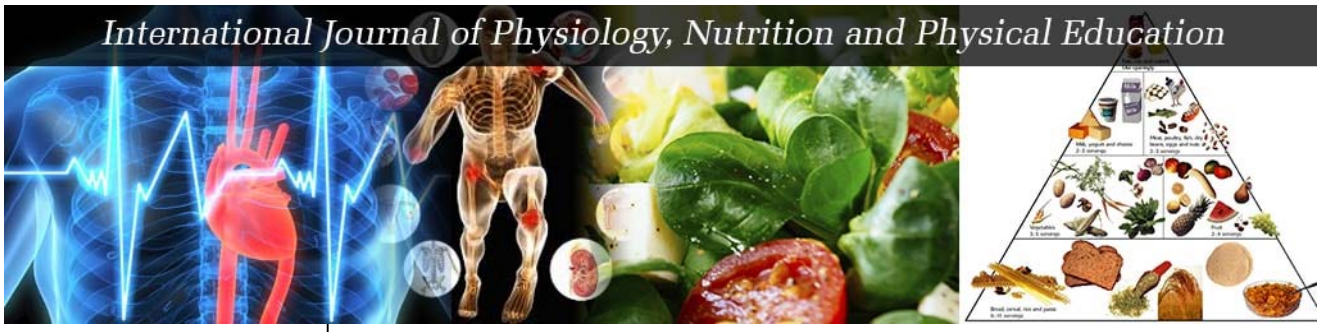

ISSN: 2456-0057
IJPNPE 2017; 2(2): 373-379

www.journalofsports.com
Received: 06-05-2017
Accepted: 08-06-2017

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Effect of selected exercises on cardio-respiratory function and skills in handball players

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Abstract
The motivation behind this review was to discover the impact of chose activities on cardio respiratory capacity and aptitudes in world class Handball players. Sixty (60) male understudies, matured between 18 to 25 years, who know about Handball game, were chosen arbitrarily for this review. Add up to 60 subjects were isolated into two gatherings: bunch A - Experimental and gathering B – Control separately. Subjects of Experimental gathering (i.e., Group An) experienced a two months unique preparing project of activities for 45 minutes day by day. Six (06) subordinate variables i.e. cardio-vascular perseverance, circulatory strain, beat rate, top stream rate, spilling capacity and shooting capacity and one (01) autonomous factors i.e. practice preparing system was chosen for this study. Factorial ANOVA taken after by Scheffe's Post Hoc test have been applied. The recently planned exercise preparing plan enhances every single physiological variable towards change in cardio-respiratory wellness as required for the Handball players and enhance spilling and shooting aptitudes of tip top Handball players.

Keywords: cardio-vascular endurance, blood pressure, pulse rate and peak flow rate.

1. Introduction
Handball is a standout amongst the most appreciated games in the world. The diversion requires particular preparing and quality molding for achievement. This diversion is played between two groups and the reason for existing is to put the Handball in rival's wicker bin and on the other hand to keep the adversary from scoring. The Handball players require most extreme physical capacities to make fast and intense developments. Physiology manages the capacities and exercises of life or of living matter (as organs, tissues, or cells) and of the physical and substance marvels included. Cardio-respiratory capacity manages the utilitarian capacity of lungs that impact the exercises of heart. There are different segments required in the cardio-respiratory capacity viz., circulatory strain, respiratory rate, essential limit, aspiratory expiratory stream rate and heartbeat rate. Physical exercise is a sort of effort accomplished for preparing or change in execution, regardless of whether physical, scholarly, or moral. It is a practice to obtain expertise, learning, ideals, immaculateness, elegance, and so forth. Practice gives substantial and mental effort to the purpose of keeping the organs and capacities in a sound state with appropriate cleanliness.

Methodology
Selection of Subjects
Total sixty (60) male students, aged between 18 to 25 years were randomly selected for this study.

