Effects of exercise on heart and brain function

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

What is the Aim of the Project?

It is well known that aerobic type exercise is beneficial for individuals of all ages. Prolonged exercise events such as marathons are becoming more popular as we become more aware of the health consequences of an inactive lifestyle. During exercise the heart is placed under greater stress. Recent research has shown an impairment in heart function following prolonged exercise in young individuals. This impairment in heart function may compromise blood flow to the brain, leading to a temporary loss of consciousness (i.e. fainting). The effect of prolonged exercise on the heart of older athletes is not well known. The overall aim of this project is to determine the mechanisms by which prolonged exercise may compromise normal functioning of the heart and blood flow to the brain in older athletes.

What Type of Participants are being sought?

We are looking for 12 sedentary people and 12 athletes from each of two age groups: 18-35 years and 60-80 years. For the sedentary participants, you should not be engaging in exercise for >30 min, three times per week. For the athletic group, you will have previously been participating in regular endurance competitions for 15+ years (older athletes), with a weekly running mileage in excess of 25 kilometers.

You must be in apparently good health, with no known injuries, illnesses or diseases that may affect your safe participation. Therefore, you must complete a health-oriented questionnaire before inclusion in this study and will be asked to undergo a thorough clinical examination. If you meet one or more of the exclusion criteria set out in that questionnaire or from the clinical examination, you are requested not to participate in this project, because in the opinion of the researchers and the University of Otago Human Ethics Committee, it involves unacceptable risk to you. In particular, you will be unable to participate if you have known injuries, illnesses or diseases involving:
High blood pressure (or be taking medicine to lower blood pressure)

Previous history of cardiorespiratory or cerebrovascular disease

Regular cigarette smoking within the previous 10 years,

Body mass index >30 kg/m²

Musculoskeletal injuries which may prevent you from exercising

**What will you be asked to do?**

Should you agree to participate in this study, you will be asked to complete a health-orientated screening questionnaire and undergo a thorough medical examination. Therefore, the purpose of the screening is to help ensure that any risks to you, in completing this study, will be minimal. The experimental investigation will entail the following:

- **Active participants:** You will be required to visit the laboratory on four occasions.
  1. First, you will complete the health questionnaire and be asked about your training history. You will then undergo a medical examination by a cardiologist to assess your cardiovascular health. This will take approximately 2 hours.
  2. If you meet the inclusion criteria for the study you will then undergo a maximal aerobic capacity (VO₂ max) test to determine the approximate intensity you will maintain for the exercise protocol. The visit will take approximately 1 hour, however the exercise test will only last 10-15 min.
  3. Next you will be required to report to the laboratory for testing at baseline (before exercise), following 20 min of running, and again following 4 hours of running. Each block of testing will take approximately 1 hour and will include echocardiography (an ultrasound of your heart), and an orthostatic challenge test (where we monitor your blood pressure, blood flow to your brain and oxygen content of your muscle and brain when moving from lying down to standing. In total this will take approximately 8 hours.
  4. Finally you will be required to return to the laboratory 24 hours following the completion of the 4 hours of exercise for a repeat of the test described above. This will take approximately 1 hour.

- **Inactive participants:** You will be required to visit the laboratory on three occasions
  1. First, you will complete the health questionnaire and be asked about your exercise history. You will then undergo a thorough medical examination by a cardiologist to assess your cardiovascular health. This will take approximately 2 hours.
2. If you meet the inclusion criteria for the study you will then undergo a maximal aerobic capacity (VO$_2$ max) test to determine the approximate intensity you will maintain for the exercise protocol. This visit will take approximately 1 hour, however the exercise test will only last approximately 10 min.

3. Next you will be required to report to the laboratory for testing at baseline (before exercise), and following 20 min of running or walking (whichever you can manage for 20 min). Each block of testing will take approximately 1 hour and will include echocardiography (an ultrasound of your heart), and an orthostatic challenge test (where we monitor your blood pressure, blood flow to your brain and oxygen content of your muscle and brain when moving from lying down to standing). In total this will take approximately 2.5 hours.

Prior to each test you will be required to abstain from alcohol and caffeine during the 12 hours prior to testing. Before each test you should make sure you are well hydrated by drinking 1 litre of water the evening before the test and another 500 ml with breakfast on the morning of testing.

Please be aware that you may decide not to take part in the project without any disadvantage to yourself of any kind.

If you feel unwell at any stage during the 48 hours before a laboratory session, please let us know and we will arrange with you a different time for the session. We can arrange the testing sessions at anytime to suit your schedule. If at all possible, it would be good to time the sessions for the same time of day.

Can You Change your Mind and Withdraw from the Project?

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

What Data or Information will be Collected and What Use will be Made of it?

The following data will be collected from you:

**Physiological status (generally measured continuously):**

- Blood Pressure – from a non-invasive cuff around your finger. This will help monitor your safety and quantify cardiovascular strain during each test
- Near infrared spectroscopy (NIRS) – non-invasive estimate of oxygen content in your brain and muscle.
- Cerebral blood flow velocity (from a laser-Doppler ultrasound via a probe placed at the side of your head) – a non-invasive estimate of blood flow to your brain.
Once these data have been collected they will be analysed using statistical methods to determine the effect of acute and prolonged exercise on cardiac dysfunction and damage and the resulting effect on blood flow to the brain in young and older active and inactive individuals.

