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VALIDATION OF 30 MINUTES STEADY STATE JOG AS AN ESTIMATION OF PEAK OXYGEN UPTAKE IN PHYSICAL EDUCATION STUDENTS

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ABSTRACT

The purpose of the study was to validate the 30 minutes steady state jog in both treadmill and on field for an estimation of peak oxygen uptake. The study was restricted to 100 samples (50 males and 50 females) selected randomly from L.N.I.P.E. Gwalior, India. All the selected samples were into regular fitness training. The data were collected by conducting tests on treadmill and field for 30 minutes and 5 minutes riding on bicycle ergometer for measuring the VO_2 max at an optimum load. The tests were conducted after one week interval from the first test. The results from the data revealed that the '0' minute pulses of both the area after the exercise of both male and females have significant correlation with peak oxygen uptake. Further it was seen that the boys' correlated value can be validated since it falls in the acceptable region of the validation norm given by Barrow and McGee where as the girls correlated value falls in the questionable region and thus girls VO_2 max might not be validated against 30 minute steady state jog.

Keywords: *Maximal aerobic power, maximum oxygen uptake, peak oxygen uptake, cardio-respiratory endurance, nomogram.*

1. INTRODUCTION

The modern age is an age of space adventurism and technology. Machines which man built for the purpose of adding comforts to his life, have, now so much pervaded his existence that it is somewhat difficult to do away with the human dependence upon machines, they have became part and parcel of our life and in this process man himself has become an automation (Hagen, Dexter, & Williams

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1951; Barrow, 1991). This applies to the world of games and sports too. Scientific investigations of the performance of sportsmen are playing a vital role in shaping and improving such programmes (Ghosh, 2013, 2014). Players and athletes are scientifically for their participation in different sphere of sports. Sport is dynamic in nature and progressive in outlook. It is not confined to what has been, but its target is to fix new targets of better glory with each attainment of target. To some, sport is a privileged form of expression of democratic way of life; to others, popular object of demonstration for totalitarian government system. Many see it in a way of understanding among peoples, some regard it as a means of recreation and health improvement, and others condemn it as a kind of hard forced labour and as a destroyer of health (Laverbach, 1967).

In recent year more and more attention has been paid to nature of "physical fitness" not only in terms of general health, but particularly of the special requirements for competitive sports and certain highly specialized and demanding occupations. Achievement and maintenance of high level of physical fitness requires significant effort on the work of the physical education in general and human body and ergonomics in specific (Williams, 1962). Physical fitness is an inseparable part of sports performance and achievement. The quality of an individual's fitness in terms of its utilitarian values is directly proportional to the level of performance. That means the greater the level of fitness the greater the ability of a person to attain highest level of performance (Pivarnik, Fulton, Taylor, & Snider, 1993). Although considerable variation exist in the definition of physical fitness according to various authors the components of speed, strength and cardio-vascular endurance are common in almost all. The definition of fitness as stated by Astrand (1956) is "the ability of the organism to obtain equilibrium as closely as possible to the resting state during strenuous exertion and to restore promptly after exercise, any equilibrium that has been disturbed" (Williams, 1975). Cardio-respiratory endurance is an extremely complex concept and could be readily understood when the various element of cardio-respiratory system affected by exercise are recognized (Eiberg, Hasselstrom, Grønfeldt, Froberg, Svensson, & Andersen, 2005). These elements involve heart, the blood vessels supplying blood to all parts of the body, oxygen carrying capacity of the blood, the capillary system receiving the blood and the lungs. Measurement of all these elements includes blood pressure, heart rate, stroke volume and maximum oxygen uptake (Clarke, 1975). Measurement of aerobic capacity, a person's ability to maximally utilized oxygen during exhaustive work, is one of the most valid means of appraising what is commonly referred to as cardio-vascular fitness. Measurement requires trained personnel, expensive equipment and a cooperative subject (Mathews, 1973). Some of the tests are appropriate only to modern fully equipped exercise physiology laboratory and customarily make use of bicycle ergometer and treadmill. These methods are called direct methods of assessing

aerobic power. If sophisticated instruments are not available then certain indirect methods of estimation of VO_2 max have been suggested. Astrand and Ryhming, (1954) has given a Nomogram for the prediction of max VO_2 from heart rate of sub maximal work load. This load may be given by bicycle ergometer, treadmill or step bench for six minute exercise with such a load (Williams, Katch, & Katch, 1991).

