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EFFECT OF RESISTANCE BAND TRAINING ON SELECTED PHYSICAL AND SKILL PERFORMANCE VARIABLES OF COLLEGE LEVEL HANDBALL PLAYERS

Sri.P.Santhanam[1], Dr.V.Balamurugan[2]

[1]Research Scholar, Master of Physical Education (M.P.Ed),Sri Ramakrishna Mission Vidyalaya, Maruthi College of Physical Education, Coimbatore, Tamil Nadu, India.

[2]Research Supervisor & Assistant Professor, Sri Ramakrishna Mission Vidyalaya, Maruthi College of Physical Education, Coimbatore, Tamil Nadu, India.

ABSTRACT

The purpose of this study was to investigate the effect of an eight-week resistance band training program on selected physical fitness and performance variables among male handball players. A total of 30 players aged between 18 and 24 years were randomly selected from Sri Ramakrishna Mission Vidyalaya Maruthi College of Physical Education and Sri Ramakrishna Mission Vidyalaya Maruthi College of Arts and Science, Coimbatore, Tamil Nadu. The participants were divided into two equal groups of fifteen each: an experimental group and a control group. No attempt was made to equate the groups. The independent variable of the study was an eight-week resistance band training program. The experimental group underwent sports-specific drills combined with resistance band exercises three days per week on alternate days, while the control group continued their regular routine without any additional training. Participants were informed of their right to withdraw at any time; however, no withdrawals occurred during the study.The dependent variables included physical fitness and performance measures, specifically shoulder muscular strength and shooting ability. The collected data were statistically analyzed using the paired t-test and independent t-test to determine the significance of differences between pre-test and post-test scores.The results revealed that the experimental group showed significant improvement in shoulder muscular strength and shooting ability when compared to the control group at the 0.05 level of significance. It was concluded that resistance band–based sports-specific drills training is an effective method for enhancing physical fitness and performance variables among male handball players.

KEY WORDS: *Handball, Muscular Strength, Shooting Ability, College Level Handball Players.*

INTRODUCTION

Handball is an Olympic sport that involves seven players and is characterized by fast-paced defensive and offensive moves intended to score goals. Scoring entails finding an optimal position from which to throw the ball with quick moves over short distances, implementing strong changes in direction, facing off one on one against defenders, and passing the ball using different offensive tactics (IHF, 2005). Handball is played at two 30-minute halves on a field 40 m long and 20 m wide. The rapid pace of the game and continuous changes in direction engage players not only on a physical level but also on a mental dimension (**Fieseler** et al., 2017; **Severino** et al., 2019). It is distinguished from other sports by movements that require highly developed motor abilities, such as explosive energy, velocity, endurance, and strength, with focus on running, jumping, blocking, side-to-side chopping, quick starts and stops, and throwing (**Povoas** et al., 2012; **Saeterbakken** et al., 2011).

Handball is a complex sport wherein the overall performance of a team is determined by the individual performance of players and specific team maneuvers. Therefore, handball players are required to excellently coordinate their movements for running, jumping, pushing, changing directions, and the handball-specific moves of passing, catching, throwing, checking, and blocking. During a game, the intensity of movements constantly changes depending on whether a player needs to stand and walk, jog and run at a moderate speed, sprint, and execute fast forward, sideward, and backward movements (**Wagner** et al., 2014). Playing a game of handball also necessitates several basic techniques: catching the ball, passing, shooting, dribbling, feinting, executing offensive and defensive movements, and goalkeeping strategies [5]. Shooting is a form of throwing movement designed to get the ball into the opponent's goal (**Gonzales** et al., 2013). It is achieved through an earnest effort to assume good posture and requires the use of a number of techniques, including the jump shot. The jump shot is a powerful maneuver and the most effective and most impressive-looking way of throwing the ball into the opponent's goal. Before making a jump, however, an important aspect to note is the rhythm of steps (**Hermassi** et al., 2011). Jump shooting is a technique of creating numbers because scoring is achieved by jumping so that the ball is directed more precisely toward the goal (**Marques** et al., 2006).

