



Trinity College Dublin

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

A comparison of common equations used to predict maximal VO₂ consumption

WHO IS CARRYING OUT THIS RESEARCH?: Researchers from the School of Physiotherapy in Trinity College, Dublin are carrying out this study to investigate the validity of equations used to predict maximal VO₂ consumption.

INTRODUCTION: A person's maximum aerobic capacity (VO₂max) is considered the best indicator for estimating a person's level of fitness. To assess a person's VO₂ max level as accurately as possible, a strenuous exercise test is carried out and breath gases are analyzed throughout testing to give a value for VO₂max. However, in some populations (e.g. very elderly, persons with pre-existing medical or cardiac conditions), strenuous exercise testing is not recommended and may be associated with increased risk of an occurrence of an adverse cardiac (or other health-related) events. For these populations, an alternative method of exercise testing has been established. This method of testing involves exercising until a certain threshold heart rate (calculated based on age) is achieved, and then performing calculations using equations that have been designed to predict an accurate value for VO₂ max.

AIM: Our aim is to perform a form of a maximal exercise test in a healthy population to test the accuracy of these equations by comparing results from the 'gold standard' method of testing to the results of VO₂ gained from the method of calculation using predictive equations.

If you would like to take part in this study please read this document carefully. To take part you have to be available for one testing session. Testing will take place in the Trinity Centre for Health Sciences, and will take approximately 40 minutes of your time.

To be eligible to participate you should be aged at least 18 years.

PROCEDURES: If you decide to take part in this study you will be asked to visit the exercise laboratory in the Trinity Centre for Health Sciences in St James' Hospital on one occasion only. There will be 2 main components of your visit.

1. BODY COMPOSITION ANALYSIS:

You will be asked to fast for at least 12 hours before testing. Upon arrival to the exercise laboratory, your standing height will be measured. The amount of fat, water and muscle in your body will be estimated using a machine that analyses measurements including details of body weight, body mass index (BMI), percentage body fat, muscle mass and fat free mass. This machine is non-invasive and will not cause any pain. Please see the image to the right for an example of the machine used. Waist circumference and body weight will also be measured manually.



2. EXERCISE TREADMILL TEST DETERMINE YOUR LEVEL OF FITNESS:

Before testing begins in the exercise laboratory you will be asked to complete a short questionnaire (the Physical Activity Readiness Questionnaire or PAR-Q). The results of this questionnaire will indicate if you are safe to carry out an exercise test. Your cholesterol and blood sugar levels will also be checked by means of a finger-prick blood test. You will then be shown the equipment which will be used in this study; a gas analysis system with a face-mask and heart rate monitor. Please see the picture (right) for an example of the equipment used in this test. The researcher will then familiarize you with the equipment and how the test will work.

You will then be fitted with a face mask and asked to get onto the treadmill where you will follow a prescribed exercise testing protocol. This test begins at a slow pace and gradually increases every three minutes. You will begin with a 1.7mph walk for three minutes. Every three minutes, the speed and incline of the treadmill will be increased gradually. Please remember, you can stop the test at any time. Your heart rate, blood pressure and blood lactate will be monitored constantly throughout the test. You will end the test is when you reach your maximal level of effort. There will then be a 5 minute cool-down phase at a slow pace while your heart returns to its normal pace. If you feel unwell in any way at any stage during this you may stop the test. Feeling unwell can include, dizziness, excessive fatigue or any pain or discomfort.



BENEFITS: Full analysis of fitness levels and body composition measurements will be provided to volunteers on completion of the testing procedures in the form of an individualised health report, which may be of potential benefit.

RISKS:

During exercise testing participants may experience bodily pain, chest pain, fatigue, dizziness or difficulty breathing during and may wish to stop the test. If so the test will be stopped immediately. The exercise test will also be stopped if:

- You experience dizziness or loss of balance, any pain, physical or verbal manifestations of fatigue, difficulty breathing, wheezing, leg cramps, or signs of poor blood flow (cyanosis (bluish hue to skin) or pallor)
- You express a desire to stop.
- There is a failure of heart rate to increase with increased exercise intensity
- There is a failure of the testing equipment
- If any of the above symptoms present during the exercise test or when exercising you will be advised to cease exercising immediately.

FOR SAFETY REASONS, IF YOU ARE A WOMAN AND ARE PREGNANT OR IF YOU ARE LACTATING, YOU MUST NOT TAKE PART IN THIS STUDY. If you are a woman of childbearing age, you may participate in this study provided you are not be pregnant or lactating. You must have a negative pregnancy test before the study begins. The effects of cardiorespiratory fitness on the foetus or child may be harmful.

If you should become pregnant, in spite of all the precautions, please notify your doctor immediately.

