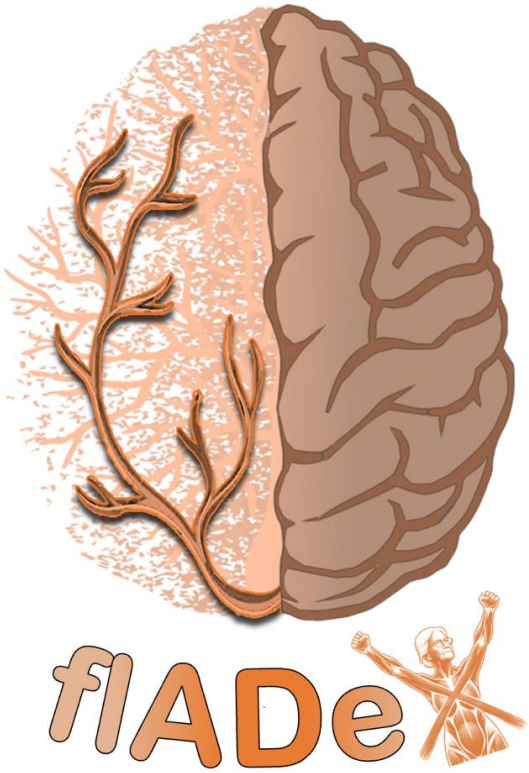


Manual of procedures FLADEX Project

MOP Chapter 8: Intervention Program

profith
Promoting Fitness & Health through Physical Activity

UNIVERSIDAD DE GRANADA

Chapter 8: Intervention conditions Program

Index

1. Introduction

The FLADEX project aims to determine the acute effects of different type of exercise on cerebral blow flow and Alzheimer's disease blood-based biomarkers. The detailed description of the elements of the exercise program is fundamental as this will ensure that the program is carried out and disseminated as clearly as possible to allow its replication in any similar context.

Participants will be randomized into 3 different conditions: A) Aerobic exercise condition, B) Resistance exercise condition and C) Resting condition.

2. Required material

The material required for the session is as follows:

- Annex 8.1. Questions (Feeling scale, RPE and PACES questions)
- Annex 8.2. Exercises technique description
- Elastic bands
- Stopwatch and pencil
- Mats
- Chair
- Anchor points (At a height of 2m, gaze height, hip height and knee height)
- Heart rate monitors
- Ipads with Polar Flow app
- H10 Polar Bands
- Polar watches

3. Pre-session procedure.

3.1 Information to the participant

Timing is very important, so as soon as the participant arrives, the procedure will be carefully explained before the session:

1. The exercises will be explained to the participant.
2. The trainer will remark on the importance of being focused on the exercise, talking as little as possible to avoid wasting time.
3. The trainer will remind the flow of the session and the importance of the times.

3.2 Training team

Prior to each training session, the person in charge of the training must check the familiarization and condition data on RedCap form corresponding to each participant **as well as the polar configuration.**

The following information will be described in the familiarization form:

- Maximal heart rate
- Resting heart rate

The following information should be described in the condition form:

- 60% maximal heart rate (HRMAX)
- 70% maximal heart rate (HRMAX)

It is very important to know the correct execution of each exercise and for this, if the trainer has any doubts, the exercise guide can be consulted on paper (**Annex 8.2. Exercises technique description**) or video before the session (https://www.youtube.com/@aguedaproject-ugr1924/videos.)

Along with this, the person in charge of the training should prepare the materials that each participant needs:

Table 1. Materials per condition.

Aerobic exercise condition (A)	Resistance exercise condition (B)	Resting condition (C)
Bike File 8.1. Questions Marker Clock Ipad Polar band Polar watch Stopwatch Blood pressure monitor	Chair Elastic bands File 8.1. Questions Marker Clock Ipad Polar band Polar watch Stopwatch Blood pressure monitor	Ocean movie File 8.1. Questions Marker watch Polar band Blood pressure monitor

3.3 Polar configuration

HR monitoring during the session will be measured through the "*Polar Team*" app installed on an iPad.

