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Effect of Plyometric Training on Selected Bio-Motor Ability among Grassroot Badminton Players

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ABSTRACT

This research aims to investigate the effect of plyometric training on speed and agility among the group of 40 grass-root badminton players from Thoubal and Kakching district of Manipur and the age between 9 to 12 years. The participants were divided into two groups: the plyometric training group (Group A) and the control group (Group B), each comprising twenty subjects. Group A underwent eight weeks training program, 3 days a week, while (Group B) served as a control with no specific training. Pre- and post-training assessments of speed by using 50-meter dash and agility using Edgren slide step test. Analysis of covariance (ANCOVA) was employed to determine significant differences between the group, with a significance level of 0.05. The result of the study indicates that eight weeks of plyometric training, three days per week, resulted a significant improvement in both speed and agility among grass-root badminton players.

Keywords: Plyometric training, Speed, Agility, Badminton, Bio-motor.

INTRODUCTION

Badminton is a popular sport played either in singles or doubles, one of the fastest sports in the world, it is an ideal sport for both boys and girls. It is a joyful game for beginner players to play because it's pretty easy to play. By focusing on some fundamental aspects, a players can build a solid foundation in badminton and have a lot of fun along the way. Badminton probably originated in India as a grown-up's version of a very old children's game known in England as battle bore and shuttlecock, the battledore being paddle and the shuttlecock a small feathered Cork, now usually called a "bird" (M.K. Singh 2006). Plyometric movements such as jumping, hopping, skipping, and bounding are frequently incorporated into dynamic sports to enhance muscular performance. Athletes use plyometric training across various sports to boost strength and explosiveness. These exercises involve a rapid muscle stretch followed by a quick contraction of the same muscle and connective tissues. When paired with a regular strength-training routine, plyometrics have been shown to increase vertical jump height and speed, as well as improve leg strength, coordination, joint awareness, and proprioception.

METHODOLOGY

The study was conducted on 40 male grass-root badminton players from Thoubal and Kakching district of Manipur, the age ranges from 9-12 years. They were divided equally into two groups, 20 in each group. (Group A) - considered an experiment group, underwent plyometric training. (Group B) is act as a controlled group, and no training was given.

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Plyometric training was given to the experimental group 3 days a week for 8 weeks, whereas control group engaged in routine exercise with no specific training. The pre and post-test were conducted before and after the eight weeks of plyometric training such as Speed and agility by using 50-meter dash and agility using Edgren slide step test. Analysis of covariance (ANCOVA) was employed to determine significant differences between the group, with a significance level of 0.05.

PLYOMETRIC TRAINING PROTOCOL

Group A (Experimental Group) received training that was administered for three days a week for eight weeks and are shown in Table-I.

TABLE-I

WEEK	Days	Exercises	Set & Reps	Training Intensity
I – II	1	Crap walk jump, Single leg deadlift to jump, Lateral lunge to single leg hop, Hand release push up	3 sets for 15 reps	Medium
	2	Battle rope, Standing overhead slam, Static rotational chest pass, Double clap push up	3 sets for 15 reps	Medium
	3	Reverse lunge with knee up, Split squat jump, Frog squat jump, Long jump	3 sets for 15 reps	Medium
III -IV	1	Broad jump to burpees, Burpees into tuck jump, Squat jump, Reverse lunge knee ups	3 sets for 15 reps	Medium
	2	Whole body clap push up, Squat thruster, Plyo lateral lunge, Pop squat	3 sets for 15 reps	Medium
	3	Jumping jacks, Alternate lunge jump, Tuck jump, Alternate leg jump	3 sets for 15 reps	Medium
V – VI	1	Judo roll with jump, Jump squat with heel, tap Kneeling jump squat, Skater hop	3 sets for 15 reps	Medium
	2	Single leg deadlift into jump, Burpee, Pistol squat, roll with jump Box jump	3 sets for 15 reps	Medium
	3	Wall chest pass, overhead forward throw, Half kneeling side toss, Depth push ups	3 sets for 15 reps	Medium
VII - VIII	1	Plyometric pull ups, Seated throw circuit, Feet elevated plyo push up Standing backward high toss	3 sets for 15 reps	Medium
	2	Jumping jacks, push up to stand, Star jump, Jump lungs	3 sets for 15 reps	Medium
	3	Bounding,Two leg bounding Single leg bounding, Depth jump	3 set for 15 reps	Medium

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ANALYSIS OF DATA

The data obtained from the pre-test and post-test assessments of speed and agility for both the experimental and control groups were analysed using analysis of covariance (ANCOVA). The findings are presented below.

