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COMBINED EFFECTS OF TRX SUSPENSION BAND EXERCISES AND KETTLEBELL EXERCISES WITH SPORTS SPECIFIC TRAININGS ON ARM EXPLOSIVE POWER OF COLLEGE MEN BOXERS

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***ABSTRACT*- The purpose of the present investigation is to examine the combined effects of TRX suspension band exercises and kettlebell exercises with sports specific trainings on arm explosive power of college men boxers. To achieve the purpose of this study, the investigator chosen 45 college men boxers from various colleges affiliated to Annamalai University as subjects in the age group of 18 to 23 years. They were divided into three groups of fifteen subjects each. Group-I underwent combined TRX suspension band training and sports specific training, group-II underwent combined kettlebell training and sports specific training and group-III acted as control, who did not participate in any training programme. The training duration for all two groups was restricted to 12 weeks (3days/week). The arm explosive power was preferred as dependent variable. The raw data of 3 group's obtained through standardized tests was analyzed to found the significant variation between two tests (pre & post) through paired 't' test. Furthermore, magnitude (%) of alteration was also calculated. To eradicate the early mean inequality the group's data (pre & post) were calculated via ANCOVA statistics. While the 'F' ratio (adjusted) score in ANCOVA was higher, the post (Scheffe's) hoc test was followed. The confidence level 0.05 was set. Due to the combined effects of TRX suspension band exercises and kettlebell exercises with sports specific trainings the arm explosive power of college men boxers was greatly increased. Though, kettlebell exercises with sports specific training was much better than the combined TRX suspension band exercises with sports specific training protocols in improving the arm explosive power of college men boxers.**

Key Words: TRX suspension band exercises, Kettlebell exercises, Sports specific training, Arm explosive power and College men boxers

I. INTRODUCTION

Boxing has become an exciting sport in today's time. Boxing is perceived and be fond of world wide. Maintenance of elite performances is a challenge in boxing. All most all the aspect of fitness such as physical, physiological, and psychological plays important in achieving elite performances in boxing. Magnitude of factors influences the performance of boxing players some of them can be foreseen and can be manipulated such as diet, physical fitness, the player's mental toughness, mental ability, creativity, and brain functions. The best boxer should be very strong quick, highly skillful with a good foot work and with excellent physical condition with coverage in spite of pain and exhaustion. Attacking boxing skills – each boxer develops an attacking style, for example some boxers rely on speed and others on strength. One the basic stance second the straight right punch third the uppercut. Four leftjab, and five is left hook. Defence boxing skills – In defence boxing a boxer use number of techniques to avoid his opponents punches or make them ineffective, One clinching, two ducking, third slipping, four parrying and the five blocking.

Core strength training is a new and emerging topic of discussion in connection with exercise. But, many people assume that this training is it applicable only to competitive players and hardcore athletes. Everybody can get benefit out of core weight training in their own way. But it all depends on how do we use and implement it in the weekly schedule. Core strength training is a term that denotes building the strength of the muscles of the body in such a manner that the entire body is fully balanced and supported. The core is the center of gravity in the body surrounding the center of the abdomen. One cannot expect to have a lean and graceful body without this as this is the focal point of balance and movement. The sedentary lifestyle that many people are accustomed to has made core weight training very popular. Because of white collar jobs and luxurious lifestyle, our body is kept more relaxed instead of being active and that is the reason for out of shape. This can be observed in the complaints of back pain, sagging abdominal muscles and tell tale signs of poor posture. When the core muscles are in proper shape, then the entire body carries different look.

In the recent years, various programs in connection with strength training are evolved. They are organized to stress the importance of strengthening core muscles. These are the muscles of the trunk and pelvis in addition to the muscles of the legs, arms and shoulders. Core training specific to athletes are very much needed. Thus, for a given individual, particular muscle groups in the core become very important. Athletes have to strengthen the trunk and pelvic muscles and this is very much required for them. Exercising the lower back and abdominal muscles together is the unique feature of most of the core training programs. A huge emphasis is there to provide training for multi-plane, dynamic and multi-directional movements and it is achieved by core strength training. Significant improvement will be there in these movements if core strength training and related exercises are utilized properly.