EXCLUSION FROM PARTICIPATION:

You cannot be in this study if any of the following applies to you:

- Female over 55
- Male over 45
- Non-fluent in English
- Poor brain function that would affect your ability to give informed consent
- History of a cardiac, respiratory or neurological condition
- Known blood pressure abnormalities (e.g. hypertension/hypotension)
- Participants for whom exercise is contra-indicated as per results of the PAR-Q or anyone falling under the absolute contra-indications to exercise testing as per the American Heart Association's Guidelines for Exercise testing, including:
 1. Acute cardiac event within 2 days
 2. Unstable angina (chest pain)
 3. Uncontrolled cardiac arrhythmias causing symptoms

4. Uncontrolled symptomatic heart failure
 5. Symptomatic severe aortic stenosis
 6. Suspected or known blood vessel wall damage
 7. Acute infection in the cardiac area
 8. Acute lung blockage
 9. High cholesterol or abnormal blood sugar levels
 10. Acute systemic infection, accompanied by fever, body aches or swollen lymph glands.
- A neuromotor, musculoskeletal or rheumatic condition
 - Medication use (exception of oral contraceptives)
 - Musculoskeletal injury in the previous 3 months
 - Inflammatory, autoimmune or allergic condition
 - Pregnancy, or possible pregnancy
 - Smoker
 - Epilepsy
 - BMI ≥ 30
 - Chronic infectious disease
 - Metabolic condition (Diabetes)
 - Physical or mental impairment leading to an inability to exercise adequately
 - Fitted electronic device (e.g. pacemaker)
 - Exclusion for any other reason deemed appropriate by the lead investigator.

Confidentiality:

Your identity will remain confidential. Your name and personal details will not be published and will not be disclosed to anyone outside of this study. All information relating to you will be stored in a secure office only accessible by the research team.

COMPENSATION:

The research team are covered by standard medical malpractice insurance. Nothing in this document restricts or curtails your rights.

VOLUNTARY PARTICIPATION: You have volunteered to participate in this study. You may quit at any time.

If you decide not to participate, or if you quit, you will not be penalized and will not give up any benefits which you had before entering the study. You should not feel in any way obliged to take part in this study. If you wish to seek more information about this study without contacting the research team directly, Ms. Ann Monaghan will be able to provide you with information. You are also free to contact the research team yourself at any stage. Contact details for Ms. Monaghan and a member of the research team are provided overleaf.

STOPPING THE STUDY: You understand that the research team may stop your participation in the study at any time without your consent.

PERMISSION: This research project has TCD ethics committee approval.

ON THE DAY OF TESTING:

- Please wear loose clothes and comfortable shoes that you will be able to exercise in.
- It would be best to bring a towel, shower gel, and change of clothes as you may wish to shower after testing.
- Please try to drive or use public transport to get to the testing venue and avoid walking or cycling on the day of your visit to the exercise laboratory as it will make for more accurate results of your fitness test if you have not done much physical activity prior to testing.
- Please remember to fast for 12 hours prior to testing. Please also limit your liquid intake while fasting. Fasting ensures more accurate results of body composition analysis.

FURTHER INFORMATION: For more information or answers to your questions about the study, your participation in the study, and your rights please see the contact details below.

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**Title: A comparison of common equations used to predict
maximal VO₂ consumption**

Lead Investigator: Ms Ann Monaghan

Principal Investigator: Dr John Gormley

Study Information: This study aims to look at the validity of equations used to predict VO₂ max. As a participant, you are required to attend one testing session in St James's Hospital. Testing involves assessing body composition and cardiorespiratory fitness by means of assessing breath gases during a graded exercise test to exhaustion on a treadmill. Once testing is completed, your fitness and body composition analysis results will be provided in the form of an individualised health report and you will be given an opportunity to discuss these results with the research team. During the testing, there is a risk of experiencing chest pain, dizziness, nausea or difficulty breathing while exercising intensely. If this occurs, testing will be stopped immediately and the investigators will assess your condition. If further care is required due to an adverse event, you will be transported to the nearest hospital facility for further care. All data collected will be coded with numerical ID to maintain participant confidentiality.

Participation is entirely voluntary and consent can be withdrawn at any stage of testing.

This study and this consent form have been explained to me. A member of the research team has answered all my questions to my satisfaction. I believe I understand what will happen if I agree to be part of this study. I have read, or had read to me, this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I have received a copy of this agreement.

PARTICIPANT'S NAME: _____

PARTICIPANT'S SIGNATURE: _____ Date: _____

Date on which the participant was first furnished with this form: _____

Where the participant is capable of comprehending the nature, significance and scope of the consent required, but is physically unable to sign written consent, signatures of two witnesses present when consent was given by the participant to a registered medical practitioner treating him or her for the illness.

NAME OF 1st WITNESS: _____ SIGNATURE: _____

NAME OF 2ND WITNESS: _____ SIGNATURE: _____

Statement of investigator's responsibility: I have explained the nature, purpose, procedures, benefits, risks of, or alternatives to, this research study. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

Investigator signature: _____ Date: _____