Universidade Federal de São Carlos

Centro de Ciências Biológicas e da Saúde

Departamento de Fisioterapia

Programa de Pós-Graduação em Fisioterapia

PROMOÇÃO DA QUALIDADE DE VIDA NA FIBROMIALGIA POR MEIO DO EXERCÍCIO FÍSICO: perspectivas biopsicossociais e contribuições metodológicas.

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Orientadora: Profª. Drª. Mariana Arias Avila

São Carlos

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André Pontes-Silva

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Tese apresentada ao Programa de Pós-Graduação em Fisioterapia da Universidade Federal de São Carlos para obtenção do Título de Doutor em Fisioterapia.

Orientadora: Profª. Drª. Mariana Arias Avila

São Carlos, São Paulo, Brasil

2026

UNIVERSIDADE FEDERAL DE SÃO CARLOS

Centro de Ciências Biológicas e da Saúde
Programa de Pós-Graduação em Fisioterapia (Doutorado)

Folha de Aprovação

Defesa de Tese de Doutorado do candidato André Pontes Silva, realizada em 06/02/2026.

Comissão julgadora:

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“Quando disseram
‘*uma caneta pesa menos que uma enxada’*
estavam falando apenas sobre quilogramas”.
Enir Rodrigues (2024).

“Uma diferença só é diferença se fizer diferença”.
Darrell Huff (1954).

RESUMO

Introdução: A fibromialgia é uma condição musculoesquelética crônica, multifatorial e de elevada complexidade clínica, caracterizada por dor generalizada, fadiga, distúrbios do sono, alterações de humor e impacto funcional significativo. Embora o exercício físico seja amplamente recomendado como intervenção não-farmacológica, ainda há lacunas quanto aos parâmetros ideais de prescrição, à comparação entre intensidades, à validade dos instrumentos diagnósticos, à incorporação do modelo biopsicossocial e aos fatores associados à aderência ao tratamento não-farmacológico. **Objetivo:** esta tese teve os seguintes objetivos: (1) comparar os sintomas da fibromialgia com os de outras dores musculoesqueléticas crônicas por meio dos instrumentos propostos pelo Colégio Americano de Reumatologia; (2) comparar os efeitos de 24 sessões de treinamento de força com intensidade progressiva versus intensidade constante e de caminhada sobre o impacto da fibromialgia e sobre desfechos clínicos secundários; (3) investigar variáveis biopsicossociais associadas ao apoio social, ao autocuidado e ao conhecimento sobre a fibromialgia; (4) examinar variáveis clínicas, sociodemográficas e sociais associadas à adesão ao exercício físico em mulheres com fibromialgia. Métodos: foram conduzidos quatro estudos – um ensaio clínico controlado e aleatorizado, dois estudos transversais e um estudo de coorte. Participaram adultos com diagnóstico de fibromialgia segundo os critérios de 2016, predominantemente mulheres fisicamente inativas. As intervenções envolveram treinamento de força com intensidade progressiva, treinamento de força com intensidade constante e caminhada em intensidade moderada. Foram avaliados desfechos autorrelatados, como impacto da fibromialgia, qualidade do sono, ansiedade, depressão, dor, percepção de melhora e adesão ao tratamento; mecanismos de dor, como somação temporal, modulação condicionada e limiar sensitivo cutâneo; e desempenho musculoesquelético, por meio de dinamometria isocinética e força de preensão manual, além da habilidade de caminhar. As análises estatísticas incluíram modelos lineares mistos com base no princípio da intenção de tratar, regressões logísticas, análises de variância e tamanhos de efeito. **Resultados:** os instrumentos utilizados para avaliar os sintomas, discriminaram adequadamente pessoas com fibromialgia em relação a outras dores musculoesqueléticas crônicas e

não devem ser utilizados fora desse contexto. Vinte e quatro sessões de treinamento de força com intensidade progressiva não reduziram mais o impacto da fibromialgia do que a intensidade constante ou a caminhada. Todos os tipos de exercício proporcionaram melhoras significativas em diversos desfechos clínicos e fisiológicos, mas não alcançaram diferenças mínimas clinicamente relevantes. O treinamento de força com intensidade progressiva promoveu ganhos significativos no desempenho musculoesquelético, especialmente na extensão do joelho. A adesão ao exercício foi baixa após três meses sem intervenção. O apoio social emergiu como o principal fator protetor para a adesão à atividade física. Variáveis sociais explicaram proporções relevantes da variabilidade nos escores de apoio social, autocuidado e conhecimento sobre fibromialgia. **Conclusão:** O exercício físico, independentemente do tipo ou da estratégia de progressão da intensidade, proporciona benefícios clínicos e fisiológicos a pessoas com fibromialgia, embora não sejam suficientes para mudanças clinicamente relevantes e duradouras. Diferentes exercícios geram adaptações biológicas semelhantes, o que reforça a importância do trabalho total e do esforço aplicado. A adesão ao tratamento continua sendo um desafio e está fortemente associada a fatores sociais, especialmente ao apoio social. Esses achados reforçam a necessidade de uma abordagem biopsicossocial integrada no diagnóstico, na avaliação e no tratamento não-farmacológico da fibromialgia.

