NATIONAL PEDAGOGICAL UNIVERSITY

MASTER'S DEGREE IN SPORTS SCIENCE AND PHYSICAL ACTIVITY

THESIS

PRIOR TO OBTAINING THE TITLE OF
Master of Science in Sport and Physical Activity

ISSUE

Effects of Polarized and Threshold Intensity Distribution Models on Running Time and Body Composition in Recreational Runners Aged 20 to 45 Years: A Randomized Controlled Trial

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Primary Objective

To compare the effects of polarized and threshold TID models over 12 weeks on 5 km running time in recreational runners aged 20-45 years.

Secondary Objective

To compare the effects of polarized and threshold TID models over 12 weeks on body composition in recreational runners aged 20-45 years.

Specific Objectives

- Characterize the sample of recreational runners between 20 and 45 years old by the initial assessment of 5 km running time and body composition before the intervention.
- Apply polarized and threshold intensity distribution models (IDM) as intervention strategies in the assigned groups for 12 weeks.
- Evaluate the changes in 5 km running time and body composition between the groups subjected to the polarized DIE model and the threshold TID model after 12 weeks of intervention.

Study Assumptions

Primary Alternative Hypothesis

The polarized TID model is superior by at least 60 seconds in 5k running time, compared to the threshold TID in a 12-week program in recreational distance runners.

Secondary Alternative Hypothesis

The polarized TID model is superior in body composition compared to the threshold TID model in a 12-week program in recreational distance runners.

Primary Null Hypothesis

No differences in 5k running time were identified between the polarized TID model compared to the threshold TID model in a 12-week program in recreational distance runners.

Secondary Null Hypothesis

No differences in body composition were identified between the polarized TID model compared to the threshold TID model in a 12-week program in recreational long-distance runners.

Methodology

Variables

Two variables were considered: dependent and independent. The dependent variables included running time, measured as total time in minutes/seconds, and body composition, measured as body fat percentage, muscle mass percentage, and body mass index (BMI kg/m²). These variables were affected by the independent variables, which were the polarized and threshold DIE models (see Table 1). As Gil Pascual (2015) argues, there was one dependent categorical variable, with as many categories as there were groups, and a set of discriminant independent variables, in which the different groups were assumed to differ.

Operationalization of Variables

Table 3. Operationalization of the variables.

Variable	Nature	According to its continuity	Values or unit of measurement	Function in the study	Verification method
Age	Quantitative (For reason)	Continue	Years	Independent or confounding variable (depending on the design)	Citizenship card
Gender	Qualitative Nominal	Discrete (nominal)	Male / Female	Confusing or controlling	Citizenship card
5K race time	Quantitative That makes sense	Continue	Minutes and seconds (e.g., 25:45)	Dependent	5K Test
Body composition	Quantitative That makes sense	Continue	% body fat, % muscle mass, body mass index (BMI kg/m²)	Dependent or confusing	Bioimpedance scale
Muscle mass	Quantitative That makes sense	Continue	Kilograms or percentage (%)	Dependent	Bioimpedance scale

Source: own elaboration.

Research Approach

Regarding the research approach, the research idea, objectives, and variables to be investigated are considered. The approach adapted to this project is quantitative. As Gil Pascual (2015) states, the quantitative approach in the research process, in most cases, aims to generalize results to a target population using data from a sample randomly drawn or selected from that population. In this process, statistical hypotheses about population parameters are formulated based on knowledge of the sample. The researcher must distinguish between research hypotheses, formulated as conjectures about a topic of scientific interest, and statistical hypotheses, formulated in statistical terms of probability about one or more population parameters. Examples of these hypotheses can be found in educational research when decisions are being made about the effectiveness of one teaching method compared to another, or when assessing whether certain relationships between variables observed in a sample also exist in the population. These are just two examples, among countless others, where hypothesis testing must be performed.

Type of Research

Two-arm parallel randomized controlled clinical trial (RCT) designed with the CERT and CONSORT guidelines, Friedman, Furberg, DeMets, Reboussin and Granger (2015).

Furthermore, in relation to the research approach and in accordance with the objectives and variables to be investigated, the design type is experimental, as stated by Ñaupas Paitán et al. (2018). Experimental design allows for establishing the consequences achieved after applying an experiment. In this method, the researcher controls the independent variable, which is generally a treatment, applies it to the dependent variable, and explains what has happened.

