ISRCTN15820243 https://doi.org/10.1186/ISRCTN15820243

Effects of a combined training programme in adults with obesity: in-person vs online format

Submission date	Recruitment status	[_] Prospectively registered
03/06/2025	No longer recruiting	[X] Protocol
Registration date	Overall study status	[_] Statistical analysis plan
05/06/2025	Completed	[_] Results
Last Edited	Condition category	[_] Individual participant data
02/01/2026	Nutritional, Metabolic, Endocrine	[X] Record updated in last year

Plain English summary of protocol

Background and study aims
Obesity is a growing global public health concern, projected to affect over half of the world's population by 2030. It is associated with numerous health risks, including Type 2 diabetes, cardiovascular disease, and mental health conditions. A major contributor to obesity is low physical activity and high levels of sedentary behaviour.
To address this, we developed the Progressive Power Programme (PPP) - a flexible, engaging 12-week training programme tailored for adults living with overweight and obesity. The programme blends elements of high-intensity interval training (HIIT), high-intensity functional training (HIFT), and moderate-intensity continuous training (MICT), allowing participants to exercise at their own pace while receiving peer support.
The main aim of this study is to assess the effectiveness of the PPP in reducing body mass index (BMI) and body fat. Secondary objectives include evaluating quality of life, intrinsic motivation to exercise, and participant engagement with both in-person and online versions of the programme.

Who can participate?
You may be eligible to take part if you are aged 18–65 years, have a BMI ≥25 kg/m2 (classified as overweight or obese), are not currently meeting physical activity guidelines (i.e., less than 150 minutes/week of moderate activity, and are medically cleared to engage in exercise.

What does the study involve?
Participants took part in the 12-week PPP exercise protocol, either in person or online. Each 50-minute session combined flexible-intensity training and ended with a walk (moderate or vigorous). Participants:
1. Underwent initial assessments (including anthropometric, body composition, and clinical measures)
2. Were encouraged to adjust intensity and pacing during sessions based on comfort and ability
3. Were re-evaluated at 12 weeks (post-programme) and again at 24 weeks (follow-up) to assess long-term impact and maintenance
Data were collected on physical health, exercise habits, quality of life, and motivation.

What are the possible benefits and risks of participating?
Benefits may include:

1. Improved fitness, body composition, and mental well-being
2. Increased motivation to maintain an active lifestyle
Risks may include:
1. Temporary muscle soreness or fatigue
2. Potential for minor injuries associated with physical activity (minimised through warm-up and self-paced training)
All exercise activities were adaptable and monitored for safety.

Where is the study run from?
The study is coordinated by the University of Évora (Portugal), and sessions are held online and at selected indoor/outdoor locations.

When is the study starting and how long is it expected to run for?
November 2022 to July 2025

Who is funding the study?
The study is conducted within the scope of the PhD Programme in Human Kinetics at the University of Évora. It does not receive funding from any institution, fund, or external scholarship.

Who is the main contact?
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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

ClinicalTrials.gov (NCT)

Nil known

Protocol serial number
Approval No. 22175

Study information

Scientific Title
The Progressive Power Program (PPP): a randomized clinical trial protocol to improve health outcomes in adults living with overweight and obesity

Acronym
PPP

Study objectives
Hypothesis 1 (H1): The Progressive Power Program (PPP) increases the percentage of lean mass while reducing the percentage of fat mass.
Hypothesis 2 (H2): The effects of in-person monitoring are longer-lasting, delaying weight regain compared to online monitoring.
Hypothesis 3 (H3): The effects of PPP are mediated by biocultural factors, capable of promoting early weight regain.

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 21/07/2023, Comissão de Ética da Universidade de Évora (Universidade de Évora - Colégio do Espírito Santo, R. do Cardeal Rei 6, Évora, 7000-645, Portugal; +351 (0)266740800; geral@sas.uevora.pt), ref: 22175

Study design
Randomized controlled trial

Primary study design
Interventional

Study type(s)
Efficacy, Prevention, Quality of life, Treatment

Health condition(s) or problem(s) studied
Overweight and obesity

Interventions
After verifying the inclusion and exclusion criteria, participants were block-randomised based on their order of registration, using a Microsoft Excel spreadsheet to generate the allocation. This procedure ensured a balanced distribution among the three study groups.

