

Letter To Editor

Validity of Cooper's 12-min Run Test for Estimation of Maximum Oxygen Uptake in Female University Students

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Sir,

Indirect protocols for determination of maximum oxygen uptake ($VO_2\text{max}$) are often helpful because the direct protocols are exhausting, laborious, complicated and expensive (1). Various indirect protocols exist for prediction of $VO_2\text{max}$ but many of them are not yet standardised in Indian context. Cooper's 12 minute run test (CRT) is a popular indirect method of $VO_2\text{max}$ estimation and requires only a measuring tape to determine the distance covered in 12 min. The protocol was standardised in Western population and its application in Indian context has not yet been explored. The present study was therefore aimed to assess the suitability for application of CRT to predict $VO_2\text{max}$ in female sedentary university students of Kolkata, West Bengal, India.

Ninety (90) healthy sedentary female students (20–25 years) belonging to similar socio-economic status with mean age, body height and body mass of 22.85 ± 1.69 years, 159.0 ± 4.28 cm, and 52.47 ± 4.17 kg, respectively were selected for the study by simple random sampling from the University of Calcutta, West Bengal, India. They were randomly separated into study group (N=60) on which the existing experimental protocol of CRT was tested and confirmatory group (N=30) on which the modified equation was validated. The entire experimental protocol was well explained to all the participants to allay apprehension and written informed consent was obtained from them. They took light breakfast 2-3 hours before the test and refrained from any energetic physical activity for that period. The participants had

no history of any major disease and received no physical conditioning programme except some recreational sports. The whole experiment was performed during September 2012 to February 2013 at a room temperature varying from 26-29°C and at a relative humidity ranging between 72 to 83%. Human Ethical Clearance was obtained from the Human Ethics Committee, Department of Physiology, and University of Calcutta.

Maximum oxygen consumption of each subject was determined by both indirect and direct methods, respectively, at an interval of 4 days by cross-over design. Subjects were asked to take rest at least for half an hour prior to the exercise, so that pulmonary ventilation and pulse rate could come down to a steady state (2). Direct estimation of $VO_2\text{max}$ was comprised of incremental bicycle exercise followed by micro-gas analysis of expired air (3) whereas indirect estimation of $VO_2\text{max}$ ($PVO_2\text{max}$) was conducted by following the protocol of CRT (4) on a 400 meter round track. Paired t-test, Pearson's product moment correlation, linear regression analysis and Bland and Altman approach for limit of agreement (5) were adopted for the statistical treatment of the data.

The mean and standard deviation (SD) of $PVO_2\text{max}$ (29.1 ± 4.0 ml.kg⁻¹.min⁻¹ with a range of 23.3–37.2) showed significant difference with $VO_2\text{max}$ (32.8 ± 3.4 ml.kg⁻¹.min⁻¹ with a range of 25.8–37.0) in the study group. Bland and Altman (5) method revealed that the limits of agreement between $PVO_2\text{max}$ and $VO_2\text{max}$ were large enough (0.4 to 7.1 ml.kg⁻¹.min⁻¹) with poor confidence intervals, indicating inapplicability of current protocol of CRT in this particular population. Moreover, significant ($P < 0.001$) difference between $PVO_2\text{max}$ and $VO_2\text{max}$ indicated that it would not be justified to accept the prediction of

***Corresponding author :**

E-mail: bamit74@yahoo.co.in

maximum oxygen uptake in the studied population by applying CRT as suggested by Cooper (4). However, on the basis of significant correlation ($r=0.88, P<0.001$) between distance covered in CRT and $VO_2\text{max}$, a prediction equation has been computed (Fig. 1) for more accurate and reliable assessment of $VO_2\text{max}$ in the studied population. The standard error of regression coefficient and constant were 2.138 and 1.176, respectively.

Application of this newly derived equation in the confirmatory group revealed insignificant difference between $PVO_2\text{max}$ ($32.2\pm 2.9 \text{ ml.kg}^{-1}.\text{min}^{-1}$) and

$VO_2\text{max}$ ($32.7\pm 3.3 \text{ ml.kg}^{-1}.\text{min}^{-1}$). Moreover the standard error of estimate of this norm was substantially small ($SEE = 0.208 \text{ ml.kg}^{-1}.\text{min}^{-1}$). Prediction of $VO_2\text{max}$ from this new equation showed a variation of less than 5% in 63 participants, 5–9% in 16 participants, 10–14% in 9 participants and 15–19% in 2 participants from their respective directly measured value of $VO_2\text{max}$. Application of Bland and Altman's analysis between directly measured $VO_2\text{max}$ and indirectly predicted $VO_2\text{max}$ from the newly derived equation revealed substantially small limits of agreement in the studied population (-0.26 to $2.46 \text{ ml.kg}^{-1}.\text{min}^{-1}$). The criteria of Test of Repeatability

