EFFECT OF PLYOMETRIC TRAINING ON FLEXIBILITY OF COLLEGIATE FEMALE BADMINTON ATHLETES

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ABSTRACT:

The purpose of this study was to evaluate the effect of Plyometric Training on flexibility of Collegiate Female Badminton Athletes. This study highlighted the impact of 12 weeks of plyometric training upon the selected physical parameter such as flexibility in females aged range 16-22 years. The subjects/participants were randomly assigned into two equal groups (n=20). All the subjects/participants were divided in to two groups with 10 subjects each as experimental and control group. Flexibility measure through sits and reach box. The results of the physical parameter i-e flexibility of female badminton athletes improved after the 12-week plyometric training program. Mean and standard value showed improvement as the pre-flexibility means was 27.60000 ± 5.274677, and the post flexibility value is 39.10000 ± 5.108816 respectively. Further, t values (10) = -5.983 the p-values are lesser than the significant values, 0.05 > .000. Flexibility was significantly improved after post-training. It is concluded that 12-weeks plyometric training program has an effect on the selected physical parameters i-e flexibility post-intervention of college-level female badminton athletes. Additionally, the anthropometric variables were also entertained such as weight and waist hip ratio. Both were significantly improved after post-training. Hence, it is recommended that, College authorities may provide maximum chances to the female athletes to participate in badminton games on regular basis to improve the selected physical parameters of flexibility.

Keywords: *Plyometric Training, Flexibility, college level female badminton athletes.*

INTRODUCTION:

Badminton is a popular sports which is played in every country across the globe. It is a beginner-friendly sports due to played in a fun way (Jiang et al., 2022). However, the individual who intends to become an advance level player of badminton, they need to play it at professional level. Beginners can learn easily

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badminton skills. The game of badminton is viewed as a competitive, leisurely, family-friendly; outdoor activity that may be enjoyed. Physical fitness is an important components of human lives especially players. The development and achievement of physical fitness components have a vital impact upon the health. Moreover, athletes/players could perform better in relation to the athlete sport specific event/activity. Plyometric training is employed in sports that call for high power output because it puts greater strain on the muscles than slower-paced resistance exercise. When combined with weight training, plyometric training has been proven to increase vertical jump height and sprint time in soccer players. Depending on the goal of the training program, different plyometric training is used (Ellapen, 2007). Physical fitness is the ability to perform the daily tasks effectively without undue fatigue and have ample energy for unforeseen activities. Physical fitness is an important component of human lives especially players. The development and achievement of physical fitness component have a vital impact upon the health (Avinash & Mittal, 2019). Moreover, athletes/players could perform better in relation to the athlete sport specific event/activity. Athletes can sustain the sports specific events for a longer period of time without undue fatigue. Furthermore, Athletes have a strong sense of execution of the relevant sports in a befitting manner through the optimum level of physical fitness (Blijlevens et al., 2018). Physical training is an essential component of each and every sport. Athletes need to build and develop a solid base of physical fitness which produces positive outcomes. Physical training and physical fitness are indispensable to each other, necessary for the mobility of the athletes sporting aspects (Xu, 2015).

Physical training develops the power of athletes in practices sessions. One sport that necessitates a lot of movement on the court is badminton. For several high-speed moves, players must be athletics enough to move quickly forward, sideways, and backward on the court. It takes systematic training like footwork training increase the qualities such as strength, speed and flexibility

(Chandrakumar, 2015). Plyometric training focus on upper and lower limbs, and provide a variety of benefits such as enhanced muscular power production, enhance flexibility muscle contractions with more force while using less energy, faster overall speed or muscle contraction frequency and enhance nimbleness or agility, as described by fitness experts, is the capacity to shift directions swiftly. While training for a sport, it is essential to choose workouts to the greatest extent possible, replicate the real movements that will be needed of during the competition (Araujo et al., 2019). Plyometric are a kind of exercise that assist athletes become more nimble by promoting forceful and quick direction shifts. Workouts known as plyometric place a focus on explosive movements such as jumping, hopping, and bounding with the intention of improving an athlete's speed, agility and quickness (Pire, 2006). Workouts that focus on plyometric help athletes improve their neuromuscular coordination, power generation, and explosiveness, all of which are essential for improving their already impressive agility. These modifications might result in improved agility, quicker direction changes, and even higher levels of athletic performance (Davies et al., 2015). It was found that a player's agility in a badminton match was connected with their level of physical capability. A sudden movement that encompasses the whole body and may entail a change in speed and/or direction in response to an external stimulus. Agility training is often included as one of the key emphases in the strength and conditioning routines that are prescribed for team sports (Gamble, 2013). Plyometric, more commonly referred to as "ballistic training," is a method that is used by athletes to improve their vertical jumps. Plyometric are exercises that educate the muscles to perform with more intensity for a shorter period of time (Wong et al., 2019).

