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# Polarized exercise training improves cardiometabolic health

**Submission date**
12/06/2016

**Recruitment status**
No longer recruiting

**Registration date**
21/06/2016

**Overall study status**
Completed

**Last Edited**
04/10/2018

**Condition category**
Nutritional, Metabolic, Endocrine

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[X] Results
[ ] Individual participant data

## Plain English summary of protocol

Background and study aims
Being obese or overweight and having poor cardiorespiratory capacity (ability of the heart and lungs to deliver oxygen around the body and remove carbon dioxide during exercise) are independent risk factors linked with development of long-term diseases and death. It is well known that having a a high cardiorespiratory capacity can improve obesity-related diseases such a type 2 diabetes, high cholesterol and high blood pressure. It is well known that exercising more has the ability to improve cardiorespiratory capacity and metabolic health (chemical processes in the body) in obese patients, however the best form of training is not known. The aim of this study is to compare the effects of a high intensity exercise programme, a moderate intensity endurance exercise programme and a polarized training (80% high intensity, 20% low intensity) programme to find out which is best able to improve cardiorespiratory capacity and metabolism in obese women.

Who can participate?
Overweight/obese adult woman aged between 20-40 years.

What does the study involve?
Participants are randomly allocated to one of four groups. Those in the first group do not do any extra exercise during the 12 weeks of the study. Those in the second group take part in moderate intensity endurance training, which involves 45-50 minute sessions of cycling exercise at a constant speed three times a week for 12 weeks. Those in the third group take part in high intensity exercise, which involves three training sessions a week for 12 weeks. These sessions involve four sets of four bouts of very high intensity cycling, with two minutes of active recovery (slow cycling) between bouts and four minutes of passive recovery (sitting or back pedaling) between sets. Those in the fourth group take part in three sessions of polarized training a week for 12 weeks. This involves 30 minutes of cycling exercise at a constant speed with two sets of three bouts of high intensity cycling for 60 seconds, with two minutes of active recovery between bouts and 4 minutes of passive recovery between sets. Participants in all groups must attend 80% of the sessions in order to finish the study. At the start of the study and then again after 12 weeks, all participants undergo a number of medical tests to measure their cardiorespiratory capacity.

What are the possible benefits and risks of participating?
The expected benefits are improved cardiorespiratory and metabolic health outcomes compared with participants included in control group. Possible risks are limited to minor injuries or discomfort during the training process.

Where is the study run from?
The University of Concepción (Chile)

When is the study starting and how long is it expected to run for?
May 2015 to December 2015

Who is funding the study?
The University of Concepción (Chile)

Who is the main contact?
Professor Hugo Cerda Kohler
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# Contact information

### Type(s)
Scientific

### Contact name
Prof Hugo Cerda Kohler

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# Additional identifiers

### Protocol serial number
2016-PI215136015-1.0IN

# Study information

### Scientific Title
Greater reductions in cardiometabolic risk factors in overweight and obese young women with polarized training

### Study objectives
Polarized training induce greater adaptive responses compared to endurance or high intensity interval training in obese and overweight female patients.

### Ethics approval required
Old ethics approval format

## Ethics approval(s)
The Ethical Committee at the Universidad de Concepción (University of Concepción), ref: 2016-PI215136015-1.0IN

## Study design
Single-centre four-arm randomised controlled trial

## Primary study design
Interventional

## Study type(s)
Treatment

## Health condition(s) or problem(s) studied
Obesity

## Interventions
Participants are randomly allocated to one of four groups using SPSS Statistics Software.

Control group: Participants do not participate in any formal physical activity.

Moderate-intensity endurance training group: Participants take part in 36 supervised cycling sessions spread over 12 weeks (3 sessions/week). These sessions involve 45-50 minutes of cycling exercise with a constant cadence (70-80 rpm) at 95% of pVT1.

High intensity interval-training group: Participants take part in 36 supervised cycling sessions spread over 12 weeks (3 sessions/week). These sessions consist of four sets of four bouts of 60 second cycling exercise at 90% pVO2max, with 2 minutes of active recovery between bouts (~30-40 W) and four minutes of passive recovery (i.e., sitting or backward pedaling in the cycle-ergometer) between sets. This prescription remained consistent for every training session.

