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INFLUENCE OF STRENGTH TRAINING ALONG WITH GAME-SPECIFIC DRILLS ON PHYSICAL AND SKILL PERFORMANCE VARIABLES OF SUB-ELITE BADMINTON PLAYERS

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ABSTRACT

Objective: The study was designed to investigate the influence of strength training along with game-specific drills on physical and skill performance variables of sub-elite badminton players from Coimbatore clubs.

Methodology: To achieve the purpose of the study, thirty (N=30) girls sub elite badminton players from various academies in Coimbatore district would be selected as subjects. Their age ranged between 14 and 17 years. The subjects were divided into two equal groups fifteen n=15 in each group, namely Experimental group I (n=15) underwent strength Training and Group II acted as control group. The investigator did not make any attempt to equate the groups. The control group did not undergo any treatment. The experimental group was given training for period of 16 weeks of strength training. Data collected from the two groups before and after the training period were statistically examined for significant improvement using the dependent 't' test. The statistical test was set to be significant if p >0.05 level of confidence.

Results: The results indicated that the physical and skill performance variables, namely arm explosive power, muscular endurance and forehand clear respectively improved significantly due to the strength training.

Conclusion: The strength training program was found to be feasible and effective in achieving an optimum level of selected physical fitness variables (arm explosive power,muscular endurance) and skill performance variables (forehand clear) of girls sub elite badminton players over an 16 week training period.

KEYWORDS: *Strength training, Physical fitness attributes, Skill performance and Badminton.*

INTRODUCTION

Badminton is a fast-paced racket sport played either as singles or doubles, where players aim to score points by striking a shuttlecock over a net into the opponent's court. It is widely recognized for its requirement of speed, agility, coordination, and quick decision-making. The game involves rapid movements such as lunges, jumps, and directional changes, making it one of the most physically demanding indoor sports (**Tony, 2008**).

Strength training is a systematic process of exercises designed to improve muscular fitness and athletic performance through progressive overload Strength quality, defined as the capability of the human neuromuscular system to overcome or resist force during physical exertion, is a fundamental component of athletic performance **(Bompa 2019).** It enables athletes to execute technical movements effectively, improving their speed, endurance, and physical capabilities. High levels of strength are crucial for achieving peak performance, as they form the basis for other physical attributes such as power, agility, and stamina **(Suchomel,2016).**

MATERIALS AND METHODS

Electronic searches were carried out by the investigators (CD and EB). Search engines used to locate published articles included MEDLINE, EMBASE, Scopus, Science Direct Databases Directory of Open Access Journals (DOAJ), PubMed, and Google Scholar. The terms "strength training", arm explosive power, muscular endurance", Forehand clear" and the conjunctions "OR/AND" were used as essential terms. Searches could only be conducted in English. The studies detailing how physical fitness and badminton skills are affected by strength training are considered for literature review.

Study Participants

In this experiment, thirty sub-elite badminton were randomly assigned to two groups (i.e., STRENGTHG and GG) using the method of randomly permuted blocks using Research Randomizer, a program published on a publicly accessible official website (www.randomizer.org) their ranged from 14 to 17 years. All subjects were advised not to decrease or increase their daily sports and regular activities over the course of the study

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Beforehand we commencing the experiment, we deliberate the required sample size for the training and control groups. Standards were set, comprising a type 1 error fraction of 0.05 and a statistical correctness of 80 percent, which indicated that a total sample of 27 participants would be sufficient to detect significant differences. However, due to practical constraints such as the limited availability of eligible participants and the controlled nature of the training intervention, 30 participants were recruited and randomly divided into two equal groups, consisting of an experimental group (n = 15) and a control group (n = 15). Although the calculated sample size suggested 27 participants, the use of 30 participants ensured adequate statistical power while maintaining equal group distribution**,** which is recommended for experimental studies to facilitate balanced group comparison and statistical analysis **(Faul ,2009)**.