Selection of Variables: The following variables selected for this study:
1. Dependent Variables:
- Cardio-vascular endurance,
- Blood-pressure,
- Pulse rate,
- Peak flow rate,
- Dribbling ability
- Shooting ability

2. Independent Variable: Exercise training programme

Criterion Measures:

- Cardio-vascular endurance was measured by Harward step test.
- Blood-pressure was measured by Sphygmomanometer.
- Pulse rate was measured by beat per minute.
- Peak flow rate was measured by peak flow meter.
- Dribbling ability was measured by Johnson Handball test.
- Shooting ability was measured by Johnson Handball test.
- Exercise training programme was included 45 minutes game of Handball.

Research Design: Parallel group design i.e., true experimental design or randomized group design (Rothstein, 1985) considering an experimental group and a control group.

Statistical Technique: Descriptive statistics have been applied to process the data prior to employing inferential statistics. Since there are 7 variables, along with two testing programmes (i.e. pre-test and post-test) conducted for two different groups, the inferential statistics i.e. 2 x 2 x 7 Factorial ANOVA followed by Scheffe's Post Hoc test have been applied.

Results of The Study

Table 1: Central tendency and dispersion of the data on physiological variables and handball skills performance

Variables (A)	Group			
	Exercise Group (B)		Control Group (C)	
	Pre-test	Post-test	Pre-test	Post-test
Cardiovascular Endurance (A1)(Index.)	69.65 (6.81)	76.35 (4.53)	67.75 (9.20)	68.90 (10.11)
Systolic Blood Pressure (A2) (mmHg.)	105.35 (6.15)	108.01 (8.58)	102.47 (7.16)	110.59 (8.25)
Diastolic Blood Pressure (A3) (mmHg.)	78.14 (6.20)	80.40 (7.90)	79.53 (7.25)	82.41 (6.89)
Pulse Rate (A4)(Beats/min.)	85.42 (8.41)	86.43 (7.40)	87.28 (8.54)	86.24 (8.42)
PEFR (A5)(Lit/Min.)	369.33 (67.36)	398.67 (68.27)	368.33 (70.03)	375.33 (45.08)
Handball Dribbling (A6)(Pts.)	13.77 (1.04)	15.03 (0.56)	13.57 (1.65)	14.97 (0.89)
Handball Shooting (A7)(Pts.)	3.87 (1.20)	4.77 (0.57)	3.00 (1.17)	3.43 (1.30)

Table No.01 Cardiovascular Endurance (Assessed by Harvard step test) (A1), indicates that the pre-test performance scores (Index) of the Exercise group and Control group were 69.65 (SD=6.81) and 67.75 (SD=9.20) respectively. This result indicates that the pre-test means of both the Exercise group and the Control group in Cardiovascular Endurance test were more or less similar. However, post-test performance scores (Index) of the Exercise group and Control groups were 76.35 (SD=4.53) and 68.90 (SD=10.11) respectively. This result indicates that the post-test means of both the Exercise and the Control in Cardiovascular Endurance test were different.

Table No.01 Systolic Blood Pressure (Assessed by Sphygmomanometer) (A2), indicates that the pre-test performance scores (mmHg.) of the Exercise group and Control group were 105.35 (SD=6.15) and 102.47 (SD=7.16) respectively. This result indicates that the pre-test means of both the Exercise group and the Control group in Systolic Blood Pressure test were more or less similar. However, post-test performance scores (mmHg.) of the Exercise group and Control groups were 108.01 (SD=8.58) and 110.59 (SD=8.25) respectively. This result revealed that although the real difference could not be evident here, however, the post-test performance score (mmHg.) of control group was higher than the Exercise group in Systolic Blood Pressure test.

