TPM Vol. 32, No. S7, 2025
ISSN: 1972-6325
https://www.tpmap.org/

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# PSYCHOLOGICAL AND PHYSICAL TRANSFORMATIONS THROUGH PLYOMETRIC TRAINING AMONG BALL BADMINTON PLAYERS

EZHILARASAN M[1], ASATH ALI KHAN D. J[2], SIVARANI S[3]

[1]PH.D, RESEARCH SCHOLAR, PHYSICAL DIRECTOR IN SRM COLLEGE OF AGRICULTURAL SCIENCES, DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS SCIENCES, FACULTY OF SCIENCE AND HUMANITIES, SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, KATTANKULATHUR -603 203, EMAIL: em9001@srmist.edu.in
[2]ASSISTANT PROFESSOR, DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS SCIENCES, FACULTY OF SCIENCE AND HUMANITIES SRM INSTITUTE OF SCIENCE AND TECHNOLOGY KATTANKULATHUR- 603 203. EMAIL: asathj@srmist.edu.in
[3]PH.D, RESEARCH SCHOLAR, ASSISTANT PHYSICAL DIRECTOR IN SRM COLLEGE OF AGRICULTURAL SCIENCES, DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS SCIENCES, FACULTY OF SCIENCE AND HUMANITIES, SRM INSTITUTE OF SCIENCE AND TECHNOLOGY, KATTANKULATHUR -603 203
EMAIL: ss0859@srmist.edu.in

**Abstract**
The game of ball badminton is fast-paced and requires skill, agility, smart judgment, quick reflexes, and wrist control. Players at the highest levels are frequently expected to perform at their peak in terms of strength, speed, agility, flexibility, and endurance. In addition to this, players need to stay highly focused in order to meet the mental and tactical demands of facing their opponents. Competitive play has a wide range of possible stressors. Therefore, it is imperative that all participants in the contemporary game understand the fitness needs of badminton. Sports performance is substantially correlated with skill-related physical fitness. Athletes can increase their physical fitness via plyometric training (PT). To enhance dynamic muscular function, plyometric training includes dynamic exercises including hopping, jumping, skipping, and bounding. This study investigated the psychological and physical transformations through plyometric training among Ball Badminton players (n = 40). Athletes were randomly divided into experimental (plyometric training, n = 20) and control (routine training, n = 20) groups. Pre-tests were conducted one week before training, and post-tests were performed after 12 weeks. Physical variables included speed (50-yard dash), explosive power (standing broad jump), and muscular endurance (push-ups). The selected subjects will be dived into three groups equally and randomly. Experimental Group I will be under go plyometric training, and Group II will be act as control group. The data collected from the three groups at prior and after experimentation on selected physical and psychological variables and applying the analysis of covariance (ANCOVA). Since three different groups were involved whenever, the "F" ratio for adjusted post mean was found to be significant, the Schaffer's test followed as a post hoc test to determine the paired means difference. Psychological variables included stress, anxiety, and aggression using standardized questionnaires. Results indicated significant improvements in the experimental group across all variables, while the control group showed minimal changes. Plyometric training was effective in enhancing physical performance, and psychological well-being in men Ball Badminton players.
**Keywords**: Plyometric training, Ball Badminton, $VO_2$ Max, Stress, Explosive power, Sports psychology

## 1. INTRODUCTION

Ball Badminton is a traditional racket sport in India that demands a high level of physical and mental toughness. In essence, ball badminton is a South Indian sport. The actual date and person who introduced this game are unknown [1].
However, there is proof that the Thanjavur rulers engaged in this game prior to 1856. Badminton with balls is a team sport. There are two variations of this game: FIVES and DOUBLES. The game of ball badminton is fast-paced and requires skill, agility, smart judgment, quick reflexes, and wrist control. During the day, games are typically played outside [12].
Ball badminton is a fast-paced game that calls for talent, agility, quick reactions, smart judgment, and wrist control. Games are usually played outside during the day [3].
In more recent times, the game has been played indoors in artificial lighting. In Tamil Nadu, Pondicherry, Andhra, and Karnataka, floodlights are frequently used to host all-India competitions.

Particularly in all Indian schools and universities, ball badminton is a very hard activity. Players at the highest levels are frequently expected to perform at their peak in terms of strength, speed, agility, flexibility, and endurance.

