EFFICACY OF 6 WEEKS STRENGTHENING EXERCISES ON DYNAMIC BALANCE AND ENDURANCE AMONG MALE CRICKETERS.

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Abstract:

Background: *Strengthening exercises are given to cricket players(bowlers) to improve their dynamic balance and endurance of lower limb which in turn increases the overall performance and prevent injuries. The study objective was to compare the efficacy of 6 weeks strengthening exercise on dynamic balance and endurance among male cricketers. Experimental study* ***Materials and methods:*** *40 subjects aged between 18-26 years, males were selected. They were divided into 2 groups (20 subjects) each group using convenient sampling method. Experimental (group A) group received strengthening exercise. Exercise include squat, leg extension, calf raise, lunge, curl up. Control (group B) group received their conventional routine sports PT. The exercise program was given with a total period of 6 weeks. The outcome measures used were Star excursion balance test(SEBT) and half squat test were done before and after exercise program to test for dynamic balance and endurance respectively.* ***Results:*** *The results showed a significant increase in dynamic balance and endurance among experimental group ($p<0.0001$).* ***Conclusion:*** *The present study concluded that the bowlers are benefitted more in experimental group which showed significant improvement than the group B (control group) conventional physiotherapy in improving dynamic balance and endurance among male cricketers.*

KEYWORDS:

bowlers, strengthening exercise, endurance, dynamic balance, SEBT

INTRODUCTION:

Cricket is a popular game that is played all over the world. In the game of cricket, players take on specific roles which includes batting, wicket keeping, fielding, bowling. Each of these role has its own demands. To become an outstanding cricket player, one should have a sound physique, ability to concentrate and perform task with high level of determination. Cricket requires a variety of skills that are commonly used in number of sports. Hand eye coordination, throwing or catching a ball, balance and intense, long term concentration are just a few(9). In cricket, bowling action is a dynamic, complex sequence of highspeed movements that may be repeated between 300 and 600 times each week during a cricket season (6). The thrower's paradox: the thrower's shoulder must be lax enough to allow excessive external rotation but stable enough to prevent symptomatic humeral head subluxations, thus requiring a delicate balance between mobility and functional stability. The basic bowling technique (right handed bowler) has many characteristics: the run up, leap, right foot contact, left arm motion, bowling arm rotation, left foot contact, ball release, and follow though. A good technique allows the bowler to deliver a ball with speed at a chosen point on the pitch while maintaining a straight bowling arm. In cricket, the ability to throw a ball at high velocity with great accuracy is critical to successful performance and often determines the outcome of matches. A major issue in cricket is the risk of injury to players attributed to an acute spike in throwing intensity and volume during practice and matches (7).

Bowlers are considered as one of the most influential players on the cricket field. Bowling in cricket involves an initial run up, numerous rotations and circumduction of a straight arm about the glenohumeral joint to propel a ball at a batsman. Bowling compromises of a short phase of acceleration, followed by a bound, a landing and a launch (8). Bowlers will often attempt to maximise ball release velocity (BRV) to assist in dismissing opposing batsman. The ground reaction force (GRF) can contribute to increase BRV. Consequently, bowlers must ensure they have the necessary lower limb strength to appropriately attenuate and utilise the forces experienced during. Current research has shown that at front foot contact, ground reaction forces (GRF) can be as high as 8 to 12 times bodyweight. Epidemiological research has also shown that young and adolescent bowlers are at the highest injury risk (8). Overhead throwing involves the transfer of ground reaction and lower extremity forces through muscles of the trunk to the upper extremities (7). so lower limb conditioning is essential for bowlers in the game of cricket. Bowlers are more prone for injury, especially lower limb up to 45% (14). So as stated by john cronin et al. strength and conditioning for bowlers are more important. This will even improve the throwing performance [7]. So this study concentrates on lower limb strengthening for bowlers on improvement of endurance and dynamic balance.

Dynamic balance is defined as the neutralization of external forces acting on the body by the muscles and soft tissues around the joints [18]. Neuromuscular control and especially superior balance ability is likely to be important during the bowling action due to its high load, dynamic and asymmetrical nature. As stated by B Olivier Et.al, The importance of optimal balance ability in the bowling action is emphasised by the known relationship between highly developed balance ability and reduced incidence of injuries as was established in other populations [6]. Lack of balance leads to injuries such as sprain in ankle and knee and knee osteoarthritis is associated. Endurance is defined as the ability of the muscles to resist fatigue for prolonged period of time. endurance is necessary for bowlers to cope up with the prolonged duration of matches. As stated by T D Noakes Et.al, endurance fitness is required for cricketers to cope with repeated muscle contraction [16]. Deficits in strength of lower extremities and postural control have been associated with a high risk for sustaining sport related injuries [1].

