Efficacy Of A Self-Selected Resistance Training Programme Compared With A Physiotherapist-Prescribed Resistance Training Programne In People With Chronic Low Back Pain (MYBACK EXERCISE): A Randomized Control Pilot Study Protocol

La Fe
Departament de Salut

OPINION OF THE RESEARCH ETHICS COMMITTEE WITH MEDICATION

JUAN EDUARDO MEGIAS VERICAT, head of the Technical Secretariat of the Research Ethics Committee with medicines of**CEIM - LA FE UNIVERSITY AND POLYTECHNIC HOSPITAL,**

CERTIFIES

That this Committee has evaluated in its session of 20/05/2026, the Thesis Project:

Qualification:**"Effectiveness of a patient-preferred strength training program versus a physiotherapist-prescribed strength training program in people with chronic low back pain.**
Registration number:**2026-0301-1**
Protocol code/acronym:**MYBACK EXERCISE** Promoter:
FRANCISCO JOSE GARCIA BUSTOS

Document	Version - Date
Protocol - Thesis	October 7, 2025 - May 20, 2026
Information Sheet and Informed Consent - ADULTS	Version 1.0 - Version date 14.04.2026 - 20/05/2026

That said project complies with the ethical regulations on biomedical research with human subjects and is viable in terms of the scientific approach, objectives, material and methods, etc., described in the application.

Accordingly, this Committee agrees to issue**FAVORABLE REPORT**of said Thesis Project which will be carried out at the HOSPITAL UNIVERSITARI I POLITÈCNIC LA FE, the Thesis Director being Dr. / Dr. JOSÉ ANTONIO MORAL MUÑOZ, from the University of Cádiz, the Hospital Tutor being Dr. / Dr. FRANCISCO JOSE GARCIA BUSTOS from the service/unit Emerging Research Group in Physiotherapy, and the DOCTORAL CANDIDATE Mr./Ms.**LUIS GONZÁLEZ GÓMEZ**.

That the CEIM - HOSPITAL UNIVERSITARIO Y POLITÉCNICO LA FE, both in its composition and in its procedures, complies with the GPC standards (CPMP/ICH/135/95) and with the current legislation that regulates its operation, and that the composition of the CEIM - HOSPITAL UNIVERSITARIO Y POLITÉCNICO LA FE is as indicated in Annex I, taking into account that, in the event that any member participates in the study or declares any conflict of interest, he or she will not have participated in the evaluation or in the opinion of the application for authorization of the clinical study.

I sign this in Valencia, on 20/05/2026

Firmat per Juan Eduardo Megias Vericat, el 21/05/2026 08:18:53

GENERALITAT VALENCIANA

Signed: JUAN EDUARDO MEGIAS VERICAT Head of the technical secretariat of the CEIm

CSV:4NRIM6GP:2RCL3A82:CSSJDKPC Validation URL:https://www.tramita.gva.es/csv-front/index.faces?cadena=4NRIM6GP:2RCL3A82:CSSJDKPC

ABSTRACT

Objectives: To evaluate the efficacy of a self-selected resistance training (RT) programme compared with a physiotherapist-prescribed RT programme, based on pain-related distribution and intensity, disability, biopsychosocial factors and functional tests in people with chronic low back pain (CLBP). **Design**: Simple-blind, parallel-group, low-risk randomized controlled trial (RCT). **Method**: 110 participants (18–65 years), including a pilot phase of 34, will be randomly allocated to self-selected or physiotherapist-prescribed RT groups. Both groups will perform two supervised sessions per week with individualized progression over 12 weeks. Outcomes include pain-related distribution and intensity, disability, treatment satisfaction, degree of compliance, kinesiophobia, self-efficacy, muscular endurance, and surface electromyographic activity of the erector spinae (longissimus) muscle (sEMG-ESL). Statistics will include descriptive analysis, between-group comparisons, and mixed-design ANOVA, with missing data handled via complete case analysis (<5%) or multiple imputation (>5%) depending on attrition. **Discussion**: In line with recent literature, improvements in clinical, BPS, and functional parameters are expected. Despite limited and inconclusive data, we hypothesize that individual preferences and autonomous decision-making may maximize the potential benefits of exercise, thereby supporting the role of patient-centered approaches. **Clinical implications**: If the expected benefits are observed, the results may recommend including self-selection as a fundamental component of ET in CLBP management.

1. INTRODUCTION

Low back pain (LBP) is one of the leading causes of disability, reduced quality-of-life and occupational absenteeism (1,2), prevailing among older women with lower socioeconomic and educational status (3). After one year from the first LBP episode, 10% of people develop chronic low back pain (CLBP) (4), rated as the most prevalent chronic pain subtype in Spain (5).

CLBP can be defined as pain persisting beyond 12 weeks after excluding specific causes that could justify its presence, such as tumor, fracture, infection, or cauda equina síndrome (6). CLBP pathophysiology is associated with morphological and functional changes in prefrontal cortex, limbic system, and amygdala (7), as well as alterations in gray matter density, cortical representation of the lumbar region (8), and resting-state brain activation patterns compared with healthy individuals (9).

Persistence of CLBP may be associated with a range of modifiable and non-modifiable risk factors: (i) sociodemographic components such as age, sex, ethnicity, and employment status (10–12); (ii) clinical characteristics such as inadequate management of an acute LBP episode, comorbid pain or health conditions (13–17); (iii) behavioral agents such as sleep higiene (18), substance use (19,20), obesity (21), mental health (22), patient and physiotherapists`s beliefs, expectations, preferences, and the achieved therapeutic Alliance (23–25).

In this context, exercise therapy (ET) is considered a emergent option within the conservative management of CLBP (26–28), where appropriate monitoring, dosage, and regularity are potentially influential parameters for long-term benefits (29,30). To date, the most common ET programmes for CLBP include resistance training (RT),

sensorimotor exercises, and aerobic exercise (31,32).

1.1 Background and rationale

A major challenge in CLBP management is adherence to ET programs (33). Evidence highlights the importance of addressing factors that facilitate or hinder adherence to ET in CLBP, with reported adherence rates below 30% in some cases (34,35). In this regard, patient self-selection of treatment may be an important factor in improving adherence and outcomes in CLBP. There is growing evidence regarding the influence of patient expectations and preferences on decision-making and on the choice of exercise modality (36–40). Some studies suggest that the physiotherapist-prescribed ET may be beneficial on improving fear-avoidance behaviors (41,42). However, other results have emphasized the patient self-selection ET as a potential key to produce hipoalgesia (43), to promote self-efficacy and satisfaction (44–49), and to improve adherence to physical activity (50–52). Previous estudies (49,53) showed that aligning ET programmes with patient preferences may be associated with greater perceived CLBP recovery (36,41,43).

Considering this background, evidence regarding patient self-selected exercise compared with physiotherapist-prescribed exercise remains emerging. Therefore, our study aims to provide new insights into exercise preferences among patients with CLBP. This may enhance patient autonomy and facilitate continuous and immediate decision-making. Furthermore, analysis of the data collected and stored in a database will enable further investigations into the effectiveness of the intervention on patient improvement, as well as factors associated with CLBP progression and its impact on physical and mental health.

1.2 Objectives

The primary aim of this study is to evaluate the efficacy of a self-selected RT programme compared with a physiotherapist-prescribed RT programne after 12 weeks of intervention

in reducing pain-related distribution and intensity, and disability in individuals with CLBP.