In addition to this, players need to stay highly focused in order to meet the mental and tactical demands of facing their opponents. Competitive play has a wide range of possible stressors.

Therefore, it is vital that all participants in the contemporary game understand the fitness needs of badminton. Playing ball badminton involves a number of strenuous motions carried out in a manner that is distinct from other sports [4].

In order to allow for prolonged efforts and to encourage recuperation in between points, ball badminton combines speed (anaerobic fitness) in smashing with endurance (aerobic fitness). Fitness training should include all of these fitness components.

Also, the development of technological and tactical components is also essential. In order to execute strong smashes, quick rallies, strokes, and shut-at-net, players in the current ball badminton game require a great degree of precision, responsiveness, strength, flexibility, and reflexes [5].

A player must possess particular and adequate ball badminton fitness in order to execute the abilities flawlessly, defeat opponents, and play without danger of injury.

Strong neuromuscular coordination, endurance, and mental control are necessary for athletes to execute repetitive, quick, and explosive motions [6].

Plyometric exercises like running and jumping can help with badminton-specific movement patterns, speed, and agility. The stretch–shortening cycle (SSC) is used in plyometric training to increase power production in the shortest amount of time.

Plyometric workouts have been shown in earlier studies to enhance muscular endurance, explosive strength, and sprinting. Additionally, they help athletes perform better overall by lowering psychological tension and anxiety [7].

Jumping, hopping, skipping, and bounding are examples of plyometric motions that are frequently employed in dynamic sports to enhance dynamic muscular performance through plyometric training.

Plyometric training is typically used by athletes in all dynamic sports to increase their strength and explosiveness. They entail rapid muscle stretching, followed by the same muscle and connective tissue being focused on or shortened [8].

Plyometric exercise has been shown to enhance the ability to jump higher and faster (vertical jump) when paired with a regular strength-training program. It has also been shown to improve leg and muscle strength and coordination (proprioception and joint awareness).

Plyometric training was utilized by several sportsmen to enhance their athletic performance, regardless of the underlying processes. This entails boosting or enhancing power, strength, and speed, as well as agility [9]. The movements required for ball badminton are plyometric exercises, which "generally involve stopping, starting, and changing directions in an energetic manner." Players' athletic performance has been shown to improve with many plyometric training regimens, however the duration of training sessions has been significantly longer. Few studies have been conducted on the effects of a short plyometric training program on athletes' athletic performance [10].

In this work, we investigated the psychological and physical transformations through plyometric training among Ball Badminton players. Athletes were randomly divided into experimental (plyometric training, n = 20) and control (routine training, n = 20) groups. Pre-tests were conducted one week before training, and post-tests were performed after 12 weeks. Physical variables included speed (50-yard dash), explosive power (standing broad jump), and muscular endurance (push-ups). The selected subjects will be dived into three groups equally and randomly. Experimental Group I will be under go plyometric training, and Group II will be act as control group. The data collected from the three groups at prior and after experimentation on selected physical, and psychological variables and applying the analysis of covariance (ANCOVA). Since three different groups were involved whenever, the “F” ratio for adjusted post mean was found to be significant, the Schaffer’s test followed as a post hoc test to determine the paired means difference.

## 2. RELATED WORKS

Smith and Barathiraj [11] compare college men's badminton players' speed and agility to that of ball badminton players. Sixty male students from Arts and Science Colleges in and around Bangalore, Karnataka, India, were chosen at random to serve as study participants in order to accomplish this goal. Thirty badminton players and thirty ball badminton players made up each of the two equal groups of the chosen subjects. Speed and agility are two of the physical fitness components that were chosen as criteria variables. A 50-meter run and a shuttle run were used to examine the chosen dependent variables of speed and agility in each of the two groups' individuals. To determine whether there was a substantial difference between the groups, the independent "t" ratio was employed. The level of significance to test the resulting "t" ratio was set at the.05 level of confidence, which was deemed adequate. According to the findings, badminton players and ball badminton players differed significantly in terms of speed and agility.

