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Effect of balance exercise program on static balance of male handball players at school level

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Abstract
The purpose of the present study is to find out the individualized and comparative effect of balance exercise training program on static balance of male handball players at school level. To achieve the purpose of the present study, 48 subjects, the male handball players studying in schools and participated in the inter school competitions are selected as samples using the random sampling method. As a experimental design, pre-post random group experimental design is employed in the study. The selected subjects are equally divided into two groups and named as experimental group and control group. Experimental group is named as balance exercise training group. Subjects of both the groups are tested on static balance. It was considered as pre -test score. After completion of the pre –test, the subjects of balanced exercise group are treated with the balance exercises for three days a week totally 12 weeks. The subjects of control group are followed their own traditional training other than the specific training. After completion treatment period, subjects of both the balance exercise training group and control group are tested as such in the pre-test and considered this as post test score. To achieve the purpose of both the individualized and comparative effect the collected data are tested by the statistical techniques of Paired-test and Analysis of co-variance. The results of the Paired t-test is explained that the changes from the pre-test to post test on static balance is significant to the subjects of the balance exercise group whereas the subjects for the control group, the changes from the pre-test to post test on the static balance is statistically not significant. Further, as the primary objective of comparing the effect of balance exercise training program on the static balance, the results of analysis of covariance is explained positively are favored to the subjects of balance exercise training group. 0.05 level is used as the level of significance to test the significance of results derived in this study.

Keywords: Balance, stability, mobility, strength, proprioceptive, coordination, sensory motor, feedback

1. Introduction
Handball is a game of complex movements. The techniques and skills of this game are underling the movements, skills and techniques of the games namely basketball, and volleyball. The major fundamental skills of this game are passing, shooting and throwing. These skills are executed by handball players both at the movements of static and dynamic. Basic need of the motor fitness components for this game is agility, endurance, speed, arm explosive power, leg explosive power and coordination. Along with these motor fitness components, balance is a main factor influencing the learning of skills and executing the technique during the game situations. Lacking in balance ability, player will be disturbed in executions of skills successfully which in turn results in affecting the team coordination. In the game of handball the coordinative ability in balancing helps the players to develop the ability to control their bodies which enables them to reduce the unwanted movements, free from the opponent distractions and to move easily with the ball to the directions in which they required. Balance is one among the essential abilities that are determining the performance of the handball players because of its use in man to man defense during the game. Balance is an ability to maintain the line of gravity of a body within the base of support with minimal postural sway. (Shumway-Cook A, Woollacott M, 2011) [6]. Maintaining the balance requires coordination of input from the multiple sensory systems including the vestibular, somatosensory, and visual systems. (Gribble; Hertel, 2004) [9]. In nature the balance can be divided into static and dynamic based on its movements.

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Static balance is defined as trying to keep a body condition with slight movement or with no motion (Gribble & Hertel, 2003) [10] Static balance refers to stances and being in the correct position for each technique executed; whether the players are executing the technique, in the middle of the technique, or in the end of the technique.

Balance as a type of psychophysical movement, it demands on strength, flexibility and sensory motor awareness. For instance, in the game of handball, player has to either pass or receive the ball which would happen both in the movements of stationary and in moving. In this circumstance, player is in need to keep up his posture over the base of the support without swaying position. This ability is referred as balance. In maintaining the balance of body posture, player should have the stability and mobility other than the sensory motor awareness. Among these three components, now a days the training systems exists to concentrate over the stability and mobility other than the sensory motor abilities. Thus the lack of sensory motor awareness is partially affecting the abilities to balance among the players which in turn affect the efficiency of the fundamental skills and tactics in the game of handball.

Hence, to develop the sensory motor ability and its associated components in balancing, the formulating psychomotor drills and implicate the same into the regular training schedule are the mode to extract the full potential from the player. Based on this, the present study was formulated to study the effect of balance exercises program on static balance of male handball players. To achieve the purpose of the study, the methodology adopted in the present study is as follows.

2. Methodology
48 samples for this study were the players participated in the inter-school competitions were selected using the random sampling method. Selected subjects were rated by three experts on their overall playing ability using ten points rating scale. Among them, the player scored in the range of 4 to 6 was extracted for the further study. Thus finally 26 handball payers were selected. From them randomly 24 player were selected and segmented equally into two groups namely experimental group and control group. As the research design pre post random experiment design was used in the study. Subjects of the experimental group and control group were measured on the static balance using the stork hand test. Following the measure on static balance, the subjects of experimental group was treated with the scientifically designed balance exercise training program for about twelve weeks.

