EFFECT OF UPHILL TRAINING ON SELECTED PHYSIOLOGICAL VARIABLES AMONG INTERCOLLEGIATE LEVEL MEN BASKETBALL PLAYERS

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Abstract

The main purpose of the study was to find out the effect of uphill training on selected physiological variables among inter collegiate level men Basketball players. To achieve the purpose of the study forty (N=40) male students in theage group of 19 to 25 years were selected as subjects at random from Ernakulam district.(n = 40, age 21.4 ± 0.4 y, height 178.8 ± 14.2 cm, weight 69.6 ± 12.7 kg).The physiological variables selected for the study were blood pressure, resting pulse rate and cardiorespiratory endurance. The following testing procedures were followed; blood pressure was measured (systolic and diastolic) using sphygmomanometer, resting heart rate was measured counting the pulse at resting condition and cardio-respiratory endurance was measured by using Coopers's12 minutes run/ walk test and it was converted in VO2 max. Analysis of covariance was used to find out the significant difference if any, among the experimental groups and control group on selected criterion variables separately. The result of the study statistically found a significant improvement in the physiological variables such as bloodpressure, resting heart rate and cardio respiratory endurance due to uphill training on the experimental groups.
Keywords: Systolic and Diastolic Blood pressure, Resting Heart Rate and Cardio respiratory Endurance, Uphill Sprint Training, Uphill Lateral Shuffle and Uphill Back Pedal Training.

Introduction

Basketball is a popular team sport which requires a high level of aerobic and anaerobic fitness. However, the demands vary depending on the age, level and gender of the players. For this, physical fitness can be evaluated through different physiological components, including resting pulse rate, blood pressure and cardiorespiratory or muscular endurance. The importance of this capacity is due to the fact that the athlete must quickly recover from intense efforts in a short period of time in order to be able to chain a greater number of efforts during the competition. Sports training aim at improving the performance of a sports person. For best result the system of training has to be based and conducted on scientific facts and lines. Uphill training program is an appropriate and efficient method for improving both agility speed and endurance ability in basketball players. Athletes use uphill running as a movement-specific form of resistance training to enhance performance. Hill workouts can be manipulated in many ways through five variables: grade, intensity, volume, length, and time. Any of these variables can be combined to create results in a specific stimulus. In uphill running, the athlete is using their body weight as a resistance to push against, so the

driving muscles from which their leg power is derived have to work harder. Running inclines, either on a hill outdoors or on a treadmill, is a form of resistance training that builds up the muscles in your calves, quads, hamstrings, and gluteus. Hill running strengthens those areas more than running on flat ground such as hip flexors and Achilles tendons. The results of various studies strongly support the application of uphill training on the basketball players; demonstrating that to optimize endurance performance, strength training should be a vital component in the physical preparation of basketball players. The great thing about uphill training is that no additional equipment or a training partner is required to get an incredible resistance sprinting workout. Today the preparation of an athlete for achievement is a complex dynamic state, characterized by high level of physical, physiological and psychological efficiency and the degree of perfection of the necessary skill and knowledge, techniques and tactical preparation. To enhance the performance of basketball players, the coaches have to include hill training workouts in their training plan. Thus the aim of the study was to investigate the effect of 12 week uphill training on selected physiological parameters of selected intercollegiate level men basketball players.

Methodology

To achieve the purpose of the study forty inter collegiate level male athletes of Ernakulam District in the age group of 19 to 25 years(age 21.4 ± 0.4 y) were selected as subjects at random and they were divided into four equal groups; three experimental groups and one control group. Group - I underwent uphill sprint training for a distance of 50 mts , group - II underwent lateral shuffle uphill sprint training

for a distance of 50mts, group-IIunderwent uphill backpedal training for a distance of 50 mts and group IV acted as the control group which did not participate in any special training apart from their regular training sessions. Training session usually begin with warm up exercises for 15 minutes before the training program begin. The uphill training program was carried out for 40 minutes, the cool down activities were for 5 minutes and total time for active rest was 10 minutes. The intensity of each exercise started at 60% maximum heart rate and gradually increased to 85% of maximum heart rate before the end of the 12 weeks training. The variables studied in the present study were blood pressure, resting heart rate, cardio-respiratory endurance.The blood pressure was measured (systolic and diastolic) using sphygmomanometer, resting heart rate was measured counting the pulse at resting condition and cardio-respiratory endurance was measured by using Coopers's 12 minutes run/ walk test and it was converted in VO2 max. The data obtained from the subjects were treated statically employing the analysis of covariance to compare the adjusted mean difference among the groups. The Scheffe's post hoc test was used to find out the significant difference of paired means.