Polarized training group: Participants take part in 36 supervised cycling sessions spread over 12 weeks (3 sessions/week). These sessions consist of 30 minutes of cycling exercise with a constant cadence (70-80 rpm) at 95% of pVT1; plus 2 sets of 3 bouts of 60s cycling exercise at 100% pVO2max, with 2 minutes of active recovery between bouts (~30-40 W) and 4 minutes of passive recovery (i.e., sitting or backward pedaling in the cycle-ergometer) between sets.

To be included in the analysis, the participants have to attend at least 80% of the training sessions. Nutritional intake is not standardized, but all the participants are instructed to maintain their normal dietary habits throughout the course of the study. In order to maintain the intensity prescribed, the overall rating of perceived exertion and heart rate is obtained at the end of all training sessions. If one of these variables decreased over two consecutive training sessions, the power output is increased by 5-10 watts. Participants in all groups are followed up after 12 weeks.

## Intervention Type
Other

## Primary outcome(s)

Cardiorespiratory capacity is assessed through a maximal incremental test on a cycle-ergometer and gas exchange recorded continuously with a portable breath-to-breath gas analyzer at baseline and 12 weeks.

### Key secondary outcome(s))
1. Blood lactate concentration is measured using a standard enzymatic lactate analyzer at baseline and 12 weeks
2. Heart rate is measured during exertion using a cardiac monitor at baseline and 12 months
3. Perceived exertion (RPE) is measured immediately after exercise using the ten-point Borg scale at baseline and 12 weeks
4. Body composition (total body and regional estimates of bone mass, bone mineral density, fat mass, lean mass, and fat percentage) is measured using dual X-ray absorptiometry (DXA) at baseline and 12 weeks
5. Whole body insulin sensitivity was assessed using an oral glucose tolerance test and the Quantitative Insulin Sensitivity Check Index (QUICKI) at baseline and 12 weeks
6. Insulin resistance is estimated using the Homeostasis Model of Assessment of Insulin Resistance (HOMA-IR) at baseline and 12 weeks

### Completion date
04/12/2015

## Eligibility

### Key inclusion criteria
1. Age between 20 and 40 years
2. Female.
3. Body mass index (BMI) between 27 and 40 kg/m2
4. Physically inactive (i.e. less than 2 hours of physical activity/week)
5. Non-diabetic
6. Able to be enrolled in a high-intensity exercise training program

### Participant type(s)
Patient

### Healthy volunteers allowed
No

### Age group
Adult

### Sex
Female

### Key exclusion criteria
1. Hypertension, cardiovascular or respiratory disease
2. Acute or chronic inflammatory diseases
3. Digestive system surgery
4. Thyroid hormone replacement
5. Antidepressants consumption

6. Pregnancy
7. Recent participation (i.e. less than two months) in training or diet interventions

**Date of first enrolment**
03/08/2015

**Date of final enrolment**
28/08/2015

# Locations

**Countries of recruitment**
Chile

**Study participating centre**
**Universidad de Concepción**
Concepción
Chile
4440000

# Sponsor information

**Organisation**
University of Concepción

**ROR**
https://ror.org/0460jpj73

# Funder(s)

**Funder type**
University/education

**Funder Name**
Universidad de Concepción

**Alternative Name(s)**
University of Concepcion, UdeC

**Funding Body Type**
Private sector organisation

**Funding Body Subtype**
Universities (academic only)

**Location**
Chile

# Results and Publications

## Individual participant data (IPD) sharing plan

### IPD sharing plan summary
Data sharing statement to be made available at a later date

### Study outputs

| Output type | Details | Date created | Date added | Peer reviewed? | Patient-facing? |
|---|---|---|---|---|---|
| Results article | results | 18/09/2018 | | Yes | No |
| Participant information sheet | Participant information sheet | 11/11/2025 | 11/11/2025 | No | Yes |