Experiments manipulate treatments, stimuli, influences, or interventions (called independent variables) to observe their effects on other variables (dependent variables) in a controlled situation. In other words, experimental designs are used when the researcher intends to establish the possible effect of a manipulated cause.

In this research, the aim is to determine the effects of polarized, and threshold DIE intensity distribution models on running time in recreational runners between 20 and 45 years old.

Scope of the Investigation

In accordance with the complexity of the research objectives, its scope is explanatory, as supported by Ñaupas Paitán et al., 2018. Explanatory studies are based on properly formulated problems that seek to establish cause-and-effect relationships. They necessarily work with hypotheses that explain the effect of independent variables on the dependent variable. This is a more complex, deeper, and more rigorous level of basic research, whose main objective is the verification of causal or explanatory hypotheses; the discovery of new socio-scientific laws, of new social micro-theories that explain the causal relationships of the properties or dimensions of facts, events within the system, and social processes. They work with causal hypotheses, meaning they explain the causes of facts, phenomena, events, and natural or social processes. At this level

of research, the formulation of hypotheses is fundamental because they guide the research path. Investigating without hypotheses is like walking in the jungle or sailing on an ocean without a compass, as we will see later when analyzing the importance of hypotheses.

Inclusion and Exclusion Criteria

Table 4. *Inclusion and exclusion criteria*

Inclusion	Exclusion
• Age between 20 and 45 years • 1 to 3 years of experience • Men's race time between 25:00 and 40:00 • Women's race times between 28:00 and 43:00 • Residing in Bogotá or surrounding municipalities at an altitude of 2,640 meters above sea level • Have a GPS system	• Having a chronic non-communicable disease • Smokers or drinkers • Having some musculoskeletal injury. • DO NOT sign the informed consent form • 10% compliance with training sessions.

Source: own elaboration.

Types of Sampling

For selecting the type of sample, the type of design must be considered, which in this case is experimental. Therefore, the appropriate approach is probabilistic sampling. According to Ñaupas Paitán et al. (2018), this is based on the law of large numbers and probability calculations (Ander-Egg, 1995). From these two laws, those related to the sampling procedure are derived. These are: Law of statistical regularity. This implies that the units of a sample (n) have the same characteristics as the population (N) to which they belong. Law of inertia of large numbers. According to this law, the result obtained in a sample (n) is almost always the same as that found in the population (N). Based on this law, it is possible to generalize the results. Law of permanence of small numbers. This law states that if two samples are obtained from a population (N), in each of the samples (n) there will be a small number of units that have the peculiar characteristics of the population, in the same proportion.

In this way, probability samples have many advantages, perhaps the main one being that the size of the error in our predictions can be measured. It is even said that the main objective in the design of a probability sample is to minimize this error, which is called the standard error (Kish, 1995; Kalton and Heeringa, 2003). Probability samples are essential in cross-sectional research designs, both descriptive and correlational-causal (opinion polls or surveys, for example), where the aim is to estimate variables in the population. These variables are measured and analyzed

with statistical tests in a sample, where it is assumed that the sample is probabilistic and that all elements of the population have the same probability of being selected. The sample units or elements will have values very similar to those of the population, so that the measurements in the subset will give us accurate estimates of the larger set. The accuracy of these estimates depends on the sampling error, which can be calculated.

Sample Size Calculation

The sample size was calculated using EPIDAT version 4.2 for independent samples, considering a 95% confidence level ($\alpha = 0.05$) and 80% statistical power ($\beta = 0.20$). A standard deviation of 60 seconds was used, taken from previous studies of 5 km races in a similar population (Cruz et al., 2022), and a minimum clinically relevant difference of 60 seconds in race time between the groups was established. Under these assumptions, an approximate sample size of 8 participants per group was estimated; however, to strengthen the validity of the study and anticipate possible losses during follow-up, it was decided to include 10 participants per group, for a total of 20 participants.

Strategy for Recruiting Participants

The recruitment strategy will utilize the researchers' social media accounts (Instagram and Facebook) to reach recreational runners who meet the inclusion criteria for this study. Following this, an Excel database will be created with the participants' key information to ensure data traceability. Communication with the runners will be handled via WhatsApp and email.