The secondary objectives are, first, to determine the differences between both groups based on treatment satisfaction, degree of compliance with treatment, kinesiophobia, self-efficacy, muscular endurance and lumbar electromyographic (EMG) muscle activity.

2. MATERIAL AND METHODS

2.1 Design trial

An 12-week, simple-blind, parallel-group, low-risk, RCT will be conducted in people with CLBP. This protocol was reported according to the Standard Protocol Items: Recommendations for Interventional Trials (CONSORT 2025 Statements), available in the supporting information (**Supplementary Material, Appendix 1**). Furthermore, the Consensus on Exercise Reporting Template (CERT) (55) (**Supplementary Material, Table S1**) has been considered to provide comprehensive programmes details and guarantee the intervention's replicability.

2.2 Participants and study setting

Eligible participants will be identified by their medical and selected from the waiting list for the back school at the Centro de Salud Campanar II, Valencia, Spain. Physicians will provide an appointment for a future session in which the information sheet for the participant and informed consent (**Supplementary Material, Appendices 2-3**) will be provided to potential participants, and they will be contacted approximately 48 hours later to discuss their willingness to take part. The recruitment will begin on September 1, 2026, and will end on September 1, 2027.

2.3 Eligibility criteria

The inclusion criteria will be as follows: i) male and female participants aged 18–65 years; ii) LBP, with or without referred pain to the lower limb, persisting for ≥12 weeks; iii) not currently engaged in a regular structured exercise programme; and iv) sufficient cognitive and communication abilities to complete the assessment scales and participate in the study intervention. Participants will be excluded if they present: i) lumbar radiculopathy or radicular pain syndrome, defined by clinical signs of nerve root involvement (e.g., dermatomal pain, neurological deficits, or positive neurodynamic tests); ii) serious spinal or non-spinal pathology explaining LBP, identified through clinical assessment (e.g., malignancy, vertebral fracture, spinal infection, cauda equina syndrome, inflammatory spinal disease, vascular, visceral or other serious causes); and iii) medical contraindications to exercise, as determined by the treating physician.

The presence of lumbar degenerative imaging findings (e.g., degenerative disc disease, lumbar spondylosis, facet joint osteoarthritis, or Modic changes) will not be constitute an exclusion criterion, provided that the clinical presentation is consistent with CLBP.

2.4 Interventions

For this study, both groups both groups will be organized into small cohorts of 5 or 6 participants and will undergo an intervention consisting of a RT programme (56). Based on previous literature (57,58), this approach may help to reduce pain and improve disability in patients with CLBP. All participants will perform exercises aiming to achieve the full range of motion to enhance neuromuscular adaptation and performance (59–61). Exercises will also be designed to develop movement variability, reduce fear-avoidance behaviors, decrease pain-related distribution and intensity, and promote freedom of movement, as previously studied in CLBP (62–68).

The experimental group will follow a programme with different RT options (**Table 2**).

This proposal will be displayed on a board with detailed images of the exercises in the treatment centre. Each patient will individually choose six exercises daily; two for each body part (upper limb; lower limb; trunk). Each patient's individual choice of exercises will be recorded using checklists. Under no circumstances will the physiotherapist guidance take precedence; the clinician will refrain from expressing their preferences and beliefs regarding the selected-exercise. The patient will have the option to repeat or vary the exercises throughout the training programme, if they so decide.

<< INSERT **Table 2** >>

The control group will carry out a physiotherapist-prescribed RT programme (**Table 3**). Participants in this group will not be able to choose their exercises and will perform six exercises: push-ups, row, squat, deadlift, abdominal crunch and back extension.

<< INSERT **Table 3** >>

For both groups, the treatment materials will include variable-resistance elastic bands, adjustable dumbbells, chairs, and a roman chair. Therapeutic supervision will be provided face-to-face for all study participants by four experimented physiotherapists from the research group, adjusting exercise dosage to each patient's individual characteristics, ensuring a minimum effective dose and proper progression, and clarifying any doubts on exercise execution if necessary. A detailed description of the physiotherapists' technical qualifications is provided in the supplementary material **Supplementary Material**, **Appendix 4**.

The exercise dosage will follow the F.I.T.T.-V.P. (Frequency, Intensity, Type, Time - Volume, Progression) framework (69), in line with reported parameters in the literature for patients with CLBP (56,70). Detailed descriptions of the execution technique for each exercise, along with illustrative photographs, are provided in the **Supplementary**

Material, **Appendix 5.** Progression criteria in RT will be based on clinical parameters (**Table 4**).

Resistance will also progress according to limb and level, with upper limb exercises using barbell, weight plates or elastic bands starting at 1 kg (easy) and reaching 3 kg (maximal), and lower limb exercises starting at 2 kg (easy) and reaching 10 kg (maximal).

<< INSERT **Table 4** >>

To monitor training volume and ensure compliance with World Health Organization (WHO) Recommendations (71), perceived exertion will be assessed using the Rating of Perceived Exertion (RPE) scale (72), ranging from 0 (minimal effort) to 10 (maximal effort) (**Supplementary Material**, **Appendix 6**). During the study, no additional interventions unrelated to exercise such as pain education, cognitive-behavioral therapy, or manual therapy, will be applied. The type or dosage of pain medication will not be modified and will remain under the discretion of the treating physician.

2.5 Outcomes

At Campanar II Health Center, a clinical interview will be conducted to obtain the following information: comorbidities, date of medical diagnosis of CLBP, previous hospitalization due to CLBP, marital status, educational level, employment status, substance use, and pain medication intake during the previous two weeks.

To evaluate the effectiveness of the strength training program based on preferred and prescribed exercises, several outcomes will be assessed. Pain related-distribution and intensity, and disability will be considered the primary outcomes, whereas treatment satisfaction, degree of compliance with the intervention, kinesiophobia, self-efficacy, muscular endurance, and sEMG-ESL will be considered secondary outcomes.

Additionally, the following sociodemographic and clinical variables will be collected to characterize the sample and explore potential associations with the outcomes of interest: age, biological sex, height, and body composition.

2.6 Sociodemographic factors

All baseline data described below are detailed in the **Supplementary Material** (**Appendix 7**). Baseline sociodemographic and clinical characteristics will include age, sex, nationality, marital status, height, weight, body mass index, self-reported pain duration, history of CLBP-related hospitalisation, Charlson Comorbidity Index (73), previous CLBP-related treatment, current pain medication use, physical activity level, alcohol consumption, daily tobacco use, educational level, socioeconomic status, and employment status.

2.7 Variables

Independent variables will correspond to the treatment conditions to which participants are allocated. In this study, two dichotomous nominal qualitative variables will be defined:

· Self-selected RT programme, referring to an intervention in which the selection of exercises is based on the participant decision.

· Physiotherapist-prescribed RT programme, alluding to an intervention in which the ET program is designed and determined by the physiotherapist according to clinical criteria.

The dependent variables, all questionnaires, and detailed descriptions of testing procedures are provided in **Supplementary Material**, **Appendices 8-15**:

Pain-related distribution will be examined identifying painful body regions using a standardized body map consisting of 45 anatomical regions to quantify pain distribution.

A greater number of painful regions indicates a more widespread pain distribution.

Pain intensity will be assessed as a continuous quantitative variable using the Numerical Pain Rating Scale (NPRS) (74), with scores ranging from 0 to 10 points, where higher scores indicate greater pain intensity.

Disability will be measured as a discrete quantitative variable using the Oswestry Disability Index (ODI) (75), with a total score ranging from 0 to 50 points, reflecting the degree of functional limitation associated with CLBP.

