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EFFECT OF DIFFERENT TYPES OF TRAINING ON LEG ANAEROBIC POWER AMONG UNIVERSITY MALE HANDBALL PLAYERS

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Abstract

The purpose of this study was to investigate the effect of a weight, plyometric and compound training program on leg anaerobic power of university male handball players. To achieve this purpose 30 male handball players were selected randomly from Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu. These players had more than 5 years of training experience and who represented Annamalai university in interuniversity competition were enrolled. The selected subjects were assigned into 3 groups: weight training group (n=10), plyometric training group (n=10) and compound training group (n=10). Leg anaerobic power was selected as criterion variable and tested by Sargent's jump test. The duration of the training prescribed in this study was eight weeks was carried out during preparatory phase. Pre and post leg anaerobic power was measured on the indoor. The result of the study showed that adjusted post test mean showed significant ($p < 0.001$) difference among the groups on leg anaerobic power. It elicited that 3.10cm (8.16%) improvement was noticed in weight training group, 3.30cm (6.53%) in plyometric training group and 6.00cm (12.02%) in compound training group.

Keywords: Weight training, Plyometric training, Compound training, anaerobic power, Handball, Players.

INTRODUCTION

Handball, a popular game throughout the world, was introduced in Germany by a gymnastics teacher, Max Heiser, in 1917. The game was primarily devised for girls and played 11-a-side on a football field. However, authentic reports of a similar game, "Hand-bold" being played in Denmark as early as 1904. Modern team handball consists of intense, intermittent activities such as running, sprinting, jumping, feinting etc. The research indicates that need for bigger, stronger and faster team handball players. The larger players have the same aerobic capacity, but most important are faster and more explosive than their opponents (Donald, 2000). The activity pattern and physiological demands in handball games and training are closely dependent on the physical capacity of the player, technical abilities, tactical role, playing position, style of playing, the opponent, as well as numerous environmental and internal factors.

For Handball players, training aims to improve technical, tactical, psychological, and physical qualities. During the pre-season, training emphasizes physical fitness improvements, whereas during the inseason period the emphasis is mainly on making tactical and technical improvements while maintaining physical fitness (Bobbert and Van Ingen Schenau, 1988). Training is any organized and regular activity done for increasing the performance of athletes and are divided into different kinds considering the performance requirements of athletes. Some training that athletes use to improve different performances is strength and plyometric training. In most of the researches, it is reported that a combination of plyometric trainings and strength trainings in comparisons with using these trainings alone and separately, cause to achieve the highest performances (Stane and Powers, 2005; Adams, *et al*., 1992). For this reason, the main purpose of this study was to investigate the effect of a weight, plyometric and compound training program on leg anaerobic power of university male handball players.

MATERIAL AND METHODS

SUBJECTS AND VARIABLES

In this study 30 male handball players were selected randomly from Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu. These players had more than 5 years of training experience and who represented Annamalai university in interuniversity competition were enrolled. The selected subjects were assigned into 3 groups: weight training group (n=10), plyometric training group (n=10) and compound training group (n=10). The selected subjects mean age: 22.18±2.32years; weight: 70.90±8.22kg; height:176±3.07cm and BMI: 22.90±3.47kg/m2. All subjects were instructed to refrain from participation in any other form of training during the testing and training period that might improve their leg anaerobic power. All subjects were nonsmokers and none ergogenic aid or medication users known to affect vertical jump during the study. The variables and tests selected for the study are presented in table 1.

TABLE 1
VARIABLES AND TESTS

No	Variables	Tests/Measures
1	Weight	Digital standing scale
2	Height	Stadiometer
3	Leg anaerobic power	Sargent's jump test

EXPERIMENTAL DESIGN

The duration of the training prescribed in this study was eight weeks was carried out during preparatory phase. Pre and post leg anaerobic power was measured on the indoor.

PROTOCOL

The selected subjects were classified into four groups each consisting of ten subjects. The first group did weight trainings, second group plyometric trainings and third group compound trainings (mix of strength and plyometric) for 8 weeks. Prior testing leg anaerobic power suitable warm up was administered. Weight training group participated in the 8-week training program in two sessions in a week and with the intensities and repetitions shown in table 2, six strength movements were done by subjects (Squat, weight training on the stairs, angled leg press, dead lift, and forward scissor and bending knees). The intensity of weight trainings as it was considered for the previous group increased in week seven and decreased in week eight (Karim Salehzadeh, *et al*., 2011). One RM (repetition maximum) was measured and the load was fixed.

TABLE 2
STRENGTH GROUP TRAINING PROTOCOL

Week	Resistance	Resting between each stage	Sets*Rep
1	Doing all the repetitions in each stage with proper technique before adding weights	1	RM 8*3
2		1	RM 10*3
3		1	RM 8*3
4		1	RM 8*3
5		1	RM 8*3
6		1	RM 8*3
7		1	RM 8*3
8		1:30	RM 6*3

The designed protocol of plyometric is including two times in a week with the Training volume ranged from 90 foot contacts to 140 foot contacts per session (table 3) while the intensity of the exercises increased for seven weeks before tapering off during week eight so that fatigue would not be a factor during anaerobic power test (Stane and Powers, 2005). The cone height is 40cm and barrier height is 50cm was used in this study. Combinational training group also started for 8-weeks and two sessions in a weak (on session strength training and one session plyometric training) based on designed training programs in table 1 and 2 (Stane and Powers, 2005). After finishing training period, post-test SEBT was carried out in the same environment from four groups.