The personal data will only be accessible by the researchers. Results of this project may be published and/or presented at a relevant conference but any data shown will not be linked to any specific participant (each participant will be identified by a unique letter, e.g. ‘A’), and data will typically only be presented for the group as a whole. The data collected will be securely stored in such a way that only those mentioned above will be able to gain access to it. At the end of the project any personal information will be destroyed immediately except that, as required by the University’s research policy, any raw data on which the results of the project depend will be retained in secure storage for five years, after which it will be destroyed. You are most welcome to request a copy of the results of the project.

Benefits and Risks of Participation

Benefits

Should you choose to participate, you will gain:

- A clinical cardiovascular health assessment, free of charge
- An assessment of your aerobic fitness
- A greater understanding of the benefits and risks of prolonged exercise
- For the inactive individuals; the opportunity to become involved in a subsequent study where you will receive a free 6-month supervised exercise programme which will result in major health gains for your body, will improve your fitness and will help you to maintain a healthy lifestyle.

Risks/inconveniences

- During all exercise tests there will be experienced researchers monitoring you at all times to ensure your safety.

What happens if there are any ill effects from the trial?

In the unlikely event of a physical injury as a result of your participation in this study, you will be covered by the accident compensation legislation, with its limitations. If you have any questions about ACC please feel free to ask us for more information before you agree to take part in this trial.
What if Participants have any Questions?

If you have any questions about our project, either now or in the future, please feel free to contact:

Carissa Murrell  
Department of Physiology  
Tel: 479 7893 / 027 235 6880  
carissa.murrell@stonebow.otago.ac.nz

Dr Phil Ainslie  
Department of Physiology  
Tel: 479 7893  
philip.ainslie@stonebow.otago.ac.nz

This project has been reviewed and approved by the Lower South Regional Human Ethics Committee.
Effects of exercise on heart and brain function

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:-

1. My participation in the project is entirely voluntary.

2. I am free to withdraw from the project at any time without any disadvantage.

3. The data on which the results of the project depend will be retained in secure storage for five years, after which they will be destroyed.

4. I will be required to complete up to four experimental trials in the Department of Physiology over the study period.

5. Each experimental session will involve the following measurements:
   - Non-invasive ultrasound measurements of my heart
   - Continuous measurements of blood pressure, blood flow to the brain and muscle and brain oxygenation whilst lying down and standing
   - The application of a device to the neck which will either apply pressure or suction
   - A small venous blood sample

6. I should not take part in this study if I am pregnant and/or experience regular headaches.

7. I will not be receiving any reward or compensation for my participation in this study.

8. The results of the project may be published and will be available in the University of Otago Library but every attempt will be made to preserve my anonymity.

9. In the unlikely event of significant pathology approval will be obtained before forwarding results to my GP.

I agree to take part in this project.

.................................................................................................................................
(Signature of participant)........................................................................................................
(Date)
Effects of exercise on heart and brain function

PRE-ACTIVITY SCREENING QUESTIONNAIRE

Name ____________________________________________

DOB: ____/____/____  Home Phone: _____________  Work Phone: ______________

This study involves exercise and pharmacological interventions. Safe participation requires that participants are free from observable illness or injury – particularly cardiovascular, respiratory or neurological concerns. This questionnaire will help determine whether there are medical reasons why you should not participate in this study. Your responses to the following questions are therefore important for ensuring your safety. Please read each question carefully and answer every question honestly.

1) Has a doctor ever said you have a heart condition and you should only do physical activity recommended by a doctor?  
   Yes / No

2) When you do physical activity, do you feel pain in your chest?  
   Yes / No

3) When you were not doing physical activity, have you had chest pain in the past month?  
   Yes / No

4) Do you ever lose consciousness or do you lose your balance because of dizziness? Yes/ No

5) Are you currently taking any medications?  
   Yes / No

6) Do you have insulin dependent diabetes?  
   Yes / No

7) Have you ever had heat stroke or heat intolerance?  
   Yes / No

8) Do you have kidney or gut dysfunction?  
   Yes / No

9) Do you know of any other reason you should not exercise?  
   Yes / No

Your signature: _____________________________  Date: __/___/___
Effects of exercise on heart and brain function

TRAINING HISTORY QUESTIONNAIRE

Name: _______________________________________

1. In a normal week, how many days per week do you train?
   [ ] 0-1   [ ] 2-3   [ ] 4-5   [ ] 6+

2. If you do train, on average, how long does each session last?
   [ ] 0-30min   [ ] 30-60min   [ ] 1-2h   [ ] 2-3h   [ ] 3h +

3. What intensity do you normally train at?
   [ ] Can easily have a conversation
   [ ] Have difficulty with/cannot speak full sentences
   [ ] Breathing heavily

4. Approximate total number of hours per week _______________________

5. Approximate total number of kilometers per week _______________________

6. What types of training do you do? ____________________________________
   ________________________________________________________________
   ________________________________________________________________

7. In a normal week, how many days per week do you engage in physical activity for at least 30 minutes (i.e. walking, gardening etc)?
   [ ] 0-1   [ ] 2-3   [ ] 4-5   [ ] 6+
8. When doing physical activity, how hard do you generally work?
   [ ] Can easily have a conversation
   [ ] Have difficulty with/cannot speak full sentences
   [ ] Breathing heavily

9. Approximate total number of hours per week _________________

10. What types of physical activity do you participate in? _________________
    ___________________________________________________________________
    ___________________________________________________________________

11. Is this information typical of your training and/or physical activity routine in the past 6 months?
    a. If not why not? ___________________________________________________________________
       ___________________________________________________________________

12. Please list any activities/events that you have participated in during the past 2 years and at which level.
    ___________________________________________________________________
    ___________________________________________________________________
    ___________________________________________________________________
    ___________________________________________________________________

13. Approximately how many years have you been training for and competing in endurance events?
    ___________________________________________________________________

14. Approximately how many events (marathon, ironman etc) have you competed in during your lifetime?
    ___________________________________________________________________
Effect of exercise on blood flow to the brain in young and older active and sedentary individuals

INFORMATION SHEET FOR PARTICIPANTS

What is the aim of the project?

