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Effect of Plyometric Training on Important Skill Related Fitness of Players

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ABSTRACT
In the present study, plyometric training was extended to the male students grouped as novice and trained players of 25 numbers in each group of age group between 18 and 25 years who were studying in various colleges of Bengaluru, Karnataka. The training was given in three alternative sessions per week of one hour per day for 12 weeks. Before and after training, specific motor fitness components like speed, balance, coordination and reaction time were evaluated as per standard field tests. Novice players revealed hike in speed, balance, coordination and reaction time by 6, 9, 20 and 12 per cent, respectively. Trained players had 5, 8, 14 and 8 percent raise with respect to speed, balance, coordination and reaction time, respectively. On an average, novice players exhibited 17 per cent improvement in their performance whereas 11 per cent was exhibited by trained players as previously also they had received continuous training for one hour per day. On the whole, the selected motor fitness tests of both the groups' novice and trained players revealed significant increase among groups with respect to the parameters after the plyometric training.

Keywords: Plyometric; Novice; Speed; Coordination

1. INTRODUCTION

Sport is any form of physical activity or game, either competitive or organized aiming to use, maintain as well improve physical ability and skills that provides enjoyment to participants along with that entertainment to spectators. It is dependent on numerous motor skills, with variables like power, speed and agility that may affect performance (Garcia-Gil *et al.,* 2018). A type of exercise training with speed and force of different movements to build muscle power is termed as plyometrics. Plyometrics training thus helps in improving physical performance and ability to do different activities. However, effective contextual improvement with plyometric training requires knowledge about the intervention and the kind of athletes targeted (Markovic, 2007). Moreover, the requirement to produce an accurate training session of plyometric elements to improve physical fitness, which involves open and complex skills, is not new for team sports like Soccer, basketball, handball and rugby (Chaouachi *et al*., 2009). The exercises such as sit ups, double leg lowering and push-ups performed on a plyometric training increase the level of muscular activity of the abdominals and obliques more than curl-ups, double leg lowering, and push-up performed on a stable surface (Barbado *et al.,* 2015). Godara (2016) provided plyometric training

programme for a period of six weeks with explosive strength, muscular endurance, speed and agility (vertical jump, sit ups, 50 meters run and shuttle run tests were used respectively) for 50 national level handball players aged 14 to 15 years old divided as experimental group (n=25) and control group (n=25), belonging to Kendriya Vidyalaya STPS Suratgarh, Sri Ganganagar, Rajasthan. It was interesting note that due to the training programme experimental group increased in the explosive strength 15.44%, muscular endurance 12.46%, speed 11.13%, agility 1.27% and flexibility 2.15% at the end of the treatment. Turgut *et al* (2017) revealed that 12-week plyometric training for 14 female volleyball players resulted in improvements in star excursion balance test scores for legs. Anitha *et al* (2018) found that the plyometric training extended to 24 male volleyball players from various engineering college in Chennai, Tamilnadu for 6 weeks significantly improved the speed, muscular endurance, flexibility, agility, explosive strength, vital capacity and anaerobic capacity. During the regular basketball training, an additional 7-week plyometric training improved lower extremity strength, balance, agility and jump performance in adolescent female basketball players (17 years old) as per Mezler and Vaczi (2019) and Bouteraa *et al*., (2020). Rangaraj and Rajkumar (2021) gave plyometric training consisting of 45-60 min/day, 3 days in a week till twelve weeks to hockey players (n=30; age 18 ± 3.04; height 1.68 ± 6.64 cm; weight=58 ± 7.36 kg) of SRMIST, Kattankulathur, Tamilnadu, India that significantly increased their speed (10.22), muscular endurance (11.17) and flexibility (18.71) exhibiting their better performance. While Shumye and Ephrem (2022) also observed statistically significant differences in power, agility, muscular endurance and balance of female volleyball trainees after 12 weeks of interventions of plyometric training two days a week for forty minutes. Upper and lower limb plyometric training induced distinct neuro-muscular adaptations in the upper and lower body musculature and was considered as an efficient method for enhancing athletes' physical fitness when 523 participants aged 12 to 22 years were included in the analyses by Soh *et al*. (2023).

In the present study, attempt has been made to explore the variations in chosen motor fitness components such as speed, balance, coordination and reaction time due to plyometric training intervention.

2. MATERIALS AND METHODS

In the present study the participants and their details along with their plyometric training test performance and statistical analysis are mentioned in this section.

2.1 About the subjects:

The subjects or participants (novice & trained players) of the present study were confined to fifty male students (18-25 age group) studying in various colleges involved in any type of group games in Bangalore, Karnataka, India during the academic year 2018-2019. Of which 25 each from novice (inexperienced or untrained persons) and already trained (received 1 hour training per day continuously) categories were considered.

2.2 About plyometric training:

Both novice and trained players performed plyometric training of three alternative sessions of exercises like weight lifting, endurance of 1 hour per day per week for 12 weeks. The motor fitness components chosen as follows: speed, balance, coordination and reaction time were assessed as per standard field tests (Heyward and Gibson, 2014) prior to and immediately after the training period.