STATISTICAL TECHNIQUE

Pre and post test data were collected before and after 8 weeks of training. The collected data was analysed using analysis of covariance (ANCOVA). Statistical significance was set to a priority at $p < 0.05$. When adjusted post test is significant Bonferroni post hoc test was applied to know the difference between the three training. All the statistical tests were calculated using the statistical package for the social science (SPSS) for windows (Version 11.5).

TABLE 3
PLYOMETRIC TRAINING PROTOCOL

Training week	Foot contacts	Plyometric drill	Sets* Reps	Training intensity
Week 1	90	Side to side ankle hops	15*2	Low
		Standing jump and reach	15*2	Low
		Front cone* hops	6*5	Low
Week 2	120	Side to side ankle hops	15*2	Low
		Standing long jump	6*5	Low
		Lateral jump over barrier	15*2	Average
		Double leg hops	6*5	Average
Week 3	120	Side to side ankle hops	12*2	Low
		Standing long jump	6*4	Low
		Lateral jump over barrier	12*2	Average
		Double leg hops	8*3	Average
		Lateral cone hops	12*2	Average
Week 4	140	Diagonal cone hops	8*4	Low
		Standing long jump with lateral sprint	8*4	Average
		Lateral cone hops	12*2	Average
		Single leg bounding	7*4	High
		Lateral jump single leg	6*4	High
Week 5	140	Diagonal cone hops	7*2	Low
		Standing long jump with lateral sprint	7*4	Average
		Lateral cone hops	7*4	Average
		Cone hops with 180 degree turn	7*4	Average
		Single leg bounding	7*4	High
		Lateral jump single leg	7*2	High
Week 6	150	Diagonal cone hops	8*4	Low
		Hexagon drill	8*4	Average
		Cone hops with change of direction sprint	12*2	Average
		Double leg hops	7*4	High
		Lateral jump single leg	6*4	High
Week 7	150	Diagonal cone hops	7*2	Low
		Standing long jump with lateral sprint	7*4	Average
		Cone hops with 180 degree turn	7*4	Average
		Single leg bounding	7*4	Average
		Lateral jump single leg	7*4	High
Week 8	130	Side to side ankle hops	12*2	Low
		Standing long jump	6*4	Low
		Lateral jump over barrier	12*2	Average
		Double leg hops	8*3	Average
		Lateral cone hops	12*2	Average

Results

Table 4 clearly shows that pre and post test on leg anaerobic power showed no significant difference. However, adjusted post test mean showed significant ($p < 0.001$) difference among the groups on leg anaerobic power.

TABLE 4
ANALYSIS OF COVARIANCE FOR THREE GROUPS BEFORE AND AFTER TRAINING EFFECT ON LEG ANAEROBIC POWER

Variables	Testing conditions	SOV	Sum of squares	Degrees of freedom	Mean-Square	Value (F)	Value (*p*)
Leg Anaerobic power	pre	Between	1.800	2	0.900	0.015	0.985
		Within	1577.000	27	58.407		
	Post	Between	24.067	2	12.033	0.214	0.809
		Within	1518.600	27	56.244		
	Adjusted post test	Between	37.856	2	18.928	9.643	0.001
		Within	51.033	26	1.963		

It is clear from table 5 that weight - compound training and plyometric – compound training showed significant difference at 0.05 level. In weight training group 8.16%, Plyometric training group 6.53% and compound training group 12.02% improvement was noticed.

TABLE 5
BONFERRONI POST-HOC TEST ON LEG ANAEROBIC POWER

TRAINING (I)	TRAINING (J)	Mean Difference (I-J)	Std. Error	Sig	95% Confidence Interval for Difference(a)	
					Lower Bound	Upper Bound
Weight	Plyometric	.789	.627	=.657	-.814	2.393
	Compound	-1.889*	.627	<.017	-3.493	-.286
Plyometric	Compound	-2.679*	.627	<.001	-4.283	-1.075

Based on estimated marginal means

[a] Adjustment for multiple comparisons: Bonferroni.

* The mean difference is significant at the .05 level.

DISCUSSION FINDINGS

The research aims to investigate the effect of 8-week weight, plyometric and compound trainings (weight and Plyometric) on leg anaerobic power of male university handball players. In the present study 3.10cm (8.16%) improvement was noticed in weight training group, 3.30cm (6.53%) in plyometric training group and 6.00cm (12.02%) in compound training group. This result matches Adams, *et al*., (1995) that regular training by using weight for six weeks leads to increase of Jump and reach about 3.3 cm and the plyometric leads to Increase of jump about 3.8 cm, but the compound increase jump about 10.7 cm.

CONCLUSION

The three different types of training registered a significant improvement in leg anaerobic power in male university handball players. Among compound training was considered to be the best training because it combines both weight and plyometric training which benefits vertical jump of handball players (Ebben, 2002).

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