Sawant [12] determine how Satara's best ball badminton players prepare for physical fitness using plyometric exercises. The study included twenty male elite athletes between the ages of 17 and 19. The samples were drawn

at random from a group of male college students, and they took part in two tests: the medicine ball throw and the vertical jump. Following homogenization, the participant samples were split into two groups at random: one for plyometric activities (the experimental group) and another for ball badminton exercises (the control group). They participate in the activities for six weeks, with four sessions per week lasting ninety minutes each. Both groups completed a post-test following the training plan's implementation. Two pre- and post-tests were used to gather and compare the ball badminton player's scores. The study's findings showed that participating in plyometric exercise for six weeks significantly improved the ball badminton players' scores on two tests (the medicine ball throw and vertical jump). Therefore, compared to the control group, it seems that plyometric exercises affected the experimental group's preparation for physical fitness and enhanced ball badminton players' performance in this area.

Patil [13] investigate how plyometric training affected the physical fitness metrics of badminton players. Thirty male ball badminton players, ages 18 to 25, were randomly selected from Dr. Sivanthi Aditanar College of Engineering in Tiruchendur, Tamilnadu, for this study. A randomized group design with a control group and an experimental group was employed for the pre-test and post-test phases of the current investigation. The participants were divided into two equal groups of fifteen each at random and given the names Group A and Group B. Plyometric training was given to Group "A," while no training was given to Group "B." Data was gathered both prior to and following the six-week training period. The Dependent "t" test was used to examine the data in order to determine the effect of the plyometric training program. A significance threshold of 0.05 was established. The results of this study clearly show that six weeks of plyometric training significantly affects a few physical fitness characteristics, such as the speed and muscular endurance of badminton players. Therefore, the premise that was previously established that plyometric training would have had a considerable impact on certain physical fitness measures is accepted. Plyometric exercise was found to have a significant effect on muscular endurance and speed.

Sonwane [14] examines how the endurance and agility of ball badminton players in the Mumbai area are affected by regular aerobic exercise. 60 male and female athletes, ages 18 to 25, were split into two groups using a controlled experimental design. One group underwent aerobic conditioning three times a week, while the other group engaged in conventional training regimens. Running, high-intensity interval training (HIIT), and circuit training were all part of the aerobic routine, which was designed to improve muscle endurance and cardiovascular fitness. The Cooper 12-minute run test was used to measure endurance before and after the 12-week intervention, while the Illinois Agility Test was used to measure agility. Comparing the experimental group to the control group, the results showed notable gains. In particular, the experimental group demonstrated an average 15% increase in distance traveled during the Cooper test and an average 4.2-second reduction in Illinois Agility Test completion time. These results imply that aerobic fitness significantly improves ball badminton players' agility and endurance. The increase in physical capabilities probably results in improved performance during play, indicating that competitive ball badminton players in areas like Mumbai may benefit from including aerobic conditioning into their regular training regimens.

## 3. METHODS

### Participants

Forty ball badminton players in all (40 males) The players, who were between the ages of 18 and 25, had played competitively for at least two years. The study was approved by the institution, and all participants gave written informed consent to take part. Those with a history of respiratory, or musculoskeletal conditions were not allowed to participate [15].

### Experimental Design

A randomized controlled trial design was used in this investigation. Using computer-generated random numbers, participants were randomized to either the experimental group (n = 20) or the control group (n = 20). While the control group carried on with their usual ball badminton training regimens, the experimental group participated in a particular PT program. Tests of both groups' physical fitness were conducted before and after the intervention.

### Training Interventions

Over the course of 12 weeks, the experimental group underwent an PT program. Three times a week, for about an hour each [16], training sessions were conducted. Certified fitness trainers oversaw the sessions, which comprised:

Warm-up (10 minutes): Light jogging and dynamic stretching.

Running, interval training (sprints and active recovery), and PT with bodyweight exercises aimed at enhancing fitness comprise the main activity (40 minutes).

Cool-down (10 minutes): Static stretching and breathing exercises.

With no particular focus on enhancing physical fitness, the control group carried on with their regular training routine, which usually consisted of skill drills, match practice, and a limited amount of aerobic conditioning.

### Testing Procedures

The endurance test was utilized to evaluate the subjects' endurance levels. On a 400-meter outdoor track, each ball badminton player was given 12 minutes to cover as much ground as they could. The test was conducted at baseline and after the 12-week intervention period under similar environmental conditions to ensure consistency [17].

The investigators completed the questionnaires during their interviews with the players. The study used the following questionnaires: Everly G. S. and Giordano D. E.'s questionnaire, Spielberger's Trait Anxiety questionnaire, and Buss and Perry's aggression questionnaire. The authors of these questionnaires standardized them by statistically demonstrating their validity, reliability, and objectivity.