The maintenance of blood flow to the brain is critical for proper brain function, and is tightly controlled. As we age there is a gradual reduction in blood flow to the brain of 30-40% between 20 and 80 years of age. A reduced blood flow to the brain is a risk factor for stroke. Interestingly, individuals who are more active have higher brain blood flows than sedentary individuals of the same age. However, it is unknown whether previously sedentary individuals can increase their brain blood flow by participating in an exercise training programme. The project has two main aims; First, to determine the effect of age and fitness on the control of blood flow to the brain and cognitive (brain) function at rest, and during exercise; and; Second, to investigate the effect of a 12-week aerobic based exercise programme on the above measures in previously sedentary young and older individuals.

What type of participants are being sought?

If you fit into one of the following four groups, and are healthy (no known illness, disease, or injuries), we may want you to participate in the study:

1. Older Trained - 60-80 years of age, previously (during last 15+ years) and currently training for and participating/competing in endurance type events (e.g. running and/or cycling).
2. Older Untrained - 60-80 years of age, not engaging in more than 30 minutes of exercise, three times per week.
3. Young Trained - 18-35 years of age, currently training for and participating/competing in endurance type events (e.g. running and/or cycling).
4. Young Untrained - 18-35 years of age, not engaging in more than 30 minutes of exercise, three times per week.

If you meet one or more of the exclusion criteria set out in the initial medical screening, you are requested not to participate in this project, because in the opinion of the researchers and the University of Otago Human Ethics Committee, it involves unacceptable risk to you. In particular, you will be unable to participate if you have known injuries, illnesses or diseases involving:
• High blood pressure (or be taking medicine to lower blood pressure)
• Previous history of cardiorespiratory or cerebrovascular disease
• Regular cigarette smoking within the previous 10 years,
• Body mass index >30 kg/m²
• Musculoskeletal injuries which may prevent you from exercising

What will participants be asked to do?

Prior to your inclusion in the study you will undergo a general cardiovascular health assessment, including a medical history questionnaire and a 12-lead ECG (which records the electrical activity in your heart; and may or may not require you to undergo further assessment by a cardiologist); and a physical activity questionnaire.

If you meet our criteria you will be asked to complete a further three (active participants) to six (sedentary participants) testing sessions. For the sedentary subjects, three of these sessions will precede your participation in a 12-week aerobic based training programme. The final three testing sessions will be conducted following the training programme.

The sessions are as follows….

Initial Screening Session: As outlined above [Approximately 40 minutes]
  • Medical and physical activity questionnaire
  • 12-lead ECG

Session One: Maximal aerobic power (VO₂ max) test [Approximately 40 minutes]
  • You will complete a short (approximately 10-15 min) incremental exercise test on a stationary cycle until exhaustion. This will give us an indication of your cardiovascular fitness and will enable us to determine the exercise intensity for later testing sessions.

Session Two: Familiarisation [Approximately 2.5 hours]
  • You will be introduced to all of the experimental procedures that will be used in the main testing session, all of which are non-invasive, including assessments of:
    1. Blood flow to your brain
       • A small probe will be placed on the side of your head to measure the blood flow in the major artery supplying blood to your brain.
    2. The ability of the blood vessels in your arm and leg to dilate (flow-mediated dilation)
       • We will use ultrasound to image a major artery in your arm and leg before and after the inflation/deflation of a blood pressure type cuff on your forearm and thigh. The deflation of the cuff causes an increase in blood flow to the arm/leg. This change in blood flow gives us an indication of the health of your blood vessels.
    3. The stiffness of your arteries
       • A probe will be placed on top of your carotid (neck) and femoral (upper leg) arteries to determine the reflection of the pulse wave
generated when your heart contracts. This measurement gives us an indication about the stiffness of your blood vessels.

4. The ability of the blood vessels in your brain to dilate
   - To assess the reactivity of your blood vessels in your brain you will breathe a gas mixture that has more carbon dioxide than normal air does. This will cause the blood vessels in your brain to dilate, increasing blood flow to your brain. We will also ask you to increase the depth and frequency of your breathing to lower the amount of carbon dioxide in your blood, causing blood flow to your brain to decrease slightly for a short period.

5. Other measures
   - During each session we also continuously measure your blood pressure, heart rate (by ECG) and oxygen content in your brain (by near-infra red light reflection).

6. Cognitive function
   - You will complete a basic test to assess your cognitive (brain) function, and any changes in blood flow in response to the task.