Palavras-Chave: Dor. Fibromialgia. Qualidade de vida. Exercício físico. Sistema musculoesquelético.

ABSTRACT

Introduction: Fibromyalgia is a chronic, multifactorial musculoskeletal condition of high clinical complexity, characterized by widespread pain, fatigue, sleep disturbances, mood alterations, and substantial functional impairment. Although physical exercise is widely recommended as a nonpharmacological intervention, important gaps remain regarding optimal prescription parameters, comparisons between training intensities, the validity and specificity of diagnostic instruments, the integration of the biopsychosocial model, and factors associated with adherence to nonpharmacological treatment. **Objectives:** This thesis aimed to: (1) compare fibromyalgia symptoms with those of other chronic musculoskeletal pain conditions using instruments proposed by the American College of Rheumatology; (2) compare the effects of 24 sessions of resistance training with progressive versus constant intensity and walking on fibromyalgia impact and secondary clinical outcomes; (3) investigate biopsychosocial variables associated with social support, self-care, and fibromyalgia knowledge; and (4) examine clinical, sociodemographic, and social variables associated with exercise adherence in women with fibromyalgia. **Methods:** Four studies were conducted: one randomized controlled clinical trial, two cross-sectional studies, and one cohort study. Participants were adults diagnosed with fibromyalgia according to the 2016 criteria, predominantly physically inactive women. The interventions included resistance training with progressive intensity, resistance training with constant intensity, and moderate-intensity walking. Self-reported outcomes were assessed, including fibromyalgia impact, sleep quality, anxiety, depression, pain, perceived improvement, and treatment adherence. Pain mechanisms were evaluated through temporal summation, conditioned pain modulation, and cutaneous sensory thresholds. Musculoskeletal performance was assessed using isokinetic dynamometry and handgrip strength, in addition to walking ability. Statistical analyses included mixed linear models based on the intention-to-treat principle, logistic regression analyses, analyses of variance, and effect size calculations. **Results:** The instruments used to assess symptoms adequately discriminated individuals with fibromyalgia from those with other chronic musculoskeletal pain conditions and should not be applied outside this

specific context. Twenty-four sessions of resistance training with progressive intensity did not result in greater reductions in fibromyalgia impact compared with constant-intensity resistance training or walking. All exercise modalities produced significant improvements across multiple clinical and physiological outcomes; however, these changes did not reach minimal clinically important differences. Resistance training with progressive intensity led to significant improvements in musculoskeletal performance, particularly in knee extension strength. Exercise adherence was low after three months without supervised intervention. Social support emerged as the primary protective factor for physical activity adherence. Social variables explained meaningful proportions of the variance in social support, self-care, and fibromyalgia knowledge scores. **Conclusion:** Physical exercise, regardless of modality or intensity progression strategy, provides clinical and physiological benefits for individuals with fibromyalgia; however, these benefits are insufficient to produce sustained, clinically meaningful changes. Different exercise modalities induce similar biological adaptations, highlighting the relevance of total workload and applied effort rather than specific training strategies. Treatment adherence remains a major challenge and is strongly associated with social factors, particularly social support. These findings underscore the need for an integrated biopsychosocial approach to the diagnosis, assessment, and nonpharmacological treatment of fibromyalgia.

Keywords: Pain. Quality of Life. Aerobic Exercise. Musculoskeletal System. Rehabilitation.

LISTA DE ABREVIATURAS E SIGLAS

CID	Classificação Internacional de Doenças
CONSORT	*Consolidated Standards of Reporting Trials*
EHAD	Escala hospitalar de ansiedade e depressão
END	Escala numérica de dor
ESS	Escala de severidade dos sintomas
IBM	*International Business Machines Corporation*
IC95%	Intervalo de Confiança de 95%
IDG	Índice de dor generalizada
IQSP	Índice de qualidade do sono de Pittsburgh
ITRF	Instrumento de triagem rápida para fibromialgia
GF	Grama-força
KG	Quilograma
OMS	Organização Mundial da Saúde
QIF	Questionário de Impacto da Fibromialgia revisado
REBEC	Registro Brasileiro de Ensaios Clínicos
TC6	Teste de caminhada de seis minutos
TST	Teste de somação temporal
UFSCar	Universidade Federal de São Carlos
SPSS	*Statistical Package for the Social Sciences*
TIDieR	*Template for Intervention Description and Replication*