In the present study, the training programs utilized is mainly to improve the balance includes aerobic, muscle strengthening, and balance exercises Balance training program used in this study was consisted of warm-up exercise for 5-7 minutes, balance exercise training for about 30 to 35 minutes, and cool-down exercise for about 5 to 7 minutes. Thus the balance exercise training program for the subjects of experimental group was treated for 45 to 50 minutes. Balance training program was composed with the exercises of muscle stretch exercises around the joints and the muscle resistance exercises around the joints. The subjects of the experimental group were administered with the balance exercise training program in addition to their regular training schedule. The subjects of control group were trained only with their regular training schedule without any specific training. After completion of the training period of twelve weeks, subjects of both the experimental (Balance exercise training) and control group were measured on the static balance as such in the case of pre-test.

The collected data on static balance were treated with the analysis of covariance to study the effect of balance exercise training between the subjects of experimental and control group. The derived results were tested for significance of 0.05 level. The results obtained were presented as follows with the analysis

Table 1: Descriptive statistics of balance exercise group on static balance

Source	Number of subjects	Mean	Standard Deviation	Standard Error
Balance Exercise group	12	42.08	2.06	.59
Balance Exercise group	12	46.50	3.14	.90
Control group Pre test	12	40.08	2.42	.70
Control Group Post test	12	40.58	1.92	.55

Table-1 explains the descriptive statistics on static balance of players treated with the balance exercise program and control group as follows. The mean and standard deviation of players (N=12) used in the balance exercise group prior to treatment and post treatment are: 42.08 ± 2.06 and 46.50 ± 3014 respectively. Likewise in the mean and standard deviation of players (N=12) used in the control group prior to treatment and post treatment are: 40.08 ± 2.42 and 40.58 ± 1.92 respectively.

Table 2: Testing the significance of mean difference from the pre- test to post test on static balance of Balance Exercise group and Control group

Source	Mean Difference	Std. Deviation	Std. Error Mean	t-ratio	DF	Sig. (2-tailed)
Balance Exercise Program pre - post	4.41	2.87	.82	5.32	11	.000
Control Group pre - post	0.50	2.39	.69	0.72	11	.484

Table 2 explains that the results derived from the paired t-test to test the individualized effect of balance exercise program and control group on static balance. The obtained t-value (5.32) for balance exercise group was found to be significant at 0.05 level. From the result derived, it is inferred that the changes occurred from the pre-test to post test (Fig.1) on static balance is statistically significant and balance exercise program used in the present study is the significant source to develop the static balance for the handball players. Further in testing the individualized effect of Control group, the obtained t-value (0.72) is found to be not significant at 0.05 level and led to infer that the changes from the pre-test to post test (Fig.1) on static balance of player pertain to control group is statistically not significant.

Mena value of pre and post test of balance exercise group and control group on static balance
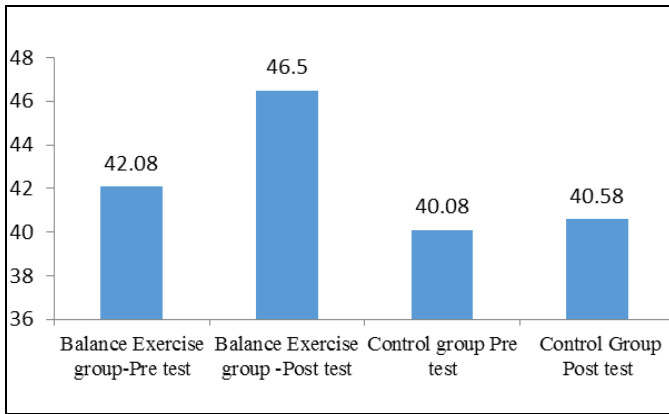
Fig 1

Table 3: Analysis of variance for pre -test on static balance

Source	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	24.00	1	24.00	4.72*	.04
Within Groups	111.83	22	5.08		
Total	135.83	23			

*Table value 4.30 - Significant at 0.05 level

Table -3 reveals that the f-value for pre-test is 4.72. To be significant at 0.05 level for DF 1, 22, the required critical value is 4.30. The obtained f-value 4.72 is found to be significant at 0.05 level as it exceeds the required critical value of 4.30. From the results, it is inferred that there is a significant mean difference exist between the players of balance exercise group and control group.

Table 4: Analysis of variance for post - test on static balance

Source	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	210.04	1	210.04	30.82 *	.00
Within Groups	149.91	22	6.81		

*Table value 4.30 - Significant at 0.05 level

Table -4 reveals that the f-value for pre-test is 30.82. To be significant at 0.05 level for DF 1,22, the required critical value is 4.30. The obtained f-value 30.82 is found to be significant at 0.05 levels as it exceeds the required critical value of 4.30. From the results, it is inferred that there is a significant mean difference exist between the players of balance exercise group and control group after completion of training (post-test)

3. Results on Analysis of covariance

Table 5: Adjusted posttest mean on static balance

Groups	Mean
Balance Exercise group	46.01
Control group	41.06

Table 5 explain that the adjusted post test mean on static balance for balance exercise group and control group are 46.01 and 41.03 respectively.

