COMPARATIVE EFFECTS OF PLYOMETRIC EXERCISES AND DRILLS ON POWER PERFORMANCE, AGILITY AND COORDINATION IN BADMINTON PLAYERS

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***Abstract*- Background**: Badminton is one of the most popular racquet sports in the world. The agility and vertical jump are important motor skills to hit a shuttlecock in badminton game.

Objectives: To compare the effects of plyometric exercises and drills on the agility, power performance and coordination of athlete.

Methodology: In this single-blinded, randomized, controlled study, 30 badminton player aged 18 – 60 years were randomly assigned into two groups, intervention group (plyometric training) and control group (drill training). Both groups received these interventions for 6 week.

Results: The results showed that there was statistically significant difference between two groups with $p < 0.05$.Independent sample t-test was applied to compare pre-treatment and post-treatment (vertical jump test) VJP value between two groups. Agility increased to greater extent in group1 as compared to group 2 with mean Plyometric training demonstrated more clinical benefits than drill training with regard to Vertical jump test (VJP), Hand wall toss test (HWT) and Hexagon agility test (HAT).

Conclusions: Plyometric training and drill training is a suitable and durable approach for agility, power and coordination. The mean difference was more in plyometric training group as compared to drill training group that showed the greater effect of plyometric training over drill training in badminton player because plyometric exercises improves the muscle strength and coordination Hence, Alternate Hypothesis was accepted.

***Index Terms*-** Plyometric, Drill training, Agility, Power, Coordination, Badminton athlete.

I- INTRODUCTION

Plyometric preparing is a viable technique to forestall knee wounds in female competitors; be that as it may, the impacts of plyometric preparing on bounce execution in female competitors is unclear (1). Plyometric preparing is a doable and safe preparing choice with potential for working on different execution, utilitarian, and wellbeing related results in more seasoned persons (2). Plyometric preparing is for the most part expected to improve exhibitions during stretch-shortening cycle works out, for instance, hopping and running. In these investigations, the philosophies (e.g., the swaying strategy) utilized couldn't assess the mechanical properties of muscles and ligaments separately (3). The adequacy of a plyometric exercise ought not to be estimated by "how drained" a competitor feels. It should zero in on the "quality" of the developments. The "activity to-weakness approach" may prompt overtraining, work out related torment, and even abuse wounds. Design and responsibility are essential while incorporating plyometric practices in restoration and strength and molding programs remembering movement for work volume and force (4). PT consolidates stretch-shortening cycle muscle activity, where energy is put away and muscle axles are invigorated during the offbeat stacking stage to work with power creation during the concentric period of the activity (5). Plyometric preparing uses the stretch shortening cycle (SSC), which is normally connected with more compelling utilization of ligament versatility and stretch reflex initiation than concentric just training (6). It is conjectured the misuse of flexible energy, through the stretch shortening cycle marvel, might be a dominating element that advances running mechanical effectiveness and economy of development (7). Plyometric practices are frequently used to prepare this limit of the shoulder as they consolidate strength with speed of glenohumeral joint movement, which is very trying for scapular dependability (8). Chest area plyometric preparing brought about extra enhancements in chest area force and strength and perseverance (9). Plyometric preparing was more viable in further developing leap performance (10). Badminton is one of most loved games by the local area. Further developed execution is impacted by specialized play and actual capacities of competitors. One of the significant abilities in badminton is deftness. Dexterity can be accomplished by further developing equilibrium and strength of lower appendage. Plyometric exercise can build force of lower furthest point. A steady, reformist, and quantifiable exercise further develops competitor execution and diminishes hazard of injury (11). A modified plyometric practice as an activity that consolidates components of plyometric work out, which ordinarily includes tedious bouncing, running, and violently adjusting motion (12). Spryness practices contain more unique and game explicit developments contrasted and balance training (13). Readiness execution among youthful world class soccer could be further developed utilizing COD training (14). Badminton is quite possibly the most generally played games in the world (15). Badminton is a racket sport for two or four individuals, with a fleeting design portrayed by activities of brief length and extreme focus (16). Sporting badminton match play can be arranged as vivacious power proposing that it very well may be a suitable method for accomplishing suggested actual work and working on oxygen consuming fitness (17). We conjectured that prepared youthful badminton players may show prevalent static single-leg standing equilibrium and dynamic practical equilibrium than their undeveloped counterparts (18). A new neuroimaging study affirmed that badminton work on, including