Treatment satisfaction will be evaluated as an ordinal quantitative variable using the Treatment Satisfaction Scale (CRES-4 (76), with total scores ranging from 4 to 20 points, where higher scores indicate greater satisfaction with the received treatment.

Degree of compliance with treatment will be assessed as an ordinal quantitative variable based on the percentage of completed sessions out of the total 24 scheduled sessions.

Kinesiophobia will be measured as a continuous quantitative variable using the Tampa Scale for Kinesiophobia (TSK-11) (77), with scores ranging from 11 to 44 points, where higher scores reflect greater fear of movement.

Self-efficacy will be assessed as an ordinal quantitative variable using the Pain Self-Efficacy Questionnaire (PSEQ) (78), with scores ranging from 0 to 60 points, indicating the individual's confidence in performing daily activities despite pain.

Muscle endurance will be evaluated as a continuous quantitative variable using the Biering-Sørensen test (79), with performance time ranging from 0 to 240 seconds.

sEMG-ESL will be assessed as a continuous quantitative variable using surface EMG, expressed in microvolts (μV), and quantified through the root mean square (RMS) using the mDurance® device (80).

2.8 Sample size calculation

A consecutive sampling strategy will be employed, including all patients attending the Campanar II Health Center (Valencia, Spain) who meet the previously defined eligibility criteria.

The preliminary sample size was calculated using G*Power software (version 3.1.9.7), based on the study by Unsgaard-Tøndel et al. (81), which included 36 and 37 participants per group and considered disabilityassessed by the ODI as a primary outcome.

The effect size (δ) for unequal groups (**Table 5**) was estimated using Cohen's formula (82):

$$\text{d Cohen } (\delta) = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1-1) \times {\sigma_1}^2 + (n_2-1) \times {\sigma_2}^2}{n_1 + n_2 - 2}}}$$

<< INSERT **Table 5** >>

An effect size of δ = 0.57 was obtained, corresponding to a required sample size of 100 participants (50 per group). All calculations assumed a two-tailed hypothesis, a significance level (α) of 0.05, a statistical power (1−β) of 80%, and a 1:1 allocation ratio. To account for potential attrition, the sample size was increased by 10%, resulting in a total of 110 participants (55 per group).

2.9 Pilot Study Sample Size

The final sample size will be determined based on the results obtained from an initial pilot phase. This phase will allow estimation of key parameters, such as the standard deviation (SD) of primary outcomes, and will assess the feasibility of the study protocol, including recruitment, adherence, and retention rates.

According to the recommendations of Whitehead et al. (83), and assuming a medium

effect size ($\delta = 0.57$), the pilot study will include 30 participants (15 per group). Considering an anticipated 10% dropout rate, the total sample size will be increased to 34 participants (17 per group).

Upon completion of the pilot phase, the definitive sample size will be recalculated using the observed data from the primary outcomes. This calculation will be based on a two-sided design, $\alpha = 0.05$ and $1-\beta = 80\%$, assuming a clinically meaningful between-group difference defined according to existing literature and expert consensus.

2.10 Allocation concealment

A member of the research team will perform consecutive sampling of patients attending the Centro de Salud Campanar II who meet the eligibility criteria and provide written informed consent. Once enrolled, each participant will be randomly assigned to either the intervention group or the control group (1:1) using a random number sequence generated with the Simple Random Sampling module of Epidat 3.1.

Specifically, to achieve a target sample size of $n = 110$, the software will generate a sequence that determines each participant's group assignment according to their order of enrollment. This simple randomization procedure will ensure maximum unpredictability in allocation, preventing any anticipation of future assignments.

The allocation sequence will be generated in advance by an independent member of the research team, who will prepare sequentially numbered, truly opaque, sealed envelopes. Finally, the investigator responsible for recruitment will open the corresponding envelope to reveal the participant's group assignment.

2.11 Blinding

Participants will receive ET instructions from a clinician different from the one

conducting the evaluations. None of the participants will be aware of their group assignment, as all will receive the same exercise dosage, but with differing decision-making approaches regarding the training. The physiotherapists delivering the ET sessions will not be involved in participant allocation. Statistical analyses will be performed by a statistician from the research team who will not participate in allocation, evaluation, or intervention. Additionally, participant data will be provided anonymously.

In the event of any adverse effect or circumstance that may compromise participant health, records will be maintained in both paper and electronic formats and will remain accessible to all authorized researchers.

2.12 Status and timeline of the study

The present project will be structured into work packages (WP), each internally composed of several tasks. Every WP will include a subtask for analysis and proposal review, as well as a development subtask. Each task will have at least one lead responsible, along with one or more participants and/or work team assigned to specific activities (**Supplementary Material, Appendix 16**). Patient recruitment is expected to be completed by 31 August 2026. Data collection is anticipated to conclude by 31 January 2027, with results expected to be ready for publication in the second quarter of 2026 (**Supplementary Material, Appendix 17**).

2.13 Data management plan

To ensure the privacy and confidentiality of participants, all clinical data collected in the study will be anonymized prior to analysis. Names, identification numbers, and specific dates will be removed, and any indirect identifiers that could allow subject identification will be grouped and coded. The anonymization process will be conducted in accordance with current ethical and regulatory standards, ensuring that the data remain valid for

statistical analysis without compromising individual privacy.

All physical documents will be stored in locked filing cabinets within a secure area with restricted access. Electronic data will be entered into a secure, password-protected database specifically designed for the study. Access to the data will be limited to research team members listed in the study protocol.

Data supporting the findings of this study will not be publicly available due to sensitivity but may be obtained from the corresponding author upon justified request. All data will be stored in a controlled-access data storage system at the University of Cádiz (Spain). Participant data and variables to be collected are summarized in **Table 1**.

<< INSERT **Table 1** >>

2.14 Statistical analysis

First, a descriptive analysis of the data will be performed. Qualitative variables will be presented as absolute (n) and relative (%) frequencies, while quantitative variables will be summarized using measures of central tendency (mean) and dispersion (SD). The normality of quantitative variables will be assessed using the Kolmogorov–Smirnov test. To evaluate the effectiveness of the self-selected RT programme, the following analyses will be conducted. Between-group differences (intervention vs. control) will be examined using Student's *t*-test for normally distributed data, or the Mann–Whitney *U* test otherwise. Changes over time and between groups will be analyzed using a mixed-design ANOVA, with time as the within-subject factor and intervention group as the between-subject factor. When assumptions such as normality or homogeneity of variances are violated, appropriate corrections will be applied, including Pillai's trace, Roy's largest root, Greenhouse–Geisser correction, or lower-bound adjustment. In all analyses, a confidence level of 95% will be adopted. Statistical analyses will be performed using

IBM SPSS (version 24) and AMOS.

2.15 Plan for detecting adverse effects and procedure to be followed

Throughout the entire procedure, all incidents will be monitored and recorded. These will be reviewed by the site investigator at the hospital and by the principal investigator; should any be deemed attributable to the intervention, appropriate measures will be implemented.

2.16 Ethical considerations

This project will adhere to the ethical principles governing medical research involving human subjects, as set out in the Declaration of Helsinki. The present clinical trial was approved by the Research Ethics Committee with Medicines of the CEIM - La Fe University and Polytechnic Hospital (Spain) under code 2026-0301-1, held on 20 May 2026 (**Supplementary Material, Appendix 18**).