Table 6: Analysis of variance for adjusted post -test on static balance

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	121.15	1	121.15	20.53 *	.00
Within Groups	123.92	21	5.90		

*Table value 4.32 - Significant at 0.05 level

Table - 6 reveals that the f-value for pre-test is 20.53. To be significant at 0.05 level for DF 1,21, the required critical value is 4.32. The obtained f-value 20.53 is found to be significant at

0.05 level as it exceeds the required critical value of 4.32. From the results, it is inferred that there is a significant mean difference (fig-2) exist between the players of balance exercise group and control group on adjusted post- test means. The obtained results confirm the effect of balance exercise program on static balance is significant and positive. In the present study since the two groups are used for the research purpose, post hoc test is not necessary as the mean difference on static balance is found statistically significant. The derived results are discussed as follows.
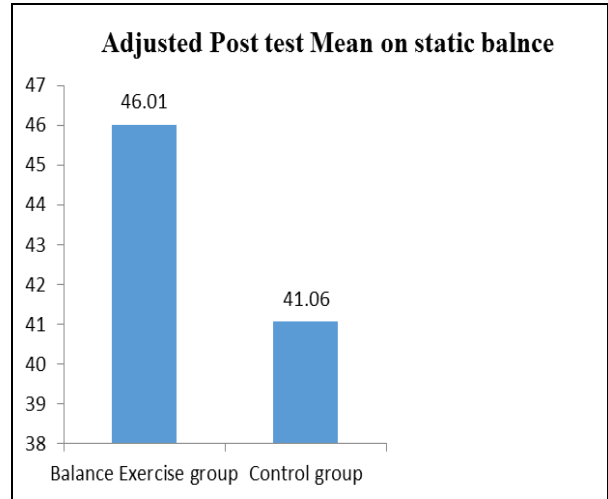

Fig 2

3.1 Discussions on findings

In high level competitions, the role of balance ability is a crucial one in determining the success of the game. Such an important component of balance ability of static balance is to be developed in addition to the physical and motor components. To fulfill this, scientifically designed balance exercise training program was developed and tested among the players of handball. From the results of this, it was observed that the subjects practiced with the balance training program were found to do better in the static balance when compared to the subjects of control group. The obtained results confirmed the positive effects of balance exercise program.

 In the balance exercise training program, exercises used are primarily underlies the stability and mobility. To develop the stability basically the strengthening exercises were imparted. Strength training exercises aimed at enhancing the stability, by gaining of neuromuscular control, the individual can have the core stability and postural alignment (Hori N *et al.*, 2005) [3]. During such exercises, neuromuscular control of the trunk is based on reactive (feed-back) control. Simenz *et al.* (2005) [7] stated that the neuromuscular control provides the information concerning the position of each segment in the kinetic chain which is used to modify the descending movement commands. The lack of neuromuscular control contribute to unstable or faulty movement patterns throughout the kinetic chain (Zazulak *et al.*, 2007) [8]. Gee (2011) [2] had suggested that the strength training exercises would serve as part of neuromuscular training programs, and balance/core training (Ebben *et al.* 2004) [1] described as key areas of development.

In such a way the strengthening exercises used in the training program may have the significant source for the experimental group in achieving the static balance positively. The findings of the present study are found to substantiate by the previous research studies. Postural stability is a joint factor of stability and mobility. In the study of development of postural stability (Balogun, Adesinasi, & Marzouk *et al.* 1992) found a

significant improvement in balance ability in subjects who underwent a 6 week course of wobble board training. In the game of basketball Mahmoud Houssain Mahmoud, (2011) [4] studied the effects of balance exercise program so as to develop the ability of static balance. Results indicated that the existence of significant differences between the two groups of experimental and control groups in both the levels of physical and skill performance in favor of the experimental group. In the light of the results, they were recommended that incorporating the balance exercises in the programs of young players' preparation and deriving them from the motor components for basic skills.

4. Conclusions

Based on the results, the following conclusions have been made. A result of the present study was favour to the subjects treated with the balance exercise training program in the development of static balance. In addition to the regular training schedule the handball players used as subjects in the experimental group were initially concentrated over their strengthening muscles and stretching of joints following the proprioceptive components using specifically designed physical exercises. Resulting of this, concomitantly enable the subjects to strengthen their muscles and to enhance the movements of joints. Exercises underlie the neuromuscular development used in the training program helps the subjects to acquire the patterns related to the neuromuscular movements which in turn to develop the coordinative abilities and ability to control the body parts. Thus the cumulative effects of balance exercise training program used in the present study leads to conclude that the incorporation of the physical exercises consisting the motor and psychomotor characteristics might have been the prime source in the development of the static balance among the players.

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