First, we created a team whose name will be "*Fladex*". Below are examples of the steps to follow:

1. In the options on the left side of the app, click on the symbol ⚙.
2. In main sport, we mark "*Other",* metric units and, we will add the photo of the team, which is the symbol of the project.
3. This step will be completed before the project starts because it only needs to be configured once

After this, let's introduce the participants, as if they were team players. These steps will be performed for each participant:

1. Click in a black person icon on a white background 👤
2. At the top, on the right, click "*Admin. Gamblers"*

Figure 1. Steps 1-2.

3. Click on "*Add new player*".
4. We enter the data of name, surname, date of birth, email, gender, height, weight, HR settings (we will already have them through previous tests). The name should be the number ID_ID (e.g., 101_101).
5. Finally, link the H10 sensor for HR by clicking on "*Link sensor*".
6. Once finished, click on "*Done*".
7. These steps must be done just once time per participant so it will be done in the familiarization session.

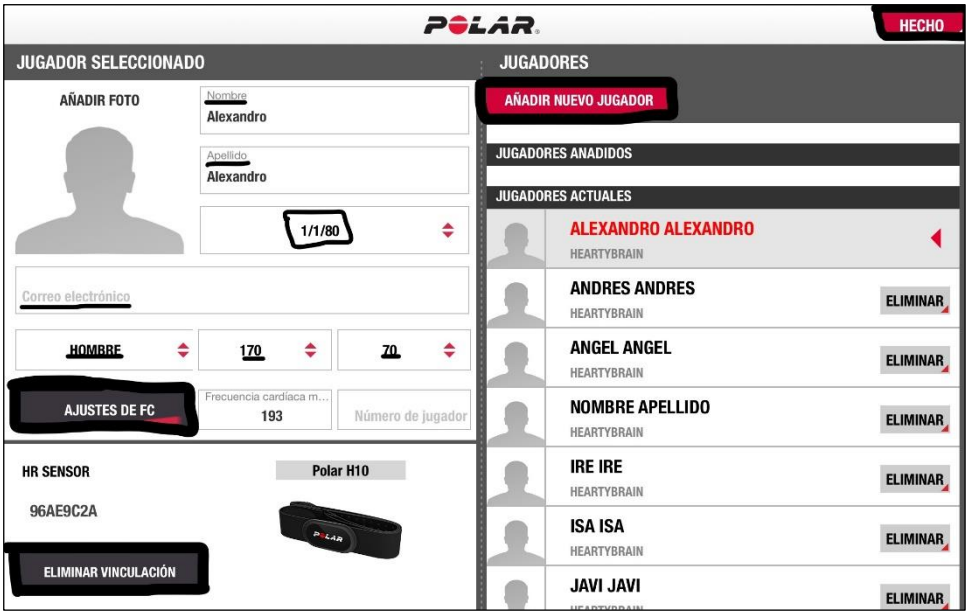


Figure 2. Steps 4-5-6.

4. Intra-session procedure

4.1 Specific questions prior to the training session

The participant will be asked about their intrinsic motivation (Ellis et al., 1981) **(Figure 3)** before starting the session. (Rose & Parfitt, 2008)

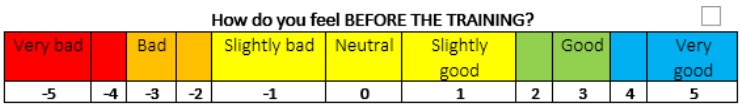


Figure 3. Questions: Motivation pre-session.

4.2 Polar Activation

Once participants have their chest strap on and the watch on top of the mat, the trainer will start the training session on the clock. To do this:

1. Press the clock button
2. Select "start workout"
3. Select "SIT" on the clock

During the training session, we will be able to observe in real time the target variables of the participant on the iPad through the "*Polar Team" App.* As we have already set up. The app automatically detects the sensors that are monitoring HR at that moment, so that only participant with a band participate in that session.

4. Open the "*Polar Team" App*
5. In the options on the left, click on the symbol to select the "*Fladex"* team, since it is the one with the list of participants, and there may be another team created in the App with a different list (Figure 4).