Improving the throwing technique through the successive action of strong arm muscles and bodily segments is expected to increase ball speed. In the act of throwing, muscular activity in the forearm is a very dominant component of the arm acceleration phase (**Clements** et al., 2001). The most specific exercise for upperarm throwing is the technique exercise, which can be achieved in two ways: by increasing duration through variations in repetition or by imposing additional weight on the forearm (**Ettema** et al., 2008; **van Edwards Muijen** et al., 1991). Previous studies proposed forearm strengthening programs for achieving or maintaining balance and strengthening arm muscles (**Page** et al., 1993). These programs typically entail the use of exercise

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equipment, such as external weights or machines, but elastic rubber bands are more popular because of their versatility, simplicity, and low cost. In addition, the resistance achieved by stretching these bands is affected by the force of gravity. Such resistance in training loads that consist of elastic bands also depends on the tensile properties of latex or elastic polymers (**Hughes**, 1999). Numerous studies have been conducted to confirm the efficacy of this type of muscle strengthening because elastic band resistance programs are widely implemented and appreciated by athletes, coaches, and sports medicine specialists. Their findings demonstrated that elastic band training effectively enhances the strength of shoulder and arm muscles (**Hibberd** et al., 2012; **Niederbracht** et al., 2008).

In the context of handball, a necessary task is for players to perform exercises that start with light loads before gradually transitioning to actual training loads so that athletes are not overwhelmed by the weight imposed on their bodies and prevented from carrying on exercising. In this regard, resistance bands are suitable training tools. Correspondingly, our main objective was to identify the effects of forearm muscle training using an elastic band on throwing velocity. We hypothesized that such an intervention would effectively improve the muscle strength and throwing performance of male handball players

METHODOLOGY

The investigator randomly selected from (N=30) men handball players From Sri Ramakrishna Mission vidyalaya Maruthi College Of Physical Education in Coimbatore, Tamilnadu and Sri Ramakrishna Mission vidyalaya Maruthi College Of art and science in Coimbatore, Tamilnadu . The participants were segregated into two equallent groups consisting of fifteen each and age group between 18 and 24. No effort was made to equate the groups. Experimental group I (N= 15) underwent sports specific drills training (RBE), as control group (N= 15) (CG). The respective training was given to the subjects in the experimental groups 3 days per week alternate days for a training period of eight weeks. The subjects in control group were not given any sort of training other than their regular activity. The participants were free to leave their approval in case of any uneasiness during their involvement but there was no withdraw in the study. The selected group were exposed to training program for a period of eight weeks.

TRAINING PROGRAMME

The eight-week training program was carried out on Mondays, Wednesdays, and Fridays, totaling three sessions per week. Each session extended for 60 minutes, including a 10-minute warm-up, 40 minutes of resistance band training, and a 10-minute cool-down phase. The session design and timing were systematically maintained across the training period to provide steady and balanced exposure to the SAQT schedule.

EIGHT WEEK TRAINING SHEDULE FOR RESISTANCE BAND EXERCISE IN COLLEGE LEVEL HANDBALL PLAYERS

Week	Day	Exercise	Sets x Reps
Weeks 1-2	MONDAY: Shoulder Resistance Band Exercise	Shoulder flexion	3 sets of 10 reps
		Shoulder extension	3 sets of 10 reps
		Shoulder abduction	3 sets of 10 reps
		Shoulder adduction	3 sets of 10 reps
		Lateral raise	3 sets of 10 reps
		Over head press	3 sets of 10 reps
	WEDNESDAY Arms Resistance Band Exercise	Elbow flexion	3 sets of 10 reps
		Elbow extension	3 sets of 10 reps
		Wrist flexion	3 sets of 10 reps
		Wrist extension	3 sets of 10 reps
		Radial deviation	3 sets of 10 reps
		Triceps kickback	5 sets of 10 reps
	FRIDAY Leg Resistance Band Exercise	Leg press	3 sets of 10 reps
		Quick kicks	3 sets of 10 reps
		Dead lift	3 sets of 10 reps
		Knee flexion	3 sets of 10 reps
		Knee extension	3 sets of 10 reps

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Week	Day	Exercise	Sets x Reps
Weeks 3-4	MONDAY: Shoulder resistance band exercise	shoulder internal rotation	4 sets of 12reps
		shoulder external rotation	4 sets of 10 reps
		lateral raise	4 sets of 12 reps
		front raise	4 sets of 12 reps
		overhead press	4 sets of 12 reps
	WEDNESDAY Arm (+) core resistance band exercise	elbow flexion	4 sets of 12 reps
		elbow extension	4 sets of 12 reps
		radial deviation	4 sets of 12 reps
		side bends	3 sets of 12 reps
		side plank row	3 sets of 12 reps
		russian twist	3 sets of 12 reps
	FRIDAY Back (+) leg resistance band exercise	seated row	4 sets of 10 reps
		upright row	4 sets of 12 reps
		scapular retraction	4 sets of 10 reps
		knee flexion	4 sets of 15 reps
		knee extension	4 sets of 12 reps
		leg press	4 sets of 12 reps per leg