Participants were randomly distributed among two intervention groups (an in-person exercise group and an online exercise group) and one control group. Participants were assessed at four time points: baseline (prior to the 12-week intervention), mid-intervention (week 6), post-

intervention (at the end of the 12-week program), and at 24 weeks from baseline (following a 12-week follow-up period corresponding to the detraining phase)

Participants enrolled on a 12-week, 3 x 50 min/session per week. Each session included three phases and was supervised by a qualified instructor with a degree in Sports Sciences:

Phase 1: General Warm-Up. Consisted of 5 minutes of walking at approximately 65% of the participant's maximum heart rate (HRmax). Walking was selected because it was the most common form of daily physical activity and played a key role in the body's thermoregulation. Furthermore, it was a familiar, low-impact activity that effectively prepared the body for subsequent exercise and was especially beneficial in individuals without previous experience in structured training programs.

Phase 2: Specific Training Component. Consisted of a 35-minute training session performed at 75–95% of the participant's maximum heart rate (HRmax), incorporating a combination of high-intensity interval training (HIIT), high-intensity functional training (HIFT), and moderate-intensity continuous training (MICT). The session was progressive in nature, adapted weekly, and continued at high intensity until the participant reached voluntary fatigue. At that point, participants transitioned to walking at a moderate pace, at approximately 65% of HRmax. Each session included six calisthenic exercises selected based on participants' accessibility, ease of learning, adaptability for beginners, and applicability in injury recovery contexts. Exercises were performed using only body weight, with no external weights or equipment.

Training progression over 12 weeks in phase 2:
The 12-week training program was structured into three progressive levels, with three sessions per week held on Mondays, Wednesdays, and Fridays.

Level 1 (Weeks 1–4):
Sessions 1 and 2: Each session consisted of 2–3 sets of six exercises, with 15 to 25 repetitions per exercise performed at 75–85% of HRmax or until volitional fatigue. Rest between exercises was 10 seconds. Following each set, participants performed 90 seconds of walking on a flat surface at 65% of HRmax. Each set lasted approximately 4 minutes, with rest periods adjusted based on individual participant needs.
Session 3: Was structured as 2–3 sets of six exercises performed in intervals of 20 seconds of vigorous activity at 75–85% HRmax, alternated with 10 seconds of recovery. Each set averaged 4 minutes, consisting of eight active intervals and seven passive recovery intervals. The seventh and eighth intervals involved walking at 65% HRmax. Rest between sets was 2 minutes. Following the sets, participants completed 19 minutes of walking indoors or outdoors at 50% HRmax, depending on weather conditions.

Level 2 (Weeks 5–8):
Sessions 1 and 2: The volume increased to 4–5 sets of six exercises, performed with 15 to 25 repetitions at 85–90% HRmax or until fatigue. Rest between exercises remained 10 seconds. Each set was followed by 90 seconds of walking at 65% HRmax, and the average set duration was approximately 4 minutes, with rest adjusted individually.
Session 3: Consisted of 2–3 sets of six exercises performed as 20-second bursts of vigorous activity at 85–90% HRmax, interspersed with 10-second recovery periods. Each set lasted about 4 minutes (eight active and seven passive intervals), with the last two intervals performed as walking at 65% HRmax. Rest between sets was 90 seconds. The session concluded with 9 minutes of walking at 50% HRmax indoors or outdoors.

Level 3 (Weeks 9–12):
Sessions 1 and 2: Volume further increased to 6–7 sets of six exercises, with 15 to 25 repetitions performed at 90–95% HRmax or until fatigue. Rest between exercises remained 10 seconds. Each set was followed by 90 seconds of walking at 65% HRmax. The average duration per set remained around 4 minutes, with rest adjusted to participant needs.
Session 3: Comprised 2–3 sets of six exercises performed in 20-second intervals at 90–95% HRmax, alternating with 10-second recovery periods. Each set lasted approximately 4 minutes, with eight active intervals and seven passive recoveries. The final two intervals were walking at 65% HRmax. Rest between sets was reduced to 45 seconds. The remaining 2 minutes and 30 seconds of the session involved walking at 50% HRmax, indoors or outdoors, based on weather conditions.

Phase 3: Active Recovery. The third phase consisted of 10 minutes of active recovery, performed by walking at approximately 50% of the participant's maximum heart rate (HRmax). Each training unit consisted of multiple sets and repetitions, following high-intensity patterns. Within the specific component phase, participants performed 15 to 25 repetitions of the PPP protocol, interspersed with 10 seconds of low-intensity active recovery (walking). These high-intensity intervals were followed by 1-minute breaks at 65% of HRmax.