There are many direct laboratory based methods to measure the VO_2 max which are sometime not feasible for a researcher to use because of many reasons. It could be due to cost or the outside the lab setup. It is sometimes become difficult to collect data on maximal aerobic capacity of large samples in a laboratory setup using heavy equipments. So we need to have some alternative method to collect data and then we have to rely on some indirect method. The study was done with an intension to validate such an indirect method. The purpose of the study was to validate 30 minutes steady state jog as an estimation of peak oxygen uptake of physical education students.

2. METHODS AND MATERIALS

The purpose of the study was to validate an indirect method of collecting the measurement of maximal oxygen uptake (VO_2 max). The outcome of this study would be a validated test to measure peak oxygen uptake.

2.1 Sample

The subjects for this study were selected from Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh, India, who had been pursuing degree course in Physical Education. Fifty male and fifty female students were selected from the undergraduate level. The subject's age ranged from 18 to 25 years. It was ensured from the health examination records of the subjects maintained as a part of regular institute's procedure that all the subjects were medically fit for going through the experimental requirements of the study.

2.2 Procedure

Single group design was employed for this experimental study. The subjects were taken test for two times that was once in the track and once in the laboratory. For the collection of data the subjects were asked to run for 30 minutes both in the field as well as in the lab. In the field the subjects were asked to run at comfortable pace for 30 minutes. After the successful completion of run at both the areas '0' minute heart rate of all the subjects were taken for the first 10 seconds which was further calculated for 1 minute.

2.3 Pilot Study

A pilot study was conducted to assess the optimum work load which would bring the heart rate of the subject approximately between 125 and 170 beats/minute after minutes of cycling at that optimum load. For pilot study 10 subjects of each sex were randomly selected. After assessing the load each subject was asked for cycle in the given work load for 5 minutes. Before the work out 2 minutes of warm up were given to the subjects. Immediately after the workout '0' minute heart hate was taken and this heart rate was taken to determine VO_2 max by using Astrand and Astrand Nomogram. It was found that girls achieved the target heart rate at 450 watts work load and boys at 600 watts work load. The weight of all the individuals was taken so that the VO_2 max could be calculated in the form of $ml.kg^{-1}.min^{-1}$.

Another pilot study was done in the laboratory to find the pace at which the subjects had to run for 30 minutes. For that also 10 subjects of both sexes were selected to find out the optimum speed at which the subjects could run at comfortable speed. After assessing the different speed it was found that for girls at 4 km/hr and for boys 6 km/hr (2 inches up hill) was the appropriate speed at which they could run comfortable for thirty minutes.

2.4 Statistical Analysis

For validating the 30 minute steady state jog in both the laboratory as well as in the field with VO_2 max coefficient of correlation was employed and the level of significance was set at 0.05 level of confidence.

3. RESULTS

The data was collected on hundred students of LNIPE Gwalior the coefficient of relationship obtained by correlating the VO_2 max with the '0' minute pulse have been presented in Table 1.

Table 1: Relationship of VO_2 max with 30 minute steady state jog in field and in laboratory

Sex	Correlation Coefficient of Field	Correlation Coefficient of Lab
Male	-0.82	-0.72*
Female	-0.62	-0.52*

*Significant at 0.05 level of confidence $r.05\ (48) = 0.273$

The statistical analysis of Table 1 indicates that the post exercise pulse of both the area after the specific exercise among same sex showed a significant negative correlation with VO_2 max. The sign of correlation value found negative due to the nature of relation of two parameters (VO_2 max and post exercise heart hate). In fact for determination of aerobic potentiality VO_2 max of any individual is directly proportional where as resting as well as post exercise sub maximal heart rate has inversely proportional relationship. Hence the sign of correlation value was nullified and interpreted as positive correlation.