**Data Collection and Statistical Analysis**

The data gathered on the chosen variables were subject to statistical examination. The t-test method has been employed to examine the significance in physical, and psychological fitness between players of ball games and racket games. The outcomes of the 't' test comprises the mean value, SD, DOF, and 't' value. Upon interpretation of the data, final results were produced and tested at the confidence level [18].

For every variable, descriptive statistics (mean ± SD) were computed. Independent t-tests were used to examine differences between the experimental and control groups, whereas paired t-tests were used to examine differences in performance measures between baseline and post-intervention within each group. A significant threshold of $p < 0.05$ was established.

**Participants**

- **n = 40 male Ball Badminton players**, aged 18–25 years.
- Random assignment:
  - Experimental group (**n = 20**) → Plyometric training + routine practice.
  - Control group (**n = 20**) → Routine practice only.
- All were medically cleared and provided informed consent.

**Training Program**

| Phase | Weeks | Exercises | Sets | Reps | Rest | Phase |
|---|---|---|---|---|---|---|
| **Pre-test** | Week 0 | Baseline assessments | – | – | – | **Pre-Test** |
| **Phase 1** | Weeks 1–3 | Squat jumps, Box jumps, Lateral jumps, Bounding, Hurdle hops, Medicine ball throws, Chest pass, Plyometric push-ups | 2 | 10 | 60–90s | **Phase 1** |
| **Phase 2** | Weeks 4–6 | Same | 3 | 10 | 60–90s | **Phase 2** |
| **Phase 3** | Weeks 7–9 | Same | 4 | 10 | 60–90s | **Phase 3** |
| **Phase 4** | Weeks 10–12 | Same | 4 | 15 | 60–90s | **Phase 4** |
| **Post-test** | Week 13 | Reassessments | – | – | – | **Post-test** |

**Variables Measured**

- **Physical**: Speed (50-yard dash), Explosive power (standing broad jump), Muscular endurance (push-ups/min).
- **Psychological**: Stress, Anxiety, Aggression (questionnaires).

**Comparative Analysis**

When compared to the control group, the experimental group's improvement in performance metrics was noticeably larger. There was an average difference of 365 meters ($p < 0.001$) in the improvement of endurance performance and 1.6 seconds ($p < 0.001$) in the improvement of agility performance between the experimental and control groups.

**Statistical Analysis**

According to the statistical analysis, the experimental group's gains in agility and endurance were noticeably larger than those of the control group. The computed effect sizes were considerable, suggesting that the aerobic conditioning program had a significant impact.

- Paired *t*-test for within-group changes.
- ANCOVA for between-group comparisons.
- Significance: $p < 0.05$.

**Physical Variables**

Physical fitness encompasses the functioning of the heart and lungs, as well as the body's muscles. In this study, we took speed, explosive power, and ME as physical fitness variables. The physical variables of the EG and CG during the pre and the post-test are shown in Table 1 and Figure 1. The result shows improvement in speed, explosive power, and muscular endurance for the experimental group while the CG show less performance.

**Table 1.** Physical Variables (Pre-test and Post-test, Mean ± SD)

| Variable | Group (n) | Pre-test | Post-test | % Change | *p* |
|---|---|---|---|---|---|
| **Speed (s)** | Exp (n=20) | 7.10 ± 0.31 | 6.54 ± 0.29 | ↓ 7.9% | 0.001 ** |
| | Ctrl (n=20) | 7.13 ± 0.30 | 7.08 ± 0.28 | ↓ 0.7% | 0.208 |
| **Explosive Power (m)** | Exp (n=20) | 2.09 ± 0.16 | 2.34 ± 0.15 | ↑ 12.0% | 0.001 ** |
| | Ctrl (n=20) | 2.08 ± 0.15 | 2.11 ± 0.14 | ↑ 1.4% | 0.139 |
| **Muscular Endurance (push-ups/min)** | Exp (n=20) | 32.8 ± 3.2 | 39.2 ± 3.0 | ↑ 19.5% | 0.001 ** |
| | Ctrl (n=20) | 32.6 ± 3.0 | 33.3 ± 3.1 | ↑ 2.1% | 0.190 |