For the intervention groups
Locations and modes of program delivery: The PPP protocol methodology was applied in the same way in both experimental groups, in-person group and online group, the only difference being the location where each session will be held:
In-person group sessions were conducted at a sports club in Évora, where each participant was equipped with a Polar M430 watch for heart rate monitoring. Sessions were supervised by a graduate in sports science and conducted in a group format.;
Participants in the online group completed the training protocol individually at home, each equipped with a Polar M430 watch for heart rate monitoring. Training sessions were remotely supervised by the researcher via the Polar Flow for Coach platform, which collects data from all devices throughout each session.
To ensure correct exercise technique, participants were asked to submit a video of the exercises performed during the first session for postural assessment and correction. This practice was repeated during the final session in subsequent weeks.
Mode of instruction: The researchers refrained from providing encouragement or motivation to complete repetitions or sets. At the beginning of each session, they indicated the transition from the high-intensity protocol to the moderate-intensity protocol, which participants could follow based on personal preference or fatigue.

Heart rate assessment and monitoring: The program was continually adjusted to match the target zones (HR) using a Polar M430 (Polar Electro Oy, Kempele, Finland.
Assessment of perceived exertion. The Borg Rating of Perceived Exertion (RPE) scale was presented to participants at the end of each session to assess their perceived exertion.
At the end of each session, participants reported their minimum rating of perceived exertion using the Borg scale.

Participants in the control group continued with their regular daily routine, participating only in the assessments. All participants were informed that they could carry out the training program under the same conditions, after 24 weeks, the date of the last assessment.

Intervention Type
Behavioural

Primary outcome(s)

Instructions for all anthropometric measures followed the standardized protocols of the International Society for the Advancement of Kinanthropometry (ISAK), in order to ensure the accuracy, reproducibility and comparability of the data. Body composition was evaluated at four timepoints: baseline and at subsequent intervals, including post-intervention (12 weeks).

1. Height (cm) was measured using a SECA stadiometer, model 213 (Hamburg, Germany – measurement category 20-205 (cm), with division of 1 (mm) to the nearest 0.1 (cm).
2. Body weight was measured using the bioelectrical impedance analyzer, model TANITA®, MC 780 MA, consisting of eight electrodes (5 kHz/50 kHz/250 kHz).
3. Body mass index (BMI) was calculated automatically by the Tanita analyzer, based on the standard formula: BMI = body mass (kg)/height2 (m2).
4. Body composition:
4.1. Fat Mass (kg). Assessed by the TANITA Body composition device. It estimates fat percentage and multiplies it by total body weight to obtain fat mass in kilograms.
4.2. Fat Mass (%): Obtained directly from bioimpedance analysis. TANITA calculates the ratio of fat mass to total body weight.
4.3. Fat-free Mass (kg): Total body weight minus fat mass. Includes muscle, bone, water and lean tissue.
4.4. Muscle Mass (kg); Estimated as a proportion of fat-free mass, using TANITA's own equations. It can be segmented by limbs (arms, legs, trunk) based on the specific impedances of each body segment.
4.5. Muscle Mass (%) (Muscle mass / Total body weight) × 100
4.6. Bone Mineral Content (kg): Estimated based on the correlation between lean mass and bone density, from empirical data and cross-validations with DEXA. It is not a direct measure of bone density, but rather of the estimated mineral content in the bones.
4.7. Basal Metabolism (Kcal): Estimated proportionally based on fat-free mass (mostly muscle), age, sex and height. TANITA's algorithm applies a predictive search (similar to Harris-Benedict or Ganpule) using data collected via BIA.
4.8. Proteins (kg): Estimated from the composition of lean mass and body water. The tissues with the highest protein content (muscles, viscera) are used for this calculation.
4.9. Degree of Obesity (%) How it is measured: ([Actual weight - Ideal weight] / Ideal weight) × 100
The "ideal weight" is calculated by TANITA based on the reference BMI (usually 22 for adults).
4.10. Total Body Water (TBW / ACT) (kg): Multifrequency bioimpedance allows for the accurate estimation of total body water, since water directly influences the electrical conductivity of tissues. The calculation is based on total body impedance.
4.11. Total Body Water (TBW / ACT) (%): (TBW in kg / total body weight) × 100
4.12. Extracellular Water (ECW) (kg): Lower frequencies (<50 kHz) in BIA do not penetrate cells, preferentially measuring extracellular water.
4.13. Intracellular Water (ICW) (kg): Obtained by subtraction: ICW = TBW - ECW
Higher frequencies (>200 kHz) cross cell membranes, allowing inference of intracellular water.
4.14. Visceral Fat Index (classification): Estimated based on empirical abdominal impedance data and correlation with imaging tests (CT/MRI). Generally classified from 1 to 59, where above 13–15 is considered high risk.
4.15. Metabolic Rate Index (classification): Classification of basal metabolic rate compared to expected values for age and sex. May indicate whether metabolism is above or below average.
4.16. Metabolic Age (years): TANITA compares the individual's estimated BMR (Basal Metabolic Rate) with the average BMR for age group. If the metabolism is slower than typical for one's chronological age, the "metabolic age" will be higher.