So, Improvement in dynamic balance help in prevention of injuries and lower limb strengthening increases the endurance, which in turn increases the efficiency of performance. Many researchers have found out the effect of strengthening exercise on strength performance. But no articles on the effect of strength exercise on endurance. So this study aims on evaluating the effects of strength exercise on endurance and dynamic balance.

Methodology:

A pre-post experimental study was done for 40 subjects aged 18-26 years bowlers from Dolphin sports academy, Ambattur based on the inclusion criteria : Duration of pain for more than 6 weeks, gender male, Age 18-26 years, Without any injuries, vestibular problems and visual problems and Exclusion criteria : Pregnancy, Bowlers with history of surgery. Exclusion criteria: lower limb, spine, Any injuries to spine, lower limb, any cardiovascular disease. Then divided into two groups using convenient sampling method group A (n=20) Experimental group and group B(n=20) control group. The exercise program was given with a total period of 4 weeks. The outcome measures used were Star excursion balance test & Half squat test

PROCEDURE:

45 zonal level cricket players were selected and 40 players who fulfilled the selection criteria were included in the study. Written consent form was obtained from the subjects. Subject's demographic data and assessment was done. Pre test was done before intervention and post test was done after the intervention. Subjects were divided into two group. 20 in the experimental group (group A) and 20 in the control group (group B). The subjects participating in study were informed that they had to do the exercise 3 days per week.

GROUP A as experimental group & GROUP B as control group

GROUP A

Experimental group receive strengthening exercises [1]
Subjects receive 5 minutes of warm up before intervention and 5 minutes of cool down after intervention. Squats, leg extension, calf raise, lunge & curl up Each exercises was done for 10 repetitions &2 minutes of rest period was given between each exercise. Each exercise should be done 3 days per week.

GROUP B (Control group) received their conventional sports physiotherapy.

Data Analysis and Interpretation:

- All statistical analysis were performed on IBM compactible micro computer using statistical package for the social sciences (SPSS 25.0)
- The significance was set at alpha = 0.005 level. Paired t test was used to compare the pre and post values of star excursion balance test and endurance test.

TABLE 1: GROUP A (EXPERIMENTAL GROUP)**STAR EXCURSION BALANCE TEST:**

RIGHT leg balance:

OUTCOME MEASURE	MEAN VALUE		STANDARD DEVIATION		t-VALUE	p-VALUE
	PRE	POST	PRE	POST		
ANTERIOR	115.90	126.25	13.98	13.92	20.5332	<0.0001
POSTERIOR	88.35	95.30	17.11	16.63	20.6726	<0.0001
MEDIAL	82.25	86.65	14.19	14.79	4.6876	0.0002
LATERAL	103.90	109.50	22.13	22.68	7.2169	<0.0001

Table 2: LEFT leg balance

OUTCOME MEASURE	MEAN VALUE		STANDARD DEVIATION		t-VALUE	p-VALUE
	PRE	POST	PRE	POST		
ANTERIOR	116.55	123.20	12.29	11.68	22.7215	<0.0001
POSTERIOR	83.95	89.45	15.73	16.30	19.9093	<0.0001
MEDIAL	80.60	84.90	13.67	13.84	15.7847	<0.0001
LATERAL	105.40	110.50	24.78	25.58	26.7622	<0.0001

TABLE 3: **HALF SQUAT TEST of GROUP A**

MEAN (DURATION IN SECS)		STANDARD DEVIATION		t-VALUE	p-VALUE
PRE	POST	PRE	POST		
85	115.85	8.83	11.73	15.0412	<0.0001

TABLE 4: GROUP B (CONTROL GROUP) **STAR EXCURSION BALANCE TEST(SEBT)**

RIGHT leg balance

OUTCOME MEASURE	MEAN VALUE		STANDARD DEVIATION		T-VALUE	P-VALUE
	PRE	POST	PRE	POST		
ANTERIOR	110.30	112.40	12.78	12.46	11.0197	<0.0001
POSTERIOR	91.0	92.40	20.33	20.24	6.2942	<0.0001
MEDIAL	85.35	86.20	15.11	15.36	3.2157	0.004
LATERAL	89.65	90.50	19.42	19.64	2.9793	0.0011