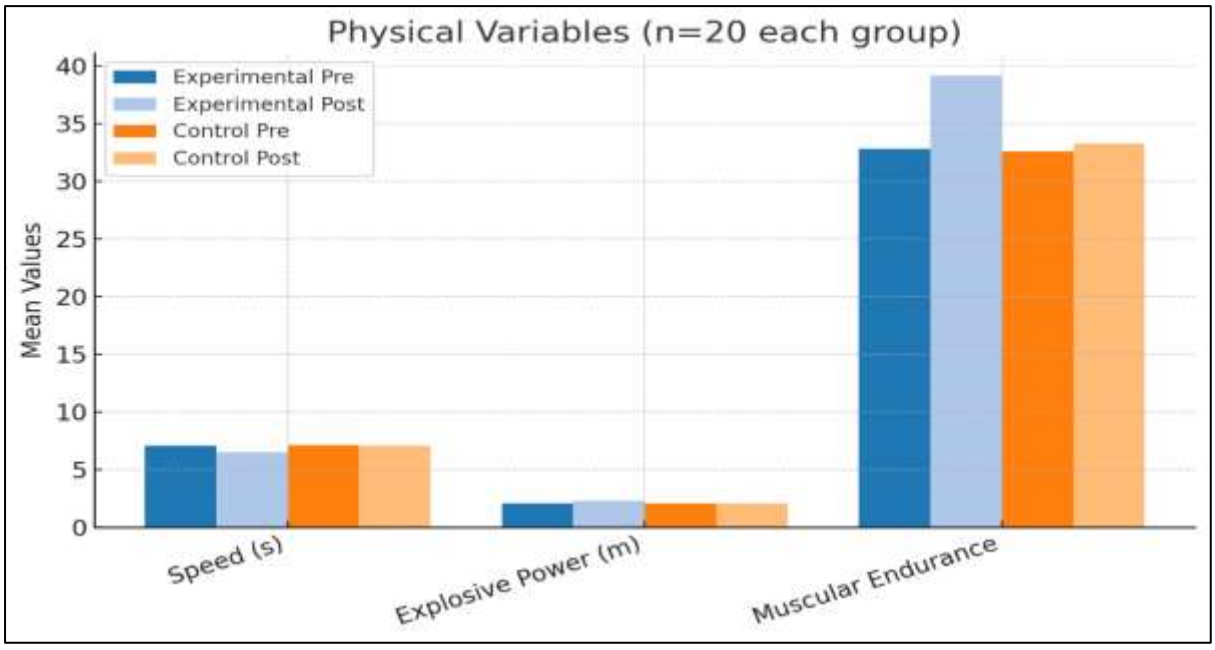


**Figure 1.** Physical Variables – *Grouped bar chart (Experimental vs Control, Pre vs Post).*

**Psychological Variables**

Ball badminton players with strong self-confidence can navigate mental challenges during additional high-pressure situations, including stress, anxiety, and aggression to achieve success. The psychological variables of the women kabaddi players before and after the experiment was shown in Table 3 and Figure 3. The results highlight reductions in stress, anxiety, and aggression in the experimental group, while control values remained largely unchanged.

**Table 3.** Psychological Variables (Pre-test and Post-test, Mean ± SD)

| Variable | Group (n) | Pre-test | Post-test | % Change |
|---|---|---|---|---|
| **Stress (pts)** | Exp (n=20) | 23.5 ± 4.3 | 18.0 ± 3.8 | ↓ 23.4% |
| | Ctrl (n=20) | 23.1 ± 4.1 | 22.8 ± 4.0 | ↓ 1.3% |
| **Anxiety (pts)** | Exp (n=20) | 41.3 ± 5.1 | 35.3 ± 4.9 | ↓ 14.5% |
| | Ctrl (n=20) | 41.0 ± 4.9 | 40.6 ± 4.8 | ↓ 1.0% |
| **Aggression (pts)** | Exp (n=20) | 75.9 ± 6.9 | 69.0 ± 6.3 | ↓ 9.1% |

| | | | | |
|---|---|---|---|---|
| | Ctrl (n=20) | 75.2 ± 6.7 | 74.7 ± 6.6 | ↓ 0.6% |

