EFFECT OF PLYOMETRIC TRAINING ON SAND SURFACE

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Abstracts

The purpose of the study was to know the plyometric training effect on sand surface. Physical improvements have important implications on team sports, as players perform numerous explosive movements like kicking, tackling, jumping, turning, sprinting, and changing pace and directions during the match (Chaouachi et al., 2009; Duncan et al., 2006; Gabbett, 2000; Ostojic et al., 2006; Stolen et al., 2005), thus, plyometric drills usually involve stopping, starting and changing directions in an explosive manner (Gabbett, 2000). Plyometrics are training methods used by sportspersons in all types of sports to improve strength and explosiveness. Plyometrics exercises consists of a rapid stretching of a muscle (eccentric action) proximately followed by a concentric or shortening action of the same muscle and connective tissue. The stored elastic energy within the muscle is used to produce more force that can be provided by a concentric action alone. Researchers have shown that plyometric training, when used with a periodized strength-training program, can contribute to increases in vertical jump performance, acceleration, leg strength, muscular power, increased joint awareness, and overall proprioception (Miller, et. al., 2006). Fifteen volunteered high school students (N=15) were selected randomly and purposive sample was taken. Subjects underwent 12 weeks progressive plyometric training on sand surface. Pre and post-test were obtained for fourteen variables. Paired sample correlations and paired 't' test was computed to interpret the treatment effect. Results revealed that twelve weeks plyometric training differed significantly in all the fourteen variables of the study. It is concluded that plyometric training on sand surface can help in improving one's physical fitness components.

Keywords: physical fitness, sports training, plyometrics, sand surface.

1. Introduction:

Plyometrics is the term now applied to exercises that have their origins in Europe and were first known as ‘jump training’ (Chu, 1998). Plyometric training gained popularity in the early 1970s as athletes from Eastern European countries began to dominate power-dependent events (Chu, 1998). Plyometric training is widely used to improve the ability of skeletal muscles to generate power. The system contains a repeated system of bouts, each comprising a rapid deceleration of the body, followed immediately by a brief transition phase and rapid acceleration in the opposite direction. This rapid combination of eccentric and concentric muscular action involves the stretch-shortening cycle, which provides a physiological benefit in that the muscular force developed during the concentric phase is potentiated by the preceding eccentric action (Tofas, et al., 2008;

Chatzinikolaou, et al., 2010). Plyometric exercise are quick, powerful movements that enable a muscle to reach maximal force in the shortest possible time (Potash & Chu, 2008). This is achieved by using a prestretch, or counter movement, that involves the stretch-shortening cycle (Wilk et al., 1993; Voight et al., 1995). The purpose of plyometric drills is to increase the power of subsequent movements by using both the natural elastic components of muscle and tendon and the reflex (Potash & Chu, 2008). Some strength and conditioning professionals suggest that performing plyometrics in the sand can result in greater improvements in performance without the impact on the skeletal muscular system seen in traditional plyometric environments.Children and teenagers need to participate frequently in physical activities that enhance and maintain cardiovascular and musculoskeletal health. While boys and girls have traditionally been encouraged to participate in aerobic training and strength building activities, a growing number of children and adolescents are experiencing the benefits of plyometric training. Formerly thought of as a method of conditioning reserved for adult athletes, the American College of Sports Medicine contends that plyometric training is a safe, beneficial and fun activity for children and adolescents provided that the program is properly designed and supervised (Faigenbaum, 2012).

2. Methodology

Fifteen (N=15) secondary school students from Sri Adichunchanagiri Vidyavardhaka *Trust high school, Bhadravati were selected randomly for sand surface plyometric training. The* age group of subjects ranged between 14 to 16 years. The treatment group underwent 12 weeks progressive plyometric training on sand surface. Descriptive statistics, paired samples 't' test was computed to compare between pre and post test results.

2.1. Selection of Test Items and Method of data collection

In order to examine the efficacy of sand based plyometric training following tests were conducted on all the subjects under the study. The subjects will undergo these tests twice during the course of this study i.e. pre-test and post-test. Prior to the administration of the test the investigator had a meeting with the subjects. The objectives and importance of the test were made clear to the subjects at the outset. Demonstration of the test will be done by the researcher if there are any ambiguities in terms of understanding of the test by subjects. A Pre-test and a Post-test was conducted on the same subjects with a time gap of 12 weeks. Data was collected by the researcher with the help of an assistant. List of tests and variables measured are given in table 1.