7. Brain blood flow response to sub-maximal exercise
   - Blood flow to your brain (along with heart rate, blood pressure and oxygen content in your brain) will be recorded during exercise at two intensities (low and moderate-high) for up to 10-15 minutes. During the final 3 minutes at each intensity, you will breathe a gas mixture higher in carbon dioxide (as mentioned above).

**Session Three: Baseline Experimental Session [Approximately 2.5 hours]**
- In this session, the tests from session two will be repeated and a small blood sample will be taken which will be analysed for certain markers indicating the health of your blood vessels.

Prior to each test you will be required to abstain from alcohol and caffeine during the 12 hours prior to testing. Before each test you should make sure you are well hydrated by drinking 1 litre of water the evening before the test and another 500 ml with breakfast on the morning of testing.

The sedentary subjects will then participate in a 12-week training programme. Throughout the 12 weeks you will be expected to attend at least three structured exercise sessions per week. These sessions will be predominantly walking (older group), jogging (younger group) and circuit based exercises (cycling, cross-training, rowing etc.; all participants). You will be provided with a heart rate monitor for the duration of the training programme for you to maintain specified exercise intensities and for us to record your progress. Increases in the intensity and duration of the sessions will be made throughout the 12-week programme as your fitness and exercise tolerance improves.

Approximately 4 weeks into the training programme we will repeat the assessments of flow-mediated dilation and arterial stiffness (Numbers 2. and 3., Outlined above under Session Two: Familiarisation).
Following the 12-weeks of training, all of the previously sedentary participants will then undergo a repeat of the three testing sessions above. Some of the young and older trained participants will also be asked to repeat the initial testing sessions following a 12-week period, during which you will participate in your normal training.

**Benefits and Risks of Participation**

**Benefits**

Should you choose to participate, you will gain:

- A clinical cardiovascular health assessment, free of charge;
- An assessment of your aerobic fitness;
- Assessments of the health and function of your blood vessels;
- A greater understanding about the physiological effects of age and fitness on your body;
- For the sedentary participants, a free 12-week supervised exercise programme to improve your health and fitness

**Risks/inconveniences**

- During all exercise tests there will be experienced researchers monitoring you at all times to ensure your safety.

**Can participants change their mind and withdraw from the project?**

You may withdraw from participation in the project at any time and without any disadvantage to yourself of any kind.

**What data or information will be collected and what use will be made of it?**

Data on the physiological variables mentioned above will be collected during the testing sessions. The personal data will only be accessible by the researchers. Results of this project may be published and/or presented at a relevant conference but any data shown will not be linked to any specific participant (each participant will be identified by a unique letter, e.g. ‘A’), and data will typically only be presented for the group as a whole. The data collected will be securely stored in such a way that only those researchers mentioned below will be able to gain access to it. At the end of the project any personal information will be destroyed immediately except that, as required by the University’s research policy, any raw data on which the results of the project depend will be retained in secure storage for five years, after which they will be destroyed. **You are most welcome to request a copy of the results of the project.**
What if participants have any questions?

If you have any questions about our project, either now or in the future, please feel free to contact:

Carissa Murrell (PhD Student)
PhD Student - Department of Physiology
Tel: 479 7893 / 027 235 6880
carissa.murrell@stonebow.otago.ac.nz

Dr Phil Ainslie (Lecturer)
Department of Physiology
Tel: 479 7893
philip.ainslie@stonebow.otago.ac.nz

This project has been reviewed and approved by the University of Otago Human Ethics Committee.
Effect of exercise on blood flow to the brain in young and older active and sedentary individuals

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand the requirements of the study. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:
1. My participation in the project is entirely voluntary.
2. I am free to withdraw from the project at any time without any disadvantage.
3. The data on which the results of the project depend will be retained in secure storage for five years, after which they will be destroyed.
4. I will be required to complete up to seven experimental trials in the Department of Physiology over the study period.
5. During my participation in the study the following will be collected from me:
   - Information about my medical history
   - Assessment of my aerobic fitness
   - Continuous measurements of blood pressure, blood flow to the brain, muscle and brain oxygenation and respiratory gases, whilst at rest and during sub-maximal exercise
   - Assessment of the function of my blood vessels in my arm, leg and brain
   - Assessment of my cognitive (brain) function at rest and during sub-maximal exercise
   - A small venous blood sample
6. I will not be receiving any compensation for my participation in this study.
7. The results of the project may be published and will be available in the University of Otago Library but every attempt will be made to preserve my anonymity.
8. In the unlikely event of significant pathology approval will be obtained before forwarding results to my GP.

I agree to take part in this project.

.................................................................................................................. ........................................
(Signature of participant) (Date)
PRE-ACTIVITY SCREENING QUESTIONNAIRE

Name: __________________________________________

This study involves exercise to maximal and sub-maximal levels. Safe participation requires that participants are free from observable illness or injury, particularly cardiovascular, respiratory or neurological concerns. This questionnaire will help determine whether there are medical reasons why you should not participate in this study. Your responses to the following questions are therefore important for ensuring your safety. Please read each question carefully and answer every question honestly.