2.3 Motor fitness components and tests carried out with unit of measurement

Variables	Test Items	Unit of Measurement
Speed	50 mts dash	Seconds
Balance	Stork Stand test	Seconds
Co-ordination	Alternate Hand Wall Toss Test	Number
Reaction Time	Reaction Time Ruler Test	Seconds

2.4 Statistical Analysis:

All the values obtained in the result of the present study were average of three trials. The data was analysed using R software [R version 4.2.0 (2022-04-22 ucrt) -- "Vigorous Calisthenics" Copyright (C) 2022] for statistical computing. ANOVA tables were prepared to analyse the data and the critical difference was calculated (*P*=.05) and used to identify the significant differences that are indicated in the result tables through superscripts.

The formula for the critical difference (CD) was

$$CD = \frac{\sqrt{2} \times MSS(E)}{} \times t\alpha \text{ @ } 0.05 \text{ level of significance}$$

Where, MSS (E) = Mean Sum of squares of the error; r = number of replications; tα = table t value at α level of significance.

3. RESULTS AND DISCUSSION

The participants divided as novice & trained players of 25 male students each in the age group between 18 and 25 years studying in various colleges in Bangalore, Karnataka, India during the academic year 2018-2019 were subjected to plyometric training three alternative sessions per week for 12 weeks and the motor fitness components like speed, balance, coordination and reaction time were assessed as per standard field tests before and after the training. Table 1 presents the data on speed, balance, coordination and reaction time obtained for novice and trained players and their analysis

3.1 Speed

The speed performance before performing plyometric training (pre) was 7.21, 7.82 and; after training (post) was 7.87 and 8.28, for novice and trained players, respectively. The running speed improved in both groups by 6 and 5 percent after training and trained group performed better than novice group with respect to data values as the continuous trained would have helped them.

3.2 Balance

The novice and trained players balance performance before plyometric training (pre) was 32.68 and 36.88 and after training (post) was 35.68 and 40.12, respectively. Trained players balanced better than the novice group who showed improvement by 9 per cent.

3.3 Co-ordination

The novice and trained players co-ordination performance before performing plyometric training (pre) was 19.24 and 23.52; after training (post) was 24.24 and 27.52, respectively. The performance by novice players was 20 percent and trained players accounted for 14 percent, indicating the significance of continuous training for the second group of players.

3.4 Reaction Time

The novice and trained players reaction time performance before performing plyometric training (pre) was 0.40 and 0.35; after training (post) was 0.36 and 0.33, respectively. This indicated faster reaction in trained group while novice group was also better by 12 per cent after plyometric training

All the selected motor fitness tests of both the groups' novice and trained players revealed significant increase among groups with respect to the parameters. Novice players showed increase in speed, balance, coordination and reaction time by 6, 9, 20 and 12 per cent, respectively. On an average novice players exhibited 17 per cent improvement in their performance whereas 11 per cent was observed in trained players which may be attributed to the continuous training provided for them. On par with the present study, Kotzamanidis (2006) demonstrated improvements in vertical jump height (ranging from 4.7 to 15% that could be attributed to the enhanced coordination and muscle power after training. Diallo *et al* (2001) also could able to find that short-term plyometric training programmes increase athletic performances in prepubescent soccer players. Godara (2016) provided plyometric training programme for a period of six weeks for 50 national level handball players aged 14 to 15 years old divided as experimental group (n=25) and control group (n=25), belonging to Kendriya Vidyalaya STPS Suratgarh, Sri Ganganagar, Rajasthan that increased the speed performance by 11.13% in experimental group at the end of the treatment. Upper and lower limb plyometric training induced distinct neuro-muscular adaptations in the upper and lower body musculature and was considered as an efficient method for enhancing athletes' physical fitness when 523 participants aged 12 to 22 years were included in the analyses by Soh *et al*. (2023) and was in agreement with Kumaravelu and Govindsamy (2018). During the regular basketball training, an additional 7-week plyometric training improved lower extremity strength, balance, agility and jump performance in adolescent female basketball players (17 years old) as per Mezler and Vaczi (2019) and Bouteraa *et al*.(2020). Rangaraj and Rajkumar (2021) also found significant increase in speed performance by 10.22% exhibiting better performance due to plyometric training consisting of 45-60 min/day, 3 days in a week till twelve weeks to hockey players (n=30; age 18 years) of SRMIST, Kattankulathur, Tamilnadu, India.

4. CONCLUSION:

Motor fitness components like speed, balance, coordination and reaction time are the key to all the type of sports activities especially in the competitive modern world. Motor fitness is referred to as skill-related fitness. The present study indicated the use of plyometric training to improve motor skills surely enhanced the power of novice and trained players in their sports activities.

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Table 1: Effect of plyometric training on Novice and Trained Groups on Speed, Balance, Coordination and Reaction time

Training period	Type of Group							
	Novice				Trained			
	Variables							
	Speed (sec.)	Balance (sec.)	Co-ordination (no.)	Reaction time (sec.)	Speed (sec.)	Balance (sec.)	Co-ordination (no.)	Reaction time (sec.)
Pre	7.21[a]	32.68[a]	19.24[a]	0.40[a]	7.87[a]	36.88[a]	23.52[a]	0.36[a]

Post	7.67[b]	35.68[b]	24.24[b]	0.35[b]	8.28[b]	40.12[b]	27.52[b]	0.33[b]
CD (*P*=.05)	**0.35**	**0.88**	**0.91**	**0.04**	**0.40**	**0.68**	**0.78**	**0.02**

Note:

- All the values are average of 3 trials with n=25 for novice and n=25 for trained Group
- CD – Critical difference
- Different superscripts in the column indicate significant difference at *P*=.05 level.