Table1. DETAILS ON TESTING PROTOCOL AND VARIABLES SELECTED FOR STUDY

Sl. No.	Variables Measured	Testing Protocol
1	Body Composition	Body Mass Index (BMI)
2	Resting Heart Rate	Radial Pulse
3	Calf girth	Measuring tape
4	Thigh Girth	Measuring tape
5	Waist Girth	Measuring tape
6	Flexibility	Sit-Reach Test
7	Coordinative Abilities	Shuttle Run
8	Speed	30 meters Sprint
9	Strength Endurance	Pull Ups (maximum)
10	Dynamic Strength	Sit Ups (1 minute)
11	Lower body explosiveness	3 Hop test
12	Vertical Jump Capacity	Sargent Vertical Jump
13	Upper body Explosiveness	Medicine ball put
14	Static Strength	Grip Dynamometer

3. Results and Discussion

The purpose of the study was to find out the significance difference on sand based plyometric training in respect of anthropometric metric measurements, physical fitness and physiological variables. In order to explore the training effects 12 weeks progressive training programme was scheduled and pre and post test results were obtained. The training results were subjected to obtain descriptive statistics and paired samples 't' test to compare between pre and post results of sand surface plyometric training by using SPSS 21 version. The results are presented and discussed in the following pages by sequence as they appeared.

3.1. Analysis of Sand Surface Training

The descriptive statistics of sand surface training are specified in table 2. The checking of table 2 reveals that the statistics is normally distributed and no skewness or kurtosis was observed as regard to data. The sand surface plyometric training data appears to be normal. All the fourteen variables of study explain greater mean values than the standard deviations. The least values were always smaller than maximum values. The paired sample presented in table 3 also disclose that the allocation is normal and paired sample correlations presented in table 4 reveals that major correlation was observed in respect of nine variables out of fourteen and the changeable which did not show notable correlations were shuttle run test, sit-ups, vertical jump, medicine ball put and hand grip strength. Sand surface paired sample ‘t’ test values are depicted in table 5. The ‘t’ values differed significantly as regard to pre and post treatment groups. The values obtained with sand surface training was greater than the table value (2.02). The plyometric training group had remarkably showed improvement in all the fourteen variables of investigation.

Table 2. DESCRIPTIVE STATISTICS OF SAND SURFACE TRAINING

	N	Minimum	Maximum	Mean	Std. Deviation	
Body Composition	Pre-test	15	17.28	24.36	20.80	2.28
	Post-test	15	15.37	22.69	19.08	2.33
Resting Heart Rate	Pre-test	15	68.00	77.00	72.0	2.69
	Post-test	15	63.00	75.00	69.73	3.56
Calf girth	Pre-test	15	26.00	35.00	30.67	2.23
	Post-test	15	28.00	38.00	32.87	2.97
Thigh Girth	Pre-test	15	35.00	46.00	41.13	2.80
	Post-test	15	36.00	47.00	43.73	3.17
Waist Girth	Pre-test	15	65.00	75.00	70.73	2.55
	Post-test	15	68.00	76.00	72.40	2.47
Flexibility	Pre-test	15	1.00	7.00	3.13	1.96
	Post-test	15	2.00	11.00	5.80	2.57
Coordinative Abilities	Pre-test	15	12.26	25.32	20.83	2.84
	Post-test	15	16.59	19.68	17.77	0.87
Speed	Pre-test	15	4.89	6.76	5.76	.516
	Post-test	15	4.22	5.24	4.75	0.39
Strength Endurance	Pre-test	15	0.00	6.00	3.40	2.17
	Post-test	15	5.00	21.00	12.73	4.46
Dynamic Strength	Pre-test	15	8.00	21.00	13.87	3.58
	Post-test	15	26.00	41.00	33.80	4.68
Lower body explosiveness	Pre-test	15	3.76	6.29	4.59	0.70
	Post-test	15	5.06	7.38	6.23	0.71
Vertical Jump Capacity	Pre-test	15	9.00	39.00	16.53	7.64
	Post-test	15	36.00	51.00	44.80	4.00
Upper body Explosiveness	Pre-test	15	1.30	2.17	1.84	0.25
	Post-test	15	2.19	4.07	3.15	0.47
Static Strength	Pre-test	15	11.00	21.00	15.53	2.59
	Post-test	15	22.00	31.00	27.60	2.92