1) Has a doctor ever said you have a heart condition and you should only do physical activity recommended by a doctor?  
   Yes / No

2) When you do physical activity, do you feel pain in your chest or unreasonable breathlessness?  
   Yes / No

3) When you were not doing physical activity, have you had chest pain in the past month?  
   Yes / No

4) Do you ever lose consciousness or do you lose your balance because of dizziness? Yes / No

5) Are you currently taking any medications?  
   Yes / No

6) Do you have diabetes?  
   Yes / No

7) Do you have asthma or other lung disease?  
   Yes / No

8) Do you or have you in the past had any neurological disease or head injury?  
   Yes / No

9) Do you have any other known disease, disorder or health concern?  
   Yes / No

10) Do you have any musculoskeletal problems that prevent you from exercising?  
    Yes / No

11) Do you know of any other reason you should not exercise?  
    Yes / No

12) Do you, or have you in the past smoked or drunk alcohol excessively?  
    Yes / No

I agree that to the best of my knowledge the above information is correct.

..........................................................................................   ........................................
   (Signature of participant)                                       (Date)
ADDITIONAL INFORMATION

Name:______________________________

DOB:______________________________

Address:______________________________________

Phone:______________________________________

Email:______________________________________

Height:______________________________

Weight:______________________________

Resting BP:________________________

Resting CBF:________________________

GP Name:____________________________________________________________________

GP Address/Clinic:_________________________________________________________________
GENERAL SCREENING QUESTIONNAIRE

Name:

Sex (M/F):

Age:

BMI [Body Mass Index = weight (kg) / height (m)^2]; (or approximate height and weight):

Are you happy to participate in the scientific experiments, as outlined in the information sheet, as well as 12-weeks of training?

Are you on any medications? If so, what, and what for?

Do you have any health concerns/illnesses that may affect your ability to participate in the study? e.g. arthritis, recent injuries etc.

Have you recently been, or are you likely to become pregnant during the duration of the study?
Are you going to be in Dunedin until at least the end of November (i.e. available to attend 3-4 exercise sessions per week; weekends away are fine)?

What is your availability like? i.e. are you only available outside of normal working hours [please note that this will not exclude you from the study, but obviously we are limited by the number of people we can test outside of working hours].

During an average week, what and how much exercise do you do? Include walking to/from/at work/university; house work (e.g. mowing lawns etc.); taking the stairs, walking to and from the shops etc.
Effect of exercise on blood flow to the brain in young and older active and sedentary individuals

INFORMATION SHEET FOR PARTICIPANTS

Thanks for your interest and participation in the study so far.....now its time to begin the next phase.....the 12 weeks of training.

By now you will have been given a heart rate monitor and a training diary to use throughout the study.

The training diary will be your guide throughout the 12 weeks, giving you things to think about (exercise goals etc), giving you information about the training (training intensities, training session timetable etc), and giving you a place to record your physical activity. The diary is mostly for your benefit; however we will want to photocopy your weekly exercise logs at the end of the study.

The heart rate monitor is yours to use for the duration of the study. It is really important as it; 1) tells you how hard you are exercising, and 2) provides us with data as to how hard you were exercising (we will be downloading the files stored by your heart rate monitor every so often throughout the study). We ask you to use your heart rate monitor every time you exercise for longer than 15-20min.

Your heart rate monitor consists of a belt and a watch. You will all be familiar with the placement of the belt from the testing sessions but you will need to moisten the plastic bit of the belt before putting it on in order for you heart rate to register. The watch is very simple to operate. The red button on the front of the watch is the start button. If you push it once you heart rate will be displayed on the screen. For your heart rate to be recorded (so we can download it later) you have to push the red button for a second time (at this point you will see that the time of day is replaced with a timer). Once you have finished your exercise session, pushing the bottom left button once will stop your heart rate monitor recording, and twice will return you to the main screen. We can help you learn how to work these at the exercise sessions so don’t worry if you are unsure.
The timetable for the training sessions is located in your training diary. We would like you to attend at least two of our supervised sessions per week. You are welcome to exercise on your own or with friends/family as well, just remember to use your heart rate monitor each time.

Also outlined in the training diary are the recommended frequency, intensity, and duration of sessions for the 12 weeks. Ideally we would like you to keep to these ranges (especially for exercise intensity) as much as possible. The programme is designed in such a way that we will start off easily and progressively increase the intensity and duration of the sessions as your fitness improves. The outdoor sessions will be on regardless of the weather, so let’s hope spring arrives just in time!

Throughout the 12 weeks of training we would like to reassess some of the measures we took at testing sessions prior to the start of the training. Normally with training studies, participants are assessed at the beginning and the end of the training study but the time course of many of these changes (especially in blood vessel function) with an exercise programme has not been studied. If possible, we would like to get everybody in for a blood test, assessment of the stiffness of your arteries (the probe that is placed on your radial, carotid and femoral arteries) and assessment of the function of your arteries (where we took an ultrasound of the artery in your arm and leg prior to and following the inflation/deflation of a cuff). These sessions will take 30-60 minutes and we would like to do them following 1 (week of 8th September), 3 (week of 22nd September) and 7 (week of 20th October) weeks of training. The good news is that some of you will not need to have the cuff around your leg any more…..if we have not been able to get a
really clear image at either of the first two sessions then we will no longer do the leg cuff measure.

Before starting the training is a good time to think about what you want to be able to achieve in 12 weeks time. Do you want to be able to run 10 km without stopping? Do you want to be able to walk briskly for 60 minutes? Write down your goal in your training diary and we will try our best to get you to achieve it. Keep the weekend of the 22nd/23rd of November free as we will celebrate the end of the 12 weeks of training with a fun run/walk event where you can bring along family/friends and achieve your goals, followed by a BBQ (more about this later).