Study Development Locations

The study will take place at Saldarriaga Park (Chía), which has a jogging track with a certified distance of 520 meters, and the athletic track at San Bartolomé La Merced School, with a certified distance of 330 meters in the inner lane and 370 meters in the outer lane. These locations were chosen to replicate the real conditions of a road race, as well as for their proximity and convenience for the research participants.

Bias Control

The following actions will be taken to control bias:

Selection and Confounding Biases:

To achieve an appropriate intervention in a clinical trial, it is important to use the double-height technique, where both the researchers and the research participants are unaware of the intervention they are about to undergo. (Ledesma, J. & Balaguer, J. 2021), (Sánchez, S. et al. 2015).

a. Generation of the randomization sequence

The randomization method used will be block randomization (Ledesma, J. & Balaguer, J. 2021). The randomization sequence will be generated using a clinical trial randomization generator developed by José María Montiel Company of the University of Valencia to

distribute the 20 athletes into two groups: polarized (POL) and threshold (THR). This task will be performed by personnel external to the research group.

b. Concealment

The concealment of the randomization sequence will be carried out using opaque envelopes, sealed and numbered sequentially from 1 to 20. This process will be performed by an individual external to the research group.

c. Assignment

The assignment of participants to each of the groups was in the order in which the initial assessments were carried out.

Information Biases

For the pre and post-tests and the monitoring of training, an open trial will be conducted where the researchers and coaches will know the groups assigned (POL group and THR group) to each of the participants.

Adherence Strategies

To maintain participant adherence to the research, the following activities will be carried out:

- Semi-face-to-face and virtual support (via WhatsApp and email) throughout the entire research process.
- Define as a training objective, to compete in races such as the “Bimbo Race”, “Women's Race” in distances of 5K or such as the “Bogotá Half Marathon” in distances of 10K by the middle of the semester of the year 2026.
- Weekly feedback via screenshots of your workouts (summary of your training via your GPS systems) to manage all load parameters.
- Individualized and progressive training programs based on the results of the initial tests.

Information Gathering

The pre and post-tests will be carried out as shown in Table 2 on different days. On the first day, the 5km test will be performed, and 72 hours later the body composition test will be carried out, considering the recovery time necessary for the body's systems to return to their normal state after maximum effort during the tests. (Chicharro, J. 2008).

Figure 4. *Evaluation schedule*

Source: Author's own work.

Tests

5000 Meter Flat Test (5km)

The 5000-meter (5K) race will be used as a means of analyzing the race time variable. Rosa-Guillamón & García-Cantó (2022) state that this race consists of covering 5000 meters, or 12.5 laps, of official outdoor athletics track at the highest possible speed. This athletic event is the shortest distance among those classified as "endurance" or long-distance races, whose main characteristic is the predominance of aerobic energy metabolism, expressed through aerobic capacity and power as a function of time and intensity of the effort. The test-retest reliability of track running tests has demonstrated high consistency coefficients, with intraclass correlation coefficient (ICC) values exceeding 0.90 reported when environmental variables such as surface, weather conditions, time of day, and warm-up standardization are adequately controlled. This level of reproducibility indicates low within-subject variability and a reduced standard error of measurement, supporting its use in intervention studies and monitoring of aerobic performance. Methodologically, Hopkins (2000) establishes statistical criteria for interpreting reliability in sports science, while Atkinson and Nevill (1998) describe procedures for quantifying measurement error and ensuring consistency in physical tests applied in a sports context—foundations that support the use of the 5000-meter test as a reliable instrument in research with adults.

A review of the literature revealed no studies using the 5-kilometer test with recreational runners in Colombia, and therefore no reference values were found. Consequently, the application of this test will serve as a reference for other studies related to recreational runners.

Protocol

The 5 km assessment will be conducted in a group setting. Participants must wear lightweight, breathable, and comfortable athletic clothing, as well as appropriate footwear, which must remain the same for both the initial and final assessments to control for potential equipment-

related biases. Participants will be instructed to maintain their usual breakfast and refrain from physical activity for 24 hours prior to the assessment. Additionally, a minimum consumption of two liters of water per day will be recommended during the week preceding the assessment to ensure optimal hydration.