Table No.01 Diastolic Blood Pressure (Assessed by Sphygmomanometer) (A3), indicates that the pre-test performance scores (mmHg.) of the Exercise group and Control group were 78.14 (SD=6.20) and 79.53 (SD=7.25) respectively. This result indicates that the pre-test means of both the Exercise and the Control group in Diastolic Blood Pressure test were more or less similar. However, post-test performance scores (mmHg.) of the Exercise group and Control groups were 80.40 (SD=7.90) and 82.41 (SD=6.89) respectively. This result revealed that although the real difference could not be evident here, however, the post-test performance score (mmHg.) of control group was higher than the experimental group in Diastolic blood pressure test.

Table No.01 Pulse Rate (Beats per minute) (A4), indicates that the pre-test status of the Exercise group and Control group were 85.42 (SD=8.41) and 87.28 (SD=8.54) respectively. This result indicates that the pre-test means of both the Exercise and the Control group in Pulse Rate test were more or less similar. However, post-test status of the Exercise group and Control groups were 86.43 (SD=7.40) and 86.24 (SD=8.42) respectively. This result indicates that there was no real difference in performance of pulse rate in both experimental and control group.

Table No.01 Peak Expiratory Flow Rate (Assessed by Peak flow meter) (A5), indicates that the pre-test performance scores (Lit/min) of the Exercise group and Control group were 369.33 (SD=67.36) and 368.33 (SD=70.03) respectively. This result indicates that the pre-test means of both the Exercise and the Control group in Peak Expiratory Flow Rate test were more or less similar.However, post-test performance scores (Lit/min) of the Exercise group and Control groups were 398.67 (SD=68.27) and 375.33 (SD=45.08) respectively. This result indicates that the post-test means of both the Exercise and the Control group in Peak Expiratory Flow Rate test were different.

Table No.01 Handball Dribbling Test (A6), indicates that the pre-test performance scores (Pts.) of the Exercise group and Control group were 13.77 (SD=1.04) and 13.57 (SD=1.65) respectively. This result indicates that the pre-test means of both the Exercise and the Control group in Handball Dribbling test were more or less similar.However, post-test performance scores (Pts.) of the Exercise group and Control groups were 15.03 (SD=0.56) and 14.97 (SD=0.89) respectively. This result indicates that the post-test means of both the Exercise and the Control group in Handball Dribbling test were different.

Table No.01 Handball Shooting Test (A7), indicates that the pre-test performance scores (Pts.) of the Exercise group and Control group were 3.87 (SD=1.20) and 3.00 (SD=1.17) respectively. This result indicates that the pre-test means of both the Exercise and the Control group in Handball Shooting test were more or less similar.However, post-test performance scores (Pts.) of the Exercise group and Control groups were 4.77 (SD=0.57) and 3.43 (SD=1.30) respectively. This result indicates that the post-test means of both the Exercise and the Control group in Handball shooting test were different.

Thus, the information as obtained from the measures of central tendency and dispersion, as presented in Table No.01, revealed that the training intervention i.e. "Exercise" may have the treatment effect in improving the physiological variables and Handball skill performance of male Handball players. However, from the above, it is not clearly evident statistically that the treatment stimuli helped to influence the selected variables of male Handball players and therefore, inferential statistics (Factorial ANOVA) have been employed followed by Scheffe's post hoc test.

Table 2: Anova for mean achievement in dependent variables of selected malehandball players

Source of Variation	SS	df	MS	F
Total	11280.03	139	-	-
Dependent Variables (A)	1982.73	6	330.45	22.48**
Subject's Group (B)	262.39	1	262.39	17.85**
Interaction (AB)	7961.81	59	134.94	9.18*
ERROR	1073.10	73	14.70	
** p < 0.01		* p < 0.05		

(2 x 2 x 7 Factorial ANOVA) as presented in Table No.02 revealed that the achievement scores in the selected dependent variables of the Exercise and Control group were significantly different (F=22.48, p<0.01). The impact of such statistical difference has been evidenced in the case of their group comparison (F=17.85, p<0.01). This indicates, the interaction was also statistically significant (F=9.18, p<0.05). However, employing Scheffe's Post Hoc techniques, the specific variables were identified, which showed significant changes as a result of Exercise interventions. The item-wise or event-wise analysis has been presented below.