I hope this provides you with all the information you need to get through the next 12 weeks. If you have any questions just ask. One or more of us (Kate, Sam, Phil (My supervisor), Jim (My other supervisor) or myself) will be at every exercise session so pick the ones that suit you and come along, get fit & meet the other participants in the study.

Cheers,
Carissa

My details again just in case…….

Carissa Murrell
Department of Physiology
Tel: 479 7893
Mobile: 027 235 6880
carissa.murrell@stonebow.otago.ac.nz
Physical Activity Diary

For the study......

Effect of exercise on blood flow to the brain in young and older active and sedentary individuals

Department of Physiology, University of Otago
Using this Diary

This recording diary will help you keep on track and document your physical activity throughout the next 12 weeks

- Write in your diary every day
- Include all moderate or strenuous physical activity you participate in, how long you were active for, and the average intensity you feel you worked at for each session (see the scale of perceived exertion, and the example week in the following pages)
- At the end of each week, see if you followed your training plan
- If not, determine what you need to do to follow the training plan for the coming week

If you have any questions about this diary or about anything else related to this training study, please do not hesitate to contact me...

Carissa Murrell
carissa.murrell@stonebow.otago.ac.nz
Ph: 479 7893 (Office), 027 235 6880 (Mobile)

“The future depends on what we do in the present” – Mahatma Ghandi
Goal Setting

Goal setting is an important first step
You need to know what you want to achieve and then
identify the steps required to achieve that goal

“These goals are your own”

An effective goal is... *Specific, Measurable, Attainable, Realistic, Written, Clear-cut*

Talk to someone about your goals and write out a plan to achieve them

My Long Term Goal/s is/are....

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

My Short Term Goal/s is/are....

________________________________________________________________________
________________________________________________________________________
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“Goals are the fuel in the furnace of achievement” – Brian Tracy
Achieving Goals

Steps I need to take to achieve my goals include...

________________________________________________________________________

________________________________________________________________________

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“Without goals and plans to reach them you are like a ship that has set sail with no destination” – Fitzhugh Dodson
Becoming More Physically Active

What are the benefits I can gain from regularly participating in Physical Activity?

What are the barriers preventing me from becoming more active?

Barrier: __________________________________________
Strategy to overcome barrier: ______________________
_________________________________________________

Barrier: __________________________________________
Strategy to overcome barrier: ______________________
_________________________________________________

Barrier: __________________________________________
Strategy to overcome barrier: ______________________
_________________________________________________

Barrier: __________________________________________
Strategy to overcome barrier: ______________________
_________________________________________________

Regard every chance to move as an opportunity rather than an inconvenience.
It takes 3 weeks to create a (good) habit, but only 3 days to break it.

Tools I am going to use to ‘stick to’ my physical activity
1. _______________________________________
2. _______________________________________
3. _______________________________________

What do you ENJOY?

________________________________________

________________________________________

________________________________________

When can you fit PHYSICAL ACTIVITY into your day?

________________________________________

________________________________________

________________________________________

What would you like to TRY?

________________________________________

________________________________________

________________________________________
The Training

To improve your fitness over the 12 week period we need to increase the frequency (number of sessions per week), intensity (how hard you work during the sessions) and the duration of the sessions.

The table below outlines this progression in the training programme. It may look a little daunting now but we will start off at a level you can manage and you may be surprised at what you can achieve later in the programme as your fitness improves.

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Frequency (sessions/week)</th>
<th>Intensity (% HRR)</th>
<th>Duration (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>3</td>
<td>50-65</td>
<td>20-30</td>
</tr>
<tr>
<td>5-8</td>
<td>3-4</td>
<td>60-75</td>
<td>30-40</td>
</tr>
<tr>
<td>9-12</td>
<td>4</td>
<td>65-80</td>
<td>40-50</td>
</tr>
</tbody>
</table>

If the 300,000,000 tiny air sacs (alveoli) in your lungs were laid out flat they would cover a tennis court.
My Intensities

One method we use to calculate the intensity we want you to work at is the Heart Rate Reserve (HRR) Method. By subtracting your resting heart rate from your maximal heart rate, we get a heart rate range for you to exercise within. We will work these intensities out from the results of your initial exercise test.

Resting Heart Rate (HR) ....................
Maximal Heart Rate ......................

How to calculate HRR:
Target HR = ([Max HR – Resting HR] × % intensity) + Resting HR

My Heart Rate Range for.......  

<table>
<thead>
<tr>
<th>Weeks</th>
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</thead>
<tbody>
<tr>
<td>1-4</td>
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<tr>
<td>5-8</td>
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<tr>
<td>9-12</td>
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</tbody>
</table>

Aerobic exercise is one of the best preventative medicines available, and one of the cheapest.
How to: Rate the intensity you feel you are working at

Another method we will use to determine your exercise intensity is a subjective scale called the OMNI Scale of Perceived Exertion (on the opposite page).

Following each exercise session we ask you to record the value (0-10) from the scale which you think best represents how hard you were exercising. There is no right or wrong answer with this scale.

In the picture opposite, look at the person who is starting to walk at the bottom of the hill. If you feel like this person when you are walking, your exertion would be extremely easy (i.e. zero). Now look at the person who is exhausted at the top of the hill. If you feel like this person whilst walking/running, your exertion would be extremely hard (i.e. 10). If you feel that your exercise intensity is somewhere in between extremely easy and extremely hard then choose a number from the scale opposite which accurately reflects that. This value can be odd numbers (1,3,5,7,9) even though no wording is associated with them.