Figure 4. Selection of the project.

6. Click in the symbol .
7. Click on "*nueva sesión*" (Figure 5).

Figure 5. Start of the session.

8. The screen automatically appears with the participants available to carry out the session, since they are the ones that the device identifies as linked HR sensors. Finally, start the session by clicking on "*start"* (Figure 6).

Figure 6. Available participants.

4.3 Blood pressure

Blood pressure will be taken before and after each condition. For this measurement, the following values will be record on the condition redcap form:

- Systolic blood pressure
- Diastolic blood pressure

- The person's posture is important. The participant must be sitting in a chair with her/his back supported. The elbow should be on the table, with the arm resting, at the level of the heart. The left arm will be prioritized, but either arm can be used if necessary (in case the blood sample has to be taken from the other arm).
- The participant may not have their legs dangling, nor crossed; The legs should be resting on the floor.
- The length of the device's inflatable pouch should cover 80% of the arm circumference. Larger, more muscular people, with thicker arms, need a larger inflatable bag. Place the bottom edge of the cuff one inch (2.5 cm) above the inner crease of the elbow. Close the cuff and then glue the Velcro on.
- Do not talk to participant let participant talk to anyone else or move from his/her chair.

5.Conditions

5.1 Information and feedback during conditions

During conditions A and B, the trainer must provide positive feedback to the participant regarding the session. This feedback should be purely informational, aiming to minimize conversations that could be cognitively stimulating as much as possible. The types of feedback and information to be provided will be of the following:

- *¿Cómo estás?*

- *Vas muy bien*
- *Llevamos la mitad de la sesión*
- *Intenta subir/bajar la intensidad*
- *Nos quedan x minutos*
- *Concéntrate en inspirar y expirar*
- *Focaliza tu atención en tus músculos.*
- *¡Tú puedes, aguanta!*

5.2 Aerobic training condition (A)

Frequency, intensity, time, and type
The aerobic exercise condition will last 30 min. The intensity target will be a continuous moderate intensity by the 60-70% of HRMax based on previous studies(Norton et al., 2010) . Aerobic exercise will be performed on a stationary bike.

The 60% and 70% HRMax will be automatically calculated by RedCap using the participant age taken with the formula:

$$220 - \text{Age}$$

Warm-up phase
The participant will perform 4 minutes trying to reach the minimum intensity target of the training on the bike (range of 60-70% of HRMax). The increase in intensity will be achieved by prioritizing the intensity of the pedaling over its speed.

Main Phase
The participant will perform a continuous moderate intensity aerobic of exercise on a bike with the intensity target of the 70% of the HRMax for 26 minutes. The trainer will encourage the participant to be among them throughout the session.

The HR and cognitive load (Annex 8.1.Questions: (Question 5)) with the 9-point Likert rating scale (Annex 8.1.Questions: (Question 5)) will be recorded at:

- 12 min, 40 s
- 20 min, 40 s
- 30 min

Cognitive load will be measured based on the conceptual framework of F. Paas et al., 2003, using the scale developed by F. G. W. C. Paas, 1992 and validated in the visual questioning format by Ouwehand et al., 2021, with a 9-point Likert rating scale (Figure 9).

5.3 Resistance training condition (B)

Frequency, intensity, time, and type

The resistance exercise condition will last 30 min. The resistance exercise condition will consist of a warm-up phase lasting 4 minutes and a main phase lasting 26 minutes. The trainings will be made up individually with a coach.

The session model will include a combination of upper and lower body exercises using elastic bands and body weight with different resistance levels and the participants' body weight as the primary resistance (see annex 8.2.). Eight different exercises will be performed with a duration of 40 seconds of work with 20-second of rest between each exercise, while a one-minute break will be taken between each set. In total, three sets will be completed. The exercises will be conducted in circuit, completing three rounds of the circuit of exercise (Figure 7).