Table 3: Ordered Treatment Means Of Cardiovascular Endurance (Control Group Vs. Exercise Group)

	Order			
	1	2	3	4
Means	70.35	78.28	70.18	72.87

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Gr.

In Cardiovascular Endurance test (Index), the Ordered Means of Exercise Group (Pre:1& post: 2) and Control Group (Pre:3 & post:4) presented in Table No.03 were 70.35, 78.28, 70.18 and 72.87 respectively (Where, 1 = Pre-test of Exercise Group, 2 = Post-test of Exercise group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

Table 4: Scheffe's post hoc test for difference betweenpairs of ordered means in cardiovascular endurance (Control group vs exercise group)

(STEPS)	3	2	1
4	0.15	0.41**	0.17
3	-	0.40**	0.13
2	-	-	0.47**
1	-	-	-

*p<0.05, **p<0.01

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

The statistical significance of Scheffe's Post Hoc test presented in Table No.04 revealed that-

1. Control group did not show significant improvement in Cardiovascular endurance or Harvard step test (CD=0.15, p>0.05).
2. Exercise group showed significant improvement (CD=0.47, p<0.01) in Cardiovascular Endurance test.
3. Exercise Group showed significant superiority over the Control group in improving Cardiovascular Endurance (CD=0.41, p<0.01) (Figure No.01).

This result helps to interpret that the selected Exercise training is found useful to increase strength and endurance of cardiac muscles of the male Handball players. Thus, Exercise training has significant effects for improving cardiovascular endurance.

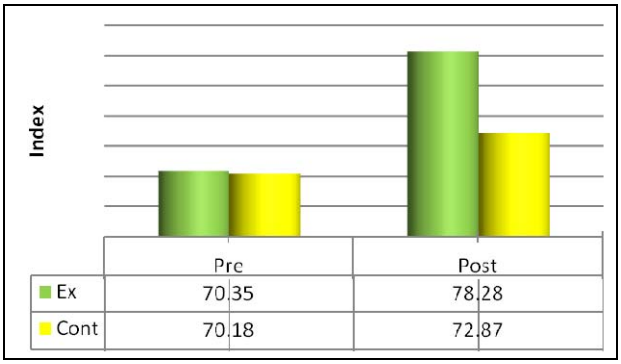

Fig 1: Exercise Schedule for Cardiovascular Endurance of Handball Players

Table 5: Ordered treatment means of systolic blood pressure (Control group vs. exercise group)

	Order			
	1	2	3	4
Means	107.40	109.57	105.79	110.06

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Gr.

In Systolic blood pressure (mmHg.), the Ordered Means of Exercise Group (Pre:1 & post: 2) and Control Group (Pre:3 & post:4) presented in Table No.05 were 107.40, 109.57, 105.79 and 110.06 respectively (Where, 1 = Pre-test of Exercise Group, 2 = Post-test of Exercise group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

Table 6: Scheffe's post hoc test for difference betweenpairs of ordered means in systolic blood pressure (Control group vs exercise group)

(STEPS)	3	2	1
4	0.13	0.11	0.07
3	-	0.10	0.12
2	-	-	0.16
1		-	-
*p<0.05, **p<0.01			

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

The statistical significance of Scheffe's Post Hoc test presented in Table 4.8 revealed that-

1. Control group did not show significant change in Systolic blood pressure test (CD=0.13, $p>0.05$).
2. Exercise group could not show significant change (CD=0.16, $p>0.05$) in Systolic blood pressure test.
3. Further, the Exercise Group did not show significant superiority over the Control group in changing systolic blood pressure (CD=0.11, $p>0.05$) (Figure No.02).

