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Effect of Step-Up and Rope Skipping Training on Selected Physical Fitness Variables on Sport Science Students

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Abstract

The purpose of the study was to find out the effect of step-up and rope skipping exercise training on selected physical fitness variables on sport science students. The selected variables were flexibility, explosive power and agility. It was hypothesized that there was a significant difference between experimental groups and control group and it was also hypothesized that there were no significant difference between the experimental groups interms of flexibility, agility and explosive power. In order to achieve the purpose of this study the research was carried out 60 female students studying physical education at Adwa College of teacher's education. The subjects were randomly allotted in to two experimental groups (rope skipping group and step up group) and control group. The rope skipping group and step up groups were involved in eight weeks of rope skipping and step up training respectively but the subjects of the control group were not participated in any of the training. The variables were assessed by: sit and reach test, standing long jump and zig-zag run test in order to measure flexibility, explosive power and agility respectively. Analysis of covariance (ANCOVA) was computed separately for each variable. It was found that there was a significant improvement of rope skipping group and step up group on: flexibility. Rope skipping group showed significant improvement on explosive power and the step up group did not show significant improvement on explosive power, the rope skipping and step up group shows significant improvement on agility. Rope skipping and step up group showed no significant differences in flexibility and agility but there was a significance difference on explosive strength.

Keywords: Step up, Rope skipping, Flexibility, Agility, Explosive power.

Introduction

Bench step-up were developed by Gin Miller during 1989. It is distinguished from other forms of aerobic exercise by its use of an elevated platform (the step or bench) which offer more vigorous work out compared to other forms of aerobic exercises. Reebok has developed plastic benches with variable heights which are frequently used for bench step test. These benches are accepted worldwide; hence these steps are often referred to as Reebok steps. Bench step up exercise has been shown to help individuals to meet the recommendations of American College of Sports Medicine (ACSM) for improvement of cardiovascular fitness, body composition and aerobic capacity in a wide variety of populations including patients with cardiac failure (Kraemer WJ.et al, 2001). Stepping exercise is often recommended during interval training to enhance physical fitness. Since late 1980's this exercise format has become a widely practiced fitness modality, especially among the female population. Step aerobics is practiced in health centers, fitness training gyms, and academic (Al Ameen J, 2013). Step up is gaining popularity among the Indian women population because of its simplicity to carry out in gyms as well as in households. Recent investigation of acute cardio respiratory responses to the current popular style of bench step exercise has validated its use in improving aerobic physical fitness particularly in women (Scharff-Olson M, et al,1996). Rope jumping was probably introduced by America in the 1600s by the Dutch settlers of New Amsterdam (modern-day New York). It is a surprise that rope jumping were strictly a boy's activity, at least in western cultures. In fact, young girls were warned not to undertake such strenuous activity. Fortunately, around the turn of the century females realized that someone was pulling the wool over their eyes and began rope jumping with a vengeance. Rope jumping requires the co-ordination of several muscle groups to sustain the precisely timed and rhythmic movements that are integral to the exercise. Rope jumping increases dynamic balance because the athlete must make numerous neuromuscular adjustments to the imbalance created by each of the hundreds of jumps per training session. These adjustments also force the athlete to balance the body weight on the balls of the feet, reinforcing the universal athletic position (Buddy Lee, 2003).

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Methodology

Sixty subjects were selected for this study from Adwa College of Teacher's Education. They were divided in to three equal groups namely Group I (Step-up), Group II (Rope skipping) and control group. Group I (Step-up) and Group II (Rope skipping) were undergone 8 weeks of training and control group did not give any special attention in terms of training.