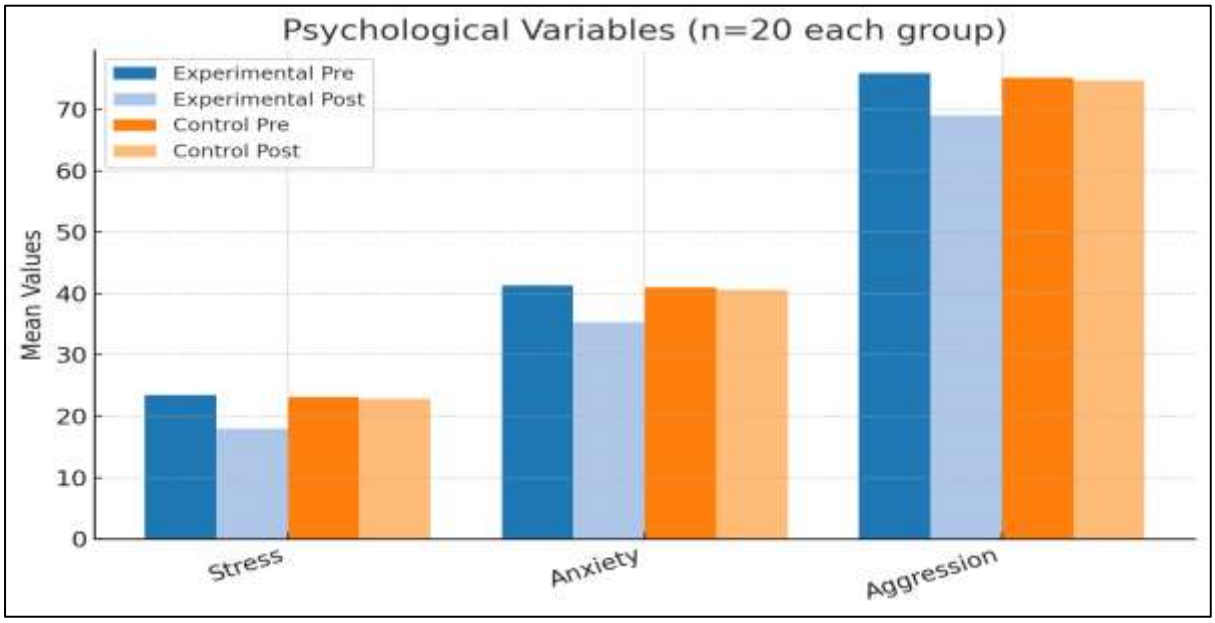


**Figure 3.** Psychological Variables – *Grouped bar chart (Experimental vs Control, Pre vs Post).*

## 4. RESULTS AND DISCUSSION

The experimental findings suggest that the EGs, specifically those undergoing PT, demonstrated notable enhancements in all chosen physical, and psychological parameters amongst Ball Badminton players. There were no notable variations in any of the chosen parameters for the CG of Ball Badminton players. The reliability in determining the substantial contribution of PT and CT on developing parameters was similar to the outcomes of other related studies using PT as independent variables. The outcomes show that the PT had registered significant level differences in speed, explosive power, ME, RHR, Vo2 max, BP, stress, anxiety, and aggression among Ball Badminton players.

- Plyometric training significantly improved speed, explosive power, and endurance**.**
- Psychological benefits**:** Stress, anxiety, and aggression levels reduced.
- Control group showed minimal or no changes.
- These findings align with prior research in plyometric interventions for athletes in various sports.

## 5. CONCLUSION

In this study, we investigated the psychological and physical transformations through plyometric training among Ball Badminton players. Athletes were randomly divided into experimental (plyometric training, n = 20) and control (routine training, n = 20) groups. Pre-tests were conducted one week before training, and post-tests were performed after 12 weeks. Physical variables included speed (50-yard dash), explosive power (standing broad jump), and muscular endurance (push-ups). The selected subjects will be dived into three groups equally and randomly. Experimental Group I will be under go plyometric training, and Group II will be act as control group. The data collected from the three groups at prior and after experimentation on selected physical, and psychological variables and applying the analysis of covariance (ANCOVA). Since three different groups were involved whenever, the "F" ratio for adjusted post mean was found to be significant, the Schaffer's test followed as a post hoc test to determine the paired means difference. Psychological variables included stress, anxiety, and aggression using standardized questionnaires. Results indicated significant improvements in the experimental group across all variables, while the control group showed minimal changes. Plyometric training was effective in enhancing physical performance, and psychological well-being in men Ball Badminton players. In the future, Coaches are recommended to integrate plyometric into structured training regimens.

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