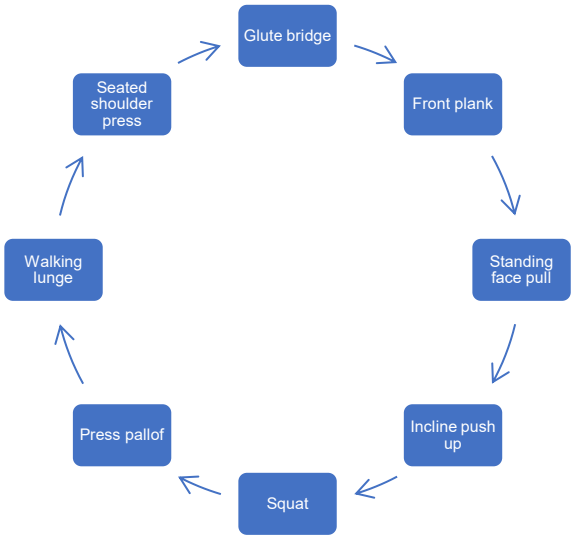


Figure 7. Circuit exercises.

The elastic bands to be used are the Theraband. The elastic bands are available in 8 different colors that correspond to different intensities. The colors, from lowest to highest intensity, are Beige-Extra Soft, Yellow-Soft, Red-Medium, Green-Strong, Blue-Extra Strong, Black-Strong Special, Silver-Athletic, and Gold-Olympic. To reach the target intensity, higher intensity elastic bands will be used, specifically Black-Strong Special and Silver-Athletic.

The speed of execution of the different exercises has been proposed as another measure to control the intensity and adaptations that occur at the muscular level. A maximum speed of execution will be used, that has demonstrated its benefits in older people. To do this, a fast and controlled execution speed (3" eccentric and 1" concentric) will be used (Da Rosa Orssatto et al., 2019).

During the session, the subjective perception of effort will be recorded by the OMNI-Resistance Exercise Scale of Perceived Exertion (RPE) (**Annex 8.1. Questions).** They are based on a scale of 0-10 where each value is attributed an intensity to which you

perceive that you are training (Figure 8) (Morishita et al., 2019). Participants will have the scale visible throughout the session with a RPE target of 4-6 for a moderate intensity.

Figure 8. OMNI-Resistance Exercise Scale of Perceived Exertion.

For a reliable knowledge of the intensity the repetitions in reserve will be recorded by a question after each exercise:

"How many repetitions do you think that could you have done more?"

The repetitions in reserve will be record at the end of each exercise:

- 12 min, 40 s
- 20 min, 40 s
- 30 min

Cognitive load will be also measured by the validated 9-point Likert rating scale (Figure 9) (Ouwehand et al., 2021) at:

- 12 min, 40 s
- 20 min, 40 s
- 30 min

Warm-up phase

The warm-up will last 4 minutes. Numerous studies have shown how warming up has a lot of beneficial acute physiological alterations on performance. Ribeiro et al. (2014) demonstrated how it decreases the risks of injury without negatively impacting resistance training itself. This reduction in injuries is mainly related to the increase in body temperature, associated with greater elasticity of the muscle and connective tissue as well as a greater range of motion in the different joints. The warm-up will consist of: (i) Cat-camel and (ii) thoracic, hip, knee and shoulder mobility.

Main Phase

The main phase of the session will consist of 8 of the exercises mentioned above (Table 2). The exercises will be based on basic movement patterns involving large muscle groups; Horizontal Traction, Vertical Traction, Horizontal Push, Vertical Thrust, Hip Extension & Flexion, Hip Dominant, Knee Dominant, Anti-Rotation, Anti-Extension, Anti-Blemish, Anti-Lateral Blossom.(BUSKARD et al., 2019; Da Rosa Orssatto et al., 2019;

Ellis et al., 1981; Page & Ellenbecker , 2008; Ribeiro et al., 2020; Sanchez -Lastra et al., 2022)

During the session , the trainer will record the HR, RPE and cognitive load with Annex 8.1 and he/she will ask for the repetitions in reserve. Exactly repetitions in reserve will be asked after each exercise and HR, RPE and cognitive load will be measured at:

- 12 min, 40 s
- 20 min, 40 s
- 30 min

The session is planned for participants not to be changing the body position excessively, as well as the inclusion of all muscle groups combining upper and lower body. In case of injuries or pain, there is a variant for each exercise.