Given that data from real participants will be used, ensuring confidentiality, privacy, and data protection is essential. Participation will therefore be voluntary, and written informed consent will be a mandatory requirement for inclusion in the study. Participants will be free to withdraw from the study at any time. To safeguard participants' identity, their names and surnames will be coded within the database. This is a low-intervention clinical trial, as RT is a safe intervention routinely applied in population with LBP. Any harm suffered by participants will be covered by the individual or collective insurance policy.

For the publication of the project results in international peer-reviewed journals and their presentation at international conferences, the CONSORT (Consolidated Standards of Reporting Trials) guidelines (84) will be followed. Furthermore, as part of the knowledge transfer strategy, results will be disseminated through institutional websites and social media, engagement with mass media will be pursued, and potential collaborating

institutions interested in the findings will be identified. The use of professional medical writers is not anticipated, as all scientific manuscripts will be prepared by the study investigators themselves.

3. DISCUSSION

This study will evaluate the efficacy of different ET programmes, based on a comparison between patient self-selection and physiotherapist-prescribed guidance. Given the potential role of patient preferences, expectations, and empowerment in daily clinical practice, improvements in pain intensity and disability are anticipated, supported by existing (low-to-moderate) evidence for ET in CLBP (26). Furthermore, we hypothesize that secondary outcomes will also improve, as allowing patients to self-select exercises may enhance compliance, satisfaction, and the overall benefits of the ET intervention. However, There is a notable gap of longitudinal evolution of the explored variables in the current literature, underscoring the need for this study.

Previous studies highlight potential avenues for research in this framework. Slade et al. (85) described a RCT protocol aimed at evaluating differences in pain intensity, disability, adherence, and fear of pain when comparing a ET programme with a self-selected programme in people with CLBP. However, to our knowledge, the trial was not published due to changes in the study objectives. Subsequently, a secondary qualitative analysis (40) was conducted involving 18 treated-patients, showing a preference for exercises tailored to their abilities and prior skills, while rejecting those perceived as boring or tedious. More recently, Levi et al. (86) evaluated self-selected ET versus physiotherapist-prescribed ET in people with CLBP, showing no significant differences in pain intensity and disability at one month post-intervention. Nevertheless, the small sample sizes of available studies limit the interpretation of these findings and underline the need for further high-quality investigations to obtain robust conclusions.

Therefore, our results will allow us to explore the influence of individual preferences and patient-driven decision-making in the prescription of ET for CLBP, which may facilitate individualized interventions and help address the existing knowledge space regarding the role of self-selection in ET practice.

3.1 Limitations and strengths

As for limitations, the large number of questionnaires may cause participant fatigue, leading to incomplete responses. To mitigate this, the research team will explain the importance of completing all tests, and participants may pause and resume later or on subsequent days. Conducting the trial in a real-world clinical setting also poses limitations, as unexpected workflow interruptions may affect intervention fidelity despite standard operating procedures. Due to the behavioural nature of ET, neither physiotherapists nor participants can be blinded, as they are required to deliver and perform the intervention protocols. To mitigate this potential bias, a single-blind design will be adopted, in which the data analyst will remain unaware of group allocation. Achieving patient adherence may also be challenging; to address this, an awareness session will outline the ET programme and its benefits, and a supportive, well-equipped environment will be provided. Research team members will be available throughout to address questions or difficulties. Participants of the self-selected RT programme may be influenced by social contagion when choosing exercises. In this regard, independent decision-making will be emphasised during the awareness session, and exercise selection instructions will only be provided at baseline, thereby reducing the influence of ongoing prompts. Finally, non-response bias and loss to follow-up may occur, but efforts to reduce it will be implemented from the outset, supported by participant engagement and education on the relevance of this study for improving quality of life.

Our study may present notable strengths. It will be conducted in a highly specific

population with a well-defined condition such as CLBP, which ensures homogeneity and allows for strong comparability between individuals. Another strength lies in the collection of numerous variables, providing comprehensive knowledge about this specific patient subgroup. Methodologically, the study is robust, as it was prospectively registered, employs concealed randomization, and adheres to the SPIRIT guidelines. Furthermore, it provides a detailed description of the ET intervention, ensuring replicability. All outcome variables will be assessed using validated instruments, maximizing data quality and interpretability. In addition, the experience of the intervention team is expected to contribute substantially to the overall quality of this RCT. Finally, conducting the study in a real-world, hospital-based musculoskeletal rehabilitation setting may facilitate the extrapolation of the findings into routine clinical practice for the management of CLBP.

4. CONCLUSION

In some cases, clinical practice supports the potential role of patient preferences and self-selection of exercise in ET prescription. However, the current evidence remains preliminary, so guidelines do not yet fully recommend their routine inclusion in rehabilitation programs for CLBP. This single-blind, parallel-group, low-risk RCT may aim to address this knowledge gap by evaluating the efficacy of a self-selected RT programme over 24 sessions in improving biopsychosocial outcomes and functional parameters in adults aged 18–65 years with CLBP.

If the study shows clinically meaningful improvements in the targeted domains, the results may support further investigation of these factors in ET prescription and their incorporation as an important component in CLBP management. Conversely, null findings may help discourage unnecessary interventions and guide future trials. In either case, the trial will advance the evidence base for optimizing rehabilitation in people with CLBP.

ACKNOWLEDGMENTS

We wish to express our gratitude to the entire research team at Instituto de Investigación Sanitaria La Fe (IIS La Fe), the staff at Centro de Salud Campanar II and the University of Cádiz (UCA) for their invaluable collaboration in the development of this study protocol.

AUTHOR CONTRIBUTIONS

Conceptualization: Luis, González-Gómez, Jose A., Moral-Munoz, Álvaro-José., Rodríguez-Domínguez; **data curation**: Luis, González-Gómez, Jose A., Moral-Munoz, Álvaro-José., Rodríguez-Domínguez; **funding acquisition**: Luis, González-Gómez, Jose A., Moral-Munoz, Álvaro-José., Rodríguez-Domínguez; **methodology**: Luis, González-Gómez, Jose A., Moral-Munoz; **project administration**: Jose A. Moral-Munoz; **writing - original draft**: Luis, González-Gómez; **writing - review and editing**: Luis, González-Gómez, Jose A., Moral-Munoz, Álvaro-José., Rodríguez-Domínguez

REFERENCES

1. Moreno-Ligero M, Moral-Munoz JA, Failde I, Dueñas M. Physical activity levels in adults with chronic low back pain: A national survey in the general Spanish population. J Rehabil Med. 2023;55. doi:10.2340/jrm.v55.4352 PubMed PMID: 36661849.
2. Xu S, Chen J, Wang C, Lin Y, Huang W, Zhou H, et al. Global, regional, and national burden of low back pain for adults aged 55 and older 1990–2021: an analysis for the global burden of disease study 2021. BMC Musculoskeletal Disorders 2025 26:1. 2025 Jan 23;26(1):81-. doi:10.1186/s12891-025-08326-3 PubMed PMID: 39849415.
3. Maher C, Underwood M, Buchbinder R. Non-specific low back pain. Lancet. 2017 Feb 18;389(10070):736–47. doi:10.1016/S0140-6736(16)30970-9 PubMed PMID: 27745712.
4. Meucci RD, Fassa AG, Xavier Faria NM. Prevalence of chronic low back pain: systematic review. Rev Saude Publica. 2015;49. doi:10.1590/S0034-8910.2015049005874 PubMed PMID: 26487293.

