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The effects of plyometric and circuit training of male handball players

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Abstract
The purpose of the study was to investigate the effects of PLYOMETRIC and CIRCUIT training of male handball players. To achieve the purpose of this study 30 handball players (boys) were selected as subjects with their ages ranging from 16 to 22 years. All the selected subjects were selected randomly and divided into two groups namely Group I Plyometric training group and, Group II Circuit training group. Each group consisted of 15 handball players. The following variables such as physical, were selected for this study and Physical variables are Speed, Strength, Endurance, Flexibility, Agility, Power. Before finalizing the training programme a pilot study was conducted to ensure that the intensity and duration of the programme were within the limits of the subjects' capacity to produce their desired effect. For this purpose, ten subjects were put into separate training to know the difficulties in the administration of varied trainings. This is the crucial portion of the thesis in arriving at the conclusion by examining the hypothesis. The procedure of testing the hypothesis accordance with the results obtained in relation to the level of confidence which was fixed at 0.05 level was considered necessary for this study. And if they obtained 't' test is lower than the table value of 't 'test at 0.05 level, then the hypothesis is rejected to the effect that the difference existing between the means of the groups under study.

Keywords: plyometric training, circuit training, speed, strength, endurance, flexibility, agility, power

1. Introduction
Handball is a modern ball game which belongs to the family of team Sports. It combines the best features of different branches of sport, that is, the Advantages of physical abilities, technical skills and tactical knowledge. The technical abilities have been improved, Tactical systems refined, and laws of the game adapted to a more modern concept. Since 1952 indoor handball has been gaining more and more ground. Indeed, handball became a universal sport and its popularity has increased quite obviously. The game is characterised by two alternating sides the attack and the defence with the purpose to score or obstruct the goal. The physical basics are natural human movement elements of running, jumping, throwing and these ensure the fundamental conditions for playing the ball or obstructing its advance. On these basic movements then, the characteristic technique is built up, specialised for the attack and for the defence.

2. Methodology
selection of subjects, design of the study, selection of variables, reliability of data, instrument reliability, reliability of testes, subject's reliability, collection of data and statistical techniques employed have been described.

3. Selection of subjects
To achieve the purpose of this study 30 handball players (boys) were selected as subjects with their ages ranging from 16 to 22 years. All the selected subjects were selected randomly and divided into two groups namely Group I Plyometric training group and, Group II Circuit training group. Each group consisted of 15 handball players.

4. Design of the study
The comparative group design was employed. The subjects chosen for the study were divided into two equal groups namely Plyometric training group, and Circuit training group. The pre and post tests were conducted and analysis of t-test technique was applied.

5. Selection of variables
The following variables such as physical, were selected for this study:
Physical variables
1. Speed
2. Strength
3. Endurance
4. Flexibility
5. Agility
6. Power

6. Instrument Reliability
1. Sit and reach box was used to find out the flexibility.
2. A jump board marked off in inches was used to measure the power.
3. 50 metre measuring tape was used for measuring speed and agility.
   Hence the instruments were considered reliable.

7. Training programme
The duration of training of exercise was given for three

minutes with three sets And 30 seconds rest in between the sets. The total duration of the plyometric training of four exercises which was given on Monday, Wednesday and Friday was 12 minutes for the first two week. The duration of training of exercise from third and fourth week was given for six minutes with four sets and 60 seconds rest in between the sets. The total duration of the plyometric training of four exercises which was given on Monday, Wednesday and Friday was 24 minutes. The duration of training of the exercise for the fifth and sixth week was given for 10minutes with five sets. The rest in between the sets was 90 seconds. The total duration of the plyometric training of four exercises which was given on Monday, Wednesday and Friday was 40 minutes.

8. Statistical Analysis

The subjects were selected at random, but the groups were equated in relation to the factors. This was achieved by the application of the analysis of t-test, where the final means were adjusted for difference in the initial means, and the adjusted means were tested for significance. The procedure of testing the hypothesis accordance with the results obtained in relation to the level of confidence which was fixed at 0.05 level was considered necessary for this study. These tests are usually called the test of significance to see whether the difference between the pre-test and post test scores of the samples are significant or not. In the present study, if they obtained‘t’ test is higher than the table value of ‘F’ at 0.05 level then the hypothesis is accepted to the effect that the difference existing between the means of groups compared. And if they obtained ‘t’ test is lower than the table value of ‘t ’test at 0.05 level, then the hypothesis is rejected to the effect that the difference existing between the means of the groups under study.

Table 1: The table indicates the mean standard deviation and t-test for speed of plyometric and circuit training of handball players

		Mean	Standard deviation	t-test
Plyometric training	Pre-test	6.08	0.35	3.99*
	Post-test	5.91	0.30	
Circuit training	Pre-test	6.02	0.51	1.44
	Post-test	5.98	0.44	

This table indicates the pre and post test scores of the subjects on speed for the plyometric and circuit training group among handball player. There was significant difference between the pre-test and post-test subjects on hand ball players among plyometric group.