high-limit visuospatial preparing and eye–hand coordination preparing, is related with neoplastic changes (eg, amplified dim matter thickness) in the cerebellum and practical modifications in the front parietal availability. Along these lines, we estimated that badminton players' eye–hand coordination is better than that of non–badminton players (19). Most research papers discussed the exercises used for the agility, coordination and power performance but the comparison of drills with plyometric in order to find out what works best for the athletes in the certain components of fitness is in dire need to be find out. So we can figure out that which training is best for athletes in respective components so it can further be added in the fitness training protocol of the badminton players for better results.

II- Methodology: In this single-blinded, randomized, controlled study, 30 badminton player; sample size calculated by Epitool, aged 18 – 60 years, with more than 5 years of singles or doubles badminton experience were included in the study. Pregnant athletes, significant musculoskeletal, neurological, visual, vestibular, cardiorespiratory, or cognitive disorders or any recent injury that required medical attention were excluded from the study; randomly assigned into two groups, intervention group (plyometric training) and control group (drill training). Both groups received these interventions for 6 week. Data was collected from Pakistan Sports Board. The study was completed within the time duration of six month (April 2021 to September 2021) after the approval of synopsis.

Intervention given to Group A: Along with the interventional therapy a complementary session of running for 30 mins and step up step down for 15 minutes was also included. Plyometric exercises were done and following exercises will be included in plyometric exercise of an athletes. 1) Lateral Hops over Cone 2) Forward/Backward Hops over Cone 3) Single Leg Hops over Cone 4) Vertical Jumps with Headers 5) Scissors Jump. Repeat all exercises for 20 continuous reps.

Intervention given to Group B: Along with the interventional therapy a complementary session of running for 30 mins and step up step down for 15 minutes was also included. Drills were done and following exercises will be included in plyometric exercise of an athletes. 1) Kettlebell Woodchopper- 15 times 2) Loaded Badminton Racket Wrist Rotations- 20 times 3) Multi-Directional Shuttle Runs- 10 minutes 4) Single Foot Calf Raises- 20 on each side of leg 5) Deep Squats- 15 times.

Tools: 1) **Vertical Jump Test- For Power Performance (20).**

Rating	Males inches)	Males cm)	Females inches)	Females cm)
Excellent	> 28	> 70	> 24	> 60
Very good	24 – 28	61-70	20 - 24	51-60
Above average	20 – 24	51-60	16 - 20	41-50
Below average	16 – 20	41-50	12 - 16	31-40
Poor	12 - 16	31-40	8 - 12	21-30
Very Poor	8 - 12	21-30	4 - 8	11-20
	< 8	<21	<4	<11

2) **Hand Wall-Toss Test- For Coordination (21).** Rating Score (in 30 seconds)

1. Excellent > 35
2. Good 30 - 35
3. Average 20- 29
4. Fair 15 - 19
5. Poor < 15

3) **Hexagon Agility Test-For Agility (22).**

Gender	Excellent	Above Average	Average	Below Average	Poor
Male	<11.2 secs	11.2 - 13.3 sec	13.4 - 15.5 secs	15.6- 17.8 secs	>17.8 secs
Female	<12.2 secs	12.2 - 15.3 secs	15.4 - 18.5 secs	18.6- 21.8 secs	>21.8 secs

Data Analysis Procedure: The data analysis was done by using SPSS version 22 for Windows software. Statistical significance was P = 0.05. Following tests were applied:

1. For Descriptive Statistics Frequency tables and clustered bar charts were used.
2. Parametric test was used to compare two population at different various intervals.
3. Independent sample t-test was applied to measure difference between two groups.
4. Paired sample t-test was applied to measure difference within each group.

IV- Results: The results showed that there was statistically significant difference between two groups with p < 0.05.Independent sample t-test was applied to compare pre-treatment and post-treatment (vertical jump test) VJP value between two groups. Agility increased to greater extent in group1 as compared to group 2 with mean Plyometric training demonstrated more clinical benefits than drill training with regard to Vertical jump test (VJP), Hand wall toss test (HWT) and Hexagon agility test (HAT).