5. Dueñas M, De Sola H, Salazar A, Esquivia A, Rubio S, Failde I. Prevalence and epidemiological characteristics of chronic pain in the Spanish population. Results from the pain barometer. Eur J Pain. 2025 Jan 1;29(1). doi:10.1002/ejp.4705 PubMed PMID: 39046161.

6. Verhagen AP, Downie A, Popal N, Maher C, Koes BW. Red flags presented in current low back pain guidelines: a review. Eur Spine J. 2016 Sep 1;25(9):2788–802. doi:10.1007/s00586-016-4684-0 PubMed PMID: 27376890.

7. Baliki MN, Schnitzer TJ, Bauer WR, Apkarian AV. Brain morphological signatures for chronic pain. PLoS One. 2011 Oct 13;6(10). doi:10.1371/journal.pone.0026010 PubMed PMID: 22022493.

8. Flor H, Braun C, Elbert T, Birbaumer N. Extensive reorganization of primary somatosensory cortex in chronic back pain patients. Neurosci Lett. 1997 Mar 7;224(1):5–8. doi:10.1016/S0304-3940(97)13441-3 PubMed PMID: 9132689.

9. Apkarian AV, Hashmi JA, Baliki MN. Pain and the brain: specificity and plasticity of the brain in clinical chronic pain. Pain. 2011 Mar;152(3 Suppl). doi:10.1016/j.pain.2010.11.010 PubMed PMID: 21146929.

10. Ünal Ö, Akyol Y, Tander B, Ulus Y, Terzi Y, Kuru Ö. The relationship of illness perceptions with demographic features, pain severity, functional capacity, disability, depression, and quality of life in patients with chronic low back pain. Turk J Phys Med Rehabil. 2019;65(4):301–8. doi:10.5606/TFTRD.2019.3248 PubMed PMID: 31893266.

11. Raspe H, Hueppe A, Neuhauser H. Back pain, a communicable disease? Int J Epidemiol. 2008 Feb;37(1):69–74. doi:10.1093/ije/dym220 PubMed PMID: 18024977.

12. Samulowitz A, Gremyr I, Eriksson E, Hensing G. “Brave Men” and “Emotional Women”: A Theory-Guided Literature Review on Gender Bias in Health Care and Gendered Norms towards Patients with Chronic Pain. Pain Res Manag. 2018;2018. doi:10.1155/2018/6358624 PubMed PMID: 29682130.

13. Pagé MG, Fortier M, Ware MA, Choinière M. As if one pain problem was not enough: prevalence and patterns of coexisting chronic pain conditions and their impact on treatment outcomes. J Pain Res. 2018;11:237. doi:10.2147/JPR.S149262 PubMed PMID: 29416373.

14. Elliott AM, Smith BH, Hannaford PC, Smith WC, Chambers WA. The course of chronic pain in the community: Results of a 4-year follow-up study. Pain. 2002 Sep;99(1–2):299–307. doi:10.1016/S0304-3959(02)00138-0 PubMed PMID: 12237208.

15. Hamood R, Hamood H, Merhasin I, Keinan-Boker L. Chronic pain and other symptoms among breast cancer survivors: prevalence, predictors, and effects on quality of life. Breast Cancer Res Treat. 2018 Jan 1;167(1):157–69. doi:10.1007/s10549-017-4485-0 PubMed PMID: 28861642.

16. Dominick CH, Blyth FM, Nicholas MK. Unpacking the burden: understanding the relationships between chronic pain and comorbidity in the general population. Pain. 2012 Feb;153(2):293–304. doi:10.1016/j.pain.2011.09.018 PubMed PMID: 22071318.

17. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: A cross-sectional study. The Lancet. 2012 Jul 7;380(9836):37–43. doi:10.1016/S0140-6736(12)60240-2 PubMed PMID: 22579043.

18. Costa N, Smits E, Kasza J, Salomoni S, Ferreira M, Sullivan M, et al. ISSLS PRIZE IN CLINICAL SCIENCE 2021: What are the risk factors for low back pain flares and does this depend on how flare is defined? Eur Spine J. 2021 May 1;30(5):1089–97. doi:10.1007/s00586-021-06730-6 PubMed PMID: 33537911.

19. Xu HR, Zhang YH, Ngo TL, Yang QH, Du SH, Wang XQ. Association between smoking and incident back pain: A prospective cohort study with 438 510 participants. J Glob Health. 2023;13. doi:10.7189/jogh.13.04152 PubMed PMID: 37988369.

20. Ferreira PH, Pinheiro MB, Machado GC, Ferreira ML. Is alcohol intake associated with low back pain? A systematic review of observational studies. Man Ther. 2013 Jun;18(3):183–90. doi:10.1016/j.math.2012.10.007 PubMed PMID: 23146385.

21. Lucha-López MO, Hidalgo-García C, Monti-Ballano S, Márquez-Gonzalvo S, Ferrández-Laliena L, Müller-Thyssen-Uriarte J, et al. Body Mass Index and Its Influence on Chronic Low Back Pain in the Spanish Population: A Secondary Analysis from the European Health Survey (2020). Biomedicines. 2023 Aug 1;11(8). doi:10.3390/biomedicines11082175 PubMed PMID: 37626672.

22. Singhal K, Muliyala KP, Pakhare AP, Behera P, Santoshi JA. Do Patients of Chronic Low Back Pain have Psychological Comorbidities? Avicenna J Med. 2021 Sep;11(3):145–51. doi:10.1055/s-0041-1734385 PubMed PMID: 34646791.

23. Butchart A, Kerr EA, Heisler M, Piette JD, Krein SL. Experience and management of chronic pain among patients with other complex chronic conditions. Clin J Pain. 2009;25(4):293–8. doi:10.1097/AJP.0b013e31818bf574 PubMed PMID: 19590477.

24. Darlow B, Fullen BM, Dean S, Hurley DA, Baxter GD, Dowell A. The association between health care professional attitudes and beliefs and the attitudes and beliefs, clinical management, and outcomes of patients with low back pain: a systematic review. Eur J Pain. 2012;16(1):3–17. doi:10.1016/j.ejpain.2011.06.006 PubMed PMID: 21719329.

25. Rainville J, Smeets RJEM, Bendix T, Tveito TH, Poiraudeau S, Indahl AJ. Fear-avoidance beliefs and pain avoidance in low back pain - Translating research into clinical practice. Spine Journal. 2011 Sep;11(9):895–903. doi:10.1016/j.spinee.2011.08.006 PubMed PMID: 21907633.

26. Hayden JA, Ellis J, Ogilvie R, Malmivaara A, van Tulder MW. Exercise therapy for chronic low back pain. Cochrane Database Syst Rev. 2021 Sep 28;9(9). doi:10.1002/14651858.CD009790.pub2 PubMed PMID: 34580864.

27. Saragiotto BT, Maher CG, Yamato TP, Costa LOP, Menezes Costa LC, Ostelo RWJG, et al. Motor control exercise for chronic non-specific low-back pain. Cochrane Database Syst Rev. 2016 Jan 8;2016(1). doi:10.1002/14651858.CD012004 PubMed PMID: 26742533.

28. Zhou T, Salman D, McGregor AH. Recent clinical practice guidelines for the management of low back pain: a global comparison. BMC Musculoskelet Disord. 2024 Dec 1;25(1). doi:10.1186/s12891-024-07468-0 PubMed PMID: 38693474.