Table.3. SAND SURFACE TRAINING'S PIRED SAMPLES STATISTICS

			Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Body Composition	Pre-test	20.79	15	2.28	0.59
		Post-test	19.08	15	2.33	0.60
Pair 2	Resting Heart Rate	Pre-test	72.07	15	2.69	0.69
		Post-test	69.73	15	3.56	0.92
Pair 3	Calf girth	Pre-test	30.67	15	2.23	0.57
		Post-test	32.87	15	2.97	0.77
Pair 4	Thigh Girth	Pre-test	41.13	15	2.80	0.72
		Post-test	43.73	15	3.17	0.82
Pair 5	Waist Girth	Pre-test	70.73	15	2.55	0.66
		Post-test	72.40	15	2.47	0.64
Pair 6	Flexibility	Pre-test	3.13	15	1.96	0.51
		Post-test	5.80	15	2.57	0.66
Pair 7	Coordinative Abilities	Pre-test	20.83	15	2.84	0.73
		Post-test	17.77	15	0.86	0.22
Pair 8	Speed	Pre-test	5.77	15	0.52	0.13
		Post-test	4.75	15	0.39	0.10
Pair 9	Strength Endurance	Pre-test	3.40	15	2.16	0.56
		Post-test	12.73	15	4.46	1.153
Pair 10	Dynamic Strength	Pre-test	13.87	15	3.58	0.93
		Post-test	33.80	15	4.69	1.21
Pair 11	Lower body explosiveness	Pre-test	4.59	15	0.70	0.18
		Post-test	6.23	15	0.71	0.18
Pair 12	Vertical Jump	Pre-test	16.53	15	7.64	1.97

	Capacity	Post-test	44.80	15	4.00	1.03
Pair 13	Upper body Explosiveness	Pre-test	1.84	15	0.25	0.06
		Post-test	3.15	15	0.49	0.13
Pair 14	Static Strength	Pre-test	15.53	15	2.59	0.67
		Post-test	27.60	15	2.92	0.75

Table 4. SAND SURFACE PAIRED SAMPLES CORRELATIONS

			N	Correlation	Sig.
Pair 1	Body Composition	Pre-test	15	0.92	0.00
		Post-test	15	0.94	0.00
Pair 2	Resting Heart Rate	Pre-test	15	0.66	0.01
		Post-test	15	0.85	0.00
Pair 3	Calf girth	Pre-test	15	0.68	0.01
		Post-test	15	0.84	0.00
Pair 4	Thigh Girth	Pre-test	15	0.26	0.35
		Post-test	15	0.63	0.01
Pair 5	Waist Girth	Pre-test	15	0.81	0.00
		Post-test	15	0.34	0.22
Pair 6	Flexibility	Pre-test	15	0.86	0.00
		Post-test	15	0.44	0.10
Pair 7	Coordinative Abilities	Pre-test	15	0.21	0.45
		Post-test	15	0.47	0.07
Pair 8	Speed	Pre-test	15	0.92	0.00
		Post-test	15	0.94	0.00
Pair 9	Strength Endurance	Pre-test	15	0.66	0.01
		Post-test	15	0.85	0.00
Pair 10	Dynamic Strength	Pre-test	15	0.68	0.01
		Post-test	15	0.84	0.00
Pair 11	Lower body explosiveness	Pre-test	15	0.26	0.35
		Post-test	15	0.63	0.01
Pair 12	Vertical Jump Capacity	Pre-test	15	0.81	0.00
		Post-test	15	0.34	0.22
Pair 13	Upper body Explosiveness	Pre-test	15	0.86	0.00
		Post-test	15	0.44	0.10
Pair 14	Static Strength	Pre-test	15	0.21	0.45
		Post-test	15	0.47	0.07

Paired samples ‘t’ values differed significantly as regard to pre and post treatment groups. The values obtained with sand surface training were greater than the table value (2.02). The plyometric training group had remarkably showed improvement in all the fourteen variables of investigation.