SPEED

ANCOVA was conducted on the pre-test and post-test scores of speeds for both the plyometric training group and the control group, with the results presented in Table-II.

TABLE-II

ANCOVA FOR PRE-TEST AND POST-TEST SCORES OF SPEED FOR BOTH GROUPS

Test	Plyometric training	Control group	Source of variance	Sum of squares	Df	Mean squares	Obtained 'F' ratio
Pre-test mean	8.02	7.94	**Between**	.064	1	0.064	1.36
S.D	.23	.19	**Within**	1.794	38	0.047	
Post-test mean	7.81	7.99	**Between**	.329	1	.329	6.23*
S.D	.24	.22	**Within**	2.008	38	.053	
Adjusted post test mean	7.77	8.02	**Between**	.605	1	.605	33.02*
			Within	.678	37	.018	

**Significant at 0.05 level of confidence.*

(The table values required for significance at 0.05 level of confidence for 1 & 38 and 1 & 37 are 4.10 and 4.11 respectively).

Table-II shows the pre-test mean scores for the plyometric training group and the control group are 8.02 and 7.98 respectively. The calculated pre-test 'F' ratio of 1.36 suggests no significant difference between the two groups as it is below the critical 'F' ratio of 4.10 with degrees of freedom (df) 1 and 38.

In the post-test, the mean scores for the plyometric training group and the control group are 7.81 and 7.99 respectively resulting to an 'F' ratio of 6.23. This value is higher than the critical 'F' ratio of 4.10 (with df 1 and 38) suggesting a statistically significant difference between the groups' post-test scores.

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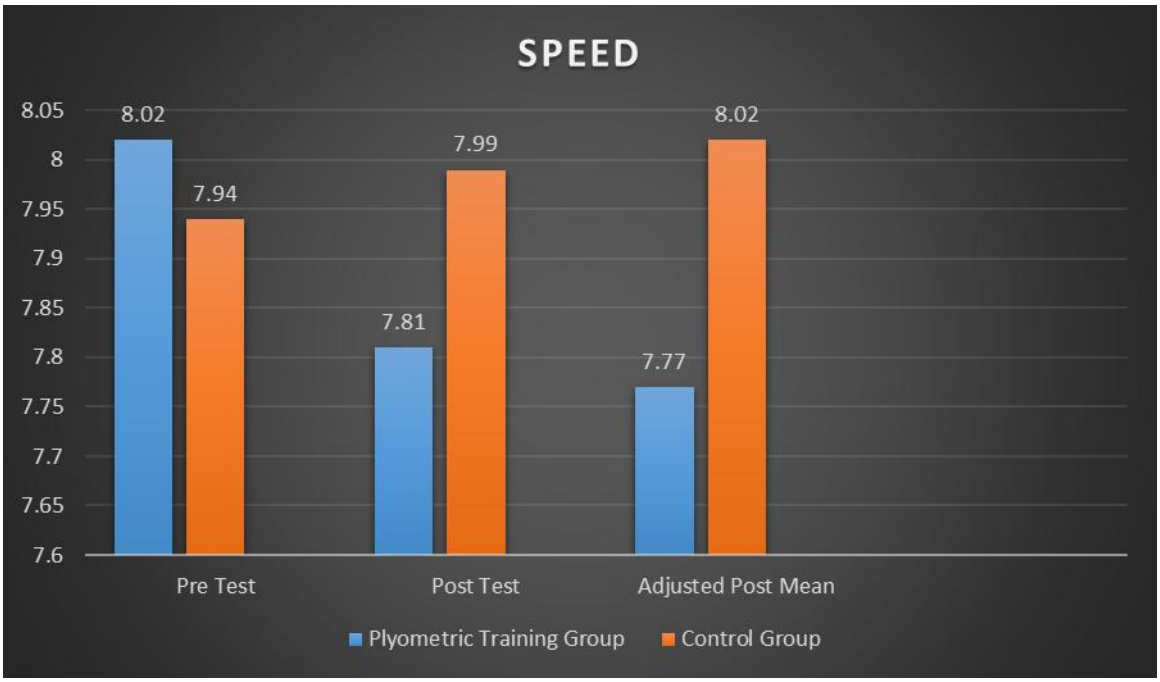
When examining the adjusted post-test mean values for speed, the plyometric training group has a mean of 7.77 while the control group has a mean of 8.02. The corresponding 'F' ratio of 33.02 is higher than the critical 'F' ratio of 4.11 (with df 1 and 37) confirming a significant difference in speed between the plyometric training group and control group.