The TRX System, also known as Total Resistance Exercises, refers to a specialized form of suspension training that utilizes equipment developed by former U.S. Navy SEAL Randy Hetrick. TRX is a form of suspension training that uses body weight exercises to develop strength, balance, flexibility and core stability simultaneously. It requires the use of the TRX Suspension Trainer, a performance training tool that leverages gravity and the user's body weight to complete the exercises. TRX's designers claim that it draws on research from the military, pro sports, and academic institutions along with experience gathered from the TRX team, who work "with thousands of athletes, coaches, trainers, first responders, subject matter experts, professors, and service members in all branches.

Supporters of TRX Training claim that it can improve mobility and stability, increase metabolic results, build lean muscle, and develop functional strength. Other advocates of the system say that we can't help but use our core for stabilization. People who like yoga and Pilates tend to like TRX because there are some crossovers. But it's also great for runners, cyclists, or anyone who is an endurance athlete and wants to have more strength training. However, some analysts worry that the instability of suspension straps could possibly result in injury, especially for those with a history of joint or back injuries, or inadequate core strength. Fabio Comana, a research scientist at the nonprofit American Council on Exercise, states that suspension training may work for well-conditioned athletes and gym-goers who regularly train their core, however, it is potentially dangerous for those who haven't built up their core.

A relatively new form of training for athletic conditioning is kettlebell training. Kettlebell training is believed to provide many of the same benefits as weightlifting. However, research on kettlebell training is limited. To our knowledge, there has been only one study that has examined the effects of performing kettlebell exercises, specifically an examination of the oxygen cost of a particular movement (swings) with the kettlebell. Anecdotal reports of the benefits of using kettlebells over weightlifting movements include ease of teaching, less expense than purchasing a whole weight set, and less intimidating to use. Coaches may have an interest in using kettlebells; if space is limited, there is a lack of funding for Olympic bars or weights, or to assist athletes who have never lifted weights in gaining a foundation in the fundamentals of similar movements relating to strength and power (squat, press, clean and jerk, snatch). Therefore, the purpose of the present study was to analyze the combined effectiveness of boxing specific training with TRX suspension band and kettlebell training on performance related fitness and technical skills of boxers.

II. METHODOLOGY

A. Subjects and Variables

To achieve the purpose of this study, the investigator chosen 45 college men boxers from various colleges affiliated to Annamalai University as subjects in the age group of 18 to 23 years. They were divided into three groups of fifteen subjects each. Group-I underwent combined TRX suspension

band training and sports specific training, group-II underwent combined kettlebell training and sports specific training and group-III acted as control, who did not participate in any training programme. The arm explosive power was selected as dependent variable and it was assessed by conducting seated medicine ball throw test.

B. Training Protocol

The experimental group-I performed combined TRX suspension band exercises and sports specific trainings six days in a week and the experimental group-II performed combined kettlebell exercises with sports specific trainings 6 days in a week for twelve weeks. After the initial measurements the specially designed training programme was given to the subjects of the experimental group-I named as combined boxing specific training with TRX suspension band training. They performed the following TRX suspension band exercises namely TRX push-up, TRX chest press, TRX inverted row, Kneeling triceps press, Squat, Triceps extension, Biceps curl, Lunge, hamstring curl, Reverse mountain climber respectively.

For the kettlebell group, participants trained with a 6-kg kettlebell during the first six weeks then they performed with 8kg during the remaining six weeks. Exercise selection included Kettlebell Swing, Kettlebell Thrusters, Kettlebell Clean and Press, Kettlebell Snatch, Kettlebell Pistol Squat, Kettlebell Goblet Squat, Alternate Kettlebell Shoulder Press and Alternate Kettlebell Floor Press. The exercises were performed as 3 sets of 6-8 repetitions in the first 2 weeks (I&II week) and were then increased to 3 sets of 8-10 repetitions in the second 2 weeks (III&IV week) then in the third 2 weeks (V&VI week) it was increased to 3 sets of 10-12 repetitions. Similarly they performed as 4 sets of 8-10 repetitions 7^{th} and 8^{th} weeks and were then increased to 4 sets of 10-12 repetitions in the 9^{th} and 10^{th} weeks then in the 11^{th} and 12^{th} weeks it was increased to 4 sets of 12-14 repetitions. The work rest ratio of 1:1 between exercise and 1:2 between sets was given.

After the initial measurements the specially designed sports specific training was given to the subjects of the experimental group-I and II. The training sessions were conducted six days a week over a period of twelve weeks. They performed ten boxing drills such as shadow boxing, skipping rope, medicine ball rotational throws, speed footwork, cardio boxing, boxing bags, working with dancing ball, speed ball, combating with one hand or two handed, combating with tall, short, right respectively.