Mean score of the plyometric group among pre-training was 6.08 and post training was 5.91, the standard diviation were 0.35 and 0.30 respectively, and there t-test value of 3.99*.

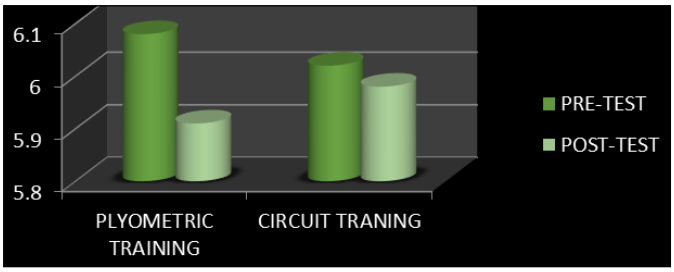

Fig 1: Showing the comparison of hand ball players speed of pre-test and post-test mean score among plyometric training and circuit training group.

Table 2: The table indicates the mean standard deviation and t-test for power of plyometric and circuit training of handball players

Training methods	Test	Mean	Standard deviation	t-test
Plyometric training	Pre-test	2.24	0.30	3.64*
	Post-test	2.32	0.31	
Circuit training	Pre-test	2.13	0.23	2.26*
	Post-test	2.19	0.24	

This table indicates the pre and post test scores of the subjects on hand ball players power for the plyometric and circuit training group. There was significant difference between the pre-test and post-test subjects on hand ball players among plyometric group.

Mean score of the plyometric group among pre-training was 2.24 and post training was 2.32, the standard deviation were 0.30 and 0.31 respectively, and there t-test value of 3.64.

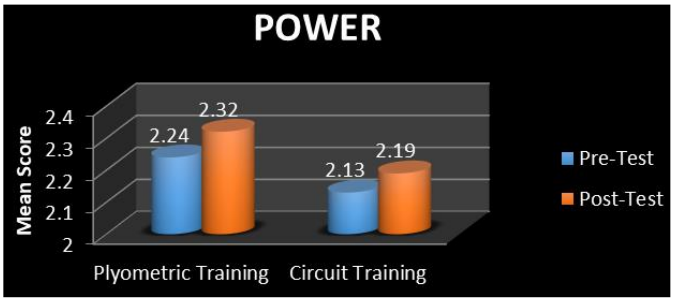

Fig 2: Showing the comparison of hand ball players power of pre-test and post-test mean score among plyometric training and circuit training group.

Table 3: The table indicates the mean standard deviation and t-test for flexibility of plyometric and circuit training of handball players

Training methods	Test	Mean	Standard deviation	t-test
Plyometric training	Pre-test	16.07	1.33	2.45*
	Post-test	16.47	1.25	
Circuit training	Pre-test	16.40	3.27	3.29*
	Post- test	17.33	2.52	

This table indicates the pre and post test scores of the subjects on hand ball players flexibility for the plyometric and circuit training group. There was significant difference between the pre-test and post-test subjects on hand ball players among circuit group.

Mean score of the plyometric group among pre-training was 16.07 and post training was 16.47, the standard deviation were 1.33 and 1.25 respectively, and there t-test value of 2.45*.

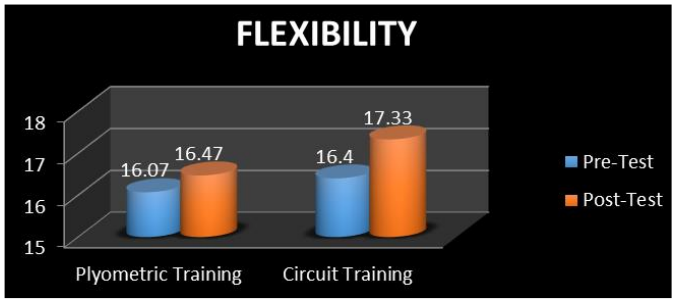

Fig 3: Showing the comparison of hand ball players flexibility of pre-test and post-test mean score among plyometric training and circuit training group.

Table 4: The table indicates the mean standard deviation and t-test for strength of plyometric and circuit training of handball players

Training methods	Test	Mean	Standard deviation	t-test
Plyometric training	Pre-test	23.47	5.91	4.32*
	Post-test	26.27	5.27	
Circuit training	Pre-test	5.20	5.56	4.29*
	Post-test	27.60	5.29	

This table indicates the pre and post test scores of the subjects on hand ball players strength for the plyometric and circuit training group. There was significant difference between the pre-test and post-test subjects on hand ball players among plyometric group.