Findings

In all the cases 0.5 level of significance was fixed to test the significance, which was considered as appropriate. Since there were three groups involved in this study the Scheffe's test was used as post-hoc test.

TABLE I
ANALYSIS OF COVARIANCE ON SYSTOLIC BLOOD
PRESSURE (In mm Hg)

Test	Exp. Group -1	Exp. Group -2	Exp. Group -3	Control Group	SOV	Sum of Squares	df	Mean square	'F' Ratio
Pre-test Mean	124.50	128.90	135.20	120.10	B:	567.90	3	188.67	2.23
S.D	10.27	8.74	10.24	9.19	W:	3362.30	36	93.40	
Post-Test Mean	118.10	123.80	125.70	128.60	B:	654.27	3	217.43	1.99
SD	11.20	8.54	12.14	9.44	W:	3916.50	36	108.79	
Adjusted Post-test Mean	124.29	128.38	121.87	128.76	B:	327.42	3	109.14	17.54*
					W:	215.37	35	6.15	

Significant at 0.05 level of significance

Table-I shows that the pre-test values of systolic blood pressure for experimental group I, experimental group - II, experimental group-III and control group are 124.50, 128.90, 135.20 and 120.10 respectively. The obtained 'F' ratio value of 2.23 for pre-test Scores on systolic blood pressure is less than the required table value of 2.85 for significance with df 3 and 36 at 0.05 level of significance. The post-test mean values of systolic blood pressure for experimental group -I, experimental group- II, experimental group-III and control group are 118.10, 125.70, 128.60 and 129.0 respectively. The obtained 'F ratio value of 1.99 for post-test scores on systolic blood pressure is less than the required table value of 2.85 for significance with df 3 and 36 at 0.05 level of significance.

The adjusted post-test mean values of systolic blood pressure for experimental group - I, experimental group -II, experimental group-IIIand control group are 124.29, 128.38, 121.87 and128.76 respectively. The obtained 'F ratio value of 17.54 for post-test scores is greater than the required table value of 2.87 for significance with df 3 and 35 at 0.05 level of significance. The above statistical analysis indicates that there is a significant improvement in systolic blood pressure after the training intervention, further to determine which of the paired means has a significant increase, Scheffe's post hoc test was applied.

TABLE II
SCHEFFE'S TEST FOR THE DIFFERENCE BETWEEN THE
ADJUSTED POST-TEST MEAN OF SYSTOLIC BLOOD
PRESSURE (in mmHg)

Exp Group-1	Exp Group-2	Exp Group-3	Control Group	Mean Difference	CD at 0.05 level of significance
124.93	124.38			0.08	3.61
124.93		121.757		2.42	3.61
124.93			129.76	5.46	3.61
	124.38	121.872		2.51	3.61
	124.38		129.76	5.38	3.61
		121.872	129.76	7.89	3.61

Significant at 0.05 level of significance

Table- II shows that the adjusted post-test mean difference in systolic blood pressure between experimental group-I and control group, experimental group-II and control group, experimental group-III and control group are 5.46, 5.38 and 7.89 respectively, which is significant at 0.05 level of significance. The adjusted post-test mean difference between the experimental group- I and experimental group II, experimental group-I and experimental group-III and experimental group-I and experimental group - III are 0.08, 2.42 and 2.51 which are insignificant at 0.05 level of significance.

