Correlation Between Borg's Rate Of Perceived Exertion And $\dot{V}O_{2max}$ in Indian Male Medical Students

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Abstract: **Background & Objectives:** Maximal aerobic capacity ($\dot{V}O_{2max}$) is regarded as the gold standard for the assessment of cardiorespiratory fitness level. Borg's rate of perceived exertion (RPE) is another parameter used to assess the physical fitness and regulation of exercise intensity. The objective of the study is to assess and evaluate the correlation between Borg's RPE & $\dot{V}O_{2max}$ in young Indian male medical students and to validate the Borg's RPE as a criterion to regulate the exercise intensity. **Method:** 100 subjects from a tertiary care hospital of Greater Mumbai, in the age group of 18-22 years were included in the study. Subjects undertook the Queen's College step-test for 3 minutes. After each minute, the subjects were asked to rate their exertion on Borg's RPE scale . After the test, heart rate was recorded and $\dot{V}O_{2max}$ was computed indirectly employing the Queen's step test formula. The correlation between Borg's RPE , heart rate and $\dot{V}O_{2max}$ was evaluated using Spearman Correlation Test. **Results**: Borg's RPE showed significantly positive correlation with heart rate (ρ= 0.715; $p<0.0001$) and significantly negative correlation with $\dot{V}O_{2max}$ (ρ = - 0.715; $p<0.0001$). **Interpretation & Conclusion:** Hence, Borg's RPE can be considered a valid criterion to assess and regulate exercise intensity in young Indian male population.

Key words – Borg's rate of perceived exertion (RPE), Maximal aerobic capacity ($\dot{V}O_{2max}$)

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Introduction: The advent of new technologies and modernization have contributed immensely to reduction in physical activities at work place and home. Therefore, assessment of cardiorespiratory fitness is of paramount importance.

Maximum oxygen uptake ($\dot{V}O_{2max}$) is a globally accepted measure of cardiorespiratory fitness. $\dot{V}O_{2max}$ reflects the amount of oxygen utilized by working muscles & is the maximum capacity of an individual 's body to transport and utilize oxygen during incremental exercise , which reflects the physical fitness of the individual and thus cardiorespiratory endurance[1].

The assessment of cardiorespiratory fitness has been growing in importance because several data link the $\dot{V}O_{2max}$ with cardiovascular risk factors[2]. The rate of perceived exertion (RPE) is another criterion which reflects the physical fitness and helps to regulate the exercise intensity of an individual.

The body interacts with the environment that produce the work perceived as exertion. Several sensory systems are involved in conveying information to the brain about the quanta of body exertion. According to G. Borg (1962), the "overall perceived exertion should be regarded as a "gestalt" consisting of many cues - sensations from the organs of circulation and respiration, from the muscles, the skin, the joints etc. together with perceptions of pedal resistance, effort, fatigue, strain, exertion, heat, pressure, pain or anxiety. Still, an overall perceived exertion may be viewed as a uni-dimensional continuum and its intensity may be scaled".

Perceived exertion is a feeling which is purely subjective and is based on physical sensation experienced during physical activity. This includes increased heart rate, respiration or breathing rate, increased sweating and muscle fatigue[3].

Borg's Rating of Perceived Exertion[4] is based on subjective feeling of exertion and fatigue during exercise where perceived exertion is how hard that you interpret that your body is working[5]. Borg's Rating of Perceived exertion (RPE) scale is a numerical Scale from 6 to 20. American College of Sports Medicine (ACSM) has recommended Borg's Rating of Perceived Exertion (RPE) for exercise intensity since 1986[6].

Minimal literature is available to comment authoritatively on the correlation between $\dot{V}O_{2max}$ and Borg's rate of perceived exertion (RPE) in Indian population. The present study intends to evaluate the correlation between the two methods.

Material and Method: The study was conducted in the department of physiology of a tertiary care hospital of Greater Mumbai. A total of 100

healthy male medical students in the age group 18 - 22 years were randomly sampled to be included in the study. Detailed medical history and physical examination of the subjects were carried out. The permission to conduct the said study was obtained from the institutional ethics committee. Each participant was subjected to a test period of not more than 15 minutes on a single visit basis. Exclusion criteria required that the individuals did not have a history of any cardiorespiratory diseases, neuromuscular disorders and skeletal abnormalities, acute illness such as respiratory tract infection, gastroenteritis; undergone any major surgery like abdominal, cardiovascular etc. Athletic population was also excluded from the study.

Study Procedure: Participants were asked to take light breakfast 2-3 hours before the test and refrain from having any energetic drink. Prior to testing, the subjects were instructed on how to use the Borg's scale. A stepping bench 16.25 inches in height was used to carry out the Queen's College Step test. The subjects were asked to step up and step down in cadence with the metronome at the rate of 24 beats per minute for three minutes which is the standard speed and duration for this step test. At each minute, the subjects were asked to grade / rate their exertion on Borg's Scale of Perceived Exertion. After 5 seconds of conclusion of test, the subjects remain standing while the rate of perceived exertion was noted and the heart rate was measured for 15 seconds, 5 to 20 seconds into recovery using a heart rate monitor (Citizen, India).