This results in increased power production and explosiveness. They also aid to enhance landing mechanics, eccentric muscle control, knee extension, and hamstring activity, all of which contribute to the reduction of landing forces and the reduction of the risk of non-contact injuries. It has been discovered

that this practice improves not only one's strength but also one's running economy, agility, and sprinting ability (Ozmen & Aydogmus, 2017). Keeping this backdrop, flexibility is an unavoidable aspect of badminton game, which is unexplored so far in female athletes with special context of plyometric training. In this research, we have tried to address this gap and highlighted the important issue of female athletes.

MATERIALS AND METHODS:

The purpose of this study was to determine how flexibility and anthropometric attributes of college level female badminton athletes through plyometric training. In this research study, the researcher examined the effect of plyometric training on selected physical parameter of collegiate female badminton athletes. Therefore, 12-weeks' plyometric training protocol were employed on the participants.

Study Site:

Government Graduate College for Women 122 JB, Sargodha Road Faisalabad Punjab Pakistan was selected for the conduct of intervention.

Participants:

The researcher selected 20 participants for the current study on the basis of inclusion criteria. The participants were splited into two groups: the experimental group and the control group. The experimental group was composed of 10 participant (EG, N=10) given the prescribed exercise protocol to experimental group, whereas the control group (CG, N = 10) received no exercise.

Table No. 1
Inclusion Exclusion Criteria

S # No	Inclusion Criteria	Exclusion Criteria
1.	No chronic disease	Chronic disease
2.	No physical disability	Physical disability
3.	Age between 16-22 years	Age below 16 and above 22

Ethics & Informed Consent:

Informed consents were taken from participants, parents and respective College.

Training Protocol for The Participants:

In this research study, the researcher employed 12-weeks' plyometric training protocol to the participants.

Selection of Tests and Procedures:

Sit and Reach Test: It was used to measure the flexibility of lower back and hamstring muscles of the participants. Equipment required sit and reach box (or alternatively a ruler was used and a step or box). This test was important as tightness in lumbar lordosis, forward pelvic tilt and lower back pain. Sit and reach box was used. This test involved sitting on the floor with legs stretched out straight ahead. Shoes were removed. The soles of the feet are placed flat against the box. Both knees were locked and pressed flat to the floor - the tester assisted by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reached forward along the measuring line as far as possible. We ensured that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at least one-two seconds while the distance is recorded. The researcher ensured to restrict the jerky movements.

Figure 01: Sit and Reach Test

DATA ANALYSES:

Data was analyzed using the inferential statistical (Paired sample t-test and independent sample t-test) through International Business Machines Corporation IBM Statistical Product and Service Solutions (SPSS) version 26.

RESULTS:

Table No. 2

Paired sample T-test showing the difference between Pre and Post-test flexibility of (Experimental and Control Group)

Name of variable	Groups	Pre - test results (Mean ± SD)	Post - test results (Mean ± SD)	Pre and post- test results (Mean ± SD) difference	t	Sig.(2-tailed)
Flexibility	CG	25.40000±5.358275	27.60000±5.796551	2.200±0.43827 -1.500		.168
	EG	27.60000±5.274677	39.10000±5.108816	11.500±0.16586 -5.983		.000

Significant level = 0.05, SD=Standard Deviation

Table 02 interpret no meaningful difference in control groups (CG) regarding pre and post-intervention of female badminton athletes. The pre flexibility value was flexibility (M±SD = 25.4000 **±** 5.358275) to post-program flexibility (M±SD = 27.6000 **±** 5.796551; *t values (10)* = 1.500 the p-values values greater than to the significant values, 0.05 < *.168).* Based on the statistical results, there is no

significant difference was found in control groups (CG) regarding pre and post-intervention of female badminton athletes. Paired samples t-test demonstrates the Pre & Post-intervention characteristics of experimental groups (EG) of female badminton athletes. Table 01 interpret that there is a meaningful difference was found in experimental groups (EG) regarding pre and post-intervention of female badminton athletes. Therefore, the mean and standard deviation values (flexibility = 27.60000 ± 5.274677) to post-program (flexibility = 39.10000 ± 5.108816; *t values* $_{(10)}$ = -5.983, the P-values less than to the significant values, 0.05 > .000). Due to the above statistical results, there is the significant difference was found in experimental groups (EG) regarding pre and post-intervention of female badminton athletes.

Table No. 3

Paired sample T-test showing the difference between anthropometric attributes like weight, waist hip ratio Pre and Post-test of (Experimental and Control Group)

Name of variable	Groups	Pre - test results (Mean ± SD)	Post - test results (Mean ± SD)	Pre and post-test results (Mean ± SD) difference	t		Sig.(2- tailed)
Weight	CG	46.50000±6.132790	45.70000±6.864563	0.8±0.731773	1.714		.121
	EG	61.50000±8.058812	55.90000±7.125073	5.6±0.933739	14.000		.000
Waist hip ratio	CG	28.90000±1.370320	28.90000±1.523884	0±0.153664	0.000		1.00
	EG	31.60000±1.955050	29.60000±1.264911	2±0.690139	6.000		.000

Significant level = 0.05, SD=Standard Deviation

Table 03 indicates the Pre and post-intervention characteristics of control and experimental groups of female badminton athletes. A paired samples t-test shows the Pre & Post-intervention characteristics of control groups (CG) of female badminton athletes. Table 03 interpret that there is no difference in

control groups (CG) regarding pre and post-intervention of female badminton athletes. Therefore, the mean and standard deviation values of weight, waist hip ratio of pre-intervention (Weight = 46.500 ± 6.132790, waist hip ratio = 28.900 ± 1.370320) to post-program (Weight = 45.700 ± 6.864563, west hip ratio = 28.900 ± 1.523884) *t values* $_{(10)}$ = 1.714, 0.000, the p-values values greater than to the significant values, 0.05 < .121, 1.000. Based on the above statistical results, there is no significant difference was found in control groups (CG) regarding pre and post-intervention of female badminton athletes.