In conclusion, the results of the study indicate a significant difference in speed between the plyometric training and control groups.

For a clearer visualization of these findings, Figure-I displays a bar chart showing the pre-test, post-test, and adjusted post-test mean values.

FIGURE-I

A BAR CHART SHOWING THE PRE-TEST, POST-TEST, AND ADJUSTED POST-TEST MEAN VALUES FOR SPEED



AGILITY

ANCOVA was conducted on the pre-test and post-test scores of agilities for both the plyometric training group and the control group, with the results presented in Table-III.

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TABLE-III

ANCOVA FOR PRE-TEST AND POST-TEST SCORES OF AGILITIES FOR BOTH GROUPS

Test	Plyometric training	Control group	Source of variance	Sum of squares	df	Mean squares	Obtained 'F' ratio
Pre test mean	17.45	17.95	**Between**	2.500	1	2.500	.63
S.D	1.85	2.11	**Within**	149.900	38	3.945	
Post test mean	21.65	18.40	**Between**	105.625	1	103.625	27.61*
S.D	1.89	2.01	**Within**	145.350	38	3.825	
Adjusted post test mean	21.79	18.26	**Between**	122.011	1	122.011	44.70*
			Within	100.984	37	2.729	

**Significant at 0.05 level of confidence.*

(The table values required for significance at 0.05 level of confidence for 1 & 38 and 1 & 37 are 4.10 and 4.11 respectively).

Table-III shows the pre-test mean scores for the plyometric training group and the control group are 17.45 and 17.95 respectively. The calculated pre-test 'F' ratio of .63 suggests no significant difference between the two groups as it is below the critical 'F' ratio of 4.10 with degrees of freedom (df) 1 and 38.

In the post-test, the mean scores for the plyometric training group and the control group are 21.65 and 18.40 respectively resulting to an 'F' ratio of 27.61. This value is higher than the critical 'F' ratio of 4.10 (with df 1 and 38) suggesting a statistically significant difference between the groups' post-test scores.

When examining the adjusted post-test mean values for agility, the plyometric training group has a mean of 21.79 while the control group has a mean of 18.26. The corresponding 'F' ratio of 44.70 is higher than the critical 'F' ratio of 4.11 (with df 1 and 37) confirming a significant difference speed between the plyometric training group and control group.

In conclusion, the results of the study indicate a significant difference in agility between the plyometric training and control groups.

For a clearer visualization of these findings, Figure-II displays a bar chart showing the pre-test, post-test, and adjusted post-test mean values.