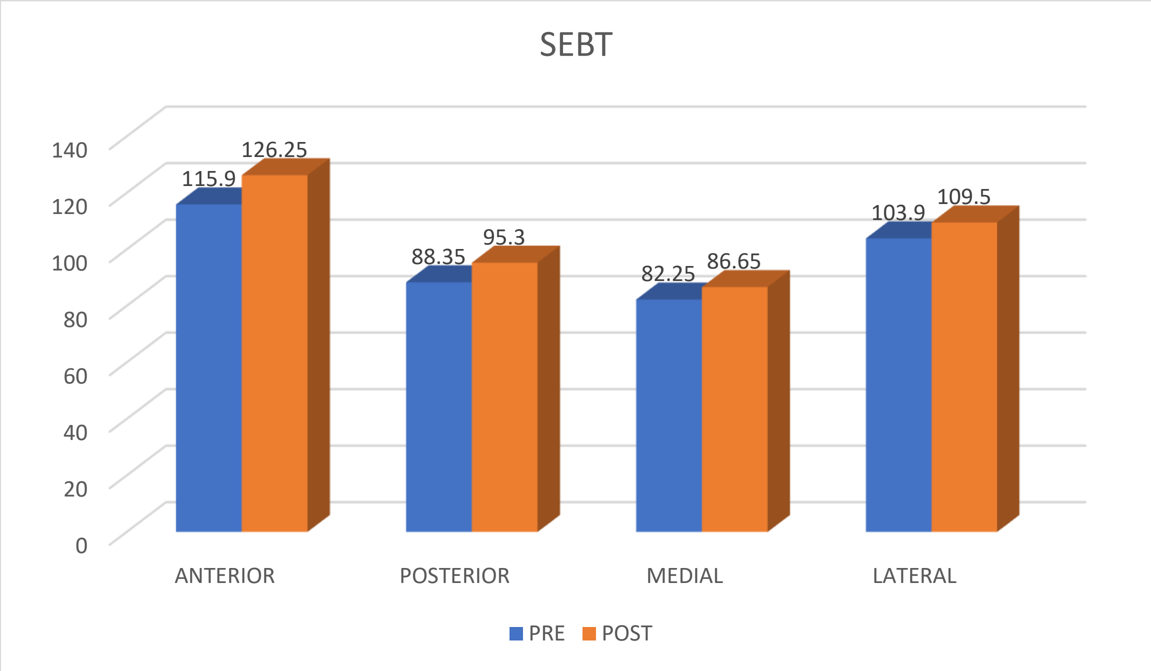
Table 5: LEFT leg balance

OUTCOME MEASURE	MEAN VALUE		STANDARD DEVIATION		T-VALUE	P-VALUE
	PRE	POST	PRE	POST		
ANTERIOR	113.15	114.25	14.55	13.97	3.3166	0.0036
POSTERIOR	89.30	90.10	14.05	14.57	2.5569	0.0193
MEDIAL	82.25	83.35	8.08	8.03	2.9234	0.0087
LATERAL	113.45	114.95	18.72	18.93	2.3759	0.028