Please record this value for your AVERAGE exercise intensity for each session in the ‘intensity’ column on your weekly physical activity recording sheets.

“Pain is temporary. Quitting lasts forever” – Lance Armstrong
OMNI Scale of Perceived Exertion

0  Extremely easy
1  Easy
2  Somewhat easy
3  
4  Somewhat hard
5  
6  Hard
7  
8  
9  
10 Extremely hard

Utter et al. (2004), MSSE
### 12 week Training Study

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
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<tr>
<td>7am</td>
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<td>1</td>
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<tr>
<td>8am</td>
<td>PE Circuit Gym</td>
<td>PE Circuit Gym</td>
<td>1</td>
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<td>9am</td>
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<td>12pm</td>
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<td>Walk/jogging group</td>
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<td>1pm</td>
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<tr>
<td>3pm</td>
<td></td>
<td>Walking group</td>
<td>4</td>
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<td>4pm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5pm</td>
<td>Walk/jogging group</td>
<td>Walk/jogging group</td>
<td>3</td>
</tr>
<tr>
<td>6pm</td>
<td></td>
<td>PE Circuit Gym</td>
<td>1</td>
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<tr>
<td>7pm</td>
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</tbody>
</table>

**Locations:**

1. Circuit Gym, Ground Floor, School of Phys Ed, Corner Cumberland and Union Streets

2. Logan Park;  
   Meeting place: Caledonian Ground carpark

3. Botanical Gardens;  
   Meeting place: Gardens entrance on the corner of North Rd & Opoho Rd
# Session Timetable

<table>
<thead>
<tr>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
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<td>2</td>
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<tr>
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<td>Walk/jogging group</td>
<td>PE Circuit Gym</td>
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<td>5</td>
<td>3</td>
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<td></td>
<td>Walking group</td>
<td>Walk/jogging group</td>
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<td>6</td>
<td>6</td>
<td>Walk/jogging group</td>
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<td>Walk/jogging group</td>
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<tr>
<td></td>
<td>PE Circuit Gym</td>
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</tbody>
</table>

**Locations:**

- 4 Harbour;
  Meeting place: Vauxhall Yacht Club carpark
- 5 Beach;
  Meeting place: St Clair Esplanade
- 6 Reservoir;
  Meeting place: Entrance to Woodhaugh Gardens on George St
My Physical

<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
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<td>AM</td>
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<td>PM</td>
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Blood flow to the brain decreases 30-40% between 20-80 years of age
“You don’t have to be a fantastic hero to do certain things. You can just be an ordinary chap, sufficiently motivated to reach challenging goals” – Sir Edmund Hillary
Sample Week

Goal of the week: Build up to jogging

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONDAY AM Walked dog on beach</td>
<td>30 min</td>
<td>4</td>
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<tr>
<td>PM</td>
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<tr>
<td>TUESDAY AM</td>
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<td>PM</td>
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<tr>
<td>WEDNESDAY AM Circuit session at PE gym</td>
<td>45 min</td>
<td>6</td>
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<td>THURSDAY AM</td>
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<td>PM</td>
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</tbody>
</table>

Frequency 3-4
Intensity 55-65%
HR range 130-140
Duration 35 min
<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
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<tbody>
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<tr>
<td>AM</td>
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<tr>
<td>PM Walk/jog around Gardens</td>
<td>30 min</td>
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<td><strong>SATURDAY</strong></td>
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<tr>
<td><strong>SUNDAY</strong></td>
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<tr>
<td>AM Walk around harbour</td>
<td>40 min</td>
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<td>PM</td>
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</table>

**Evaluation:**

Did I follow my plan this week?  √ Yes  □ No
If not, what changes do I need to make? __________
_________________________________________________________________
_________________________________________________________________
By the age of 65, individuals who haven’t engaged in exercise on a regular basis may incur a decrease in their muscular strength by as much as 80%.

Week One

Goal of the week:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
<th>Frequency</th>
<th>Intensity</th>
<th>HR range</th>
<th>Duration</th>
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</table>

**Evaluation:**

Did I follow my plan this week?  □ Yes  □ No

If not, what changes do I need to make?  


30 minutes a day you’ve got to Push Play – SPARC Recommendations
**Week Two**

The highest ever recorded VO2 max was 94 ml/kg/min by a Norwegian Cross-Country Skier; twice that of an average value for a young male.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
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<td><strong>MONDAY</strong></td>
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</tbody>
</table>

**Evaluation:**

Did I follow my plan this week? □ Yes □ No

If not, what changes do I need to make? __________

________________________________________________________________________

________________________________________________________________________

“Motivation is what gets you started, Habit is what keeps you going” – Jim Rynn
If all the blood vessels in the human body were lined up end-to-end, they would circle the world twice.
**Activity**  | **Duration** | **Intensity**
--- | --- | ---
**FRIDAY** | | |
 AM | | |
 PM | | |
**SATURDAY** | | |
 AM | | |
 PM | | |
**SUNDAY** | | |
 AM | | |
 PM | | |

**Evaluation:**

Did I follow my plan this week?  □ Yes  □ No

If not, what changes do I need to make?  