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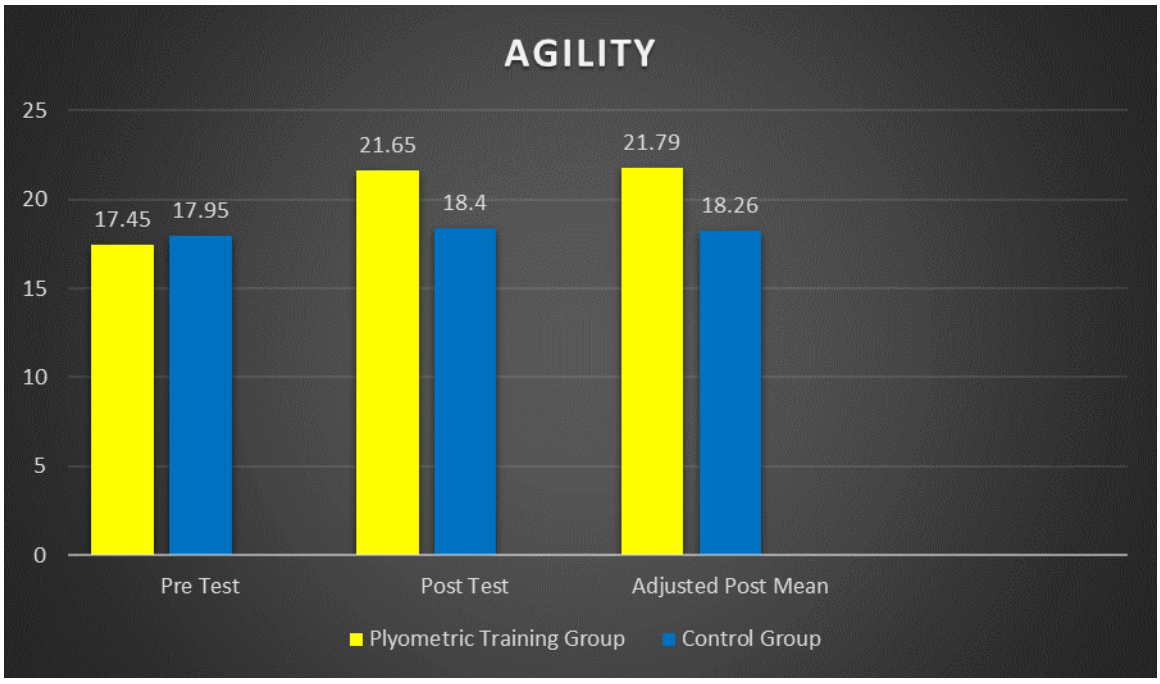
Figure-II

A BAR CHART SHOWING THE PRE-TEST, POST-TEST, AND ADJUSTED POST-TEST MEAN VALUES FOR AGILITY.



DISCUSSION

The findings of this study highlight the positive impact of plyometric training on the speed and agility of grassroots badminton players in the 9-12 age group from Thoubal and Kakching districts of Manipur. The results suggest that after eight weeks of plyometric training, significant improvements were observed in both speed and agility, as measured by the 50-meter dash and Edgren slide step test. Plyometric training can improve jumping performance and running velocity in both pubertal and prepubertal populations. It has been shown that jumps of various kinds can also precede the specific session of one's sport, with clear improvements on the various performances of jumping or running. However, it is unclear whether the resulting improvement in explosive performance is because of introduction of a new training regimen or whether it merely reflected the response to an additional training load. Thus, this randomized controlled trial aimed to examine the effect of a combined plyometric and traditional athletics training on speed and explosive strength of the lower limbs. Participant (22 boys, 13-14 yr) were randomly assigned to an 8-wk experimental group (EG, n = 10) who performed plyometric training or a control group (CG, n = 12) who continued their traditional training. The EG performed twice weekly sessions of plyometrics (15 min.), in addition to their standard training without increasing the total training time (90 min.). At baseline and after training all participants were tested on the 20-m sprint (time) and Squat Jump (power, velocity, force and height). The EG group showed significantly ($p < 0.05$) improvement than CG in the 20-m sprint time (-0.1 vs. 0.1 sec) and Squat Jump (160.8