Table 5. SAND SURFACE PAIRED SAMPLE 't' TEST

			Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1	Body Composition	pretest	1.72	0.95	0.25	7.02	14	0.00
		posttest	2.33	1.40	0.36	6.47	14	0.00
Pair 2	Resting Heart Rate	pretest	-2.20	2.24	0.58	-3.80	14	0.00
		posttest	-2.60	1.68	0.43	-6.00	14	0.00
Pair 3	Calf girth	pretest	-1.67	2.02	0.52	-3.19	14	0.01
		posttest	-2.67	1.40	0.36	-7.39	14	0.00
Pair 4	Thigh Girth	pretest	3.06	2.75	0.71	4.32	14	0.00
		posttest	1.02	0.41	0.11	9.70	14	0.00
Pair 5	Waist Girth	pretest	-9.33	2.99	0.77	-12.08	14	0.00
		posttest	-19.93	4.85	1.25	-15.93	14	0.00
Pair 6	Flexibility	pretest	-1.63	0.37	0.10	-17.06	14	0.00
		posttest	-28.27	6.90	1.78	-15.86	14	0.00
Pair 7	Coordinative Abilities	pretest	-1.31	0.50	0.13	-10.19	14	0.00
		posttest	-12.07	2.84	0.73	-16.46	14	0.00
Pair 8	Speed	pretest	1.72	0.95	0.25	7.02	14	0.00
		posttest	2.33	1.40	0.36	6.47	14	0.00
Pair 9	Strength Endurance	pretest	-2.20	2.24	0.58	-3.80	14	0.00
		posttest	-2.60	1.68	0.43	-6.00	14	0.00
Pair 10	Dynamic Strength	pretest	-1.67	2.02	0.52	-3.19	14	0.01
		posttest	-2.67	1.40	0.36	-7.39	14	0.00
Pair 11	Lower body explosiveness	pretest	3.06	2.75	0.71	4.32	14	0.00
		posttest	1.02	0.41	0.11	9.70	14	0.00
Pair 12	Vertical Jump Capacity	pretest	-9.33	2.99	0.77	-12.08	14	0.00
		posttest	-19.93	4.85	1.25	-15.93	14	0.00
Pair 13	Upper body Explosiveness	pretest	-1.63	0.37	0.10	-17.06	14	0.00
		posttest	-28.27	6.90	1.78	-15.86	14	0.00
Pair 14	Static Strength	pretest	-1.31	0.50	0.13	-10.19	14	0.00
		posttest	-12.07	2.84	0.73	-16.46	14	0.00

4. Conclusions

Within the limitations of the present investigation it is concluded that twelve weeks plyometric training on sand training group had remarkably showed improvement in all the fourteen variables of investigation. Sand surface plyometric training can improve physical fitness, decrease resting heart rate and noteworthy improvements is possible with body girth measurements.

5. References:

Chaouachi A, Brughelli M, Levin G, Boudhina NB, Cronin J, Chamari K. Anthropometric, physiological and performance characteristics of elite team-handball players. J Sports Sci, 2009; 15: 151-7.

Chatzinikolaou, A.; Fatouros, I.G.; Gourgoulis, V.; Avloniti, A.; Jamurtas, A.Z.; Nikolaidis, M.G.; Douroudos, I.; Michailidis, Y.; Beneka, A.; Malliou, P.; et al. Time course of changes in performance and inflammatory responses after acute plyometric exercise. J. Strength Cond. Res. 2010, 24, 1389–1398.

Chu, D.A., & L. Plummer. The language of plyometrics. National Strength Conditioning Association Journal. 6(5):30-31. 1984

Chu, D.A., & L. Plummer. The language of plyometrics. National Strength Conditioning Association Journal. 6(5):30-31. 1984

Faigenbaum, Avery D(2012). Official statements Written for the American College of Sports Medicine concerning topics of interest to the public at large. Reviewed online at http://www.acsm.org/docs/current-comments/plyometrictraining.pdf.

Potash, D.H., And Chu, D.A.6(2008). Plyometric Training. In: Earle, R.W. And Baechle, T.R., (Eds.), Essentials Of Strength Training And Conditioning. (3rd Ed.) (414–455). Champaign, Il: Human Kinetics.

Tofas, T.; Jumurtas, A.Z.; Fatouros, I.; Nikolaidis, M.G.; Koutedakis, Y.; Sinouris, E.A.; Papageorgakopoulou, N.; Theochathios, D.A. Plyometric exercise increases serum indices of muscle damage and collagen breakdown. J. Strength Cond. Res. 2008, 22, 490–496

Voight, M.L. &Tippett, S. Plyometrics in rehabilitation. (2004). In: Rehabilitation techniques for sports medicine and athletic training. (4th ed.). (225-241). New York, USA: Churchill Livingstone.

Wilk, K.E.; Voight, M.L.; Keirns, M.A.; Gambetta, V.; Andrews, J.R. &Dillman, C.J. (1993). Stretch-shortening drills for the upper extremities: Theory and clinical application. Journal Orthopaedics and Sports Physical Therapy, (17): 225–239.