Procedure

To minimize any learning effects, two familiarization sessions for the testing procedures and three familiarization sessions for the strength training exercises were held prior to the start of the intervention, right before the baseline assessments. Data on demographics were gathered. In addition, participants were instructed to eat a regular food and abstain from caffeine for three hours prior to testing, as well as to refrain from any strenuous activity for a full day. To reduce the impact of circadian fluctuations, pre-post measurements were carried out for all participants at similar times of day. Every participant underwent the same testing in the same order. On the day of the test, participants completed a general warm-up that lasted ten minutes. The methods used adhered with the (**Helsinki Declaration,1964)** and its subsequent amendments' ethical guidelines regarding human experimentation **(World Medical Association, 2013)**.

Experimental Design

We utilized a research design with two groups to explore the findings of 16 weeks of strength training on physical fitness attributes and skill performance of girls sub-elite badminton players. The subjects were arbitrarily assigned to **STRENGTHG and CG**. The treatment groups were given 60 minutes of strength training three days per week on Monday, Wednesday and Friday during the course of 16 weeks. The participants in the control group were allowed to involve in their regular fitness routine. These training sessions were overseen by the qualified fitness expert, who was conscious of the group distribution. Three orientation sessions were held two weeks before the first assessment to make sure participants were familiar with the tests and exercises used in the study. Throughout the intervention, the researchers used spoken instructions and demonstrations to ensure that the right technique was being used.

Assessment Protocols

A thorough range of assessments were carried out both prior to and after the training program, including arm explosive power, muscular endurance, Forehand clear Since the same testers conducted all test measurements, uniformity was preserved. The participant's assigned group was known to the evaluation professionals. Each assessment was completed in a span of two days.

ARM EXPLOSIVE POWER

The aim of this test is to determine arm explosive power. Equipment’s are measuring tape ,medicine ball and clear surface . Procedure: Sit on the floor with legs fully extended and feet approximately 60 cm (24 inches) apart. Position your back flat against a wall (or yoga block against lower back for OPAT protocol).Hold the medicine ball with hands on the sides and slightly behind center, ball at chest level.Position forearms parallel to the ground. Throw the ball vigorously forward and upward at approximately 45 degrees. Maintain back contact with the wall throughout the throw. Measure the distance from the wall to where the ball first contacts the ground. **Scoring:** Record the distance to the nearest centimeter (or 10 cm for OPAT protocol). The best result of three throws is used as the final score.

MUSCULAR ENDURANCE

The sit-up test is a measure the endurance of the abdominal and hip-flexor muscles. The aim of this test is to perform as many sit-ups as you can in 30 seconds. This test measures the endurance of the abdominal and hip-flexor muscles. equipment required: floor mat or flat ground, stopwatch, partner to hold feet. The aim of this test is to perform as many sit-ups as you can in 30 seconds. Lie on the mat with the knees bent at right angles, with the feet flat on the floor and held down by a partner. The fingers are to be interlocked behind the head. On the command 'Go', raise the chest so that the upper body is vertical, then return to the floor. Continue for 30 seconds. For each sit up the back must return to touch the floor. The maximum number of correctly performed sit ups in 30 seconds is recorded. The sit up will not be counted if the subject fails to reach the vertical position, fail to keep your fingers interlocked behind your head, arch or bow your back and raise your buttocks off the ground to raise your upper body, or let your knees exceed a 90-degree angle.

FRENCH CLEAR TEST

To assess a player’s accuracy and consistency in executing the forehand overhead clear in badminton. Equipment**:** Badminton racket, Shuttlecocks, Badminton court (standard size, with a net), Targets or marked zones on the opponent’s court (these may be circles, squares, or specific marked areas for accuracy testing) Procedure: The feeder throws or hits the shuttle towards the player,

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The player performs a forehand overhead clear aiming toward the deep backcourt target zones, Each player is given 10 trials (or as per protocol).
The player must return the shuttle using proper technique, the landing position of each shuttle is recorded.. Scoring: Points system is based on the landing accuracy of the shuttle within the designated target zones: Landing in the innermost/highest-value zone (often a circle or marked area) gets the highest points. Landing in a secondary/outer zone gets fewer points. Shuttle landing outside all target areas but within the opponent's court gets a minimal score. Shuttles that go out-of-bounds or into the net are scored as zero. The total score is the sum of points from all attempts, with higher totals reflecting better clear accuracy and power.