Recovery heart rate was then converted into beats per minute (15sec HR X 4). Aerobic capacity ($\dot{V}O_{2max}$) was computed indirectly by substituting the Queen's College step-test (QCT) heart rate in the following formula:

$\dot{V}O_{2max}$ = 111.33 – [0.42 x QCT pulse]

where $\dot{V}O_{2max}$ is in ml. $kg^{-1}.min^{-1}$ and QCT pulse is in $beats.min^{-1}$.

The correlation between Borg's Rate of Perceived Exertion and $\dot{V}O_{2max}$ was then computed in Indian male Medical Students using SPSS(version 20) and MedCalc statistical analysis software to find whether the correlation between Borg's Rate of Perceived Exertion and $\dot{V}O_{2max}$ is significant or not ($p<0.0001$).

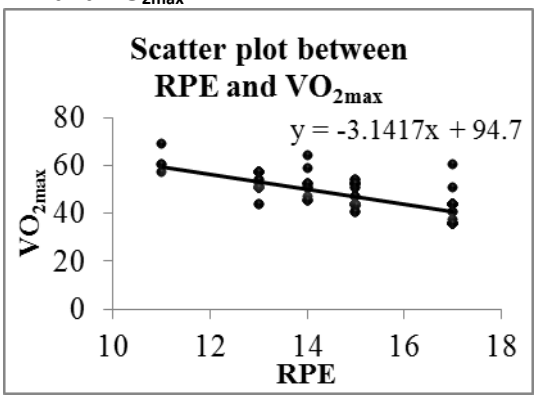
SPSS version20 and MedCalc software were used for statistical analysis.

Results: Table 1 shows the correlation between Borg's RPE and QCT Pulse at 3min. It was found that Borg's RPE showed a significant positive correlation with QCT Pulse at 3min ($\rho= 0.715$; $p< 0.0001$). The correlation between Borg's RPE and $\dot{V}O_{2max}$ was also computed using Spearman Correlation test. A significant negative correlation was found between RPE at 3min and $\dot{V}O_{2max}$ ($\rho = -0.715$; $p<0.0001$).

Table 1: Correlation between RPE , QCT Pulse and $\dot{V}O_{2max}$

Parameters		QCT Pulse at 3min (bpm)	$\dot{V}O_{2max}$ (ml/kg/ min-1)
RPE at 3min	Spearman Correlation	0.715	-0.715
	P value	<0.0001	<0.0001

Figure 1 shows the linear relationship between RPE and $\dot{V}O_{2max}$.



Discussion: The basic purpose of physical activity and exercise optimization in primary and secondary preventive medicine is to augment health benefits without compromising safety. Hence the ability to individually assess exercise intensity is of paramount importance in the prescription and monitoring of physical activity. Understanding these relationships is essential to define useful guidelines for exercise intensity[7].

In the present study, a population of 100 male participants demonstrated a strong correlation between RPE and QCT Pulse of $\rho= 0.715$ and a significant negative correlation was found between RPE at 3min and $\dot{V}O_{2max}$ ($\rho= -0.715$; $p<0.0001$).

In a meta-analysis, Chen *et al.* (2002) observed the correlation between RPE and heart rate was 0.62[8].

These results indicate that RPE is a valid criterion to regulate the exercise intensity in young Indian population. Hence, Borg's RPE could be used as an affordable, practical tool for monitoring and prescribing exercise intensity.

Conclusion: Borg's Rate of perceived exertion has profound future implications and potential applications. With accurate predictions of $\dot{V}O_{2max}$ from Queen's step test , RPE could emerge to be used accurately and appropriately in rehabilitation centres . With more studies , it is more likely that the concept of using the RPE to predict $\dot{V}O_{2max}$ may become more widely applied by the health professionals.

References:

1. McArdle WD, Katch FI, VL. K. Exercise Physiology, Energy, Nutrition and Human Performance. Philadelphia: Lea and Febiger; 1986.
2. Lars H , Lange K. Aerobic work capacity in young Norwegian men and women. . J Appl Physiol. 1965; 20(3):425-31.
3. Centers for Disease Control and Prevention website. [cited 2012 16-7]; Available from: http://www.cdc.gov/nccdphp/dnpa/physical/mesuring/perceivedexertion.htm.
4. Borg G. Perceived Exertion as an indicator of somatic stress. Scandinavian Journal of Rehabilitation Medicine. 1970; 2: 92-8.
5. Eston RG, Williams JG. Exercise intensity and perceived exertion in adolescent boys. British Journal of Sports Medicine. 1986; 20(1):27-30.
6. American College of Sports Medicine. ACSM's Guidelines for Exercise Testing and Prescription. 4th Ed.
7. James Faulkner, Eston RG. Perceived exertion research in the 21st century: Developments, reflections and questions for the future J Exerc Sci Fit 2008; 6(1).
8. Chen MJ, Fan X, ST M. Criterion-related validity of the Borg ratings of perceived exertion scale in healthy individuals: a meta-analysis. J Sports Sci. 2002;20: 873–99

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