C. Collection of the Data

The data on arm explosive power was collected prior to the commencement of experiment (pre test) and after twelve weeks of training period (post test). Both the pre and post tests were administered under identical conditions, with same apparatus, testing personal and testing procedures.

D. Statistical Technique

The data collected from the experimental and control groups on arm explosive power was statistically analyzed by paired ‘t’ test to find out the significant differences if any between the pre and post test. Further, percentage of changes was calculated. The data collected from the three groups prior to and post experimentation on arm explosive power was statistically analyzed, by applying the Analysis of Covariance (ANCOVA). Since, three groups were involved, whenever the obtained ‘F’ ratio value in the adjusted post test mean was found to be significant, the Scheffe’s test was applied as post hoc test. The level of confidence is fixed at 0.05 for significance.

III. RESULT

The obtained data on arm explosive power of experimental and control groups was analyzed by paired ‘t’ and put on display in table-1.

Table – 1: Paired 't' Test Results and Percentage of Improvement in Arm Explosive Power for Experimental and Control Groups

Group	Test	N	Mean	SD	DM	't' - ratio	%	P-Value
Boxing Specific Training with TRX Suspension Band	Pre	15	4.78	0.46	0.48	3.80*	10.25	.002
	Post	15	5.27	0.28				
Boxing Specific Training with Kettlebell Training	Pre	15	4.74	0.25	0.78	10.63*	16.67	.000
	Post	15	5.53	0.33				
Control	Pre	15	4.75	0.33	0.003	0.15	0.001	.878
	Post	15	4.75	0.30				

**Significant at (.05)*

The collected pre- and post-test medicine ball throw performance values of the three groups boxing-specific training with TRX suspension band, boxing-specific training with kettlebell training, and the control group revealed clear differences in explosive upper-body strength improvements. The 't' values for boxing-specific training with TRX suspension band ($t = 3.80$, $p < 0.05$) and kettlebell training ($t = 10.63$, $p < 0.05$) confirm statistically significant gains in throwing performance.

Boxing-specific training with TRX suspension band resulted in a 10.25% improvement, while kettlebell training led to a 16.67% improvement in arm explosive power. In contrast, the control group showed no meaningful change ($t = 0.15$, $p > 0.05$).

The chosen participants' medicine ball throw performance across TRX suspension, kettlebell training, and control groups were analyzed by ANCOVA statistics are exhibited in Table – 2**.**

Table – 2: ANCOVA Results on Arm Explosive Power for Boxing Specific Training with TRX Suspension Band, Kettlebell Training, and Control Groups

	Boxing Specific Training with TRX Band Suspension Training	Boxing Specific Training with Kettlebell Training	Control	SoV	SS	df	MS	'F' ratio	Sig.
Adjusted Mean	5.262	5.538	4.759	B	4.69	2	2.34	32.50*	.000
				W	2.95	41	0.07		

**Significant at (.05)*

Table-2 presents the ANCOVA results comparing medicine ball throw performance among three groups: Boxing Specific Training with TRX Suspension Band, Boxing Specific Training with Kettlebell Training, and a Control group. The Kettlebell Training group achieved the highest adjusted mean distance (5.538), followed by the TRX group (5.262), with the Control group recording the lowest (4.759). These differences were statistically significant ($F = 32.50$, $p < .001$), indicating a

significant effect of training type on medicine ball throw performance.

Table – 3: Scheffé's Test Conclusions on Arm Explosive Power for Boxing Specific Training with TRX Suspension Band, Kettlebell Training, and Control Groups

Variable	Boxing Specific Training with TRX Suspension Band	Boxing Specific Training with Kettlebell Training	Control	MD	P-Value
Arm Explosive Power	5.262	5.538		0.27*	.022
	5.262		4.759	0.50*	.000
		5.538	4.759	0.78*	.000

**Significant at (.05)*

Table-3 presents the results of Scheffé's post hoc test comparing medicine ball throw distances among three groups: Boxing Specific Training with TRX Suspension Band, Boxing Specific Training with Kettlebell Training, and the Control group. The mean throw distances were 5.262 meters for the TRX group, 5.538 meters for the Kettlebell group, and 4.759 meters for the Control group. Statistically significant differences were observed between all pairs of groups. The Kettlebell group threw the medicine ball significantly farther than the TRX group, with a mean difference of 0.27 meters ($p < 0.05$). The TRX group also performed better than the Control group by 0.50 meters ($p < 0.05$). The greatest difference was found between the Kettlebell and Control groups, with the Kettlebell group exceeding the Control by 0.78 meters ($p < 0.05$). These findings suggest that both training interventions improved medicine ball throw performance, with kettlebell training producing the highest gains.