Mean score of the plyometric group among pre-training was 23.47 and post training was 26.27, the standard deviation were 5.91 and 5.27 respectively, and there t-test value of 4.32*.

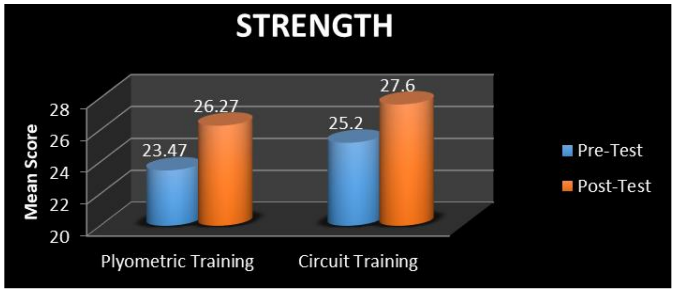

Fig 4: Showing the comparison of hand ball players strength of pre-test and post-test mean score among plyometric training and circuit training group.

Table 5: The table indicates the mean standard deviation and t-test for endurance of plyometric and circuit training of handball players

Training methods	Test	Mean	Standard deviation	t-test
Plyometric training	Pre-test	2.65	0.18	4.45*
	Post test	2.51	0.21	
Circuit training	Pre-test	2.70	0.18	3.33*
	Post-test	2.64	0.21	

This table indicates the pre and post test scores of the subjects on hand ball players endurance for the plyometric and circuit training group. There was significant difference between the pre-test and post-test subjects on hand ball players among plyometric group.

Mean score of the plyometric group among pre-training was 2.65 and post training was 2.51, the standard deviation were 0.18 and 0.21 respectively, and there t-test value of 4.45*.

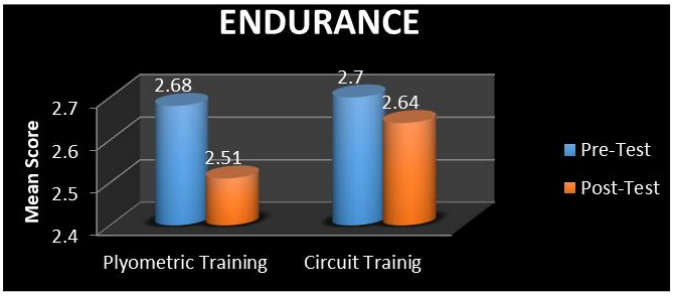

Fig 5: Showing the comparison of hand ball players speed of pre-test and post-test mean score among plyometric training and circuit training group.

Table 6: The table indicates the mean standard deviation and t-test for agility of plyometric and circuit training of handball players

Training methods	Test	Mean	Standard deviation	t-test
Plyometric training	Pre-test	10.07	0.37	3.34*
	Post-test	9.82	0.36	
Circuit training	Pre- test	9.87	0.22	1.91
	Post-test	9.92	0.18	

This table indicates the pre and post test scores of the subjects on hand ball players agility for the plyometric and circuit training group. There was significant difference between the pre-test and post-test subjects on hand ball players among plyometric group.

Mean score of the plyometric group among pre-training was 10.07 and post training was 9.82, the standard deviation were 0.37 and 0.36 respectively, and there t-test value of 3.34*.

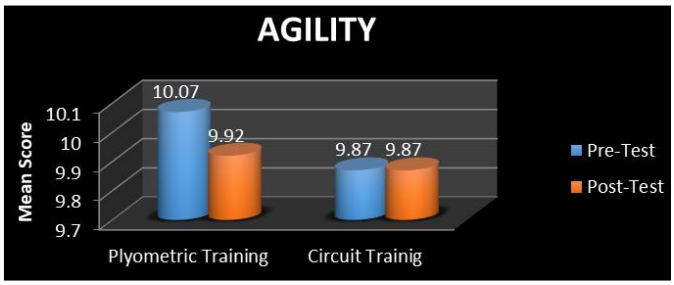

Fig 6: Showing the comparison of hand ball players agility of pre-test and post-test mean score among plyometric training and circuit training group.

Discussion

This study shows that the plyometric training certainly improved the speed. This type of training would improve the speed as a result of which the performance among the handball players would also improve. The above study shows that the plyometric training certainly improved the strength. In handball, strength is one of the important components that influence the skills of the players. The above study shows that the plyometric training certainly improved the endurance. This study shows that the circuit training certainly improved the flexibility which is very essential for handball players. This study shows that the plyometric training certainly improved the agility among handball players. In handball, agility is one of the important aspects that influence the player's skills. Hence the plyometric training would improve the playing ability by giving much more training by increasing the agility. This study shows that the plyometric training certainly improved the power. Though speed and strength are very essential in game of handball power is an important component for handball players. Hence this type of training may be given to players who need to improve their power.

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