TABLE III
ANALYSIS OF COVARIANCE ON DIASTOLIC BLOOD
PRESSURE (In mm Hg)

Test	Exp Group -1	Exp group-2	Exp group-3	Control Group	SOV	Sum of squares	df	Mean square	'F' Ratio
Pre-test Mean	68.30	67.50	68.50	65.60	B	97.46	3	32.49	0.48
S.D	9.01	7.56	9.84	7.074	W	2565.50	36	71.26	
Post-Test Mean	62.60	62.10	62.60	63.30	B	7.30	3	2.433	0.04
SD	8.072	7.09	10.024	6.77	W	2355.80	36	65.44	
Adjusted Post-test Mean	61.58	61.84	61.395	65.78	B	127.02	3	42.34	23.23
					W	63.80	35	1.82	

Significant at .05 level of significance

Table – III shows that the pre-test values of diastolic blood pressure for experimental group-I experimental group-II, experimental

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International Journal of Movement Education and Social Science
Peer Reviewed and Indexed Journal
IJMESS Vol. 9 Issue 2 (Oct 2020)

ISSN: 2278-0793 (Print) & 2321-2279 (Online)
Impact Factor 5.62
www.ijmess.org

group -III and control group are 68.30, 67.50, 68.50 and 65.60 respectively. The obtained 'F' ratio value of 0.48 on diastolic blood pressure is lesser than the required table value of 2.85 for significance with df 3 and 36 at 0.05 level of significance. The post –test mean values of diastolic blood pressure for experimental group -I, experimental group-II, experimental group- III and control group are 62.60, 62.10, 62.60 and 63.30 respectively. The obtained 'F' ratio value of 0.04 on diastolic blood pressure is lesser than the required table value of 2.85 for significance with df 3 and 36 at 0.05 level of significance.

The adjusted post-test mean values of diastolic blood pressure for experimental group-I, experimental group II, experimental group- III and control group are 61.58, 61.84, 61.40 and 65.78 respectively. The obtained F ratio value of 23.23 is greater than the required table value of 2.87 for significance with df 3 and 35 at 0.05 level of significance. The above statistical analysis indicates that there is a significant improvement in diastolic blood pressure after the training period. Further to determine which of the paired means has a significant increase, Scheffe's post hoc test was applied. The result of the follow-up test is presented.

TABLE IV
SCHEFFE'S TEST FOR THE DIFFERENCE BETWEEN THE
ADJUSTED POST-TEST MEAN OF DIASTOLIC
BLOOD PRESSURE (in mmHg)

Exp Group-1	Exp group-2	Exp group-3	Control group	Mean Difference	CD at 0.05 level of significance
61.58	61.84			0.29	1.77
61.58		61.40		0.19	1.77
61.58			65.58	4.20	1.77
	61.84	61.40		0.45	1.77
	61.84		65.58	3.94	1.77
		61.40	65.58	4.39	1.77

Significant at 0.05 level of significance

Table-IV shows that the adjusted post-test mean difference in diastolic blood pressure

between experimental group-1and control group, experimental group-IIand control group and experimental group-III and control group are 4.20, 3.94 and 4.39 respectively which is significant at 0.05 level of significance. The adjusted post-test mean difference between the experimental group-I and experimental group-III, experimental group-I and experimental group-III and experimental group-I and experimental group- III are 0.29, 0.19 and 0.45, which are insignificant at 0.05 level of significance

TABLE V
ANALYSIS OF COVARIANCE ON RESTING
HEART RATE (In numbers)

Test	Exp Group-1	Exp Group-2	Exp Group-3	Control Group	SOV	Sum of squares	Df	Mean square	'F' Ratio
Pre-test Mean	68.30	69.90	68.70	70.70	B	6.28	3	32.49	0.22
S.D	3.824	3.604	1.95	2.627	W	3.44.70	36	71.26	
Post-Test Mean	67.70	67.90	66.70	70.90	B	98.40	3	2.43	3.37
SD	3.95	3.726	70.90	2.283	W	350.00	36	65.44	
Adjusted Post-test Mean	67.91	68.02	67.01	70.26	B	56.37	3	42.34	16.61
					W	39.60	35	1.82	