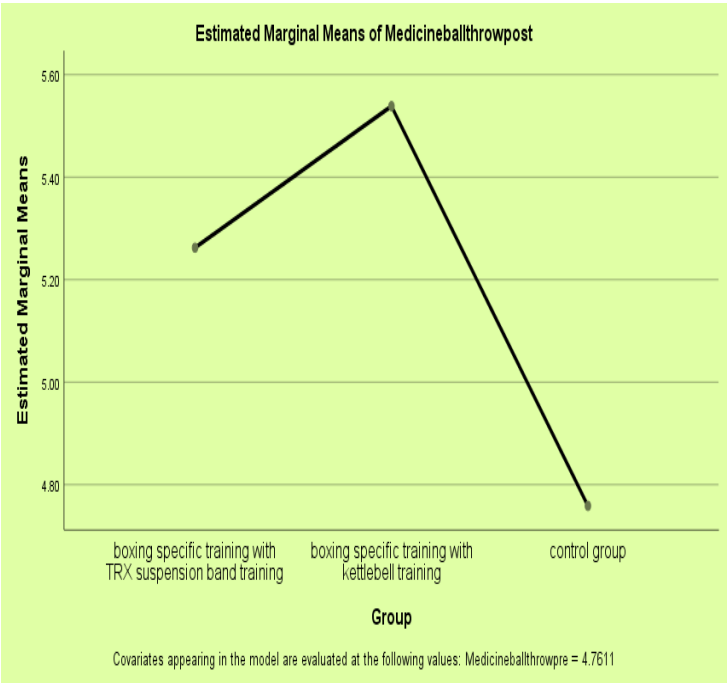

Figure – I: Graphical representation of the Estimated Marginal Means of Post-Test Arm Explosive Power among Experimental and Control Groups after Adjusting for Pre-Test Scores

IV. DISCUSSION

The improvement observed following TRX suspension band training may be attributed to the unstable and bodyweight-supported nature of the exercises, which require continuous activation of stabilizing muscles along with prime movers. TRX-based movements promote neuromuscular coordination, core engagement, and force transmission from the lower body through the trunk to the upper extremities, all of which are essential for explosive punching actions in boxing. Previous research has reported that suspension training effectively enhances functional strength and power by increasing muscle activation and improving intermuscular coordination (Snarr & Esco, 2013; Mok et al., 2015). Such adaptations likely contributed to the observed gains in medicine ball throw performance.

In contrast, the superior improvement produced by kettlebell training can be explained by its ballistic and high-velocity movement patterns, which closely align with the principles of explosive power development. Exercises such as kettlebell swings, snatches, and presses involve rapid acceleration and deceleration phases, stimulating the stretch–shortening cycle and enhancing rate of force development (RFD). Studies have demonstrated that kettlebell training significantly improves upper-body and total-body power due to its dynamic loading characteristics and requirement for synchronized multi-joint actions (Lake & Lauder, 2012; Manocchia et al., 2013). These factors likely resulted in greater transfer to the medicine ball throw, a test that emphasizes explosive concentric force production of the upper limbs.

Furthermore, kettlebell training allows the use of external resistance with progressive overload, which may have provided a stronger mechanical stimulus for muscle power adaptations compared to the relatively fixed bodyweight resistance in TRX training. According to the force–velocity relationship, training with moderate loads at high movement velocities is particularly effective for enhancing explosive power (Cormie et al., 2011). Kettlebell exercises inherently satisfy this criterion, thereby explaining the higher percentage improvement observed in this group.

Overall, the findings suggest that while TRX suspension band training is effective in improving arm explosive power through enhanced stability, coordination, and functional strength, kettlebell training may be more effective for maximizing explosive upper-body performance in boxers. Therefore, incorporating kettlebell-based ballistic exercises into boxing-specific conditioning programs may yield greater improvements in arm explosive power, particularly when the goal is to enhance striking force and speed.

V. CONCLUSION

Boxing-specific training with TRX suspension band resulted in a 10.25% improvement, while kettlebell training led to a 16.67% improvement in arm explosive power. In contrast, the control group showed no meaningful change ($t = 0.15$, $p > 0.05$). These findings suggest that both training interventions improved medicine ball throw performance, with kettlebell training producing the highest gains.

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