Table 2. Resistance exercise session.

Resistance exercise session	Variants
Glute bridge for hamstring	Glute bridge for hamstring
Front plank	Kneeling plank
Standing face pull *	Standing face pull
Incline push up	Incline push up
Squat	Squat with crossed arms
Press pallof	Press pallof
Walking lunge	Lunge
Seated shoulder press	Seated shoulder press

5.4 Resting condition (C)

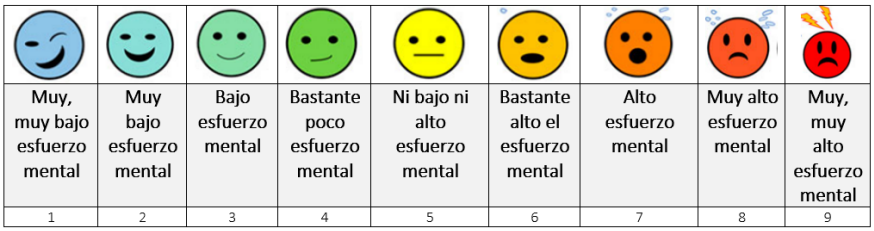
Participants will be seated while watching an ocean documentary movie (Ocean_documentary (https://www.youtube.com/watch?v=WLeTofB2wbo&t=1531s) in a tablet during 30 min. The movie will be standardized for all participants without cognitive engagement.

During the session, the HR and cognitive load (Annex 8.1.Questions: (Question 5)) will be measured. Cognitive load will be measured based on the conceptual framework of F. Paas et al., 2003, using the scale developed by F. G. W. C. Paas, 1992 and validated in the visual questioning format by Ouwehand et al., 2021b, with a 9-point Likert rating scale (Figure 9) at min:

- 12 min, 40 s
- 20 min, 40 s
- 30 min

Ahora queremos valorar la carga cognitiva que ha sentido durante la ejecución de esta actividad, para ello, por favor, indique

¿CUÁL ES SU ESFUERZO MENTAL REQUERIDO?



Muy, muy bajo esfuerzo mental	Muy bajo esfuerzo mental	Bajo esfuerzo mental	Bastante poco esfuerzo mental	Ni bajo ni alto esfuerzo mental	Bastante alto el esfuerzo mental	Alto esfuerzo mental	Muy alto esfuerzo mental	Muy, muy alto esfuerzo mental
1	2	3	4	5	6	7	8	9

Paas, F., Tuovinen, J. E., Tabbers, H., and van Gerven, P. W. M. (2003). Cognitive Load Measurement as a Means to advance Cognitive Load Theory. Educ. Psychol. 38 (1), 63–71. doi:10.1207/S15326985EP3801_8

Figure 9. Cognitive load questions.

6. Post-session procedure

Just at the end of the last exercise, the participant will be immediately directed to the chair where the nurse is going to do the blood draw. In this chair, the blood pressure will be taken again, and the last questions will be asked the PACES Scale (Mullen et al., 2011) and the Satisfaction Scale (Figure 10))

How do you feel AFTER THE TRAINING?

Very bad		Bad		Slightly bad	Neutral	Slightly good		Good		Very good
-5	-4	-3	-2	-1	0	1	2	3	4	5

Figure 10. Post-session intrinsic motivation question.

The PACES (Physical Activity Enjoyment Scale) is an 18-item scale (Figure 11), but we will use the reduced and validated version (for our study sample) of 8 items (Table 2), assessing in a range of 1-7 a series of sensations or moods with respect to its opposite, so that it is easier and more practical for participants. This scale measures the enjoyment of perceived physical activity, assuming that greater enjoyment will yield better results in adherence and intrinsic motivation and, therefore, the benefits of the proposed exercise will also be greater. Enjoyment is also indirectly related to social support.

