research, 21*(2), 543–549.
8. Markovic, S., Mirkov, D. M., Knezevic, O. M., & Jaric, S. (2013). Jump training with different loads: Effects on jumping performance and power output. *European Journal of Applied Physiology, 113*(10), 2511–2521.
9. Myer, G. D., Ford, K. R., & Hewett, T. E. (2005). Methodological approaches and rationale for training to prevent anterior cruciate ligament injuries in female athletes. *Scandinavian Journal of Medicine & Science in Sports, 15*(5), 304–313.
10. Myer, G. D., Ford, K. R., Palumbo, O. P., & Hewett, T. E. (2005). Neuromuscular training improves performance and lower-extremity biomechanics in female athletes. *Journal of Strength and Conditioning Research, 19*(1), 51–60.
11. Reilly, T., Morris, T., & Whyte, G. (2009). The specificity of training prescription and physiological assessment: A review. *Journal of Sports Sciences, 27*(6), 575–589.
12. Sheppard, J. M., & Young, W. B. (2006). Agility literature review: Classifications, training and testing. *Journal of Sports Sciences, 24*(9), 919–932.
13. Sheppard, J. M., Young, W. B., Doyle, T. L. A., Sheppard, T. A., & Newton, R. U. (2006). An evaluation of a new test of reactive agility and its relationship to sprint speed and change of direction speed. *Journal of Science and Medicine in Sport, 9*(4), 342–349.