This result helps to interpret that the selected Exercises could not change Systolic Blood Pressure. It seems the selected students were elite players in Handball and therefore this variable might have remained unaltered.

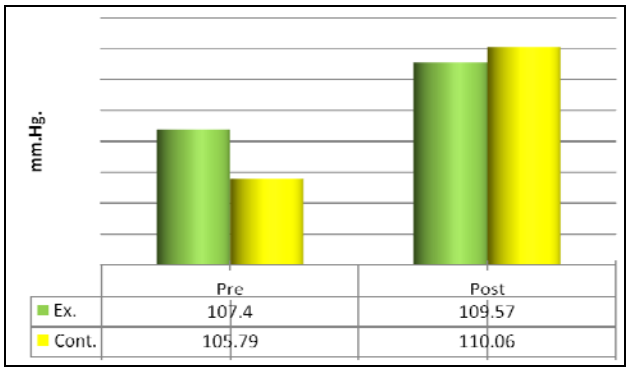

Fig 2: Exercise Schedule for Controlling Systolic Blood Pressure of Handball Players

Table 7: Ordered Treatment Means Of Diastolic Blood Pressure (Control Group Vs. Exercise Group)

	Order			
	1	2	3	4
Means	78.59	79.88	78.30	80.08

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Gr.

In Diastolic blood pressure test (mmHg.), the Ordered Means of Exercise Group (Pre:1& post: 2) and Control Group (Pre:3& post:4) presented in Table No.07 were 78.59, 79.88, 78.30 and 80.08 respectively (Where, 1 = Pre-test of Exercise Group, 2 = Post-test of Exercise group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

Table 8: Scheffe's post hoc test for difference betweenpairs of ordered means in diastolic blood pressure (Control group vs exercise group)

(STEPS)	3	2	1
4	0.16	0.07	0.09
3	-	0.06	0.11
2	-	-	0.12
1		-	-

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

The statistical significance of Scheffe's Post Hoc test presented in Table 4.10 revealed that-

1. Control group did not show significant change in Diastolic blood pressure (CD=0.16, $p>0.05$).
2. Exercise group could not show significant change (CD=0.12, $p>0.05$) in Diastolic blood pressure.
3. Further, Exercise Group could not show significant superiority over the Control group in altering Diastolic blood pressure (CD=0.06, $p>0.05$) (Figure No.03).

This result helps to interpret that the selected Exercises did not have any influence to change Diastolic Blood Pressure test.

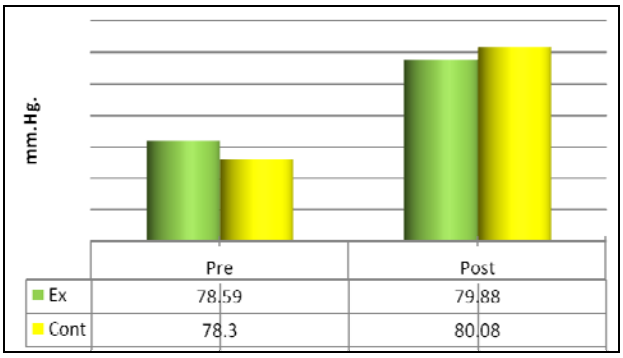

Fig 3: Exercise Schedule for Controlling Diastolic Blood Pressure of Handball Players

Table 9: Ordered Treatment Means Of Pulse Rate (Control Group Vs. Exercise Group)

	ORDER			
	1	2	3	4
Means	86.20	77.45	86.45	85.28

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Gr.