Paired samples t-test demonstrates the Pre & Post-intervention characteristics of experimental groups (EG) of female badminton athletes. Table 03 interpret that there is a meaningful difference was found in experimental groups (EG) regarding pre and post-intervention of female badminton athletes. Therefore, the mean and standard deviation values of weight, waist hip ratio of pre-intervention (Weight = 61.50000 ± 8.058812, waist hip ratio = 31.60000 ± 1.955050) to post-program (Weight = 55.90000 ± 7.125073, waist hip ratio = 29.60000 ± 1.264911). *t values* $_{(10)}$ = 14.000, 6.000, the P-values less than to the significant values, 0.05 > .000, .000). Due to the above statistical results, there is the significant difference was found in experimental groups (EG) regarding pre and post-intervention of female badminton athletes.

DISCUSSION:

The main purpose of the current study was to measure the effect of 12-weeks plyometric training on flexibility of collegiate female badminton athletes. There was no significant difference was found in the flexibility of female badminton athletes in control group (p =.168 > significant level = 0.05). Prior to the relevant training have been highlighted insignificant differences in flexibility (Rawte et al., 2021; Shukla, 2019; Khan et al., 2020).

On the other hand, present study reported significant improvement in flexibility of female badminton athletes in experimental group after the intervention. Plyometric training

significantly improved the skill of female soccer and tennis players which corresponds to the improved level of flexibility (Mengesh et al., 2015). Plyometric training increased adolescent badminton players' strength, agility, and jump performance. Moreover, plyometric group showed a greater improvement (6%) than the control group. Six 6-week plyometric training can be a useful training method to increase athletes' agility, and improvements in agility may be helpful for athletes during the last stage of pre-season preparation (Zemenu, 2020; Arazi & Asadi, 2011).

The results of this study show that there was an improvement in flexibility significantly changed after post-training, likewise that 12-week plyometric training program has effect on the selected physical parameters i-e flexibility post-intervention of college-level female badminton athletes. Aydogmus (2017), Ozmen and Aydogmus (2017) found that plyometric training increased adolescent badminton players' strength, agility, and jump performance. The plyometric group showed a greater improvement (6%) than the control group. Pancar et al., 2018); Miller et al., 2006 reported that 6-week plyometric training can be a useful training method to increase athletes' agility, and improvements in agility may be helpful for athletes during the last stage of pre-season preparation. Other researchers discovered comparable efficient outcomes in agility (Lehnert et al., 2009; Miller et al., 2006; Thomas et al., 2009) with a 6-week program for experimental group. A shorter period of 5 weeks training was also found to be effective (Robinson and Owens, 2004). The training effect was only shown in the 8 week training programs and 10 week interventions (Chelly et al., 2010; Meylan & Malatesta, 2009; Kotzamanidis, 2006; Markovic et al., 2007). The results of the anthropometric variable values of weight, west hip ratio were also significant. Therefore, the mean and standard deviation values of weight, west hip ratio of post-intervention were changed significantly after post-training**.** These results are linked with previous findings; long-term plyometric training is capable of improving flexibility, upper and lower body strength, weight, and west hip ratio (Fatouros et al., 2022; Asadi, 2013; 2012, Haq et al., 2020).

CONCLUSION:

The main purpose of the study was to measure the effect of 12-weeks plyometric training on flexibility of collegiate female badminton athletes. On the basis of results the researcher found a significant improvement regarding pre and post-test of flexibility of college level female badminton athletes. The researcher also reported that the plyometric training program have shown significant improvement on flexibility of intercollegiate badminton athletes by reducing the weight and waist hip ratio.

LIMITATIONS:

1. Proper and control diet of the subjects was a potential limitations, however new study could potentially address this gap for better understanding of the phenomena.
2. Weather condition was another limitation, as the intervention/protocol has been given in the open ground and cold weather, however the controlled and normal weather could produce more reliable outcomes.

RECOMMENDATIONS:

1. Regular plyometric training participation is beneficial for girls up to 3 to 5 days in a week to improve the flexibility.
2. Plyometric training program could be helpful to improve the flexibility in order to reduce the lower back pain in female.
3. Plyometric training program potentially effective to reduce/loss the weight and decrease the waist hip ratio.
4. There is significant effect of 12- weeks of plyometric training upon the selected physical parameters of flexibility the researcher was found however the researcher recommended that, College authorities may provide maximum chances to the girls to participate in badminton games on regular basis to improve the flexibility.

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