Table 1: Between Group Comparison of Agility, power and coordination- Vertical jump test(VJP), Hand wall toss test(HWT), Hexagon agility test(HAT).

Variables		Treatment Group		P Value
		Plyometric training (n=15)	Drill Training (n=15)	
Vertical jump test(VJP)	Pre-treatment (Mean±SD)	12±4.796	11.93±3.01	>0.05
	Post-treatment (Mean±SD)	23.93±1.79	15.53±3.270	>0.05
Hand wall toss test(HWT)	Pre-treatment (Mean±SD)	11.40±1.805	9.93±1.792	>0.05
	Post-treatment (Mean±SD)	31.33±2.024	17.27±2.374	>0.05
Hexagon agility test (HAT)	Pre-treatment (Mean±SD)	31.47±2.475	17.53±1.642	>0.05
	Post-treatment (Mean±SD)	16.27±.884	15.73±1.907	>0.05

TABLE 2: ACROSS THE GROUP COMPARISON OF AGILITY, POWER AND COORDINATION- VERTICAL JUMP TEST(VJP), HAND WALL TOSS TEST(HWT), HEXAGON AGILITY TEST(HAT).

Study Group		Paired Difference	P Value
		Mean±St. Deviation	
Plyometric training	Pre and Post Vertical jump test(VJP)	6.2±1.591	<0.05
Drill training	Pre and Post Vertical jump test(VJP)	1.74±0.56	<0.05
Plyometric training	Pre and Post Hand wall toss test(HWT)	19.93±0.219	<0.05
Drill training	Pre and Post Hand wall toss test(HWT)	7.34±0.58	<0.05
Plyometric training	Pre and Post Hexagon agility test(HAT)	15.2±1.591	<0.05
Drill training	Pre and Post Hexagon agility test(HAT)	2.74±0.56	<0.05

V-Discussion: Patrick Shu-Hang Yung et all directed an investigation in 2017 to audit the injury the study of disease transmission on 44 Hong Kong tip top badminton, players. First class senior competitors had a higher rate pace of intermittent wounds, while tip top junior and potential competitors had a higher occurrence pace of new wounds (23). Finda Linova in 2019 directed an examination that was done is 2019 on "A Relative Investigation of High-intensity exercise and Plyometric Preparing on Strength, Speed and Dexterity in athelete.they reasoned that high-intensity aerobics is a significant strategy for further developing upper limb and lower appendage strength, running velocity and readiness in yard tennis players. The aftereffect of the examination was steady with our investigation that show more prominent improvement in deftness with plyometric preparing (24). Wei-Cheng Lin et all directed an examination in 2020 to research the impacts of Dynamic extending followed by VFR (DS + VFR) during warm-ups on adaptability, muscle firmness, force, and nimbleness of the lower appendages in badminton competitors. It was presumed that DS as a first line of warm-up exercise to build ROM, CMJ tallness, and dexterity in competitors. The consequence of the investigation was reliable with our examination that show more prominent improvement in nimbleness with plyometric preparing (25). Reynold W L Lee et all led an examination in 2019 to explore the impact of applying similarity guidance for more established grown-ups in learning the badminton high serve. The outcomes showed that similarity guidance worked with the obtaining of new engine abilities in more established grown-ups, and the advantage of pressure opposition was likewise evidenced (26). Minkai Dong et all led an examination in 2019 inferred that the nimbleness preparing for beginner badminton players ought to be more perceptually than actually testing to keep away from vain exertion and pointless injuries (27). Jie Yu et all directed an investigation in 2019 reasoned that visual wounds brought about by badminton player. Non-entering injury was more continuous; infiltrating injury was typically more serious (28).

VI- Conclusions: Plyometric training and drill training is a suitable and durable approach for agility, power and coordination. The mean difference was more in plyometric training group as compared to drill training group that showed the greater effect of plyometric training over drill training in badminton player because plyometric exercises improves the muscle strength and coordination Hence, Alternate Hypothesis was accepted.

VII- Conflict Of Interest: There was no conflict of interest.

VIII- Financial Statement: No fundings were given by any authorities; it was a project thesis of Masters of Science in Sports Manual Physical Therapy.

IX- Data Availability: Data will be provided on the demand by corresponding author.

X- References:

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