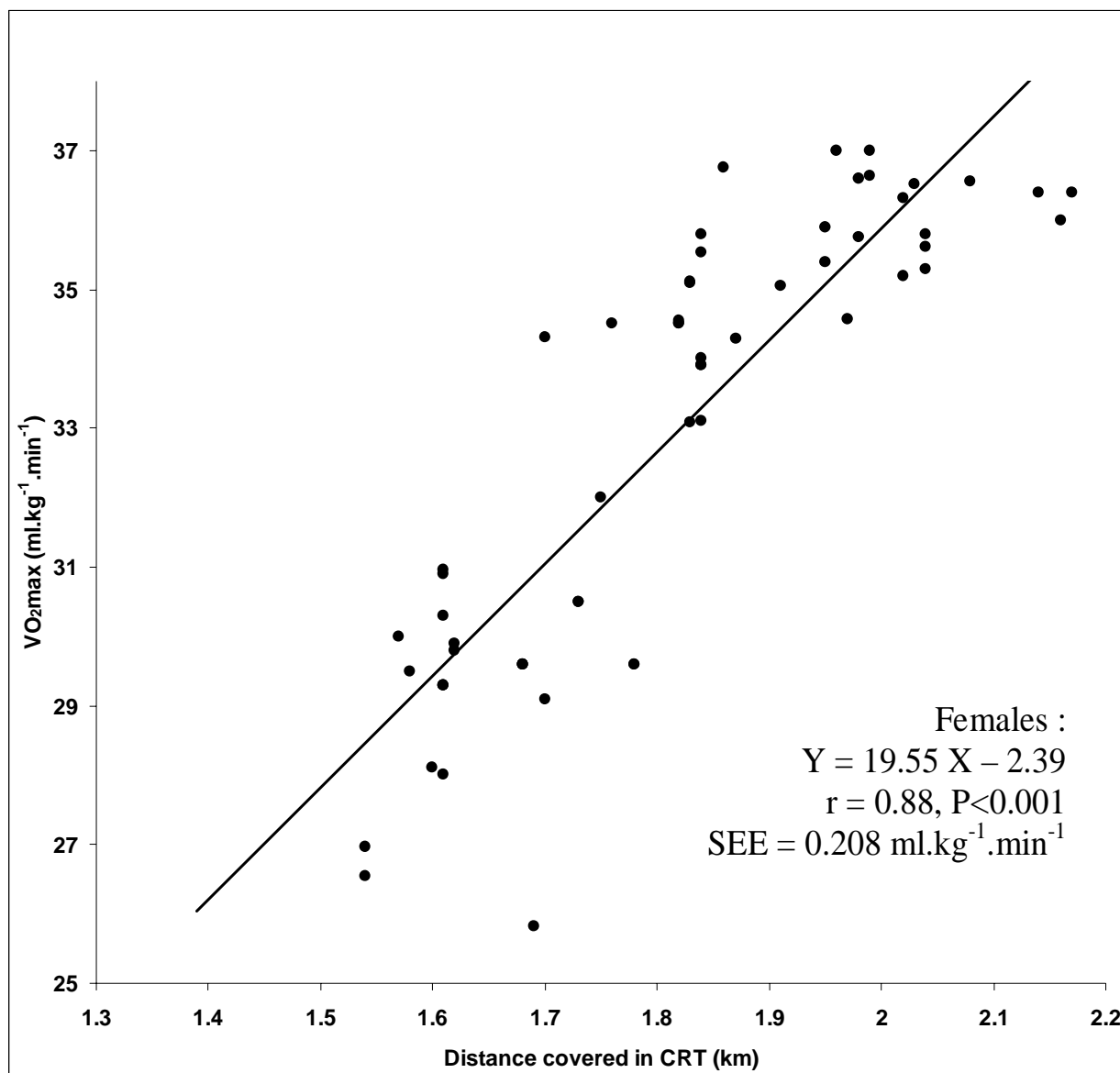


Fig. 1 : Relationship between $VO_2\text{max}$ and distance covered in CRT among young females of West Bengal, India.

Coefficient were also met in the study. The mean differences of repeated measures were $0.0051 \text{ ml.kg}^{-1}.\text{min}^{-1}$ and $0.0045 \text{ ml.kg}^{-1}.\text{min}^{-1}$ for modified equation and direct method, respectively. The corresponding values of Repeatability Coefficients were $\pm 0.0363 \text{ ml.kg}^{-1}.\text{min}^{-1}$ and $\pm 0.0462 \text{ ml.kg}^{-1}.\text{min}^{-1}$, respectively.

From the present observation it may be concluded that the presently derived or modified equation will predict VO_2max in the studied population more accurately. Therefore the newly derived norm is recommended for application of Cooper's 12 min run

test as a valid method for correct and precise evaluation of cardiorespiratory fitness in terms of VO_2max in female sedentary university students of Kolkata, West Bengal, India.

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Amit Bandyopadhyay

Sports & Exercise Physiology Laboratory,
Department of Physiology, University of Calcutta,
University College of Science and Technology,
Kolkata – 700009, India
Phone : +91 33 23508386 (Extension 221)
Fax : +91 33 23519755

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