In Pulse Rate (Beats/Min.), the Ordered Means of Exercise Group (Pre:1 & post: 2) and Control Group (Pre:3& post:4) presented in Table No.09 were 86.20, 77.45, 86.45 and 85.28 respectively (Where, 1 = Pre-test of Exercise Group, 2 = Post-test of Exercise group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

Table 10: Scheffe's post hoc test for difference between pairs ofordered means in pulse rate (Control group vs exercise group)

(STEPS)	3	2	1
4	0.10	0.24*	0.13
3	-	0.21*	0.09
2	-	-	0.31*
1		-	-

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

The statistical significance of Scheffe's Post Hoc test presented in Table No.10 revealed that-

1. Control group did not show significant reduction in Pulse Rate (CD=0.10, $p>0.05$).
2. Exercise group could show significant reduction in Pulse Rate (CD=0.31, $p<0.05$).
3. Further, Exercise Group could show significant reduction over the Control group in Pulse rate (CD=0.24, $p<0.05$) (Figure No.04).

This result helps to interpret that the selected exercises have significant effect on reduction in pulse rate among male Handball players.

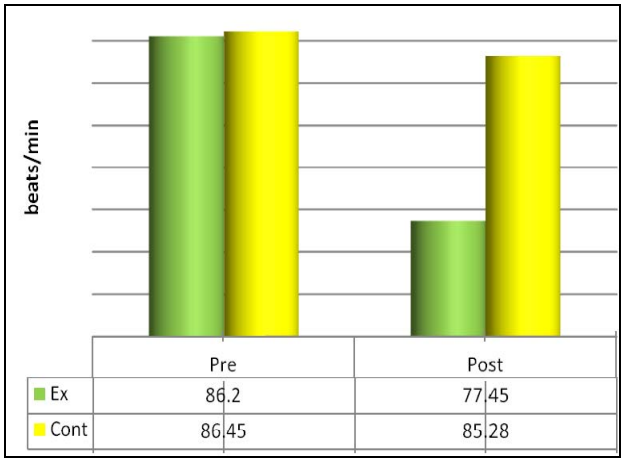

Fig 4: Exercise Schedule for Reduction in Pulse Rate of Handball Players

Table 11: Ordered treatment means of peak expiratory flow rate (Control group vs. exercise group)

	Order			
	1	2	3	4
Means	358.47	399.35	359.23	374.66

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

In Peak Expiratory Flow Rate (Lit/Min.), the Ordered Means of Exercise Group (Pre:1 & post: 2) and Control Group (Pre:3 &post:4) presented in Table No.11 were 358.47, 399.35, 359.23 and 374.66 respectively (Where, 1 = Pre-test of Exercise Group, 2 = Post-test of Exercise group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

Table 12: Scheffe's post hoc test for difference between pairs ofordered means in peak expiratory flow rate (Control group vs exercise group)

(STEPS)	3	2	1
4	0.16	0.27*	0.13
3	-	0.24*	0.12
2	-	-	0.36*
1		-	-

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

The statistical significance of Scheffe's Post Hoc test presented in Table 4.14 revealed that-

1. Control group did not show significant improvement in Peak expiratory flow Rate (CD=0.16, $p>0.05$).
2. Exercise group showed significant improvement in Peak expiratory flow Rate (CD=0.36, $p<0.05$).
3. Exercise Group showed significant superiority over the Control group in improving Peak expiratory flow rate (CD=0.27, $p<0.05$) (Figure No.05).

This result helps to interpret that the selected exercises are helpful to improve lungs capacity of male Handball players.