“The tragedy in life doesn’t lie in not reaching your goal. The tragedy lies in having no goals to reach” – Benjamin Mays
The human heart beats ~100,000 times per day, ~35 million times per year, and ~2.5 billion times an a lifetime.

### Week Four

**Goal of the week:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
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<tbody>
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<td><strong>MONDAY</strong></td>
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<td><strong>TUESDAY</strong></td>
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<td><strong>WEDNESDAY</strong></td>
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<td><strong>THURSDAY</strong></td>
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The human heart beats ~100,000 times per day, ~35 million times per year, and ~2.5 billion times an a lifetime.
By walking an extra 20 minutes per day, the average person will burn off 3 kg of body fat in a year.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
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<tr>
<td><strong>FRIDAY</strong> AM</td>
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**Evaluation:**

Did I follow my plan this week? □ Yes □ No
If not, what changes do I need to make? 

___________________________________________________________________
___________________________________________________________________

___________________________________________________________________

Week Five

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
</tr>
</thead>
</table>

**Goal of the week:**

**Frequency:**

**Intensity:**

**HR range:**

**Duration:**

---

You use 200 muscles to take one step.
**Activity** | **Duration** | **Intensity**
--- | --- | ---
| FRIDAY AM |  |  |
| FRIDAY PM |  |  |
| SATURDAY AM |  |  |
| SATURDAY PM |  |  |
| SUNDAY AM |  |  |
| SUNDAY PM |  |  |

**Evaluation:**

Did I follow my plan this week?  □ Yes  □ No

If not, what changes do I need to make?  
__________________________________________________________________________
__________________________________________________________________________

“If youth but knew, if age but could” – Henri Estienne
High blood pressure is the major risk factor for cardiovascular disease. Exercise can reduce blood pressure for up to 12-24 hours following a single bout of exercise.
**Activity** | **Duration** | **Intensity**
--- | --- | ---
**FRIDAY**
AM |  |  
PM |  |  

**SATURDAY**
AM |  |  
PM |  |  

**SUNDAY**
AM |  |  
PM |  |  

**Evaluation:**

Did I follow my plan this week? □ Yes □ No
If not, what changes do I need to make? __________

_________________________________________________________________

_________________________________________________________________

“Shoot for the moon, even if you miss you’ll land amongst the stars” – Les Brown
Well done on completing the first 6 weeks of training,

You are half way through
Evaluating your own progress is a great tool in assisting in identifying what is working and what you may need to improve on.

What have I enjoyed? ____________________________
__________________________

What positive changes have I made? ______
__________________________

What can I improve on? _________________
__________________________

What has not worked? _________________
__________________________

For the next six weeks I am going to: ______
__________________________

*More deaths can be attributed to a sedentary lifestyle than to smoking.*
The brain represents only 2% of body weight but it receives ~15% of blood flow, consumes ~20% of oxygen used, and ~25% of glucose used.

## Week Seven

**Goal of the week:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
<th>Intensity</th>
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<tbody>
<tr>
<td><strong>MONDAY</strong></td>
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<td><strong>TUESDAY</strong></td>
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Frequency ________
Intensity ________
HR range ________
Duration ________
“Nothing great was ever achieved without enthusiasm” - Emerson

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**Evaluation:**

Did I follow my plan this week? □ Yes □ No

If not, what changes do I need to make?

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Week Eight

Goal of the week:

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Frequency ________
Intensity ________
HR range ________
Duration ________

The human brain cell can hold five times as much information as the Encyclopaedia Britannica.
“I have met my hero, and he is me” – George Sheehan

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Evaluation:

Did I follow my plan this week? □ Yes □ No
If not, what changes do I need to make? __________

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The human body has 5-6 litres of blood which circulates through the body once per minute. Red blood cells travel ~10,000 km in their lifetime of 120 days.
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**Evaluation:**

Did I follow my plan this week?  □ Yes  □ No

If not, what changes do I need to make? ________

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“To do anything less than your best is to sacrifice the gift” – Steve Prefontaine
Cardiovascular disease is the leading cause of death in New Zealand, accounting for 40% of all deaths.

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**Goal of the week:**

Frequency ________
Intensity _________
HR range _________
Duration _________
**Evaluation:**

Did I follow my plan this week? □ Yes   □ No

If not, what changes do I need to make? ________

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“Procrastination is the thief of time” – Edward Young
The human brain is ~78% water.

Week Eleven

Goal of the week:

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Numerous physiological changes occur with ageing, many of which can be halted or even reversed with regular exercise.

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Evaluation:

Did I follow my plan this week?  □ Yes □ No
If not, what changes do I need to make?  

____________________________________

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"The greater the obstacle, the more glory in overcoming it" - Moliere
**Evaluation:**

Did I follow my plan this week? □ Yes □ No

If not, what changes do I need to make? _________

______________________________________________

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“*It’s not the mountains we conquer but ourselves*” – Sir Edmund Hillary
Well done on completing the 12 weeks of training

And thank you for your time and effort over the past months in helping to make this study possible
Where to from here?

Tips for keeping the ball rolling….

- Try something new, e.g. golf, cycling, ballroom dancing
- Add variety to your physical activity plan, e.g. find a new place to walk/run
- Get a friend/family member involved
- Share your success with others
- Regularly challenge yourself
- Reassess your goals
- Keep aiming for that long term goal, e.g. lose 10 kg, run a marathon, walk a half marathon etc.

Don’t forget to reward yourself when you know you have succeeded!!