Table I. Schedule for experimental group I (Step-up training)

Week	No of training per week	Training program	Exercise	Volume	Rest	Percentage of intensity
1 and 2	3days	**Monday**	-Front step-up -Side step-up -Back step-up	30steps/ min	1minute	**50% of Vo_2 max**
		Wednesday	-Front step-up -Side step-up -Back step-up			
		Friday	-Front step-u -Side step-up -Back step-up			
3 and 4	3days	**Monday**	-Front step-up -Side step-up -Back step-up	35steps/ min	1minute	**60% of Vo_2 max**
		Wednesday	-Front step-up -Side step-up -Back step-up			
		Friday	-Front step-up -Side step-up -Back step-up			
5 and 6	3days	**Monday**	-Front step-up -Side step-up -Back step-up	40steps/ min	1minute	**70% of Vo_2 max**
		Wednesday	-Front step-up -Side step-up -Back step-up			
		Friday	-Front step-up -Side step-up -Back step-up			
7 and 8	3days	**Monday**	-Front step-up -Side step-up -Back step-up	45steps/ min	1minute	**80% of Vo_2 max**
		Wednesday	-Front step-up -Side step-up -Back step-up			
		Friday	-Front step-up -Side step-up -Back step-up			

Table II. Schedule for Experimental Group II (Rope Skipping Training)

Week	No of days per week	Training program	Type of exercise	Volume	Rest	Percentage of intensity
1 and 2	3days	**Monday**	-Heel-toe -One foot single bounce -Single speed bounce	40 skip/min	1minute	**50% of Vo_2 max**

			-Crossover -Double jump			
		Wednesday	-Heel-toe -Onefoot single bounce Single speed bounce -Crossover: -Double jump			
		Friday	-Heel-toe -One foot single bounce -Single speed -Crossover: -Bounce Double jump			
3 and 4	3days	**Monday**	-One foot single bounce -Speed bounce -Crossover: -bounce Double jump -Speed single -Alternate jump	50skip/min	1minute	**60% of Vo_2 max**
		Wednesday	-One foot single bounce -Single speed -Crossover with speed -bounce Double jump -Alternate jump			
		Friday	-One foot single bounce -Crossover -bounce Double jump -Speed single -Alternate jump			
5 and 6	3days	**Monday**	-One foot single bounce -Single speed -Crossover: -bounce Double jump -Alternate jump	60 skip/min	1minute	**70% of Vo_2 max**
		Wednesday	- One foot single bounce -Crossover: -bounce Double jump -Speed single -Alternate jump			

		Friday	- Onefoot single bounce -Single speed -Crossover: -bounce Double jump -Speed single -Alternate jump			
7 and 8	3days	**Monday**	-One foot single bounce -Single speed -Crossover -Bounce Double jump -Speed single -Alternate jump	70 skip/min	1minute	**80% of Vo_2 max**
		Wednesday	-One foot single bounce -Crossover: -bounce Double jump -Speed single -Alternate jump			
		Friday	-One foot single bounce -Single speed -Crossover -bounce Double jump -Alternate jump			

Statistical techniques

Descriptive statistics was used to analysis the data prior to employing inferential statistics. The Analysis of covariance (ANCOVA) was used to find out the significant difference if any, among the experimental groups and control group on selected criterion variables separately. Further Bonefferani post-hoc test was applied when significant difference exists. Level of significance was set at 0.05.

Results

Table III. Analysis of covariance of the mean of experimental groups and control group on flexibility

Flexibility	**Experimental group**		**Control group**	**SoV**	**SS**	**Df**	**MS**	**F ratio**	**Sig.**
	Step- up group	**Skipping group**							
Pre-test mean	12.70	9.25	12.60	A	154.2	2	77.11	2.71	.087
S.D.	6.89	4.73	12.6	W	1620.7	57	28.43		
Post-test mean	19.20	18.65	14.85	A	224.4	2	112.21	5.4*	.007
S.D.	5.59	3.01	14.85	W	1168.3	57	20.49		
Adjusted	18.42	20.13	14.14	A	365.0	2	182.54	21.6*	.000

post-test mean				W	472.7	56	8.44		

Significant at 0.05 level of confidence
(The table values required for significance at 0.05 level of confidence for 2 and 57 and 2 and 56 are 2.57 and 2.56 respectively)

