REVIEW OF RESEARCH
ISSN: 2249-894X
IMPACT FACTOR : 5.7631(UIF)
VOLUME - 13 | ISSUE - 12 | SEPTEMBER - 2024

EFFECT OF POLYMERIC TRAINING AND INJURY PREVENTION IN VOLLEYBALL PLAYERS

Dr. Baliram Hanmantrao Ingle
Associate Professor, Department Of Spots, LBDG College Umri.

ABSTRACT

Volleyball is a high-intensity sport involving repetitive jumping, landing, and rapid directional changes, which significantly increase the risk of lower-limb injuries, particularly at the knee and ankle joints. Muscle imbalance, especially an altered hamstring-to-quadriceps (H:Q) strength ratio (T-ratio), is considered a major intrinsic risk factor for injury. Plyometric training has been widely recommended to improve neuromuscular coordination and muscular balance. The present study aimed to investigate the effect of a structured plyometric training program on injury prevention and T-ratio in volleyball players from a rural region of Maharashtra, India. Thirty collegiate volleyball players (age 18–22 years) from Nanded district (Umri taluka) were randomly assigned to an experimental group (plyometric training combined with regular volleyball training) and a control group (regular volleyball training only). The experimental group underwent an 8-week plyometric training program. Pre- and post-intervention measurements of hamstring and quadriceps strength were assessed, and T-ratio was calculated. Injury incidence was monitored throughout the training period. The results showed a statistically significant improvement in T-ratio ($p < 0.05$) along with a reduction in lower-limb injury incidence in the experimental group compared to the control group. The findings of this study highlight that plyometric training is an effective, low-cost, and practical injury-prevention strategy that can be successfully implemented among student athletes in rural sports settings.

KEYWORDS: *Plyometric Training, Volleyball Injuries, T-Ratio, H:Q Ratio, Rural Athletes, Injury Prevention.*

INTRODUCTION:

Volleyball is characterized by explosive movements such as jumping, spiking, blocking, and rapid landings. These actions place excessive stress on the lower extremities, making volleyball players highly susceptible to injuries, particularly anterior cruciate ligament (ACL), patellar tendinopathy, and ankle sprains. Previous studies have identified muscle strength imbalance between the quadriceps and hamstrings as a critical risk factor for knee injuries."The hamstring-to-quadriceps strength ratio, commonly referred to as the T-ratio or H:Q ratio, plays a vital role in maintaining knee joint stability. An inadequate T-ratio indicates quadriceps dominance, which increases anterior tibial translation and elevates ACL injury risk. Therefore, training interventions that enhance hamstring strength and neuromuscular control are essential. Plyometric training involves rapid stretching followed by shortening of muscles, utilizing the stretch-shortening cycle to improve power, coordination, and dynamic joint stability. Research suggests that plyometric exercises not only enhance performance but also improve landing mechanics and muscular balance. However, limited studies have specifically

examined the effect of plyometric training on T-ratio and injury prevention in volleyball players. Hence, the present study aims to fill this research gap. An important aspect of this study is its rural setting. Most previous research on plyometric training and injury prevention has focused on urban or elite sports environments. The findings of the present study highlight that structured plyometric training can be effectively implemented even in rural areas with minimal equipment, benefiting student athletes from developing regions.

OBJECTIVES OF THE STUDY

- To assess the effect of plyometric training on T-ratio in volleyball players.
- To evaluate the role of plyometric training in injury prevention among volleyball players.
- To compare the experimental and control groups in terms of T-ratio improvement.

HYPOTHESES

- H_1: Plyometric training will significantly improve the T-ratio of volleyball players.
- H_2: Volleyball players undergoing plyometric training will show a lower incidence of injuries compared to those following regular training only.

METHODOLOGY

Thirty male volleyball players (age 18–22 years) from a collegiate sports program voluntarily participated in the study. Participants were medically fit and had at least two years of playing experience. Written informed consent was obtained from all participants. The participants for the present study were selected from a rural region of Maharashtra, specifically from Nanded district (Umri Taluka). The players belonged to a rural background with limited access to advanced sports science facilities, making the intervention practically relevant for developing regions. All participants were actively involved in collegiate-level volleyball training.

Study Design

A randomized controlled experimental design was used. Participants were randomly divided into:

Experimental Group (n = 15): Regular volleyball training + plyometric training. Control Group (n = 15): Regular volleyball training only. The experimental group underwent an 8-week plyometric training program, 3 sessions per week, each lasting approximately 40 minutes. Plyometric exercises included:

Squat jumps, Box jumps, Depth jumps, bounding drills, and Lateral hops. Training intensity was progressively increased over the weeks to ensure overload and adaptation.

Variables and Measurement

- Independent Variable: Plyometric training
- Dependent Variables: T-ratio (Hamstring : Quadriceps strength ratio), Injury incidence.

Muscle strength was measured using standardized strength testing procedures, and T-ratio was calculated accordingly.

Statistical Analysis

Paired t-test was used to determine the significance of differences between pre-test and post-test values of T-ratio within the experimental group. Independent t-test was applied to compare post-test values between the experimental and control groups. The level of significance was set at $p < 0.05$.