29. Liang Z, Tian S, Wang C, Zhang M, Guo H, Yu Y, et al. The Best Exercise Modality and Dose for Reducing Pain in Adults With Low Back Pain: A Systematic Review With Model-Based Bayesian Network Meta-analysis. J Orthop Sports Phys Ther. 2024 May 1;54(5):315–27. doi:10.2519/jospt.2024.12153 PubMed PMID: 38457134.

30. Sivertsson J, Sernert N, Åhlund K. Exercise-based telerehabilitation in chronic low back pain – a scoping review. BMC Musculoskelet Disord. 2024 Dec 1;25(1):948. doi:10.1186/s12891-024-07952-7 PubMed PMID: 39580408.

31. Ferro Moura Franco K, Lenoir D, dos Santos Franco YR, Jandre Reis FJ, Nunes Cabral CM, Meeus M. Prescription of exercises for the treatment of chronic pain along the continuum of nociplastic pain: A systematic review with meta-analysis. Eur J Pain. 2021 Jan 1;25(1):51–70. doi:10.1002/ejp.1666 PubMed PMID: 32976664.

32. Fernández-Rodríguez R, Álvarez-Bueno C, Cavero-Redondo I, Torres-Costoso A, Pozuelo-Carrascosa DP, Reina-Gutiérrez S, et al. Best Exercise Options for Reducing Pain and Disability in Adults With Chronic Low Back Pain: Pilates, Strength, Core-Based, and Mind-Body. A Network Meta-analysis. J Orthop Sports Phys Ther. 2022 Aug 1;52(8):505–21. doi:10.2519/jospt.2022.10671 PubMed PMID: 35722759.

33. Jones MD, Hansford HJ, Bastianon A, Gibbs MT, Gilanyi YL, Foster NE, et al. Exercise adherence is associated with improvements in pain intensity and functional limitations in adults with chronic non-specific low back pain: a secondary analysis of a Cochrane review. J Physiother. 2025 Apr 1;71(2):91–9. doi:10.1016/j.jphys.2025.03.004 PubMed PMID: 40175237.

34. Arensman RM, Pisters MF, Kloek CJJ, Koppenaal T, Veenhof C, Ostelo RJWG. Exploring the association between adherence to home-based exercise recommendations and recovery of nonspecific low back pain: a prospective cohort study. BMC Musculoskelet Disord. 2024 Dec 1;25(1). doi:10.1186/s12891-024-07705-6 PubMed PMID: 39090661.

35. Gilanyi YL, Shah B, Cashin AG, Gibbs MT, Bellamy J, Day R, et al. Barriers and enablers to exercise adherence in people with nonspecific chronic low back pain:

a systematic review of qualitative evidence. Pain. 2024 Oct 1;165(10):2200–14. doi:10.1097/j.pain.0000000000003234 PubMed PMID: 38635470.

36. Belitskaya-Levy I, David Clark J, Shih MC, Bair MJ. Treatment Preferences for Chronic Low Back Pain: Views of Veterans and Their Providers. J Pain Res. 2021;14:161–71. doi:10.2147/JPR.S290400 PubMed PMID: 33536780.

37. Morillon GF, Benkhalti M, Dagenais P, Poder TG. Preferences of patients with chronic low back pain about nonsurgical treatments: Results of a discrete choice experiment. Health Expect. 2023 Feb 1;26(1):510–30. doi:10.1111/hex.13685 PubMed PMID: 36482802.

38. George SZ, Robinson ME. Preference, Expectation, and Satisfaction in a Clinical Trial of Behavioral Interventions for Acute and Sub-Acute Low Back Pain (NCT00373867). The journal of pain : official journal of the American Pain Society. 2010 Nov;11(11):1074. doi:10.1016/j.jpain.2010.02.016 PubMed PMID: 20466596.

39. Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. Spine (Phila Pa 1976). 2004 Dec 1;29(23):2593–602. doi:10.1097/01.brs.0000146464.23007.2a PubMed PMID: 15564907.

40. Slade SC, Molloy E, Keating JL. People with non-specific chronic low back pain who have participated in exercise programs have preferences about exercise: a qualitative study. Aust J Physiother. 2009;55(2):115–21. doi:10.1016/S0004-9514(09)70041-8 PubMed PMID: 19463082.

41. Francois SJ, Lanier VM, Marich A V., Wallendorf M, Van Dillen LR. A Cross-Sectional Study Assessing Treatment Preference of People With Chronic Low Back Pain. Arch Phys Med Rehabil. 2018 Dec 1;99(12):2496–503. doi:10.1016/j.apmr.2018.04.027 PubMed PMID: 29852151.

42. Widerström B, Elvén M, Rasmussen-Barr E, Boström C. “How does physical examination findings influence physiotherapists’ decision-making when matching treatment to patients with low back pain?”. Musculoskelet Sci Pract. 2021 Jun 1;53:102374. doi:10.1016/j.msksp.2021.102374 PubMed PMID: 33798815.

43. Slade SC, Patel S, Psychol C, Underwood M, Keating JL. What are patient beliefs and perceptions about exercise for nonspecific chronic low back pain? A systematic review of qualitative studies. Clin J Pain. 2014;30(11):995–1005. doi:10.1097/AJP.0000000000000044 PubMed PMID: 24300225.

44. Biddle SJH. Emotion, mood and physical activity. Physical Activity and Psychological Well-Being. 2003 Jan 1;63–87. doi:10.4324/9780203468326-14

45. Lane AM, Jackson A, Terry PC. Preferred Modality Influences on Exercise-Induced Mood Changes. J Sports Sci Med. 2005 Jun;4(2):195. PubMed PMID: 24431976.

46. Parfitt G, Rose EA, Burgess WM. The psychological and physiological responses of sedentary individuals to prescribed and preferred intensity exercise. Br J

Health Psychol. 2006 Feb;11(Pt 1):39–53. doi:10.1348/135910705X43606 PubMed PMID: 16480554.

47. Parfitt G, Rose EA, Markland D. The effect of prescribed and preferred intensity exercise on psychological affect and the influence of baseline measures of affect. J Health Psychol. 2000;5(2):231–40. doi:10.1177/135910530000500213 PubMed PMID: 22049013.

48. Schneider M, Schmalbach P. Affective response to exercise and preferred exercise intensity among adolescents. J Phys Act Health. 2014 Apr 1;12(4):546. doi:10.1123/jpah.2013-0442 PubMed PMID: 24770461.

49. George SZ, Robinson ME. Preference, expectation, and satisfaction in a clinical trial of behavioral interventions for acute and sub-acute low back pain. Journal of Pain. 2010 Nov;11(11):1074–82. doi:10.1016/j.jpain.2010.02.016 PubMed PMID: 20466596.

50. Dishman RK, Farquhar RP, Cureton KJ. Responses to preferred intensities of exertion in men differing in activity levels. Med Sci Sports Exerc. 1994;26(6):783–90. doi:10.1249/00005768-199406000-00019 PubMed PMID: 8052118.

51. Rodrigues F, Jacinto M, Antunes R, Amaro N, Matos R, Monteiro D. Analysis of Exercise Intensity Preferences, Tolerance, Competence, and Their Implications for Behavioral Intentions in Fitness Settings. Journal of Functional Morphology and Kinesiology 2023, Vol 8,. 2023 Sep 20;8(3). doi:10.3390/jfmk8030139

52. Shin YA, Kim KB. The Importance of Individual Choice and Intention in Exercise Adherence and Weight Management. J Obes Metab Syndr. 2021 Dec 1;30(4):317. doi:10.7570/JOMES21092 PubMed PMID: 34934016.