The 5 km distance will be determined by a 5 km run on the Saldarriaga Park jogging track (Chía), with a certified length of 520 meters, and the San Bartolomé La Merced School athletic track, with certified lengths of 330 meters in the inner lane and 370 meters in the outer lane. The procedure will be carried out according to the guidelines established in the World Athletics International Manual (2022), guaranteeing the validity and reliability of the protocol. Running time will be recorded independently by two evaluators using Casio HS-3 stopwatches, which have a measurement accuracy of up to 1/100 of a second. These stopwatches have been used in research such as that of Cossio -Bolaños et al. (2024), where they evaluated the validity and reliability of the falls risk scale for older adults. In turn, the dependent variable of body composition will have as indicators the percentage of body fat, the percentage of lean mass and the body mass index (BMI) and its measurement instrument will be the BIA (bioelectrical impedance) Inbody H20 with a degree of error and bias inherent to bioimpedance compared to DEXA, estimated between ±3 and 5 percentage points (Kim J. et al., 2018; Siedler et al., 2022; Pereira et al., 2019).

Both the initial test and the final test must guarantee the same characteristics mentioned above in the protocol, to have the validity and reliability of the respective data analyses.

Body Composition (Inbody bioimpedance scale)

To assess participants' body composition, an Inbody H20 segmental multifrequency bioelectrical impedance analyzer, a portable device validated in various populations, will be used. This type of device estimates percentage of fat mass, muscle mass index, and total body water percentage by measuring the body's electrical resistance (Pereira et al., 2019). Although its use is practical and accessible in academic and sports settings, the scientific literature has shown that Inbody analyzers exhibit variations compared to the reference method, dual-energy X-ray absorptiometry (DEXA).

Comparative studies report that the Inbody 770 shows a high correlation with DEXA in estimating fat-free mass and appendicular skeletal mass (ICC = 0.965), although with small differences in estimating body fat percentage (Kim HJ et al., 2022). Similarly, Kim J. et al. (2018) found prediction errors of approximately ±4.2 percentage points in body fat percentage estimation among the Inbody 230, 720, and 770 models compared to DEXA. Likewise, Siedler et al. (2022) identified that Inbody devices tend to underestimate body fat percentage by 3.0 to 3.4 percentage points, while maintaining high reliability in repeated measurements (ICC $\geq$ 0.98). Finally, Pereira et al. (2019) confirmed almost perfect associations between DEXA and Inbody 270, although they noted a systematic bias based on the sex and age of the participants.

Therefore, it is acknowledged that the absolute values obtained using BIA have an approximate margin of error of ±3 to 5 percentage points compared to DEXA. Consequently, this study prioritizes the analysis of intraindividual changes (pre- vs. post-intervention) over comparison with external normative values.

Measurement Procedure

Participants were asked to arrive having fasted for at least 3 hours, having refrained from strenuous exercise in the previous 24 hours, and having emptied their bladder before the measurement, following the control guidelines proposed by Kim J. et al. (2018). Assessments were always performed at the same time (± 30 minutes) to reduce diurnal variability. Subjects stood barefoot on the plantar electrodes and held the hand electrodes according to the manufacturer's instructions. Two consecutive measurements were taken, and the average of both was used for statistical analysis.

Quality Control and Reliability

To ensure data reliability, variables that can affect BIA, such as hydration, body temperature, prior intake, and posture, were controlled. The literature supports that, under standardized conditions, Inbody analyzers achieve intraclass correlation coefficients (ICC) greater than 0.98 in repeated measurements (Kim J. et al., 2018; Siedler et al., 2022).

Interpretation of Results

Changes in body composition, specifically muscle mass and body fat percentage, will be analyzed between the pre- and post-intervention phases. Results were interpreted considering the inherent error and bias of bioimpedance compared to DEXA, estimated at ±3 to 5 percentage points (Kim J. et al., 2018; Siedler et al., 2022; Pereira et al., 2019). This approach leverages the portability and low cost of Inbody without compromising the study's internal validity.

Information gathering

For the collection of information from the tests applied to the variables, an Excel matrix will be used and the Inbody app will be used for this task, as evidenced in Table 5 and Table 6 below.

Table 5. Information collection method

Variable	Values or unit of measurement	Verification method	Collection method
5K race time	Minutes and seconds (e.g., 25:45)	5K Test	Excel Matrix
Body composition	% body fat, % muscle mass, body mass index (BMI kg/m²)	Bioimpedance scale	Excel Matrix and Inbody APP
Muscle mass	Kilograms or percentage (%)	Bioimpedance scale	Excel Matrix and Inbody APP

Table 6 Example of the information collection matrix

Recreational corridors	Race time		Body composition					
Name	5K starting time	Final time 5K	initial body fat percentage	final body fat percentage	% initial muscle mass	% final muscle mass	initial BMI	final BMI

Ethical Aspects

The principles established by the World Medical Association through the Declaration of Helsinki, and Resolution 008430 of the Ministry of Health of Colombia were considered.