Week	Day	Exercise	Sets x Reps
Weeks 5-6	MONDAY: Chest (+) shoulder resistance band exercise	Chest flies	5 sets of 12 reps
		Reverse flies	4 sets of 12 reps
		Pallof press	4 sets of 12 reps
		Shoulder internal rotation	4 sets of 12 reps
		Shoulder external rotation	4 sets of 12 reps
		Lateral raise	4 sets of 12 reps
	WEDNESDAY Back(+) core resistance band exercise	Lat put down	4 sets of 12 reps
		Bent over row	5 sets of 12 reps
		Seated row	4 sets of 12 reps
		Banded sit-up	4 sets of 12 reps
		Banded bird dog	4 sets of 12 reps
		Plank hold	4 sets of 12 reps
	FRIDAY Hip (+) leg resistance band exercise	Hip lift with band	5 sets of 12 reps
		Seated hip abduction	5 sets of 12 reps
		Standing hip abduction	4 sets of 12 reps
		Leg press	4 sets of 12 reps
		Quick kicks	4 sets of 12 reps
		Knee extension	4 sets of 12 reps

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Week	Day	Exercise	Sets x Reps
Weeks 7-8	MONDAY: Shoulder resistance band exercise	Shoulder diagonal (d1) flexion	5 sets of 15 reps
		Shoulder diagonal (d1) extension	4 sets of 15 reps
		Shoulder diagonal (d2) flexion	4 sets of 15 reps
		Shoulder diagonal (d2) extension	4 sets of 15 reps
		Lateral raise	4 sets of 15 reps
		Front raise	4 sets of 15 reps
	WEDNESDAY Arm resistance band exercise	Biceps curl	4 sets of 15 reps
		Overhead stretch	4 sets of 10 reps
		Resistance band pull apart	5 sets of 15 reps
		Resistance band push-out	4 sets of 10 reps
		Triceps kickback	5 sets of 10 reps
		Triceps reach	4 sets of 15 reps
	FRIDAY Core(+) leg resistance band exercise	Mountain climbers	5 sets of 10 reps
		Russian twist	5 sets of 10 reps
		Band bird dog	4 sets of 8 reps
		Knee extension	4 sets of 20 reps
		Knee flexion	5 sets of 12 reps

STATISTICAL ANALYSIS

The purpose of the study was to find the effects of muscular strength and resistance band exercise training on physical fitness and skill performance variables on college level handball players .the investigator used dependent 't' test to find out then significant different between pre and post tests. In all the cases 0.05 level of confidence was fixed to test the hypothesis.

TABLE – III
COMPUTATION OF 't'-RATIO BETWEEN PRE AND POST TEST MEANS OF CONTROL GROUP ON STRENGTH
(Score in Counts)

Group	Mean	Standard deviation	Standard error mean	t- ratio
Pre test	24.1333	7.55803	1.95147	0.658
Post test	22.8000	6.83687	1.76527	

* Significant at 0.05 level of confidence (2.14), 1 and 14.

Table III reveals the computation of 't' ratio between mean of pre and post test on strength of college level handball players male. The mean values of pre and post test of control group were 24.13 and 22.80 respectively. Since, the obtained 't' ratio 1.14 was less than the required table 2.14, it was found to be statistically not significant for the degree of freedom 1 and 14 at 0.05 level of confidence. The result clearly indicated that the muscular strength of the control group had not been improved

TABLE – IV
COMPUTATION OF 't'-RATIO BETWEEN PRE AND POST TEST MEANS OF EXPERIMENTAL GROUP ON STRENGTH
(Score in Counts)

Group	Mean	Standard deviation	Standard error mean	t- ratio
Pre Test	24.0000	10.77696	2.78260	10.311*
Post Test	29.4000	9.48533	2.44910	

* Significant at 0.05 level of confidence (2.14), 1 and 14.

Table IV reveals the computation of 't' ratio between mean of pre and post test on strength of college level handball players. The mean values of pre and post test of experimental group were 24.00 and 29.40 respectively. Since, the obtained 't' ratio 6.85 was

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higher than the required table 2.14, it was found to be statistically significant for the degree of freedom 1 and 14 at 0.05 level of confidence. The result clearly indicated that the muscular strength of the experimental group improved due to the influence of ins and outs core strength training.

