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EFFECT OF TREADMILL RUNNING UNDER VARIED INCLINATIONS ON SELECTED PHYSIOLOGICAL VARIABLES AND NEUROMUSCULAR INDICES AMONG INTERCOLLEGIATE ATHLETES

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Abstract

The purpose of the study was to find out the effect of treadmill running under varied inclinations on selected physiological variables and neuromuscular indices among athletes. For this purpose, thirty athletes were selected at random from the colleges in Chennai district. Their age ranged between 18 and 23 years. The selected thirty athletes were randomly assigned into two groups namely, experimental group and control group each consisting of fifteen subjects. The subjects were given treadmill running for a period of twelve weeks. The subjects were tested on the selected physiological variables namely, resting heart rate, systolic and diastolic blood pressure and the selected neuromuscular indices namely, speed, shoulder strength, explosive power, and coordination. After the experimental period, the collected data was analysed by using analysis of covariance. The level of significance was fixed at 0.05 level. The results showed that the twelve weeks of treadmill running under varied inclinations had a significant improvement on the selected physiological variables namely, resting heart rate, systolic and diastolic blood pressure and the selected neuromuscular indices namely, speed, shoulder strength, explosive power, and coordination.

Key words: *Treadmill running, Neuromuscular Indices, inclination and Athletes.*

Introduction

The treadmill running helps to improve the physical fitness. The energy cost of running on a treadmill higher while running than walking **(Bunc and Dlouha, 1997).** Two hand kettle ball exercise and grade tread mill running had similar effects on improving blood pressure and cardiorespiratory endurance **(Thomas et al. 2014). Hulsey et al. (2012)** proved that kettle ball and treadmill running improves rate of perceived exertion among triathletes.

Aquatic treadmill running was running is as effective as treadmill running on the floor for aerobic conditioning, resting heart rate, and breathing frequency in fit individuals **(Silvers, Rutledge, and Dolny, 2007).**

Treadmill training simprove the walking speed and gross motor function of adolescents with spastic cerebral palsy, without adverse effects on spasticity **(Nikolaos, 2012).**

The EMG patterns of the leg muscles were generally similar between overground and treadmill modes **(Wank, Frick , and Schmidtbleicher, 1998).**

Treadmill running at an inclination of 1% to 2% is equal to over ground running. Treadmill running at an inclination above 3% resembles uphill running.

The athletes run on various surfaces to improve their physical fitness. Countries like India, particularly in Chennai metropolitan city, college athletes practice in their college track/play fields to improve their physical fitness. During rainy season, unlike developed countries, a very few synthetic track and indoor play fields are available in Chennai. The available synthetic track and indoor play fields are restricted only to elite athletes. The treadmill running is the only weapon for the athletes during rainy season to improve their physical fitness. There are a very few research studies conducted in the area of effect of treadmill running on the physiological and neuromuscular indices. Hence, the investigator was interested to find out the effect of treadmill training on the physiological variable and neuromuscular indices.

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Methodology

Subjects

Thirty (N-30) athletes were selected at random from the colleges in Chennai district. Their age ranged between 18 and 23 years. The selected thirty athletes were randomly assigned into two groups namely, experimental group and control group each consisting of fifteen (n-15) subjects

.**Table-I**

Demographic profile of the subjects

	Age	Height	Weight
Mean	21.1	1.70	69.06
S.D±	±1.42	±0.03	±3.63
Minimum	18	1.65	62
Maximum	23	1.77	78

Variables

The physiological variables namely, resting heart rate, breath holding time, systolic and diastolic blood pressure and the neuromuscular indices namely, speed, shoulder strength, explosive power, and coordination were selected.

Procedures

The subjects were given treadmill running under varied inclinations for a period of twelve weeks. The treadmill training was designed based in the FITT formula. The treadmill training was given three days a week on alternative days of a week. The training session was scheduled in the morning between 6.30 a.m. and 7.45 a.m. The grade of the treadmill was kept at zero level during warm up. The total duration of the training was 75 minutes. Fifteen minutes was given for warm up and fifteen minutes was given for cool down. The subjects performed treadmill training for a period of 45 minutes. The initial inclination was kept at 2% for a period of 15 minutes. The inclination was fixed at 3% between 15 and 25 minutes of treadmill running. The subjects ran at an inclination of 4% between 25 and 35 minutes. The final phase of treadmill running between 35 and 45 minutes was ran at an inclination of 5%. The intensity (speed) was increased once in every four weeks. Initially, the subjects were asked to run at a speed of 9 km/hr on the treadmill (1^{st}, $2^{nd,}$ 3^{rd} week and 4^{th} week). 1km/hr was increased on every progression. The subjects were tested on the selected physiological variables namely, resting heart rate (Stethoscope), systolic and diastolic blood pressure (Sphygmomanometer) and the selected neuromuscular indices namely, speed (50m test), shoulder strength (Pull-up test), explosive power (Standing broad jump), and coordination (Hand-eye coordination test) before and after the training period. The training schedule is given in table-II