Table 2 Physical Activity Enjoyment Scale (PACES) 18-items

#	Item
1	I enjoy it; I hate it
2	I feel bored; I feel interested
3	I dislike it; I like it
4	I find it pleasurable; I find it unpleasurable
5	I am very absorbed in this activity; I am not at all absorbed in this activity
6	It's no fun at all; It's a lot of fun
7	I find it energizing; I find it tiring
8	It makes me depressed; It makes me happy
9	It's very pleasant; It's very unpleasant
10	I feel good physically while doing it; I feel bad physically while doing it
11	It's very invigorating; It's not at all invigorating
12	I am very frustrated by it; I am not at all frustrated by it
13	It's very gratifying; It's not at all gratifying
14	It's very exhilarating; It's not at all exhilarating
15	It's not at all stimulating; It's very stimulating
16	It gives me a strong sense of accomplishment; It does not give me any sense of accomplishment
17	It's very refreshing; It's not at all refreshing
18	I felt as though I would rather be doing something else; I felt as though there was nothing else I would rather be doing

Figure 11. PACES scale with 18 items.

See table 2 for a summary of time frame of questions of all the conditions.

Table 2. Summary of conditions, questions and time frame of each one.

	Condition A (Aerobic)		Condition B (Resistance)		Condition C (Resting)	
Pre condition	Sleep question and Feeling scale	Instantly before the condition	Sleep question and Feeling scale	Instantly before the condition	Sleep question and Feeling scale	Instantly before the condition
During condition	RPE, Cognitive load question and HR	12':40'',	RPE ,HR and Cognitive load question	12':40'',	Cognitive load question and HR	12':40'',
	RPE, Cognitive load question and HR	20':40''	RPE ,HR and Cognitive load question	20':40''	Cognitive load question and HR	20':40''
	RPE, Cognitive load question and HR	30'	RPE ,HR and Cognitive load question	30'	Cognitive load question and HR	30'
			RIR	After each exercise		
Post condition	Feeling scale and PACES scale	Instantly after the condition	Feeling scale and PACES scale	Instantly after the condition	Feeling scale and PACES scale	Instantly after the condition

6.1 Polar end

Once the session is over, we must finish and save the training session in the watch.

1. Press and hold the clock button.
2. Once you ask us if we want to save the session, click on the clock button.

3. Also, the session has to be save in the APP: save the training session in the App.
4. Tap the pause symbol ⏸ (Figure 12).

Figure 12. Pause of the session

5. Click on finish.
6. Click on "Guardar" (Figure 13).

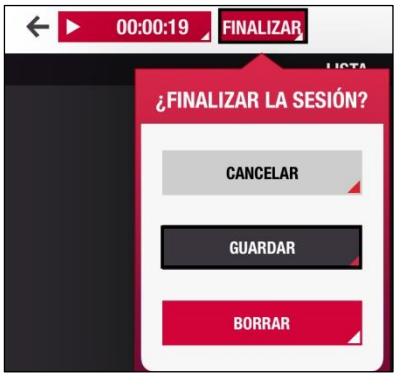


Figura 13. Save of the session

7. Data Handling

The data obtained from each training must be entered into the RedCap form called "Condition".

7.1 Polar Data Download

At the end of the day, data will be downloaded. To do this, as each participant has a polar account associated with their watch, the data is downloaded individually. The sessions are downloaded as a .zip file that we will proceed to extract to their corresponding folder. The data is downloaded as follows:

1. We will access the website *https://account.polar.com/*
2. We will log in with the email account and password associated with the polar product.
3. We will scroll to the bottom of the page, in the section "*you can download your data from here*" and select *"download"*.
4. Open the file and select the files named *"training session – corresponding date"*. Click extract and export them to the participant's folder.
5. The polar data will be saved on the Fladex server: \\profith2.ugr.es\Fladex\Documents\fladex_project\Participants\xxx(ID)/intervention
6. The document will be share with the default name (Date) but adding the ID + the condition: 194_C_2024-06-10_09-55-07 2

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9. Annex index

- Annex 8.1. Questions
- Annex 8.2. Exercises tecnique description