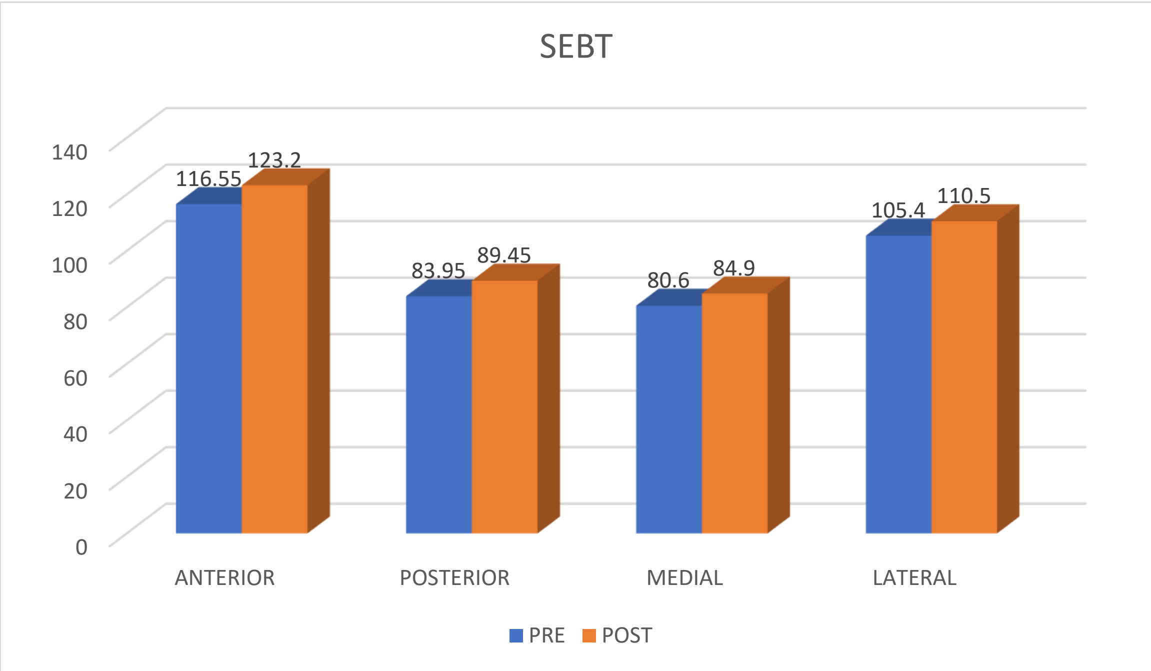
TABLE 6: **HALF SQUAT TEST of GROUP B**

MEAN (DURATION IN SECS)		STANDARD DEVIATION		t-value	p-value
PRE	POST	PRE	POST		
87.70	90.85	13.34	13.28	3.9925	0.0008

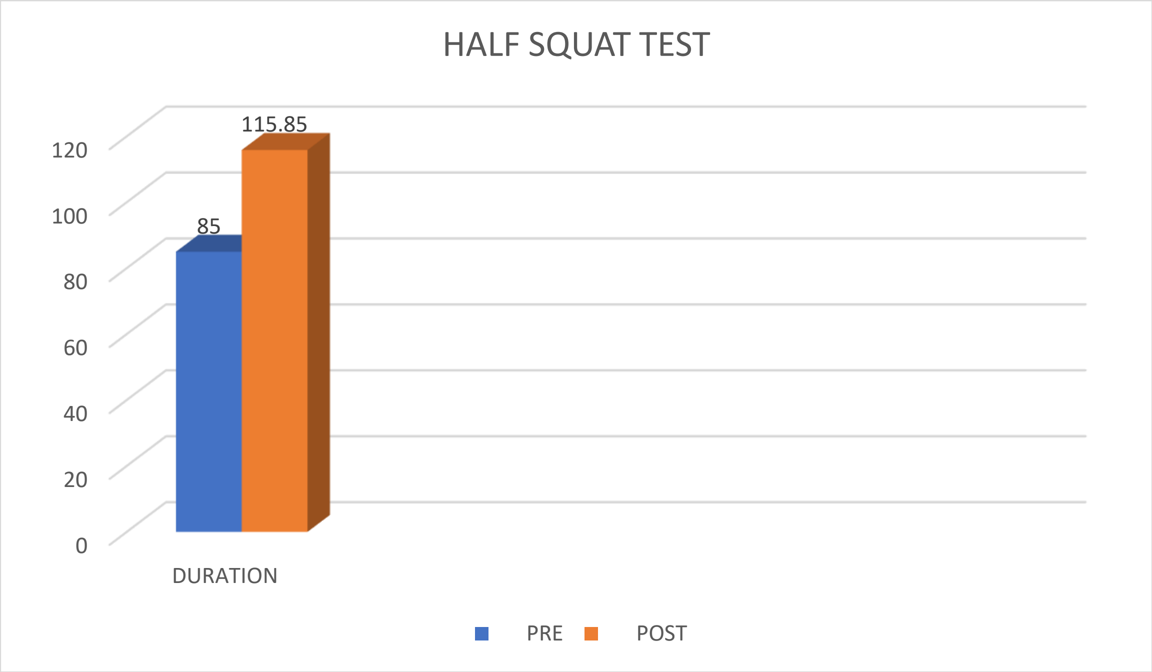
GRAPH 1 RIGHT leg balance GROUP A (EXPERIMENTAL GROUP)



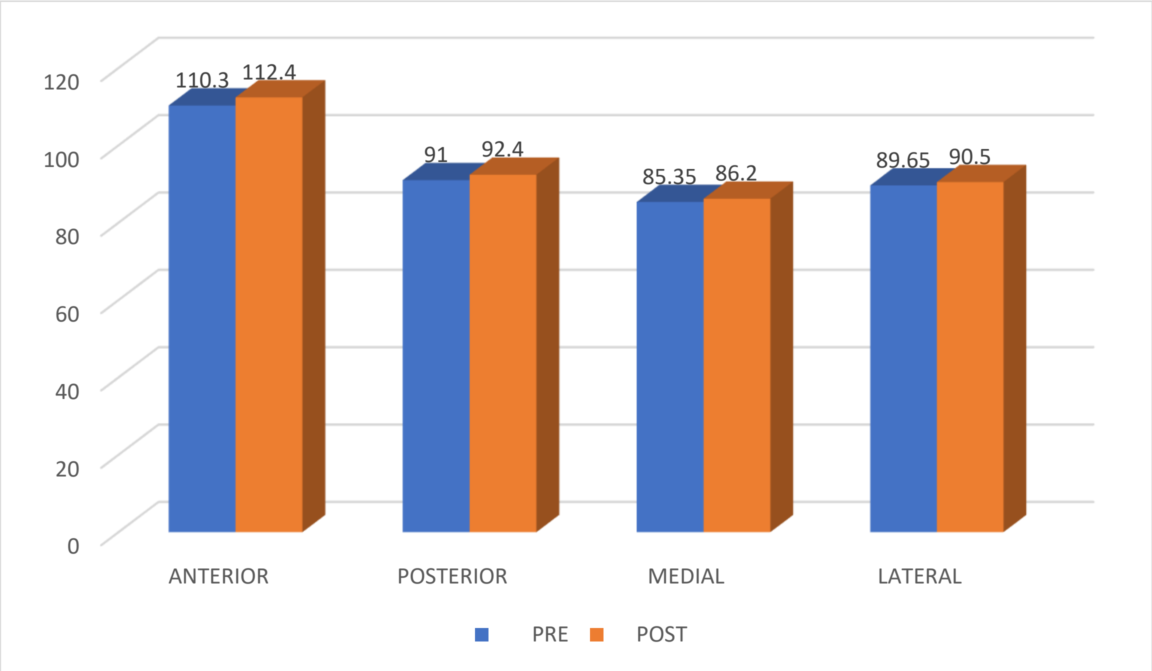
GRAPH 2 LEFT leg balance GROUP A (EXPERIMENTAL GROUP)