Table-II

Training schedule

Frequency	Intensity	Time	Type
3 days a week	➢ 9km/hr (1^{st}, 2^{nd}, 3^{rd} and 4^{th} week) (3% inclination 15 minutes, 4% at 15 and 25 minutes, 4% at 25 and 35 minutes, 5% at 35 and 45 minutes) ➢ 10km/hr (5^{th}, 6^{th}, 7^{th} and 8^{th} week) (3% inclination 15 minutes, 4% at 15 and 25 minutes, 4% at 25 and 35 minutes, 5% at 35 and 45 minutes) ➢ 11km/hr (9^{th}, 10^{th}, 11^{th}, and 12^{th} week) (3% inclination 15 minutes, 4% at 15 and 25 minutes, 4% at 25 and 35 minutes, 5% at 35 and 45 minutes)	75 minutes (15 minutes each for warm up and cool down and 45 minutes for treadmill running)	Treadmill running under varied inclinations

Statistical analysis

After the experimental period, the collected data was analysed using analysis of covariance (ANCOVA) statistical procedure. The level of significance was fixed at 0.05 level.

Results

Table-III
Results on speed

Test	Experimental Group	Control Group	SV	SV	df	MS	F
Pre test	67.93	67.73	Between	0.30	1	0.300	0.06
			Within	133.87	28	4.78	
Post test	63.53	67.60	Between	124.03	1	124.03	22.36*
			Within	155.33	28	5.55	
Adjusted	63.44	67.69	Between	135.47	1	135.47	99.23*
			Within	36.86	27	1.37	

*Significant at 0.05 level

Table value with df 27, 4.21; 28, 4.20

The pre test F value on the means of experimental group and control group 0.06 was lesser than the table F value 4.21 reveals that there was no significant difference between the groups at base line. The F value of post test means and adjusted means 22.36, and 99.23 respectively were higher than the table F value 4.21. Hence, there was a significant difference between experimental group and control group on speed.

Table-IV
Results on leg explosive power

Test	Experimental Group	Control Group	SV	SV	Df	MS	F
Pre test	2.26	2.27	Between	0.00	1	0.0003	0.30
			Within	0.03	28	0.001	
Post test	2.37	2.27	Between	0.08	1	0.08	91.83*
			Within	0.03	28	0.001	
Adjusted	2.37	2.26	Between	0.09	1	0.09	141.33*
			Within	0.02	27	0.001	

*Significant at 0.05 level

Table value with df 27, 4.21; 28, 4.20

The pre test F value on the means of experimental group and control group 0.30 was lesser than the table F value 4.21 reveals that there was no significant difference between the groups at base line. The F value of post test means and adjusted means 91.83, and 141.33 respectively were higher than the table F value 4.21. Hence, there was a significant difference between experimental group and control group on leg explosive power.

Table-V
Results on shoulder strength

Test	Experimental Group	Control Group	SV	SV	df	MS	F
Pre test	11.00	11.67	Between	3.33	1	3.33	0.56
			Within	165.33	28	5.91	
Post test	11.67	12.00	Between	0.83	1	0.83	0.16
			Within	145.33	28	5.19	
Adjusted	11.96	11.70	Between	0.49	1	0.49	0.91
			Within	14.63	27	0.54	

*Significant at 0.05 level

Table value with df 27, 4.21; 28, 4.20

The pre test F value on the means of experimental group and control group 0.56 was lesser than the table F value 4.21 reveals that there was no significant difference between the groups at base line. The F value of post test means and adjusted means 0.16, and 0.91 respectively were lesser than the table F value 4.21. Hence, there was no significant difference between experimental group and control group on shoulder strength.

Table-VI

Results on coordination

Test	Experimental Group	Control Group	SV	SV	df	MS	F
Pre test	28.00	27.13	between	5.63	1	5.63	0.81
			within	193.73	28	6.92	
Post test	33.20	27.40	between	252.30	1	252.30	55.19*
			within	128.00	28	4.57	
Adjusted	32.96	27.64	between	205.61	1	205.61	83.55*
			within	66.45	27	2.46	

*Significant at 0.05 level

Table value with df 27, 4.21; 28, 4.20

The pre test F value on the means of experimental group and control group 0.81 was lesser than the table F value 4.21 reveals that there was no significant difference between the groups at base line. The F value of post test means and adjusted means 55.19, and 83.55 respectively were higher than the table F value 4.21. Hence, there was a significant difference between experimental group and control group on coordination.

Table-VII

Results on resting heart rate

Test	Experimental Group	Control Group	SV	SV	df	MS	F
Pre test	67.93	67.73	between	0.30	1	0.3000	0.06
			within	133.87	28	4.781	
Post test	64.67	67.60	between	64.53	1	64.53	13.59*
			within	132.93	28	4.748	
Adjusted	64.57	67.69	between	72.78	1	72.78	109.48*
			within	17.95	27	0.665	

*Significant at 0.05 level

Table value with df 27, 4.21; 28, 4.20

The pre test F value on the means of experimental group and control group 0.06 was lesser than the table F value 4.21 reveals that there was no significant difference between the groups at base line. The F value of post test means and adjusted means 13.59, and 109.48 respectively were higher than the table F value 4.21. Hence, there was a significant difference between experimental group and control group on resting heart rate.