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vs. -31.9 W; 0.3 vs. -0.2 m·s-1; 45.3 vs. -6.3 N; 10.9 vs. -2.2 cm) following training. Eight weeks of plyometric training added to the standard program of athletics was highly likely to improve the lower limbs speed and explosive strength in young athletes. Our findings highlight the potential value of combined training methods in a conditioning program aimed at maximizing power performance in youth (Fischetti Francesco;Cataldi Stefania;Greco Gianpiero, 2018). The effect of two plyometric training techniques on muscular power and agility in youth soccer players. *J Strength Cond Res* 23(1): 332-335, 2009-The aim of this study was to compare the effects of two plyometric training techniques on power and agility in youth soccer players. Twelve males from a semiprofessional football club's academy (age = 17.3 ± 0.4 years, stature = 177.9 ± 5.1 cm, mass = 68.7 ± 5.6 kg) were randomly assigned to 6 weeks of depth jump (DJ) or countermovement jump (CMJ) training twice weekly. Participants in the DJ group performed drop jumps with instructions to minimize ground-contact time while maximizing height. Participants in the CMJ group performed jumps from a standing start position with instructions to gain maximum jump height. Posttraining, both groups experienced improvements in vertical jump height ($p < 0.05$) and agility time ($p < 0.05$) and no change in sprint performance ($p > 0.05$). There were no differences between the treatment groups ($p > 0.05$). The study concludes that both DJ and CMJ plyometrics are worthwhile training activities for improving power and agility in youth soccer players (Thomas, Kevin; French, Duncan; Hayes, Philip R, 2009).

Speed Improvement:

Plyometric training is known to enhance muscular power, which in turn influences an athlete's ability to accelerate and sustain higher speeds over short distances. The results of the ANCOVA analysis revealed that the plyometric training group exhibited a significant improvement in speed (7.77 seconds) compared to the control group (8.02 seconds). This difference was confirmed by both the post-test and adjusted post-test data. The improvement can be attributed to the nature of plyometric exercises, which focus on explosive movements and rapid muscle contractions, essential for the quick bursts of speed required in badminton. In contrast, the control group, which did not engage in specific training, showed no significant improvement in speed. The statistical significance of the results, confirmed by the high 'F' ratio (33.02), supports the notion that plyometric training is effective in enhancing speed among young badminton players.

Ramirez-Campillo et. al. (2018) found that six-week plyometric program improved sprint speed in young athletes, indicating its effectiveness in enhancing acceleration. Markovic & Mikulic (2010) highlighted that plyometric exercise such as depth jumps and bounding drills contribute to improved ground reaction forces, leading to faster sprint times. Singh et.al. (2019) observed that plyometric drills, including box jumps and hurdle hops, significantly enhanced movement speed, which is essential for quick shuttle retrieval.

Agility Enhancement:

Agility is another crucial aspect of badminton, where players need to quickly change direction and move efficiently around the court. The results of the agility tests revealed that

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the plyometric training group showed a significant improvement in agility, with a post-test mean score of 21.79 seconds compared to 18.26 seconds in the control group. The improvement in agility is indicative of the benefits of plyometric training in enhancing coordination, balance, and reaction time, all of which contribute to an athlete's ability to change direction swiftly. The significant 'F' ratio (44.70) further emphasizes the effectiveness of plyometric training in improving agility.

Overall, the study suggests that plyometric exercises, which emphasize strength, power, and coordination, are particularly beneficial for improving bio-motor abilities like speed and agility in young athletes. This is especially relevant for badminton players, as both speed and agility are integral components of the game.

A study by Faigenbaum et. al. (2009) emphasized that youth athletes benefit significantly from plyometric training, improving their coordination, strength, and agility. Behm et. al. (2017) suggested that structured plyometric programs tailored to young athletes enhance neuromuscular development without increasing injury risk. Harrison et. al. (2020) on junior badminton players indicated that an 8-week plyometric program resulted in significant improvements in movement speed and reaction time.

CONCLUSION

This study conclusively demonstrates that plyometric training has a significant positive effect on speed and agility in grassroots badminton players aged 9-12 years. The eight-week training program yielded measurable improvements in both physical attributes, with the experimental group showing greater gains in comparison to the control group. These findings underline the importance of incorporating plyometric training into the training regimens of young athletes, especially those involved in fast-paced sports like badminton. Future research should explore long-term effects and optimal training protocols to maximize benefits.

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