Relevance and Social Value of Research

The relevance of this study lies in its contribution to strengthening a physical culture based on scientific evidence and understanding the processes that underpin modern training. The analysis of exercise intensity models offers tools applicable in both competitive and recreational contexts, as well as promoting well-being and health. By understanding how the intensity of effort can be modulated to generate efficient and sustainable physiological adaptations, it becomes possible to design safer, more personalized training strategies that are consistent with the needs of everyone.

From a social perspective, this research is a valuable resource for athletes, coaches, and researchers interested in promoting recreational athletics and conscious, sustainable physical activity. The findings allow for a more precise understanding of the parameters that characterize the performance of recreational athletes and their relationship to physical fitness and health, fostering the development of active lifestyles and overall well-being. Thus, the study transcends the sports arena and is projected as a valuable tool for health promotion, disease prevention, and human development through responsible physical activity.

Voluntary Participation

Participation in the study was entirely voluntary. The athletes were informed beforehand about the nature of the tests, the procedures, and the research objectives. Those who chose to participate committed to rigorously adhering to each stage of the experimental protocol, including the tests and the training process, to ensure the collection of accurate, valid, and reliable individual data.

Privacy and Confidentiality

The data obtained in this research will be processed in accordance with the principles of privacy and informed consent of the participants. Participants will be duly informed about the public use of their information, always ensuring confidentiality. Only researchers will have access to the files, which are stored on systems with restricted access. Furthermore, personal identification data (such as national identification number, address, and telephone number) will be deleted, and each participant will be assigned a code. No information that could compromise their privacy will be disclosed, and the data will only be used until the publication of the study results.

Risk Statement

This research was classified, according to Article 11 of Resolution 008430, as a minimal-risk study, in which maximal exercise was applied to healthy volunteers. The participants in the interventions had experience in physical training programs and therefore had a level of adaptation to the planned activities. Furthermore, they were in good health, which allowed their participation in this research to be considered safe.

Through training, the athlete will be presented with the informed consent form, which explicitly details the study, their duties, their rights, the possible risks, the benefits, among other aspects that will allow them to make a conscious and pressure-free decision to participate or not in the study. The informed consent form will be signed during that same training and/or the day before the first initial assessment that the athlete underwent, which will be a requirement to participate in the research.

Strategies to Minimize Risks

Strategies to minimize risks are established based on the results obtained in initial tests and standardized indirect tests (to obtain maximum heart rate), supported by scientific evidence and literature. Workloads will be individually designed and monitored through heart rate tracking, following a structured plan grounded in scientific evidence and respecting training principles and the specific population. Assessments and interventions will be conducted in safe environments, equipped with first aid supplies, and will be carried out by qualified personnel experienced in applying the protocols.

Personal Benefits

Upon completion of the research, participants are expected to strengthen their understanding of the physiological, psychological, and methodological variables that influence performance and health. Using an evidence-based approach, the aim is to promote safer, more mindful, and self-care-oriented training practices. Furthermore, the goal is for athletes to understand the importance of proper training load planning and management, along with regular physical assessments, to optimize performance and prevent injuries. This educational process extends beyond the sporting arena, fostering the development of sustainable habits that integrate body, mind, and well-being, promoting responsible, balanced, and fully conscious training practices.

Institutional Benefits

The results of this research will provide significant value to the institutions involved, both in strengthening their academic projection and in the practical application of their training and sports programs.

For the National Pedagogical University, the study represents an opportunity to expand its participation in emerging research areas related to new training trends applied to recreational runners, a field still relatively unexplored both nationally and internationally. This will allow the institution to position itself as an academic leader in applied research on performance and health, contributing to the development of contextualized scientific knowledge with social impact.

Similarly, the results can be integrated into university training, professional development, and outreach programs, strengthening the connection between teaching, research, and professional practice. In this way, the University will benefit not only in terms of scientific output but also in the development of strategies that promote safe, responsible, and evidence-based sports practices.

For their part, associated sports institutions such as clubs or recreational running teams will have access to validated tools and methodologies that will allow them to optimize the planning, control and evaluation of their training processes, improving the performance and well-being of their athletes.