Table-VIII

Results on systolic blood pressure

Test	Experimental Group	Control Group	SV	SS	df	MS	F
Pre test	119.60	119.40	between	0.30	1	0.300	0.29
			within	29.20	28	1.04	
Post test	119.67	119.80	between	0.13	1	0.13	0.32
			within	11.73	28	0.42	
Adjusted	119.64	119.83	between	0.29	1	0.29	0.87
			within	8.83	27	0.33	

*Significant at 0.05 level

Table value with df 27, 4.21; 28, 4.20

The pre test F value on the means of experimental group and control group 0.29 was lesser than the table F value 4.21 reveals that there was no significant difference between the groups at base line. The F value of post test means and adjusted means 0.32, and 0.87 respectively were lesserr than the table F value 4.21. Hence, there was no significant difference between experimental group and control group on systolic blood pressure.

Table-IX

Results on diastolic blood pressure

Test	Experimental Group	Control Group	SV	SV	df	MS	F
Pre test	79.40	79.13	between	0.53	1	0.53	0.59
			within	25.33	28	0.90	
Post test	79.67	79.73	between	0.03	1	0.03	0.05
			within	18.27	28	0.65	
Adjusted	79.58	79.82	between	0.39	1	0.39	1.20
			within	8.74	27	0.32	

*Significant at 0.05 level

Table value with df 27, 4.21; 28, 4.20

The pre test F value on the means of experimental group and control group 0.59 was lesser than the table F value 4.21 reveals that there was no significant difference between the groups at base line. The F value of post test means and adjusted means 0.05, and 1.20 respectively were lesser than the table F value 4.21. Hence, there was no significant difference between experimental group and control group on diastolic blood pressure.

DISCUSSION

Figure-1

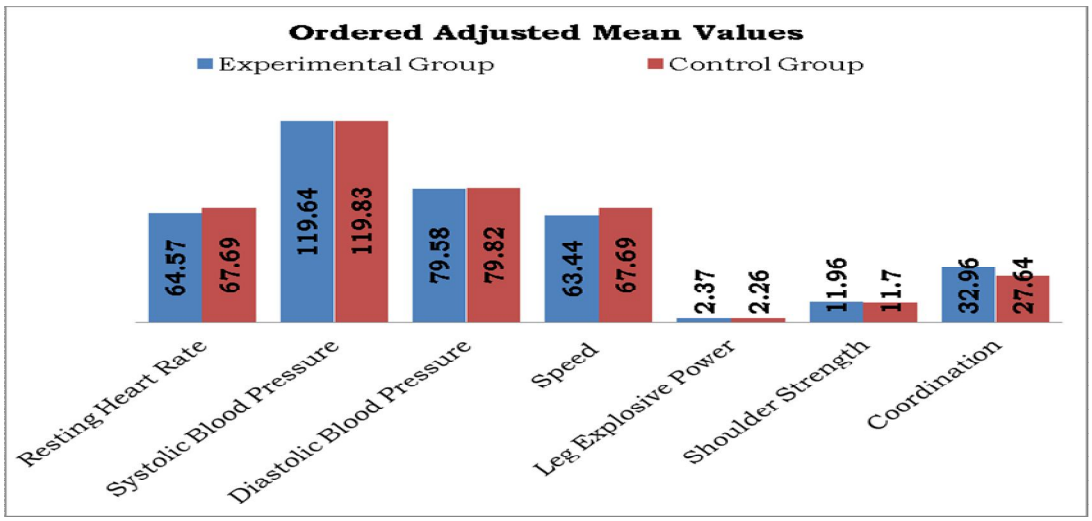

Figure-1 shows the ordered adjusted mean values of the selected physiological variables and neuromuscular indices of experimental group and control group. From the results of the study, it is understood that the treadmill running had a significant improvement on the selected physiological variable namely, resting heart rate. The present results in agreement with results of Silvers, Rutledge, and Dolny (2007). The endurance treadmill training has a direct impact on the resting heart rate.

There was no significant difference between experimental group and control group on systolic blood pressure and diastolic blood pressure due to treadmill training. The treadmill training had a significant improvement on the selected neuromuscular indices namely, speed, leg explosive power, and coordination. The uphill inclination running might have developed the leg muscles power.

There was no significant improvement on shoulder strength due to treadmill training.

Conclusions

It was concluded that the twelve weeks of treadmill training under varied inclinations had a significant improvement on the selected physiological variables namely, resting heart rate, and the neuromuscular indices namely, speed, explosive power, and coordination among intercollegiate athletes.

There was no significant difference found on the systolic and diastolic blood pressure and shoulder strength due to treadmill training under varied inclinations among intercollegiate athletes.

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