Table III shows that the pre-test mean values of flexibility for experimental group-I (Step-up), group-II (Rope skipping) and control group were 12.70±6.89, 9.25±4.73 and 12.60±12.6 respectively. The obtained "F" ratio value of 2.71 for pre-test score of experimental group I, group II and control group as flexibility was greater than the table value of 2.57 for significance with degree of freedom 2 and 57 at 0.05 level of confidence. The post-test mean values of flexibility for experimental group I, experimental group II and control group were 19.20±5.59, 18.65±3.01 and 14.85±14.85 respectively. The obtained "F" ratio value of 5.4 for post-test scores of experimental group I, experimental group II and control group on flexibility was greater than the required table value of 2.57 for significance with degree of freedom 2 and 57 at 0.05 level of confidence. The adjusted post-test mean values of flexibility for experimental group I, experimental group II and control group were 18.42, 20.13 and 14.14 respectively. The obtained "F" ratio value of 21.6 for adjusted post-test scores of experimental group and control group were greater than the required table value of 2.56 for significance with degree of freedom 2 and 56 at 0.05 level of confidence. The statistical analysis indicated that there was a significant improvement on flexibility after the eight weeks of training period. Further to determine which of the paired means has a significant increase bonferroni post hoc tests was applied. The result of the follow up test is presented in table IV.

Table IV. Bonferroni post hoc tests for paired mean comparison of flexibility

Control group	Step-up group	Rope skipping group	Mean difference	Sig
14.14	18.42		-4.284*	**.000**
14.14		20.13	-5.995*	**.000**
	18.42	20.13	-1.710	.233

* Significant at 0.05 level.

Table IV shows that the adjusted post-test mean comparison on flexibility between experimental group I, experimental group II and control group were -4.284, -5.995 and -1.710 respectively and which were significant at 0.05 level of confidence.

Table V. Analysis of covariance of the mean of experimental groups and control group on explosive power

Explosive strength	Experimental group		Control group	SoV	SS	Df	MS	F ratio	Sig.
	Step-up group	Skipping group							
Pre-test mean	161.35	150.40	153.10	A	1301.7	2	650.85	2.71	.075
S.D.	16.74	12.76	16.61	W	1366.1	57	239.77		
Post-test mean	169.10	168.65	156.95	A	1898.1	2	949.05	4.41*	.016
S.D.	16.20	13.87	13.77	W	12253.3	57	214.97		
Adjusted post-test mean	163.87	172.36	158.46	A	1943.7	2	971.86	17.4*	.000
				W	3127.13	56	55.84		

Significant at 0.05 level of confidence
(The table values required for significance at 0.05 level of confidence for 2 and 57 and 2 and 56 are 2.57 and 2.56 respectively)

Table V shows that the pre-test mean values of explosive power for experimental group-I (Step-up), group-II (Rope skipping) and control group were 161.35±16.74, 150.40±12.76 and 153.10±16.61.6 respectively. The obtained "F" ratio value of 2.71 for pre-test score of experimental group I, I, group II and control

group as explosive power was greater than the table value of 2.57 for significance with degree of freedom 2 and 57 at 0.05 level of confidence. The post-test mean values of explosive power for experimental group I, experimental group II and control group were 169.20±16.20, 168.65±13.87 and 156.95±13.77 respectively. The obtained "F" ratio value of 4.41 for post-test scores of experimental group I, experimental group II and control group as explosive power was greater than the required table value of 2.57 for significance with degree of freedom 2 and 57 at 0.05 level of confidence. The adjusted post-test mean values of explosive power for experimental group I, experimental group II and control group were 163.87, 172.36 and 158.464 respectively. The obtained "F" ratio value of 17.4 for adjusted post-test scores of experimental group and control group were greater than the required table value of 2.56 for significance with degree of freedom 2 and 56 at 0.05 level of confidence. The statistical analysis indicated that thus WGS C significant improvement in explosive power after the eight weeks of training period. Further to determine which of the paired means has a significant increase bonferroni post hoc tests was applied. The result of the follow up test is presented in table VI.