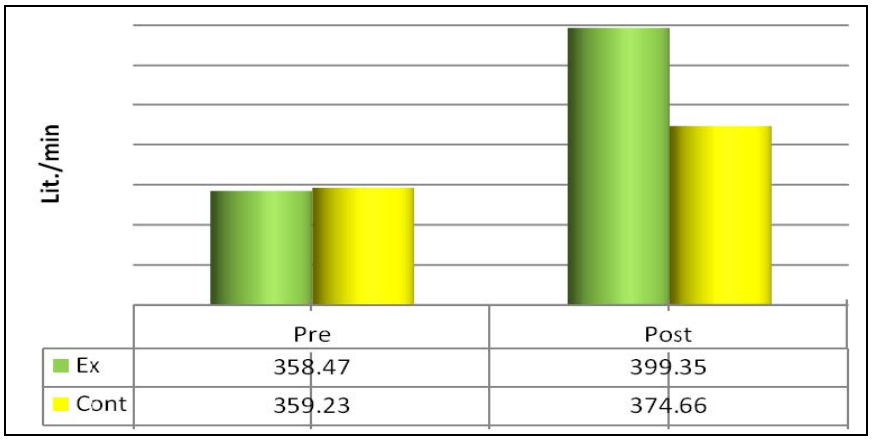

Fig 5: Exercise Schedule for Reduction in Peak Expiratory Flow Rate of Handball Players

Table 13: Ordered treatment means of handball dribbling (Control group vs. exercise group)

	Order			
	1	2	3	4
Means	11.25	15.82	11.37	12.36

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

In Handball dribbling event (Points), the Ordered Means of Exercise Group (Pre:1 & post: 2) and Control Group (Pre:3& post:4) presented in Table No.13 were 11.25, 15.82, 11.37 and 12.36 respectively (Where, 1 = Pre-test of Exercise Group, 2 = Post-test of Exercise group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

Table 14: Scheffe's post hoc test for difference between pairs ofordered means in handball dribbling (Control group vs exercise group)

(STEPS)	3	2	1
4	0.13	0.30*	0.15
3	-	0.24*	0.12
2	-	-	0.37*
1		-	-

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

The statistical significance of Scheffe's Post Hoc test presented in Table 4.16 revealed that-

1. Control group did not show significant improvement in Handball dribbling ability (CD=0.13, $p>0.05$).
2. Exercise group showed significant improvement

(CD=0.37, $p<0.05$) in Handball dribbling ability.
3. Exercise Group showed significant superiority over the Control group in improving Handball dribbling (CD=0.30, $p<0.05$) (Figure No.06).

This result helps to interpret that the selected exercises are suitable to Handball practice for improving Handball dribbling ability. The results might have appeared positive as the selected exercises training were perhaps supportive for improving other fitness ability required for this game.

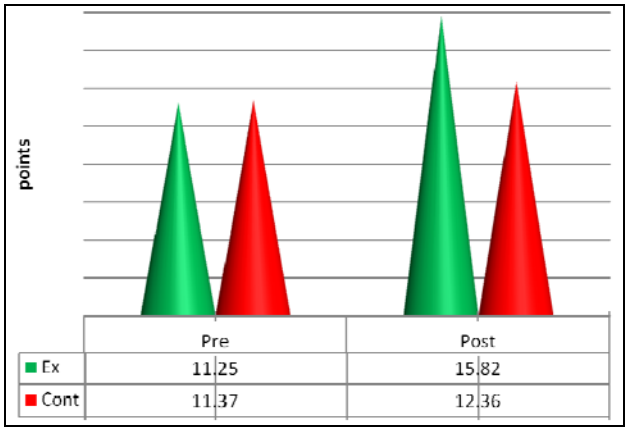

Fig 6: Exercise Schedule for Improvement in Dribble Skill Ability of Handball Players

Table 15: Ordered treatment means of handball shooting (control group vs. exercise group)

	Order			
	1	2	3	4
Means	3.08	5.15	3.05	3.39

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

In Handball shooting event (Points), the Ordered Means of Exercise Group (Pre:1 & post: 2) and Control Group (Pre:3 & post:4) presented in Table No.15 were 3.08, 5.15, 3.05 and 3.39 respectively (Where, 1 = Pre-test of Exercise Group, 2 = Post-test of Exercise group, 3 = Pre-test of Control group, and 4 = Post-test of Control group).