Significant at .05 level of significance

Table – V shows that the pre-test values of diastolic blood pressure for experimental goup-1 experimental group-11, experimental group -111 and control group are 68.30, 69.90, 68.70 and 70.70 respectively. The obtained 'F' ratio value of 0.48 on diastolic blood pressure is lesser than the required table value of 2.85 for significance with df 3 and 36 at 0.05 level of significance. The post-test mean values of resting heart rate for experimental group -I, experimental group-II, experimental group-III and control group are 67.70, 67.90, 66.70 and 70.90 respectively. The obtained 'F' ration value of 3.37 on resting heart rate is greater than the required table value of 2.85 for significance with df 3 and 36 at 0.05 level of significance.

The adjusted post-test mean values of resting heart rate for experimental group-I,

International Journal of Movement Education and Social Science
Peer Reviewed and Indexed Journal
IJMESS Vol. 9 Issue 2 (Oct 2020)

ISSN: 2278-0793 (Print) & 2321-2279 (Online)
Impact Factor 5.62
www.ijmess.org

experimental group-II, experimental-III and control group are 67.91, 68.02, 67.01 and 70.26 respectively. The obtained 'F' ratio value of 16.607 was greater than the required table value of 2.87 for significance with df 3 and 35 at .05 level of significance. The above statistical analysis indicates that there was a significance improvement in resting heart rate after the training period. Further to determine which of the paired means has significant increase, Scheffe's post hoc test was applied.

TABLE –VI
SCHEFFE'S TEST FOR THE DIFFERENCE BETWEEN THE ADJUSTED POST-TEST MEAN OF RESTING HEART RATE (in mmHg)

Exp Group-1	Exp Group-2	Exp group-3	Control group	Mean Difference	CD at 0.05 level of significance
67.91	68.02			0.11	1.40
67.91		67.08		0.91	1.40
67.91			70.26	2.35	1.40
	68.02	67.08		1.01	1.40
	68.02		70.26	2.24	1.40
		67.08	70.26	3.25	1.40

Significant at 0.05 level of significance

Table-VI shows that the adjusted post-test mean difference interesting heart rate between experimental group-I and control group, experimental group-II and control group and experimental group-III and control group are 2.35, 2.24 and 3.25 respectively which is significant at 0.05 level of significance. The adjusted post-test mean difference between the experimental group-I and experimental group-II, experimental group-I and experimental group-III and experimental group-I and experimental group-III are 0. 11, 1.01, and 0.91 which are insignificant at 0.05 level of significance.

TABLE VII
ANALYSIS OF COVARIANCE ON CARDIO RESPIRATORY ENDURANCE (in ml/kg/hl)

Test	Exp Group-1	Exp Group-2	Exp Group-3	Control Group	S O V	Sum of Squares	Df	Mean square	'F' Ratio
Pre-test Mean	51.21	52.68	46.16	49.34	B:	237.11	3	79.04	1.31
S.D	6.95	7.61	9.55	6.62	W:	2169.88	36	60.27	
Post-Test Mean	58.00	59.49	53.66	52.31	B:	352.13	3	117.38	1.89
SD	7.53	7.88	9.21	6.72	W:	2238.28	36	62.18	
Adjusted Post-test Mean	56.65	56.65	57.65	52.82	B:	126.89	3	42.30	21.77*
					W:	68.00	35	1.94	

*significant at 05 level of significance

Table-VII shows that the pre-test values of cardio respiratory endurance for experimental group-I, experimental group-IIexperimental group- II and control group are 51.21, 52.68, 46.16 and 49.34 respectively. The obtained 'F ratio value of 1.31 on resting heart rate was lesser than the required tablevalue of 2.85 for significance with df 3 and 36 at 0.05 level of significance. The post-test mean values of cardio respiratory endurance for experimental group -I, experimental group-III, experimental group-III and control group are 58.00, 59.49, 53.67 and 52.33 respectively. The obtained F ratio value of 1.89 on resting heart rate is lesser than the required table valueof 2.85 for significance with df 3 and 36 at 0.05 level of significance.
The adjusted post-test mean values of cardio respiratory endurance for experimental group I, experimental group II, experimental group III and control group are 56.65, 56.65, 57.65 and 52.82 respectively. The obtained F ratio value of 21.77 is greater than the required table value of 2.87 for significance with df 3 and 35 at 0.05 level of significance. The above statistical analysis indicates that there is a significant improvement in cardiorespiratory endurance after the training period. Further to determine which of the paired means has a

significant increase, Scheffe's post hoc test was applied.