Statistical Analysis

This study employs a paired sample t-test hypothesis test. This test's objective is to compare the pretest and posttest results. For the statistical analysis in this study, IBM SPSS Statistics 16.0 was used. (SPSS, Inc.; USA; Chicago, IL)

RESULTS

TABLE 1

The t- ratio of experimental group and control group on physical fitness attributes and skill performance of Sub-elite badminton players

		Mean	N	Std. Deviation	Std. Error Mean	"t"-ratio
Experimental Group						
Arm explosive power	Pre test	3.18	15	0.07	0.01	**11.86***
	Post test	3.75	15	0.06	0.02	
Muscular endurance	Pre test	21.53	15	0.11	0.03	**13.72***
	Post test	26.80	15	0.15	0.04	
Forehand clear	Pre test	66.06	15	1.99	0.51	**13.62***
	Post test	75.13	15	1.60	0.41	
Control Group						
Arm explosive power	Pre test	3.18	15	0.05	0.01	**0.54**
	Post test	3.19	15	0.05	0.01	
Muscular endurance	Pre test	21.60	15	0.10	0.26	**1.46**
	Post test	21.80	15	0.10	0.26	
Forehand clear	Pre test	66.13	15	0.91	0.23	**1.46**
	Post test	66.26	15	0.91	0.23	

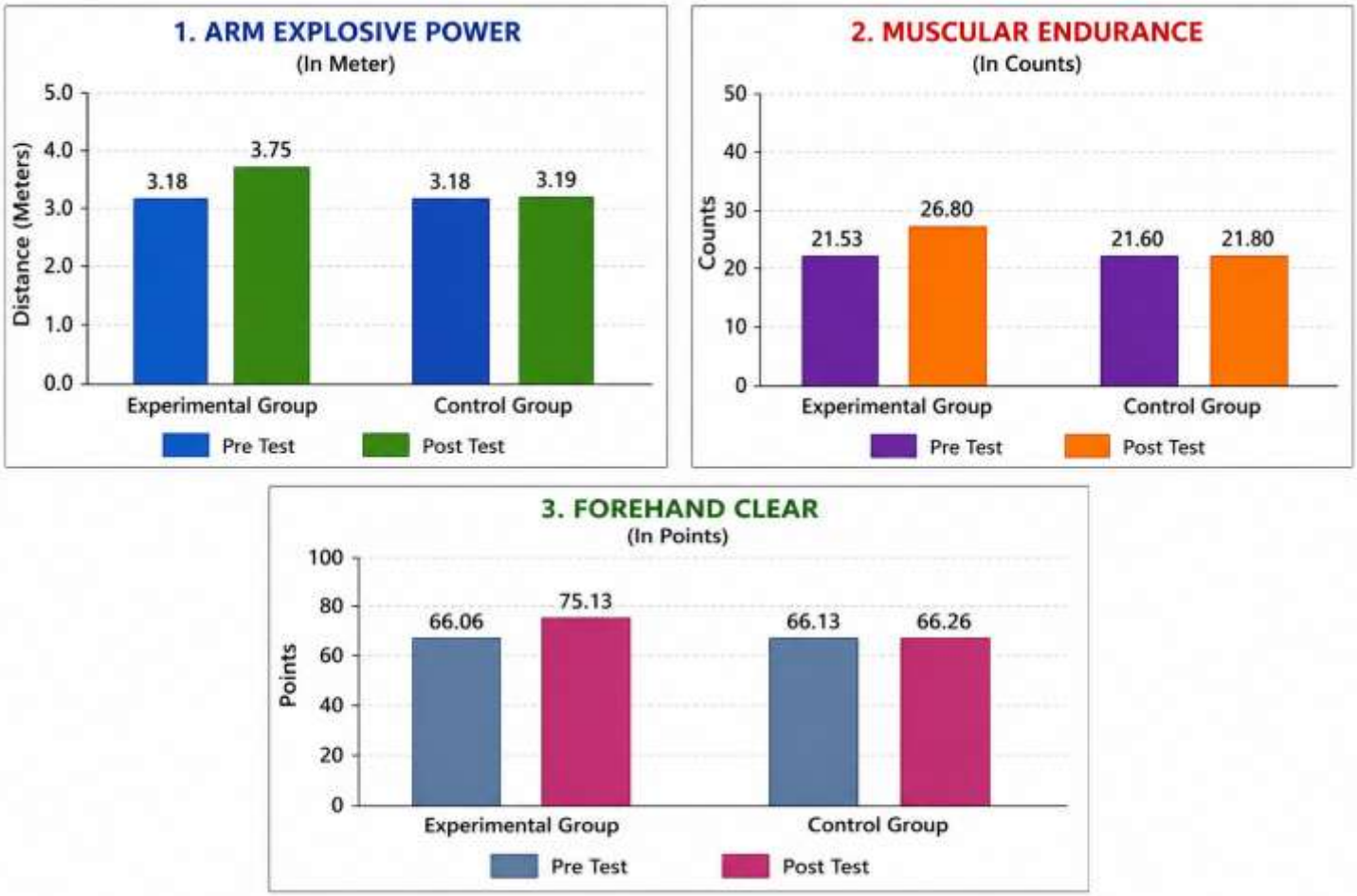
(Significance at 0.05 level of confidence for df of 15 is 2.14)