Key secondary outcome(s))

Circumference measurements were conducted at two timepoints (baseline and after 12 weeks of intervention) in accordance with standardized anthropometric protocols to ensure consistency across all participants. All measurements were performed on the right side of the body, directly on bare skin, using a non-elastic flexible tape measure with a precision of 0.1 cm. The following anatomical sites were assessed:
1. Arm circumference: Measured at the point of maximum girth of the upper arm, with the limb hanging freely and fully relaxed.
2. Waist circumference: Measured horizontally at the narrowest point of the torso, approximately at the level of the umbilicus.
3. Hip circumference: Measured in the horizontal plane at the level of greatest protrusion of the buttocks, with the participant standing upright, feet together, and gluteal muscles relaxed.
4. Thigh (crural) circumference: Measured at the level of greatest thigh girth, with the participant standing with feet slightly apart and body weight evenly distributed. The tape was positioned horizontally at the point of maximum volume.
5. Calf (geminal) circumference: Measured at the level of the largest circumference of the calf, following standard anthropometric procedures.
All measurements were conducted by the same trained evaluator to minimize inter-rater variability and enhance reliability.

Clinical and functional parameters assessed at two timepoints (baseline and after 12 weeks of intervention):
1. Systolic and diastolic blood pressure: an aneroid sphygmomanometer with Stethos Mod 21402 was used. To measure systolic and diastolic blood pressure, participants remained in a calm environment, seated and relaxed, collection was in the morning and on an empty stomach.
2. Handgrip strength. To measure the strength of handgrip, a manual digital dynamometer model T.K.K was used. Participants sat with their shoulders along their bodies and without rotation, with 90-degree elbow flexion and neutral flexion. They were also encouraged to press the dynamometer hard three times with 30-s rest intervals between measurements; the highest value collected was used in the analysis.
3. Phase angle: The phase angle (degrees at 50MHz) was used as a prognostic marker of clinical conditions associated with obesity and can be used to monitor some inflammatory, metabolic or endocrine diagnoses. Being a bioimpedance variable, it was collected by the analyzer, model TANITA®, MC 780 MA.
4. Heart Rate Variability (HRV): represents the ability to react to internal and external stimuli, being used to analyze activity and balance in the autonomic nervous system and which reflects the variation in time intervals between normal and consecutive normal R-R intervals. RR intervals were recorded via Elite HRV using a Polar H10 (Polar Electro Oy, Kempele, Finland), placed at the level of the xiphoid process of the participants who remained in the supine position during the test, for a period of 5 minutes. HRV data was analyzed using Kubios HRV software as it is an easy-to-use tool that offers a wide range of analysis options in the time domain, frequency domain and non-linear domains.

Behavioral assessment:
1. Food frequency questionnaire (FFQ) was used to monitor dietary intake at baseline and after 12 weeks of intervention.
2. Rate perception exertion (RPE) recorded at the end of each exercise session. The Borg rating of perceived exertion (RPE) was explained at the beginning of the investigation to each participant by an exercise professional, collected after the exercise sessions, on the attendance

sheet, participants identified the level of effort according to the numerical scale of 6-20.
3. Body image perception assessed using the Stunkard body perception scale at baseline and after 12 weeks of intervention

Completion date
04/07/2025

Eligibility

Key inclusion criteria
1. Residence in the municipality of Évora, Portugal
2. Ages between 18 and 65 years old
3. Regular access to a computer, tablet or smartphone
4. Regular internet access
5. Body mass index (BMI) >25 kg/m2 (overweight)
6. No diagnosis or use of medication for heart, lung, kidney, liver or neurological diseases
7. No medical or orthopedic conditions preventing from exercising or walking independently

Participant type(s)
Other

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
18 years

Upper age limit
65 years

Sex
All

Total final enrolment
180

Key exclusion criteria
1. A diagnosis or use of medication for heart, lung, kidney, liver or neurological diseases
2. Medical or orthopedic conditions that prevent them from exercising or walking independently and independently. It will also be mandatory for participation in the study to provide informed, free and informed consent signed by the participant

Date of first enrolment
01/11/2023

Date of final enrolment
20/11/2023

Locations

Countries of recruitment
Portugal

Study participating centre
Universidade de Évora
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Sponsor information

Organisation
University of Évora

ROR
https://ror.org/02gyps716

Organisation
Loughborough University

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated and analyzed during the current study will be stored in the University of Évora repository after the end of the doctorate (https://dspace.uevora.pt/rdpc/)

IPD sharing plan summary

Stored in publicly available repository

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol article		14/12/2025	02/01/2026	Yes	No