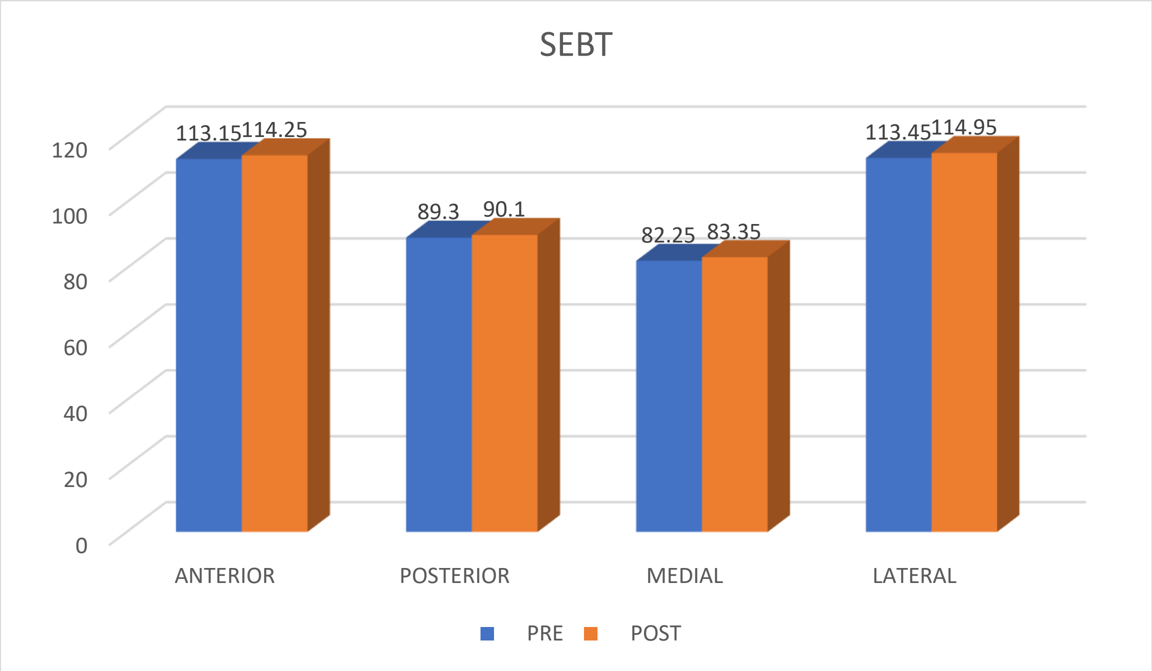
GRAPH 3 : HALF SQUAT TEST GROUP A (EXPERIMENTAL GROUP)