Intervention

These are two intervention groups that will use the polarized and threshold TID models as shown below:

1. TID POL
2. TID THR

TID POL and THR models

Regarding the intervention, it will last 12 weeks, a period during which physiological adaptations to resistance training occur, as Neuman (1994) states with chronological cycles of 8 to 12 weeks. Now, we will go into detail about how the interventions will work with the DIE models. For the TID POL model, the intensity distribution was as follows: Zone 1 (80%), Zone 2 (5%), and Zone 3 (15%). For the TID THR model, the intensity distribution was as follows: Zone 1 (50%), Zone 2 (40%), and Zone 3 (10%), in the three-zone model according to Skinner and McLellan (1980). This will be monitored using the theoretical heart rate model developed by Tanaka, Monahan, and Seals (2001). The training periodization for the two TID models was designed using a 3:1 weekly block structure, meaning three weeks of training followed by one week of recovery. The weekly training frequency will consist of four running sessions, each including 10 minutes of running technique drills and two strength training sessions. The running sessions will have the same training volume across the three blocks, which span weeks 1-3, 5-7, and 9-11. The first week of each block will have a volume of 240 minutes, the second week 300 minutes, and the third week 360 minutes. Recovery weeks 4, 8, and 12 will have a volume of 180 minutes. Strength training sessions will be held on Mondays and Fridays, with a weekly volume of 60 minutes. Rest days from the running component will be Monday, Friday, and Sunday. The general structure of the intervention is shown in Table 7 below.

Table 7. *General structure of interventions with TID models*

Training component	Load component	Weeks of intervention											
		1	2	3	4	5	6	7	8	9	10	11	12
Career	Volume (Minutes/ Week)	240	300	360	180	240	300	360	180	240	300	360	180
	Training frequency (Sessions/ Week)	4	4	4	4	4	4	4	4	4	4	4	4
Force	Volume (Minutes/ Week)	60	60	60	60	60	60	60	60	60	60	60	60
	Training frequency (Sessions/ Week)	2	2	2	2	2	2	2	2	2	2	2	2
Running technique	Volume (Minutes/ Week)	40	40	40	40	40	40	40	40	40	40	40	40
	Training frequency (Sessions/ Week)	4	4	4	4	4	4	4	4	4	4	4	4

Source: own elaboration

Load Quantification

To quantify the training load, the Training Impulse Method (TRIMP) developed by Muñoz Pérez (2016) will be used. This method assigns a score to each minute the athlete spends in each training zone of the three-phase model according to Skinner and McLellan (1980). The scoring is as follows: one point for each minute in zone 1, two points for each minute in zone 2, and three points for each minute spent in zone 3. Therefore, if the runner spent 35 minutes in zone 1, 10 minutes in zone 2, and 3 minutes in zone 3, their TRIMP score would be 64. The use of this quantification method aims to ensure that all runners in the same group receive similar training loads.

Specific Training Programs for Intervention Groups

Table 8and Table 10 below describe the training program for each group to be involved:

Table 8. *POL group training program*

Cluster	Day	Week (1,5,9)	Week (2,6,10)	Week (3,7,11)	Week (4,8,12)
POL	Monday	Rest	Rest	Rest	Rest
	Tuesday	Z1 C15 min Z1-29 min Z1Vc-10 min	Z1 C 15 min Z1-45 min Z1Vc-10 min	Z1 C15 min Z1-61 min Z1Vc-10 min	Z1 C15 min Z1-13 min Z1Vc-10 min
	Wednesday	Z1 C 15 min Z1-29 min Z2-6 min Z1Vc-10 min	Z1 C15 min Z1-45 min Z2-9 min Z1Vc-10 min	Z1 C15 min Z1-61min Z2-9 min Z1Vc-10 min	Z1 C 15 min Z1-13 min Z2- 4.5 min Z1Vc-10 min