Table VI. Bonferroni post hoc tests for paired mean comparison of explosive strength

Control group	Step-up group	Rope skipping group	Mean difference	Sig
158.46	163.87		-5.408	**.089**
158.46		172.36	-13.906*	**.000**
	163.87	172.36	-8.498*	.003

* Significant at 0.05 level.

Table VI shows that the adjusted post-test mean compared as flexibility between experimental group I, experimental group II and control group were -5.408, -13.906 and -8.498 respectively which were significant at 0.05 level of confidence.

Table VII. Analysis of covariance of the mean of experimental groups and control group on agility

Agility	Experimental group		Control group	SoV	SS	Df	MS	F ratio	Sig.
	Step-up group	Skipping group							
Pre-test mean	8.74	9.07	8.92	A	1.14	2	.57	.728	.487
S.D.	1.10	0.89	0.56	W	44.61	57	.78		
Post-test mean	8.00	7.94	8.66	A	6.27	2	3.13	5.365*	.007
S.D.	0.93	0.65	0.67	W	33.34	57	.58		
Adjusted post-test mean	8.11	7.85	8.65	A	6.71	2	3.35	10.65*	.000
				W	17.64	56	.31		

Significant at 0.05 level of confidence

(The table values required for significance at 0.05 level of confidence for 2 and 57 and 2 and 56 are 2.57 and 2.56 respectively).

Table VII shows that the pre-test mean values of agility for experimental group-I (Step-up), group-II (Rope skipping) and control group were 8.74±1.10, 9.07±0.89, and 8.92±0.56 respectively. The obtained "F" ratio value of 0.728 for pre-test score of experimental group I, group II and control group as agility was greater than the table value of 2.57 for significance with degree of freedom 2 and 57 at 0.05 level of confidence. The post-test mean values of agility for experimental group I, experimental group II and control group were 8.00±0.93, 7.94±0.65 and 8.66±0.67 respectively. the obtained "F" ratio value of 5.365 for post-test scores of experimental group I, experimental group II and control group as agility was greater than the required table value of 2.57 for significance with degree of freedom 2 and 57 at 0.05 level of confidence. The adjusted post-test mean values of agility for experimental grouop I, experimental group II and control group were 8.11, 7.85 and 8.65 respectively. The obtained "F" ratio value of 10.65 for adjusted post-test scores of experimental group and control group were greater than the required table value of 2.56 for significance with degree of freedom 2 and 56 at 0.05 level of confidence. The statistical analysis indicated that there was a significant improvement in agility after the eight weeks of training period. Further to determine which of the paired means has significant increase Bonferroni post hoc tests was applied.

Discussion

The study describes clear information about the effect of rope skipping and step-up exercise trainings on

the selected physical fitness variables and the comparison between the variables. The 8 week step-up and rope skipping training showed significant improvement on the back flexibility of the female students. The result of this study proved that the rope skipping group improved on lower limb explosive power as compared with the step-up group and control group. This may be due to increase of strength of the legs as the result of rope skipping training. Step up group showed an improvement on lower limb explosive power however, the improvement was not significant like the rope skipping group. This may be due to limited activity of the upper body during the step-up or less contractility of the leg muscles.

Conclusion

The following conclusions were drown from the result of the study:

1. The rope skipping group improved significantly on physical fitness variables namely flexibility, agility and explosive strength.
2. The step-up group improved significantly on physical fitness variables namely flexibility and agility but there was no significant improvement on explosive power.
3. The rope skipping group and step-up groups showed no significant different on the physical fitness variables of flexibility and agility.
4. The rope skipping group significantly differed from step-up group on explosive strength which means the rope skipping group showed better improvement on explosive strength than step-up group.

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