Global Journal of Medical research
Volume 12 Issue 5 Version 1.0 June 2012
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4618 & Print ISSN : 0975-5888

Treadmill and Bicycle Ergometer Exercise: Cardiovascular Response comparison

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GJMR-B Classification : *NLMC Code: WK 810, WK 835, WK 815, WQ 248*

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Treadmill and Bicycle Ergometer Exercise: Cardiovascular Response Comparison

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I. Introduction

Exercises are advised for health promotion, and prophylaxis for many cardiovascular diseases and also for rehabilitation after an episode of disease. Among the exercises aerobic exercises are appropriate for these purposes. To do aerobic exercise many methods are available for example: running, jogging, walking, cycling and others. Among different modes of exercises in the modern busy life, the bicycle ergometer and treadmill exercises are the commonest to perform as indoor aerobic exercises. In motor driven treadmill exercise which is similar to walking or jogging or running depending upon the speed of the treadmill motor. In case of bicycle ergometer exercise similar to cycling, the amount of exercise can be controlled voluntarily by pedaling the cycle with predefined resistance. Bicycle ergometer exercise and treadmill exercise will save the time to go to open space to perform aerobic exercises and space utilized for the same were also less. Apart from regular exercise these methods are also used in the performance of multistage sub-maximal or maximal stress testing (1). Both treadmill and bicycle ergometer exercise have their own advantages. But, in long term exercise practices interchanging of treadmill and bicycle ergometer exercise is not advisable especially if it was advised as therapy.

Hence present study was undertaken to study the cardiovascular responses for treadmill exercise and bicycle ergometer exercise.

II. Materials and Methods

The present study was conducted in semi urban city of south India, after obtaining institutional ethics clearance. The procedure was explained to the subjects and were recruited after obtaining informed written consent. For this study twenty one male volunteers were recruited. These subject's detailed history and general physical and clinical examination was done to rule out any underlying disease. Subjects with any known medical or surgical illness or physical disability were excluded from this study.

The age group of subjects was ranged between 18 years to 20 years. These twenty one male subjects were not trained athletes or sportspersons and were not taking any medications. Between 9am to 11am each subjects underwent exercise tests for two days. They had light breakfast atleast 3 hours prior to exercise testing and atleast 24 hours of abstinence from any form of alcohol, tobacco, tea, coffee. They had not under gone any strenuous work or exercises before test. Subjects were divided into two groups randomly by picking the folded covered slips into group A and Group B. There were 10 subjects in group A and 11 subjects in group B. Test was performed for each subject in two days. Group A performed treadmill exercise and Group B performed bicycle ergometer exercise on the first day. On next day the exercising group were interchanged i.e. Group A performed bicycle ergometer exercise and Group B performed treadmill exercise. Cardiovascular parameter like blood pressure was recorded by using mercury sphygmomanometer and heart rate was counted by auscultating at the apex of heart. BP and HR were recorded at resting state and immediately after the exercise. For this study we used a motor driven treadmill and mechanically braked bicycle ergometer. Comparison of different cardiovascular parameters between treadmill and bicycle ergometer exercise were made at equivalent oxygen uptake values (2) i.e. at 17.5 ml / kg / min oxygen uptake (1;3). In treadmill exercise subjects were made to walk at the speed of 1.7mph

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(2.8km/h) at 10 degree elevation for 3min (1;3). In bicycle ergometer exercise pedaling is done at the speed of 60 times / min, with breaking resistance of 1.75kg, for 3min to do work done of 450kpm / min (1;3).

III. Results

Results of the present study are elaborated in Table 1

IV. Dicussion

Body response to exercise depends on the type of exercise. Cardiovascular changes again depend on the type of exercise and severity of exercises. Cardiovascular responses differ in bicycle ergometer exercise and treadmill exercise as the method of exercise, exercising muscles and others (as listed below) differ. Other studies have shown that increase in heart rate was more in treadmill exercise compared to bicycle ergometer exercise (2;4-6). Systolic blood pressure will increase more in treadmill exercise compared to bicycle ergometer exercise (3;5). Diastolic blood pressure decreases in both type of exercises but the decrease was same in both groups (3;5;7). Change in blood pressure and heart rate response in treadmill exercise was more compared to bicycle ergometer exercise for a given equivalent oxygen uptake values due to more sympathetic activation.

Difference between treadmill exercise and bicycle ergometer exercise:

- Bicycle ergometer is more economic compared to treadmill,
- Bicycle ergometer occupies less space compared to treadmill,
- Bicycle ergometer does not require electricity to run where as treadmill does require electricity,
- Upper body motion is less in bicycle ergometer, hence easy to record the vital signs and to collect blood samples (8),
- Bicycle ergometer is less familiar compared to treadmill walking (1),
- Subjects body weight does not influences the exercise capacity in bicycle ergometer whereas work rate is dependent on body weight in treadmill exercise (9),
- Smaller muscle mass is involved in bicycle ergometer exercise (10),
- Work load in bicycle ergometer exercise is controlled by subjects themselves, by controlling the speed of pedaling; but in treadmill it is controlled by observer, hence yield more reproducible data (1),
- Exercise output can be better quantified with bicycle ergometer exercise (1),
- Breathing is easier in treadmill exercise(11).

V. Conclusion

Therefore when advising exercise for subjects his condition and requirement has to be taken into consideration. Detailed study regarding the same still has scope for research.

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Table 1: Cardiovascular parameters in different types of exercise at resting and immediately after exercises

Variables	Type of Exercise	Rest	After Exercise	Difference	Significance#
Systolic BP mmHg	Bicycle ergometer	109±7.1	127.1±6.5	17.5±4.6	P< .001 HS
	Treadmill	109.9±7.2	144.1±4.0	34.2±6.0	P< .001 HS
	Bicycle Ergometer Vs Treadmill ##		P< .001 HS		
Diastolic BP mmHg	Bicycle Ergometer	71.4±4.6	68.0±6.6	(-)3.4±3.3	P< .001 HS
	Treadmill	71.0±4.6	63.8±7.3	(-)7.2±3.7	P< .001 HS
	Bicycle Ergometer Vs Treadmill ##		P> .001 NS		
Pulse Pressure mmHg	Bicycle Ergometer	38.2±4.3	59.1±6.0	20.9±5.8	P< .001 HS
	Treadmill	39.0±4.7	80.3±7.2	41.3±8.1	P< .001 HS
	Bicycle Ergometer Vs Treadmill ##		P< .001 HS		
Heart Rate BPM	Bicycle Ergometer	73.2±8.1	129.9±9.3	56.7±8.7	P< .001 HS
	Treadmill	72.9±7.6	161.7±14.2	88.8±15.3	P< .001 HS
	Bicycle Ergometer Vs Treadmill ##		P< .001 HS		

Intragroup, Paired t-test
Intergroup, Unpaired t-test

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