TABLE VIII
SCHEFFE'S TEST FOR THE DIFFERENCE BETWEEN THE ADJUSTED POST-TEST MEAN OF CARDIO RESPIRATORY ENDURANCE (in ml/ kg/hl)

Exp Gropu-1	Exp Group-2	Exp Group-3	Control group	Mean Difference	CD at 0.05 level of significance
56.65	56.65			0.00	1.83
56.65		57.65		0.99	1.83
56.65			52.82	3.83*	1.83
	56.65	57.65		0.99	1.83
	56.65		52.82	3.83*	1.83
		57.65	52.82	4.82*	1.83

Significant at 0.05 level of significance

Table – VIII shows that the adjusted post- test mean difference in cardio respiratory endurance between experimental group – I and control group, experimental group II and control group and experimental group-III and control group are 3.83, 3.83 and 4.82 respectively, which is significant at 0.05 level of significance. The adjusted post-test mean difference between the experimental group-I and experimental group-II, experimental group-I and experimental group II and experimental group I and experimental group-III are 0.00, 0.99 and 0.99, which are hence insignificant at 0.05 level of significance.

Conclusion
There was significant reduction in blood pressure (systolic and diastolic), Resting heart rate was found to be reduced and significant improvement was found in cardio respiratory endurance after the different intensities of uphill training programme after the different methods of uphill training programmes when compared with the control group.

References:
Baumgartner and Jackson (1984) Measurement, Evaluation in Physical and Exercise Science, Dubuque: W.M.C. Brown Publishers Ltd., p.262.

Brian J.Sharkey and Steven E. Gaskill (2006) Sport Physiology for Coaches, Human Kinetics, U.S.A., pp. 4-5.

Clarke, H. and Clarke, D.H. (1989) A Physical and Motor Test in Physical Education,6th ed.,Englewood Cliffs, New Jersey, U.S.A: Prentice hallinc, p.63.

Gottschall, J. S., Kram, R. (2005) Ground Reaction Forces During Downhill and Uphill Running, Journal of Biomechanics, 38, 445–452.

Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer (1992) Measurement of Blood Pressure: Biomedical Instrumentation and Measurements, 2nd ed., New Delhi: Prentice Hall of India Pvt. Ltd., p.126.

Michael, H. Stone, Margaret Stone and William A. Sands (2007) Principles and Practice of Resistance Training, Illinois: Human Kinetics Publishers Ltd., pp.1-3.

Paradisis, G. P., Bissas, A., Cooke, C.B. (2009) Combined Uphill and Downhill Sprint Running Training is More Efficacious than Horizontal, International Journal of Sports Physiology and Performance, 4(2), pp. 229–243.

Paradisis, Giorgos & Cooke, Carlton & Bissas, Athanassios (2013) Changes in Leg Strength and Kinematics with Uphill - Downhill Sprint Training".International Journal of Sports Science & Coaching ,8(3) pp. 543-556.

Roberts, T. J., Belliveau, R. A. (2005) Sources of Mechanical Power for Uphill Running in Humans, Journal of Experimental Biology, 208, pp. 1963–1970.

Sloniger, M.A., Cureton, K.J., Prior, B.M., Evans, E.M. (1997) Lower Extremity Muscle Activation During Horizontal and Uphill Running, Journal of Applied Physiology, 83, pp. 2073–2079.

Vivian H. Heyward (2002) Advanced Fitness Assessment and Exercise Prescription, 4h ed., Illinois: Human Kinetics Publishers Ltd., pp. 135-142.