	Thursday	Z1 C15 min Z1-29 min Z1Vc-10 min	Z1 C15 min Z1-45 min Z1Vc-10 min	Z1 C15 min Z1-61 min Z1Vc-10 min	Z1 C15 min Z1-13 min Z1Vc-10 min
	Friday	Rest	Rest	Rest	Rest
	Saturday	Z1 C15 min Z3 (6x6 min) 36 min Z2 R (6x1) 6 min Z1 Vc-15 min	Z1 C15 min Z3 (6x7.5min) 45 min Z2 R (6x1) 9 min Z1 Vc-15 min	Z1 C15 min Z3 (9x6 min) 54 min Z2 R (9x1) 9 min Z1 Vc-15 min	Z1 C15 min Z3 (9x3 min) 27 min Z2 R (9x0.5) 4.5 min Z1 Vc-15 min
	Sunday	Rest	Rest	Rest	Rest
	Z1 (Min)	192	240	288	144
	Z2 (Min)	12	15	18	9
	Z3 (Min)	36	45	54	27
	Volume (min)	240	300	360	180
	Training load TRIMPS	324	405	486	243

Abbreviations: Z1 (Zone 1), Z2 (Zone 2), Z3 (Zone 3), C (Warm-up), Vc (Cool-down), R (Rest)

Table 9. Example of a POL training session

Training session (Wednesday, week 1)		
Heating	Zone 1	15 minutes
Central phase	Zone 1	29 minutes
Central phase	Zone 2	6 minutes
Back to calm	Zone 1	10 minutes

Table 10. *THR Group Training Program*

Cluster	**Day**	**Week (1,5,9)**	**Week (2,6,10)**	**Week (3,7,11)**	**Week (4,8,12)**
THR	Monday	Rest	Rest	Rest	Rest
	Tuesday	Z1 C 15 min Z1 7 min Z2 30 min Z1 Vc 10 min	Z1 C 15 min Z1 17 min Z2 38 min Z1 Vc 10 min	Z1 C 15 min Z1 27 min Z2 46 min Z1 Vc 10 min	Z1 C 10.5 min Z1 5 min Z2 22 min Z1 Vc 9 min
	Wednesday	Z1 C 15 min Z1 7 min Z2 30 min Z1 Vc 10 min	Z1 C 15 min Z1 17 min Z2 38 min Z1 Vc 10 min	Z1 C 15 min Z1 27 min Z2 46 min Z1 Vc 10 min	Z1 C 10.5 min Z1 5 min Z2 22 min Z1 Vc 9 min
	Thursday	Z1 C 15 min Z1 7 min Z2 30 min Z1 Vc 10 min	Z1 C 15 min Z1 17 min Z2 38 min Z1 Vc 10 min	Z1 C 15 min Z1 27 min Z2 46 min Z1 Vc 10 min	Z1 C 10.5 min Z1 5 min Z2 22 min Z1 Vc 9 min
	Friday	Rest	Rest	Rest	Rest
	Saturday	Z1 C 14 min	Z1 C 14 min	Z1 C 14 min	Z1 C 7.5 min

	Z3(6x4) 24 min Z2 (6x1) 6 min Z1 Vc 10 min	Z3(6x5) 30 min Z2 (6x1) 6 min Z1 Vc 10 min	Z3(6x6) 36 min Z2 (6x1) 6 min Z1 Vc 10 min	Z3(6x3) 18 min Z2 (6x1) 6 min Z1 Vc 6 min
Sunday	Rest	Rest	Rest	Rest
Z1 (Min)	120	150	180	90
Z2 (Min)	96	120	144	72
Z3 (Min)	24	30	36	18
Volume (Min)	240	300	360	180
TRIMPS training load	384	480	576	288

Abbreviations: Z1 (Zone 1), Z2 (Zone 2), Z3 (Zone 3), C (Warm-up), Vc (Cool-down), R (Rest). Source: Author's own elaboration.

Table 11. Example of a THR training session

Training session (Thursday, week 1)		
Heating	Zone 1	15 minutes
Central phase	Zone 1	7 minutes
Central phase	Zone 2	30 minutes
Back to calm	Zone 1	10 minutes

Programming and Monitoring

The training program and monitoring are managed by the project's researchers. Runners will use GPS devices (Garmin, Polar, Apple) that will generate summaries including duration, intensity, pace, heart rate, and time spent in each training zone. This data will be collected weekly through screenshots of these summaries, focusing on the time participants spent in each training zone.

Schedule

Table 12. *General schedule*

Activity	Jan	Feb	Sea	April	May	Jun	Jul	August	Sep	Oct	Nov
Call for applications		x									
Initial assessments			x								
Final assessments					x						
Data analysis						x					
Literature review	x	x	x	x	x	x	x	x			
Article writing							x				

Socialization of results	x

Source: own elaboration.