53. George SZ, Zeppieri G, Cere AL, Cere MR, Borut MS, Hodges MJ, et al. A randomized trial of behavioral physical therapy interventions for acute and sub-acute low back pain (NCT00373867). Pain. 2008 Nov 15;140(1):145–57. doi:10.1016/j.pain.2008.07.029 PubMed PMID: 18786762.

54. Chan AW, Boutron I, Hopewell S, Moher D, Schulz KF, Collins GS, et al. SPIRIT 2025 statement: updated guideline for protocols of randomised trials. The BMJ. 2025;389:e081477. doi:10.1136/bmj-2024-081477 PubMed PMID: 40294953.

55. Slade SC, Dionne CE, Underwood M, Buchbinder R. Consensus on Exercise Reporting Template (CERT): Explanation and Elaboration Statement. Br J Sports Med. 2016 Dec 1;50(23):1428–37. doi:10.1136/bjsports-2016-096651 PubMed PMID: 27707738.

56. Rodríguez-Domínguez ÁJ, Moral-Munoz JA, Guzmán-Gómez JD, Valero-Ortiz J, González-Gómez L, Cardellat-González M. Does resistance training improve pain intensity, quality of life, and disability in people with chronic nonspecific low back pain? A systematic review and meta-analysis. Disabil Rehabil. 2026;48(6). doi:10.1080/09638288.2025.2566275 PubMed PMID: 41065407.

57. Li Y, Yan L, Hou L, Zhang X, Zhao H, Yan C, et al. Exercise intervention for patients with chronic low back pain: a systematic review and network meta-analysis. Front Public Health. 2023;11. doi:10.3389/fpubh.2023.1155225 PubMed PMID: 38035307.

58. Owen PJ, Miller CT, Mundell NL, Verswijveren SJJM, Tagliaferri SD, Brisby H, et al. Which specific modes of exercise training are most effective for treating low back pain? Network meta-analysis. Br J Sports Med. 2020 Nov 1;54(21):1279–87. doi:10.1136/bjsports-2019-100886 PubMed PMID: 31666220.

59. Tataryn N, Simas V, Catterall T, Furness J, Keogh JWL. Posterior-Chain Resistance Training Compared to General Exercise and Walking Programmes for the Treatment of Chronic Low Back Pain in the General Population: A Systematic Review and Meta-Analysis. Sports Med Open. 2021 Dec 1;7(1). doi:10.1186/s40798-021-00306-w PubMed PMID: 33683497.

60. Grooten WJA, Boström C, Dedering Å, Halvorsen M, Kuster RP, Nilsson-Wikmar L, et al. Summarizing the effects of different exercise types in chronic low back pain – a systematic review of systematic reviews. BMC Musculoskeletal Disorders 2022 23:1. 2022 Aug 22;23(1):801-. doi:10.1186/s12891-022-05722-x PubMed PMID: 35996124.

61. Ouellet P, Lafrance S, Pizzi A, Roy JS, Lewis J, Christiansen DH, et al. Region-specific Exercises vs General Exercises in the Management of Spinal and Peripheral Musculoskeletal Disorders: A Systematic Review With Meta-analyses of Randomized Controlled Trials. Arch Phys Med Rehabil. 2021 Nov 1;102(11):2201–18. doi:10.1016/j.apmr.2021.01.093 PubMed PMID: 33684362.

62. Kubo K, Ikebukuro T, Yata H. Effects of squat training with different depths on lower limb muscle volumes. Eur J Appl Physiol. 2019 Sep 1;119(9):1933–42. doi:10.1007/s00421-019-04181-y PubMed PMID: 31230110.

63. Schoenfeld BJ, Grgic J. Effects of range of motion on muscle development during resistance training interventions: A systematic review. SAGE Open Med. 2020;8:2050312120901559. doi:10.1177/2050312120901559 PubMed PMID: 32030125.

64. Pallarés JG, Hernández-Belmonte A, Martínez-Cava A, Vetrovsky T, Steffl M, Courel-Ibáñez J. Effects of range of motion on resistance training adaptations: A systematic review and meta-analysis. Scand J Med Sci Sports. 2021 Oct 1;31(10):1866–81. doi:10.1111/sms.14006 PubMed PMID: 34170576.

65. Alsubaie AM, Mazaheri M, Martinez-Valdes E, Falla D. Is movement variability altered in people with chronic non-specific low back pain? A systematic review. PLoS One. 2023 Jun 1;18(6). doi:10.1371/journal.pone.0287029 PubMed PMID: 37315096.

66. Kehl C, Suter M, Johannesdottir E, Dörig M, Bangerter C, Meier ML, et al. Associations between pain-related fear and lumbar movement variability during activities of daily living in patients with chronic low back pain and healthy

controls. Scientific Reports 2024 14:1. 2024 Oct 2;14(1):22889-. doi:10.1038/s41598-024-73430-8 PubMed PMID: 39358482.

67. Saito H, Watanabe Y, Kutsuna T, Futohashi T, Kusumoto Y, Chiba H, et al. Spinal movement variability associated with low back pain: A scoping review. PLoS One. 2021 May 1;16(5):e0252141. doi:10.1371/journal.pone.0252141 PubMed PMID: 34029347.

68. Ippersiel P, Robbins S, Preuss R. Movement variability in adults with low back pain during sit-to-stand-to-sit. Clinical Biomechanics. 2018 Oct 1;58:90–5. doi:10.1016/j.clinbiomech.2018.07.011 PubMed PMID: 30064042.

69. Barisic A, Leatherdale ST, Kreiger N. Importance of frequency, intensity, time and type (FITT) in physical activity assessment for epidemiological research. Can J Public Health. 2011;102(3):174–5. doi:10.1007/bf03404889 PubMed PMID: 21714314.

70. Kell RT, Risi AD, Barden JM. The response of persons with chronic nonspecific low back pain to three different volumes of periodized musculoskeletal rehabilitation. J Strength Cond Res. 2011 Apr;25(4):1052–64. doi:10.1519/JSC.0b013e3181d09df7 PubMed PMID: 20647943.

71. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020 Dec 1;54(24):1451–62. doi:10.1136/bjsports-2020-102955 PubMed PMID: 33239350.

72. Cabral LL, Lopes PB, Wolf R, Stefanello JMF, Pereira G. A SYSTEMATIC REVIEW OF CROSS-CULTURAL ADAPTATION AND VALIDATION OF BORG'S RATING OF PERCEIVED EXERTION SCALE. J Phys Educ. 2017;28(1):2853. doi:10.4025/jphyseduc.v28i1.2853

73. Jenkins NW, Parrish JM, Nolte MT, Jadczak CN, Geoghegan CE, Mohan S, et al. Charlson Comorbidity Index: An Inaccurate Predictor of Minimally Invasive Lumbar Spinal Fusion Outcomes. Int J Spine Surg. 2021 Aug 1;15(4):770–9. doi:10.14444/8099 PubMed PMID: 34266930.

74. Ferreira-Valente MA, Pais-Ribeiro JL, Jensen MP. Validity of four pain intensity rating scales. Pain. 2011 Oct;152(10):2399–404. doi:10.1016/j.pain.2011.07.005 PubMed PMID: 21856077.

