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Assessment of Lower Extremity Muscle Function Using Bicycle Ergometer in Young Adults

Smisha Mohan*, Bagavad Geetha. M, Padmavathi R,
Department of Physiology, Sri Ramachandra Medical College & Research Institute,
Sri Ramachandra University, Porur, Chennai

Abstract
Background: *Muscular exercise is considered as the highest expression of the activities in human body. Physical activity describes the activities involving the large skeletal muscles. Physical activity can be defined by its intensity, duration and frequency. The regular physical activity helps in prevention of primary and secondary chronic diseases and reduces risk of premature death. Cycle ergometry is an alternative investigative procedure to treadmill test.*
Aim: *To assess the lower extremity muscle function by work done using bicycle ergometer in Sedentary and physically active adults.*
Methods & Results: *History was collected using standard questionnaire. Work done was calculated using bicycle ergometer in lower limb. The work was significantly higher in physically active group than sedentary group in both sexes ($p<0.05$).*
Conclusion: *This could be due to increased strength and power of the lower limb muscles by regular training, larger muscle mass and also due to greater performance of the physically active individuals. Training also produces metabolic and physiologic adaptations in the different types of muscle fibers.*
Keywords: *bicycle ergometer, muscle strength, young adults*

I. Introduction

Muscular exercise is considered as the highest expression of the activities in human body. Every movement of the body is initiated and controlled by the nervous system. The energy is developed in the muscles which are required for the carrying out of physical work and to transform potential into kinetic energy which appears as work or heat[1]. An important interrelationship exists between the total dose of activity and the intensity at which the activity is performed while defining the amount of physical activity or exercise. Bicycle ergometer is used more often to assess the lower extremity muscle function. So it is used for research purposes also. Bicycle ergometer is used often than the treadmill because it less expensive. It occupies little space and can be easily transported. It is easier to take heart rate. It also requires less training or practice.

A healthy life during old age is based on regular physical activity and healthy lifestyles acquired during childhood and adolescence. Improving physical activity levels in young people is imperative for the future health. A sedentary lifestyle is a type of lifestyle with no or irregular physical activity. This sedentary lifestyle could contribute to develop many diseases[4]. A graded linear relationship appears between the volume of physical activity and health status which claims that most physically active people are at the safer side. When people who are least fit become physically active their health status are improved. Bicycle ergometer is used in physiological studies to measure work done and power[5.] Prospective research studies have shown clearly that regular physical activity protects against heart disease. Sedentary peoples are approximately twice as likely to suffer a fatal attack as their more physically active counterparts[6.] Hence this study was undertaken to evaluate lower extremity muscle function using bicycle ergometer among sedentary and physically active young adults.

Aim

To assess the lower extremity muscle function by work done using bicycle ergometer in Sedentary and physically active adults.

II. Material and Methods

This cross sectional study was done in department of Physiology, Sri Ramachandra medical college & research institute, Chennai on 50 sedentary and 50 physically active healthy medical and paramedical students of age between 17 to 28 years. Both male and female were included in this study. Medical history was collected using standard questionnaire. Questionnaire used for obtaining medical history was designed and validated. This study was approved by the institutional ethics committee, Sri Ramachandra University, Chennai. Written consent from the subject was obtained for carrying out the study after explaining to them the protocol of the study and the benefits of the study. First the procedure is explained to the subject, then ask to seat in a

comfortable position adjust to the height. The tension was keep as 4 kg and then asks the subject to pedal the ergometer till he feels his leg fatigue. The distance, speed and time were displayed on the digital monitor. The work done was calculated by force × distance.

Statistical Analysis:

The data was expressed in mean ± SD. Comparisons between groups for all the measured variables were made using independent't' test**.** Data was analysed using SPSS (Statistical Package for social sciences) version 19. A 5% level of probability was used to indicate statistical significance. Statistical significance (<0.05)

III. Results

100 subjects between the age group of 17– 28 years were recruited in the study. The mean height of sedentary male were 169.9 ± 8.6, sedentary female 161.4 ± 5.7, physically active male 170.6 ± 6.7, physically active female 162.7 ± 6.6. The mean weight of sedentary male were 68.9 ± 9.7, sedentary female 58.4 ± 10.8, physically active male 65.2 ± 6.3, physically active female 59 ± 10.6. The work done calculated using bicycle ergometer was significantly higher in physically active group than sedentary group in both sexes ($p<0.05$) Table 1.

IV. Discussion And Conclusion

In this cross sectional study, lower extremity strength was assessed by using bicycle ergometer and we have observed that work done was significantly higher in physically active subjects when compared to the sedentary subjects in both males and females. This could be due to increased strength and power of the lower limb muscles by regular training, larger muscle mass and also due to greater performance of the physically active individuals. Training also produces metabolic and physiologic adaptations in the different types of muscle fibers. Metabolic requirements of the body at rest or during exercise are met with by supplying oxygen to tissues and by removing carbon-di-oxide from them. These are primarily governed by cardiovascular and respiratory system. In order to load these mechanisms maximally, large muscle groups must be engaged during exercise. For this bicycle ergometers are most commonly used.

Cycle ergometry is an alternative investigative procedure to treadmill test[6]. It is a less expensive, portable one suitable for the patients in orthopaedic, peripheral vascular and neurological units. The work intensity can be adjusted by variations in resistance and cycling rate. The evaluation of exercise tolerance is important in assessing cardiopulmonary health status or in identifying the potential for endurance performance. An important index of exercise tolerance is the amount of oxygen that can be taken by the working muscles during maximal exercises[8]. Now-a day, bicycle ergometers are seen commonly in gyms and more frequently found in physiotherapy units which display the amount of exercise as work units[9]. An ergometer is an fitness device to measure the amount of muscle work performed during exercise[10]. It measure only external work. This is useful for increasing fitness and building muscular endurance. Today modern world more awareness and conscious about the health status is commonly seen among the females. This increases the statistics of females attending the gym offices and health fitness clinics regularly[11, 12].

V. Limitations Of This Study

Studies with larger sample size study would have helped us to find out the skeletal muscle function in sedentary and physically active young adults in a better manner. In this study, sample size was smaller, this is one of limitation. Physically active females are also lesser in number compared to other groups.

Future Plans

The study has to be done with larger sample size in future. As muscle function test is a simple and non-invasive one, screening can be done in the general population and comparison to be done in patients from various clinical departments with controls. We have also planned to do Interventional studies to assess the muscle functions.

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Table 1: Comparison of work done (g/m) (Bicycle ergometer) between sedentary and physically active male and female subjects

S.no	*Parameter*		*Sedentary (Mean ±SD)*	*Physically Active (Mean ±SD)*	*P Value*
1.	**work done (g/m) (Bicycle ergometer)**	**Male**	1970 ± 357	4530 ± 585	0.000
		Female	2322 ± 472	4756 ± 175	0.000

Data expressed as mean ±SD. Statistical significance (p value <0.05)

Graph 1: Comparison of work done in sedentary and physically active male and female subjects