The bar diagram shows the mean values of pre test on strength of control group and experimental group

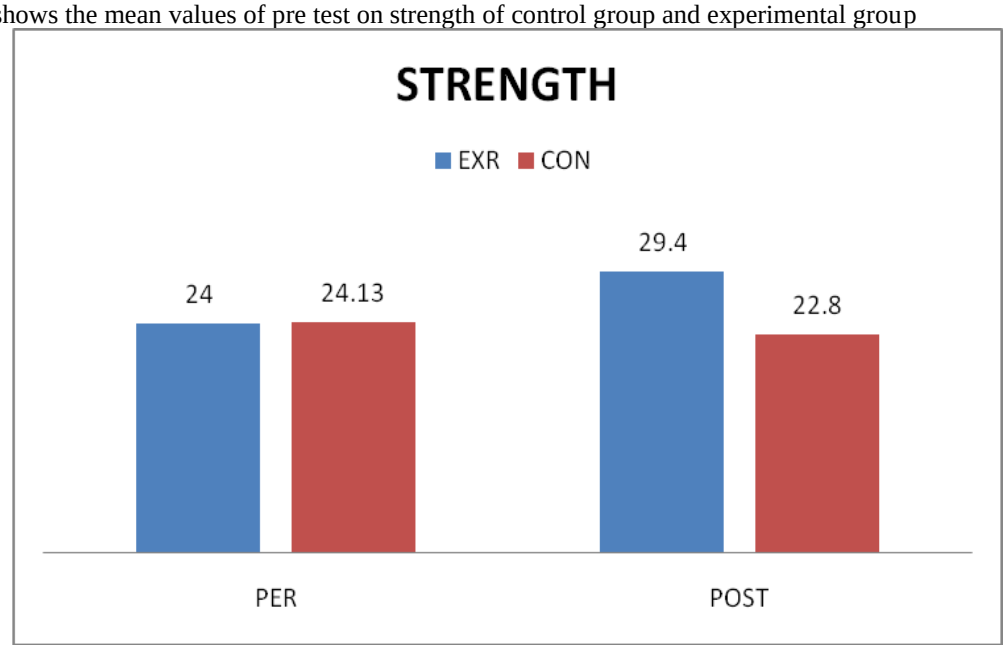

FIGURE – I
BAR DIAGRAM SHOWS THE MEAN VALUES OF PRE AND POST TEST ON MUSCULAR STRENGTH OF CONTROL AND EXPERIMENTAL GROUPS
(Scores in Counts)

TABLE – V
COMPUTATION OF 't'-RATIO BETWEEN PRE AND POST TEST MEANS OF CONTROL GROUP ON SHOOTING
(Score in Centimeters)

Group	Mean	Standard Deviation	Standard Error Mean	t- ratio
Pre Test	20.8000	4.78390	1.23520	0.722
Post Test	19.866	6.57774		

Significant at 0.05 level of confidence (2.14), 1 and 14.

Table V reveals the computation of 't' ratio between mean of pre and post test on shooting of college level handball players. The mean values of pre and post test of control group were 13.51 and 13.53 respectively. Since, the obtained 't' ratio 1.00 was less than the required table 2.14, it was found to be statistically not significant for the degree of freedom 1 and 14 at 0.05 level of confidence. The result clearly indicated that the shooting of the control group had not been improved.

TABLE – VI
COMPUTATION OF 't'-RATIO BETWEEN PRE AND POST TEST MEANS OF EXPERIMENTAL GROUP ON SHOOTING
(Score in Centimeters)

Group	Mean	Standard deviation	Standard error mean	t- ratio
Pre Test	20.7333	4.09646	1.05770	3.140*
Post Test	24.4667	4.42181	1.14171	

* Significant at 0.05 level of confidence (2.14), 1and 14.

Table VI reveals the computation of 't' ratio between mean of pre and post test on shooting of college level handball players. The mean values of pre and post test of experimental group were 15.48 and 16.46 respectively. Since, the obtained 't' ratio 12.23 was higher than the required table value 2.14, it was found to be statistically significant for the degree of freedom 1 and 14 at 0.05 level of confidence. The result clearly indicated that the shooting of the experimental group improved due to the influence of ins and outs core strength training.

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The bar diagram shows the mean values of pre test on shooting of control group and experimental group.