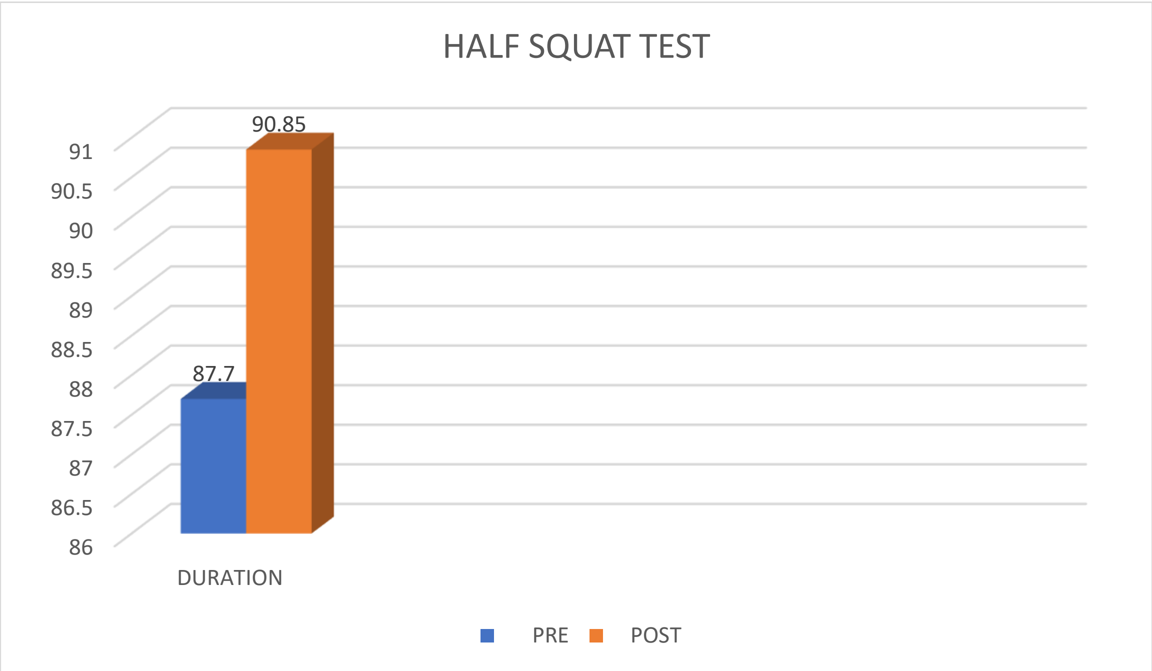
GRAPH 4 RIGHT leg balance GROUP B (CONTROL GROUP)



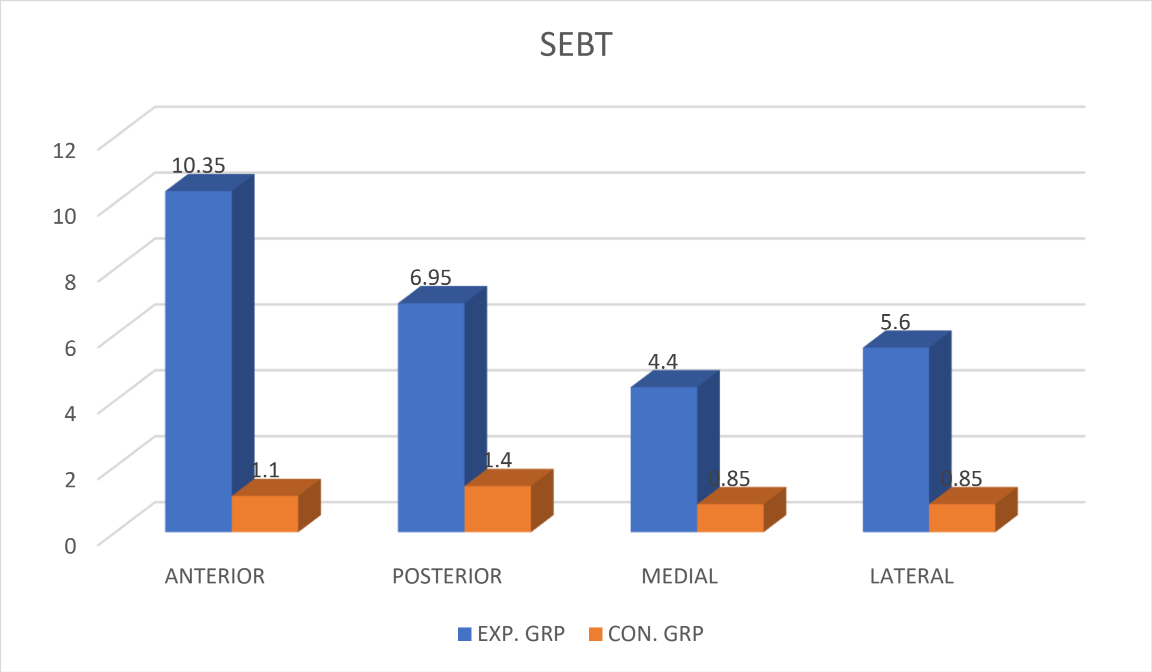
GRAPH 5 LEFT leg balance GROUP B (CONTROL GROUP)



GRAPH 6: HALF SQUAT TEST GROUP B (CONTROL GROUP)