Table 14: Scheffe's Post Hoc Test For Difference Between Pairs Ofordered Means In Handball Dribbling (Control Group Vs Exercise Group)

(STEPS)	3	2	1
4	0.17	0.28*	0.15
3	-	0.25*	0.11
2	-	-	0.39*
1		-	-

Where, 1 = Pre-test Score of Exercise Group, 2 = Post-test Score of Exercise Group, 3 = Pre-test Score of Control Group and 4 = Post-test Score of Control Group.

The statistical significance of Scheffe's Post Hoc test presented in Table No.14 revealed that-

1. Control group did not show significant improvement in Handball shooting ability (CD=0.17, $p>0.05$).
2. Exercise group showed significant improvement (CD=0.39, $p<0.05$) in Handball shooting ability.
3. Exercise Group showed significant superiority over the Control group in improving Handball shooting (CD=0.28, $p<0.05$) (Figure No.07).

This result helps to interpret that the selected exercises are helpful to improve Handball shooting ability.

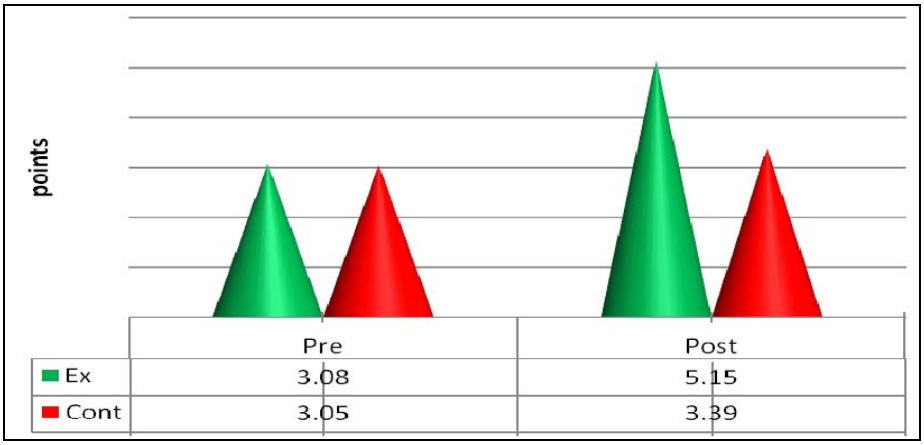

Fig 7: Exercise Schedule for Improvement in Shooting Skill of Handball Players

Discussion of Findings

to the point that they may enhance cardio-respiratory limit of the Handball players. The consequence of the present review additionally bolsters that the particularly planned exercise calendar was useful to enhance cardiovascular perseverance of the players.

This outcome shows that the presence of such outcome is by all accounts consistent on the grounds that the examples chosen in this review are the tip top players in Handball and maybe they are exceedingly prepared in the amusement so that their circulatory strain is as of now controlled.

In this review, the decrease in heartbeat rate was incredibly critical among the chosen Handball players. The presence of such outcome might be because of the way that the recently composed exercise plan comprised of solid exercise components that may have prepared further the heart muscles so that the stroke volume and additionally cardiovascular yield may have expanded, which maybe reasons for lessening in heartbeat rate.

The consequence of the present review is discovered positive and the recently outlined exercise preparing enhanced spilling capacity. Appearance of such outcome on enhanced spilling might be because of the enhanced physiological capacities and normal diversion rehearse. With respect to capacity, the

consequence of recently composed exercise preparing was incredibly valued.

Truth be told, change in shooting capacity in Handball is a higher accomplishment, in light of the fact that such change turns out to be an integral variable to win an opposition. The enhanced shooting capacity might be conceivable if a preparation intercession enhances strong extending and in addition unwinding. In this review, the recently planned preparing intercession may have brought psycho-physiological homeostasis and ascribed focus which maybe enhanced shooting capacity in Handball. Subsequently, the invalid theory HO2: "The chose practice preparing would not be helpful to upgrade the aptitudes in Handball players" has not maintained.

The general outcomes demonstrate that the recently outlined exercise preparing plan enhances physiological capacities and aptitude execution of tip top male Handball players.

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