75. Alcántara-Bumbiedro S, Flórez-García MT, Echávarri-Pérez C, García-Pérez F. Oswestry low back pain disability questionnaire. Rehabilitacion (Madr). 2006 May 1;40(3):150–8. doi:10.1016/S0048-7120(06)74881-2

76. Feixas G, Pucurull O, Roca C, Paz C, García-Grau E, Bados A. Escala de satisfacción con el tratamiento recibido (cres-4): la versión en español. Revista de Psicoterapia. 2012 Mar 1;23(89):51–8. doi:10.33898/rdp.v23i89.639

77. Gómez-Pérez L, López-Martínez AE, Ruiz-Párraga GT. Psychometric Properties of the Spanish Version of the Tampa Scale for Kinesiophobia (TSK). J Pain. 2011 Apr;12(4):425–35. doi:10.1016/j.jpain.2010.08.004 PubMed PMID: 20926355.

78. Perez-Dominguez B, Perpiña-Martinez S, Escobio-Prieto I, de la Fuente-Costa M, Rodriguez-Rodriguez AM, Blanco-Diaz M. Psychometric properties of the translated Spanish version of the Pain Self-Efficacy Questionnaire. Front Med (Lausanne). 2023;10. doi:10.3389/fmed.2023.1226037 PubMed PMID: 37465639.

79. Ghroubi S, Jribi S, Jdidi J, Yahia A, Elleuch W, Chaaben M, et al. Study of the validity and reproducibility of the Biering-Sorensen test in chronic low back pain. Ann Phys Rehabil Med. 2015 Sep 1;58:e88. doi:10.1016/j.rehab.2015.07.215

80. Molina-Molina A, Ruiz-Malagón EJ, Carrillo-Pérez F, Roche-Seruendo LE, Damas M, Banos O, et al. Validation of mDurance, A Wearable Surface Electromyography System for Muscle Activity Assessment. Front Physiol. 2020 Nov 27;11. doi:10.3389/fphys.2020.606287 PubMed PMID: 33329060.

81. Unsgaard-Tøndel M, Fladmark AM, Salvesen Ø, Vasseljen O. Motor control exercises, sling exercises, and general exercises for patients with chronic low back pain: a randomized controlled trial with 1-year follow-up. Phys Ther. 2010 Oct;90(10):1426–40. doi:10.2522/ptj.20090421 PubMed PMID: 20671099.

82. Cohen Jacob. Statistical Power Analysis for the Behavioral Sciences [Internet]. 2013 [cited 2026 Mar 25];459. Available from: https://books.google.com/books/about/Statistical_Power_Analysis_for_the_Behav.html?hl=es&id=rEe0BQAAQBAJ

83. Whitehead AL, Julious SA, Cooper CL, Campbell MJ. Estimating the sample size for a pilot randomised trial to minimise the overall trial sample size for the external pilot and main trial for a continuous outcome variable. Stat Methods Med Res. 2016 Jun 1;25(3):1057–73. doi:10.1177/0962280215588241 PubMed PMID: 26092476.

84. Merkow RP, Kaji AH, Itani KMF. Reporting Guidelines: The Consolidated Standards of Reporting Trials (CONSORT) Framework. JAMA Surg. 2021 Sep 1;156(9):877. doi:10.1001/jamasurg.2021.0549 PubMed PMID: 33825818.

85. Slade SC, Keating JL. Effects of preferred-exercise prescription compared to usual exercise prescription on outcomes for people with non-specific low back pain: a randomized controlled trial [ACTRN12608000524392]. BMC Musculoskelet Disord. 2009;10. doi:10.1186/1471-2474-10-14 PubMed PMID: 19173747.

86. Levi Y, Gottlieb U, Shavit R, Springer S. A matter of choice: Should students self-select exercise for their nonspecific chronic low back pain? A controlled study. J Am Coll Health. 2023;71(7):2099–105. doi:10.1080/07448481.2021.1960845 PubMed PMID: 34403329.

87. Fortin M, Rye M, Roussac A, Montpetit C, Burdick J, Naghdi N, et al. The Effects of Combined Motor Control and Isolated Extensor Strengthening versus General Exercise on Paraspinal Muscle Morphology, Composition, and Function

in Patients with Chronic Low Back Pain: A Randomized Controlled Trial. J Clin Med. 2023 Sep 1;12(18). doi:10.3390/jcm12185920 PubMed PMID: 37762861.

LEGENDS FOR FIGURES AND TABLES

Table 1. Schedule of enrolment, interventions ans assessments.

	STUDY PERIOD				
	Screening	**Allocation**	**Post-allocation**		
TIMEPOINTS*	***t-1***	**0**	***t0***	***t1***	***t2***
RECRUITMENT					
Eligibility criteria	X				
Informed consent	X				
Study group allocation		X			
INTERVENTIONS					
Experimental group Self-selected RT programme			X	X	X
Control group Prescribed-physiotherapist RT programme			X	X	X
ASSESSMENTS					
Baseline sociodemographics and Charlson comorbidity index			X		
Pain-related distribution and intensity			X	X	X
Disability			X	X	X
Satisfaction with treatment				X	X
Degree of compliance with treatment				X	X
Kinesiophobia			X	X	X
Self-efficacy			X	X	X
Muscle endurance			X	X	X
sEMG-ESL			X	X	X

Abbreviatures. RT: resistance training; t_{-1}; completed in clinical setting; 0: prior to the first session; t_0: baseline assessment and first in-person session; t_1: 4 weeks; t_2: 12 weeks; EMG: electromyography.

Table 2. Self-selected resistance training (RT) programme.

Upper limb	Lower limb	Trunk
Push-ups	Deadlift	Press Pallof
Shoulder press	Squat	Abdominal crunch
Chair dips	Hip bridge	Side plank
Row	Lunge	Russian twist
Lateral shoulder raise	Copenhagen adduction	Front plank
Biceps curl	Heel raise	Back extension

Table 3. Prescribed-physiotherapist resistance training (RT) programme.

Upper limb		Lower limb		Trunk	
Push	**Pull**	**Hip-dominant**	**Knee-dominant**	**Anterior**	**Posterior**
Push-ups	Row	Deadlift	Squat	Abdominal crunch	Back extension

Table 4. Exercise dosage following F.I.T.T.-V.P. (Frequency, Intensity, Type, Time - Volume, Progression) framework.

Dosing parameters		Progression criteria
Frequency	2d/week	↓* (a) Performance of the exercise with pain not exceeding 3–4/10 on the NPRS. (b) Absence of any adverse response (increased pain or general discomfort) during the 48 hours following initiation of the RT programme. (c) Fulfilment of criteria (a) and (b) for three consecutive training days, with subsequent escalation of intensity.
Intensity	30-40% 1RM	
Time	12 weeks	
Type	RT	
Volume	2-3 sets/10-20 reps.	
Progression	Level 1: 2x10 reps. ↓* Level 2: 2x15 reps. ↓* Level 3: 3x15 reps. ↓* Level 4: 3x18 reps. ↓* Level 5: 3x20 reps.	

Abbreviatures. D: days; 1RM: One repetition maximum; RT: resistance training; reps: repetitions; NPRS: Numerical Pain Rating Scale.

Table 5. Sample size calculation.

Variable (scale)	MCID	Expected Effect Size	Sample per Group	Total Sample	Reference
Pain intensity (NPRS)	2 points (82)	1.8	6	12	Fortin et al. (87)
Disability (ODI)	10-12 points (84)	0.571	50	100	Unsgaard-Tøndel et al. (81)

Abbreviatures. NPRS: Numerical Pain Rating Scale; ODI: Oswestry Disability Index; MCID, Minimal Clinically Important Difference.