The coefficient of relationship obtained by correlating post exercise pulse after the treadmill running with the post pulse rate after jogging in the field of boys and girls have been presented in Table 2.

Table 2: Relationship of post exercise pulse rate after treadmill running with post exercise pulse after field jogging

Sex	Coefficient Correlation
Male	0.78*
Female	0.71*

*Significant at 0.05 level of confidence $r.05\ (48) = 0.273$

Table 2 reveals that there is a significant positive correlation between post exercise pulse rate of field jogging and treadmill running of both the sexes since the correlated value found much higher than the required value.

4. DISCUSSION

The analysis of data revealed that a highly significant positive correlation between the post exercise pulse of field test and the laboratory test after 30 minutes steady state jogging of both male and female sexes and hence it can be said that both the laboratory test and the field test are highly correlated as far as post exercise heart rate after 30 minutes steady state running and jogging in laboratory and field respectively. Most probably the impact of 30 minutes work in both laboratory and field has affected various cardio-vascular parameters in general and steady state heart rate in particular in more or less identical manner and thus above observation was found.

Further the statistical analysis revealed high significant negative relationship between the VO_2 max and the performance of both treadmill run and field jogging. The negative sign correlation is due to the nature of the relationship between two parameters and thus interpreted as positive correlation. Moreover it was also observed that the VO_2 max of boys possessed significantly high correlation in both the areas.

For validation of anything based on concurrent correlation Barrow and McGee (1979) have given a standard Norm Chart and according to that the value more than equals to 0.70 would be accepted for validation and it can be assumed from the statistical analysis that boys correlated value of both the areas was more than 0.70 and hence that was accepted for validation. On the other hand girls both correlated value was much below the required value of 0.70 and hence that was not accepted for validation.

The difference in the aerobic capacity between men and women's performance could be interpreted due to major physiological variations. Fox, Bowers, and Foss (1984) stated that the size of the heart, stroke volume, blood pressure, cardio minute output and hematological variables like blood volume and hemoglobin are all superior in boys than in girls.

600 yards (AAHPER, 1976), 12 minutes (Cooper, 1968) and 20 minutes (Mursay, 1993) run/walk tests are already validated tests to measure the cardio vascular endurance and consequently to VO_2 max with both the sexes. The scholar in this study had increased the load in terms of duration and that could be the reason of increased post exercise heart rate of the girls in comparison of the boys. Moreover the difference in performance could be due to difference in body composition between males and females. In general boys are having more lean body mass and relatively less fat mass where as girls possess more fat percentage and relatively less lean body mass. The lean body mass helps to perform the boys for longer duration on the other hand females are having more fat percentage which hinders in their aerobic work and they have to carry this extra burden of load (fat) for entire 30 minutes period of work which in no contributed to their aerobic performance (Andersen, Henckel, & Saltin, 1987).

Further in the performance between the lab and the field difference was found. The field running is motor work which everyone does it since childhood and feels easy to perform. Whereas the individual does not feel comfortable to run on treadmill in the lab, since the subjects were not habitual to run and could have psychological stress and showed low performance. It is known that estimation of VO_2 max conducted by various mode of work carried by same individual shows different VO_2 values. Probably above reasons might contribute to have different relationship of work in laboratory and field with VO_2 max.

5. CONCLUSIONS

From the study it could be concluded that 30 minutes post exercise jog and in field was highly correlated in both males and females. Further the post exercise pulse after 30 minutes of jogging/running in field and laboratory respectively could be used as indirect predictor of VO_2 max in case of boys and girls.

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