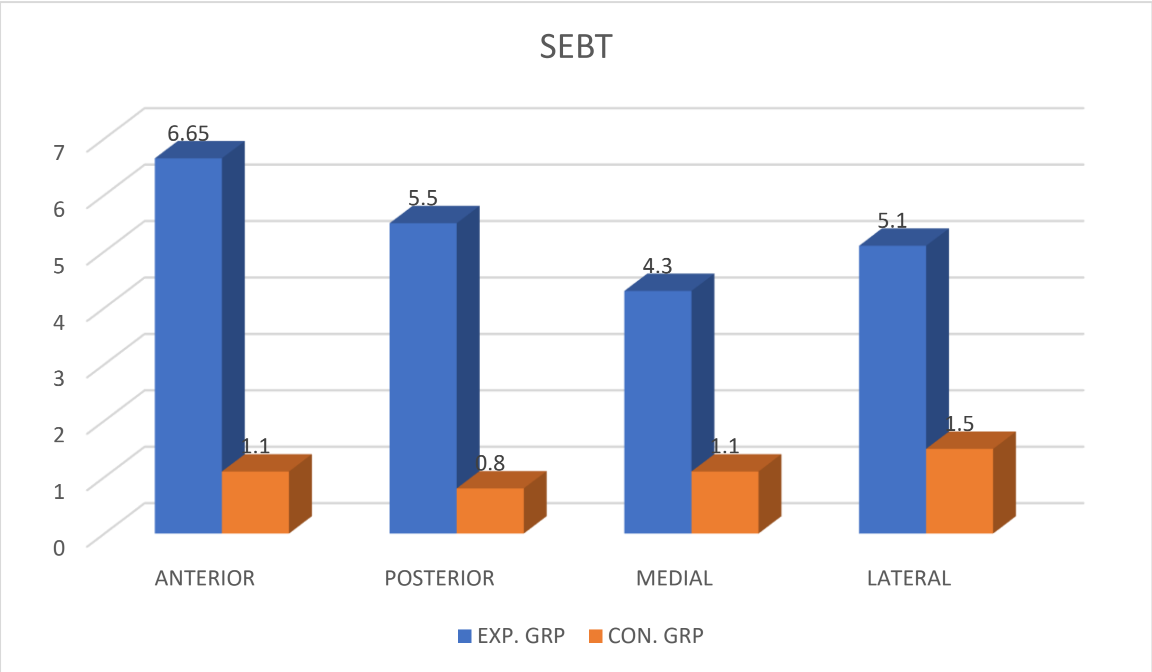


GRAPH 7 OMPARISON OF MEAN DIFFERENCE OF RIGHT LEG BALANCE



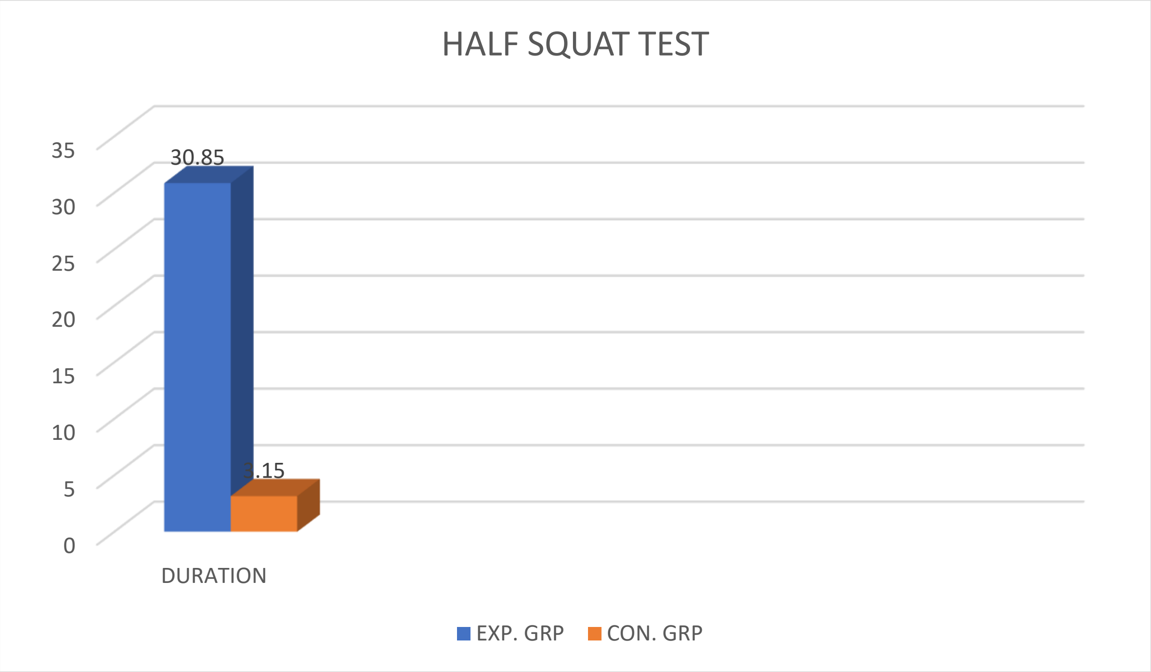
GRAPH 8

COMPARISON OF MEAN DIFFERENCE OF LEFT LEG BALANCE



GRAPH 9

COMPARISON OF MEAN DIFFERENCE OF HALF SQUAT TEST



RESULT:

Since the p-value of test statistics is less than 0.05, we reject the null hypothesis at 5% level of significance. In GROUP A(experimental group), when the means are compared, the dynamic balance was increased by 10.35 cm in anterior direction, 6.95 cm in posterior direction, 4.4 cm in medial direction, 5.6 cm in lateral direction for right leg and increased by 6.65 cm in anterior direction,5.5 cm in posterior direction,4.3 cm in medial direction,5.1 cm in lateral direction for left leg.