Table I reveals the computation of mean, standard deviation and 't' ratio on selected variables arm explosive power ,muscular endurance and forehand clear of strength training after regular physical exercise. The obtained 't' ratio on arm explosive power ,muscular endurance and forehand clear were 11.86,13.72 and 13.62 respectively. The required table value was 2.145 for the degrees of freedom 14 at the 0.05 level of significance. Since the obtained t values were greater than the table value it was found statistically significant.

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FIGURE-I

Bar diagram shows the mean values of physical fitness variables of the experimental group and control group on arm explosive



poer ,muscular endurance and forehand clear.

DISCUSSION ON FINDINGS

The finding of the present study add similarity with the findings of the investigation referred in this related study. This study confirms that strength training with game specific drills produce significant changes in physical fitness such as arm explosive power and muscular endurance and skill performance variables namely forehand clear.According to this study **(Shubham Jaiswa,2025)** showed significant improvement on explosive power ,muscular endurance performance due to strength training. In consider on this study to other related study(**Ravindra BC, 2018**) the result indicated that the effect of strength training on strength,skill and game performance of badminton players improved the explosive strength.However these authors also finding of this study, (**Shuzhen Ma,2024**) showed the result of the effect of core strength training to increase the strength, power, balance, and stability of badminton athletes. There are a number of possible explanations for the disparity between the results and those of earlier research, including the subjects' degree of training experience, the type of program, its intensity, and its length in consequence of strength training on selected physical fitness variables and skill performance variables of adolescent female badminton players.

CONCLUSIONS

Based on the results of the present study, it concluded that the sixteen weeks of strength training with game specific drills program significantly improved the selected physical fitness attributes and skill performance variables of girls sub-elite badminton players. The experimental group showed significant improvement in arm explosive power, muscular endurance and forehand clear performance after the training period, whereas the control group did not show significant changes. These physiological and performance adaptations contribute to better physical fitness and skill execution in sub-elite badminton players. Therefore, the study concluded that strength training was an effective training method for improving both physical fitness and skill performance in girls sub-elite badminton players, and it may be recommended as a useful training strategy for coaches and athletes to enhance overall performance.

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