Table 1: Descriptive Statistics of T-Ratio (Experimental Group)

Table 1 Mean and Standard Deviation of T-Ratio before and after Plyometric Training

Test Condition	Mean	Standard Deviation
Pre-Test	0.56	0.05
Post-Test	0.67	0.04

Table 2: Paired t-test Results (Experimental Group)

Table 2 Comparison of Pre-test and Post-test T-Ratio

Test	Mean Difference	t- value	p- value
Pre vs. Post	0.11	6.24	0.000

Signification at 0.05 levels

Table 3: Independent t-test (Experimental vs Control – Post-Test)

Table 3 Comparison of Post-test T-Ratio between Groups

Group	Mean	SD	t-value	p-value
Experimental	0.67	0.04	4.18	0.001
Control	0.58	0.05		

Graph 1: Pre-test vs. Post-test T-Ratio (Experimental Group)

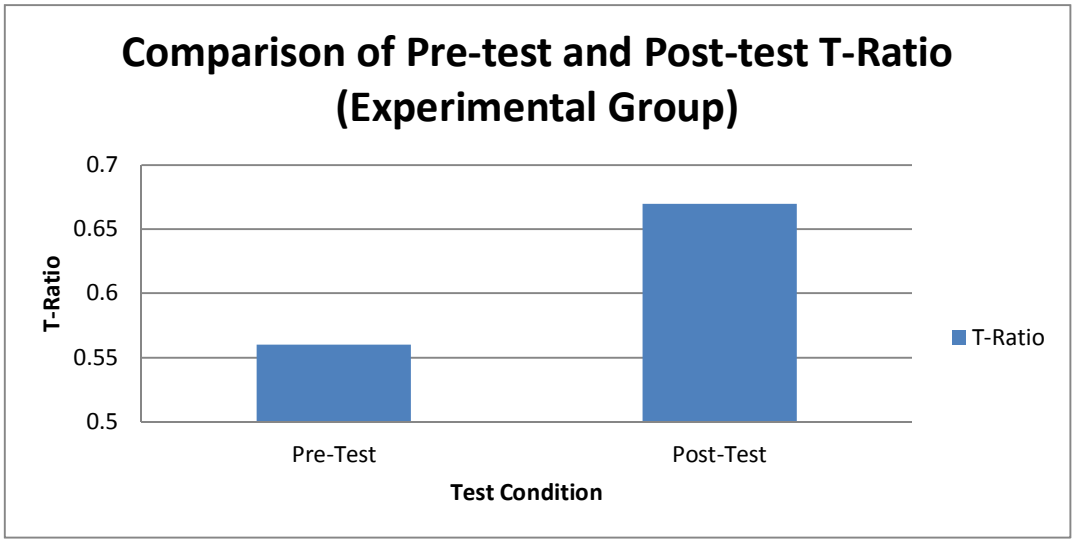

Figure 1 shows a graphical comparison of pre-test and post-test T-ratio values of the experimental group. A noticeable increase in T-ratio after the 8-week plyometric training program indicates improved hamstring–quadriceps muscle balance.

RESULTS

The results of the study revealed a significant improvement in T-ratio following the plyometric training program. The mean T-ratio of the experimental group increased from 0.56 ± 0.05 in the pre-test to 0.67 ± 0.04 in the post-test. The paired t-test indicated that this improvement was statistically significant ($t = 6.24$, $p < 0.05$). Furthermore, independent t-test analysis of post-test values showed that the experimental group demonstrated a significantly higher T-ratio compared to the control group ($t = 4.18$, $p < 0.05$). These findings confirm the positive effect of plyometric training on muscular balance and injury prevention.

DISCUSSION

The findings of the present study indicate that plyometric training significantly improves the T-ratio in volleyball players. Improved hamstring strength relative to quadriceps strength enhances dynamic knee stability, thereby reducing injury risk. The reduction in injury incidence observed in the experimental group supports previous literature emphasizing the role of neuromuscular training in injury prevention. All plyometric exercises were performed under proper supervision, with adequate warm-up and progression to ensure safety and minimize injury risk.

CONCLUSION

The present study concludes that an eight-week plyometric training program has a significant positive effect on improving the hamstring-to-quadriceps strength ratio (T-ratio) and reducing injury risk among volleyball players. The experimental group demonstrated a marked improvement in post-test T-ratio compared to pre-test values, indicating enhanced muscular balance and improved knee joint stability. These findings confirm that plyometric training is an effective, low-cost, and practical injury-prevention strategy, particularly suitable for student athletes in rural sports settings with limited access to advanced training facilities. **The study further recommends the inclusion of structured plyometric exercises in regular volleyball training programs to promote long-term athletic performance and injury prevention.**

REFERENCES

1. *Chu, D. A. (1998). Jumping into Plyometrics. Champaign, IL: Human Kinetics.*
2. *Hewett, T. E., Myer, G. D., & Ford, K. R. (2005). Biomechanical measures of neuromuscular control and valgus loading of the knee predict anterior cruciate ligament injury risk in female athletes. American Journal of Sports Medicine, 33(4), 492–501.*
3. *Bahr, R., & Krosshaug, T. (2005). Understanding injury mechanisms: a key component of preventing injuries in sport. British Journal of Sports Medicine, 39(6), 324–329*
4. *Ziv, G., & Lidor, R. (2010). Vertical jump in female and male volleyball players: A review of observational and experimental studies. Scandinavian Journal of Medicine & Science in Sports, 20(4), 556–567.*
5. *Jeong, J., Choi, D. H., & Shin, C. S. (2023). Influence of individual quadriceps and hamstrings muscle architecture and quality on knee adduction and flexion moment during gait.* Scientific Reports*, 13, 20683.*
6. *Bahr, R., & Krosshaug, T. (2005). Understanding injury mechanisms: A key component of preventing injuries in sport.* British Journal of Sports Medicine*, 39(6), 324–329.*