Endurance was increased by 30.85 seconds from pre test to post test.

In GROUP B(control group), when the means are compared, the dynamic balance was increased by 1.1 cm in anterior direction, 1.4 cm in posterior direction,0.85cm in medial direction,0.85 cm in lateral direction for right leg and increased by 1.1cm in anterior direction,0.8 cm in posterior direction,1.1 cm in medial direction,1.5 cm in lateral direction for left leg.

Endurance was increased by 3.15 seconds from pre test to post test.

On comparing group A and group B, significant improvement was seen in GROUP A in terms of dynamic balance especially in anterior direction and endurance.

DISCUSSION:

The purpose of this study was to determine the effects of strength exercise on dynamic balance and endurance among male cricketers. The findings in this study were that strength exercise was able to produce a significant increase in dynamic balance and endurance among male cricketers in experimental group than in control group.

Exercise regimen containing repetitive movements increase the ability of the person's control over joint movement in all directions[20].

In SEBT, increase in dynamic balance is due to activation of muscle spindles during strength training.

Muscle spindles are skeletal muscle sensory receptors within the body of a muscle that primarily detect changes in the length of this muscle contributing to a fine motor control and providing axial and limb position information to the central nervous system.(Muscle spindle are proprioceptors that consist of several modified muscle fibres enclosed in a sheath of connective tissue.)

There are 2 types of sensory endings found in muscle spindles: the primary and secondary endings of spindles, which are located in the middle of the spindle. The primary endings respond to its speed and the size of a muscle length change. They contribute both to movement and the sense of limb position. (proprioception). Secondary endings are only sensitive to length and not to velocity, so they contribute only to sense of positions. [22,23]

These mechanoreceptors act together to give sensory awareness of joint position, movement, acceleration and strain via afferent pathways to the CNS. The reason for this could be that the exercise increased coordination between muscle groups and the response to sensorial information [20].

So, this leads to improvement in dynamic balance.

In a similar study, V mohammadi stated that a possible reason for increase of balance in the experimental group could be increasing of muscle’s strength in lower extremity after exercise program, facilitating in fast twitch motor units, increase of muscle’s coordination, the process of decreasing dis inhibition and stimulating of muscles spindles during strength training. In these conditions , muscles contraction stimulated activity of gamma efferent in muscle spindles. Sensitivity enhancement of muscle spindles may improve joint position sense that has an important role in postural control.

In half squat test, endurance is increased due to the fact that type II A (fast oxidative glycolytic) muscle fibres are produced more than type II X (fast glycolytic) muscle fibres during strength exercise.

Type II A muscle fibres are fast twitch i.e they fire more quickly. They are also more powerful than type I fibres and are recruited for activities that require more intensity like sprinting. These fibres provide major strength. Type II A fibres are more responsive to training when compare to slow twitch fibres. The peak power of type II A fibres is also greater.

Type II fibres produce slightly more force per fibres than type I fibres and are able to contract at a significantly higher velocity, thus producing a higher power output than type I fibres.

Type II X muscle fibre is a second type of fast twitch muscle fibre. These are even faster and more powerful than type II A , but fatiguing very quickly. Type II X fibres are used for activities of very short duration that require significant power and strength.

In a similar study P aagaard (stated that reason behind improvement of endurance capacity in the study is due to the increased proportion of type IIA muscle fibres following the period the strength training. Type IIA fibres are less fatigue yet highly capable of producing contractile power compared with the type IIX muscle fibres.

B r ronnestad suggested that the improved endurance performance may relate to delayed activation of less efficient type II fibres, improved neuromuscular efficiency, conversion of fast twitch type IIX fibres into more fatigue resistant type IIA fibres, or improved musculotendinous stiffness.

LIMITATION

1. The study included only a small size of participants.
2. This study sample was based on overall bowlers.
3. Only male population has been taken
4. Only sports population was selected.

RECOMMANDATION

1. Further study, can be conducted to large number of samples.
2. The study can be done with specific type of bowlers like fast bowlers, pace bowlers.
3. The study can be extended to female population.

4. The study can be done with state, national level players.

CONCLUSION:

Both the group shows statistically improvement in terms of dynamic balance and endurance.

When comparing both the groups, experimental group shows significant improvement in dynamic balance and endurance than the control group.

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