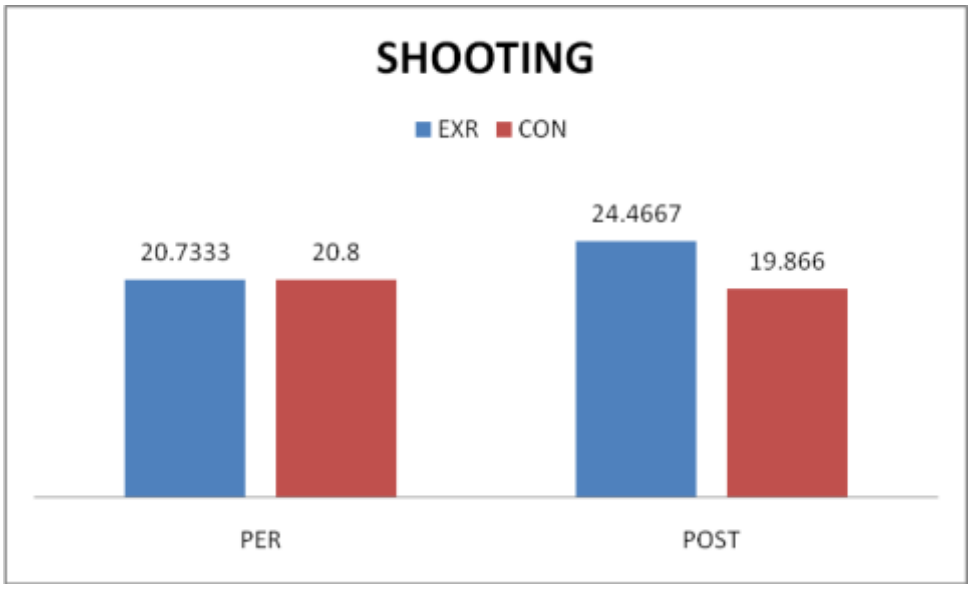

FIGURE – II
BAR DIAGRAM SHOWS THE MEAN VALUES OF PRE AND POST TEST ON SHOOTING OF CONTROL AND EXPERIMENTAL GROUPS
(Score in Centimeters)

DISCUSSION ON FINDINGS

The eight-week resistance-band training produced **significant gains in the experimental group's shoulder strength and shooting performance**, whereas the control group (no additional training) showed no meaningful change. For example, the experimental group's shoulder strength increased markedly (from 24.0 to 29.4 on the strength test), with a paired *t* indicating significance ($p<0.05$), while the control group's strength actually declined slightly (24.13 to 22.80) with no significant difference. Similarly, shooting ability (measured in centimeters) improved substantially in the band-trained players (20.73 → 24.47, $p<0.05$) but not in controls (20.80 → 19.87, ns). In other words, adding sports-specific resistance-band exercises to routine handball drills yielded **statistically significant improvements** ($p<0.05$) in both shoulder muscular strength and shooting ability that were not seen in the control group. This aligns with the study's conclusion that "additional elastic band training… improves measures relevant to game performance, particularly strength, power, and ball throwing velocity"[1].

These results are **consistent with prior research** on elastic-band training in handball and related sports. For instance, **Aloui** et al. (2019) found that 8 weeks of upper-body elastic band training twice per week produced ~25–44% gains in bench-press strength and **~25% increases in throwing velocity** among junior handball players[1]. Likewise, a 10-week "contrast" rubber-band program in youth handball increased 1RM bench-press strength by ~37–40% in the training group (versus only ~7–11% in controls) and substantially raised upper-limb power outputs[2]. Notably, studies of shorter band-training interventions (6–9 weeks, 3 times weekly) have also reported **improved shoulder rotator strength and ball-throwing speed** in handball athletes[3]. In each case, the band-training groups outperformed the control groups by a wide margin, mirroring the significant experimental-vs-control differences seen here. These converging findings strongly support the idea that **resistance band training can effectively enhance handball-specific performance measures**.

Possible mechanisms for the observed gains include **enhanced neuromuscular strength and power** from variable elastic resistance, and improved muscle activation in throwing motions. Elastic bands provide progressive tension through the range of motion, which may accentuate the concentric and eccentric phases of shoulder muscles involved in shooting. In practice, the experimental group performed *sport-specific* throwing drills with bands, likely reinforcing the coordination and stability needed for stronger shots. As many authors note, maximal upper-body strength is a key determinant of throwing performance in handball, so the sizable strength increases likely translated directly into higher shooting scores[1][3]. In short, the band exercises appear to have specifically targeted and improved the musculature and movement patterns critical for handball shooting, yielding real performance benefits.

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CONCLUSIONS

The 8-week elastic-resistance (band) training program produced **significant improvements** in shoulder strength and shooting performance in male handball players, whereas the control group showed no change. The experimental group's gains were comparable to or greater than those reported in similar studies[1][2].

These findings support the conclusion that **band-based sports-specific drills are an effective training method** for enhancing upper-body fitness and handball shooting ability.

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