SUMÁRIO

1 CONTEXTUALIZAÇÃO

1.1 Linha de pesquisa da orientadora e do programa

Esta tese foi desenvolvida sob a orientação da Profa. Dra. Mariana Arias Avila, docente do Programa de Pós-Graduação em Fisioterapia da Universidade Federal de São Carlos, cuja linha de pesquisa é "Investigação Clínica e Epidemiológica na Saúde da Mulher e da Pessoa Idosa".

1.2 Parcerias nacionais e/ou internacionais

Diversas parcerias foram estabelecidas ao longo deste período dedicado ao doutorado, com a finalidade de explorar novas perspectivas e compartilhar conhecimentos.

1.2.1 Parcerias nacionais

- Almir Vieira Dibai-Filho, Universidade Federal do Maranhão:

  Elaboração dos artigos: "*Structure and cut-off point of the short form – central sensitization inventory for primary dysmenorrhea (SF-SCI-PD)*"; "*The 9-item Tampa Scale for Kinesiophobia (TSK-9) has adequate measurement properties in patients with chronic low back pain*"; "*Tampa Scale for Kinesiophobia in chronic neck pain patients (TSK-neck): structural and construct validity and reliability in a Brazilian population (http://dx.doi.org/10.1186/s12891-024-07268-6)*"; "*15-item Roland-Morris Disability Questionnaire (RMDQ-15): structural and criterion validity on patients with chronic low back pain (http://dx.doi.org/10.1186/s12891-022-05953-y)*"; "*The Brazilian version of the work role functioning questionnaire 2.0 with 5 items (WRFQ-5) has adequate measurement properties (https://doi.org/10.1080/09593985.2022.2163211)*"; "*The best structure of the Tampa Scale for Kinesiophobia for patients with chronic low back pain has two domains and nine items (https://doi.org/10.1177/02692155221128829)*"; "*Ten-Item Lower Extremity Functional Scale (LEFS-10): Instrument Reduction Based on Brazilian Patients With Lower Limb Dysfunction (https://doi.org/10.1016/j.apmr.2022.09.010)*"; "*Women with fibromyalgia (ACR criteria) compared with women diagnosed by doctors and women with osteoarthritis:*

Cross-sectional study using functional and clinical variables (http://dx.doi.org/10.1111/1756-185X.14720)"; "*Do the instruments used to assess fibromyalgia symptoms according to American College of Rheumatology criteria generate similar scores in other chronic musculoskeletal pain? (http://dx.doi.org/10.1186/s12891-023-06572-x)*"; "*Effects of progressive intensity resistance training on the impact of fibromyalgia: protocol for a blinded randomized controlled trial (http://dx.doi.org/10.1186/s12891-023-06952-3)*"; "*Comparison between pain intensity, functionality, central sensitization, and self-efficacy in individuals with unilateral or bilateral knee osteoarthritis: a cross-sectional study (https://doi.org/10.1590/1806-9282.20220170)*"; "*The internal structure of Brazilian versions of disability questionnaires in patients with chronic low back pain: A cross-sectional study (https://doi.org/10.1016/j.msksp.2022.102587)*"; "*The Short-Form Neck Disability index has adequate measurement properties in chronic neck pain patients (https://link.springer.com/article/10.1007/s00586-021-07019-4)*"; e "*Assessment of the Reliability of the Leg Lateral Reach Test to Measure Thoraco-Lumbo-Pelvic Rotation in Individuals With Chronic Low Back Pain (http://dx.doi.org/10.1016/j.jmpt.2021.12.001)*".

- Cid André Fidelis de Paula Gomes, Universidade Nove de Julho:

  Elaboração dos artigos: "*The 9-item Tampa Scale for Kinesiophobia (TSK-9) has adequate measurement properties in patients with chronic low back pain*"; "*Tampa Scale for Kinesiophobia in chronic neck pain patients (TSK-neck): structural and construct validity and reliability in a Brazilian population (http://dx.doi.org/10.1186/s12891-024-07268-6)*"; "*15-item Roland-Morris Disability Questionnaire (RMDQ-15): structural and criterion validity on patients with chronic low back pain (http://dx.doi.org/10.1186/s12891-022-05953-y)*"; "*The Brazilian version of the work role functioning questionnaire 2.0 with 5 items (WRFQ-5) has adequate measurement properties (https://doi.org/10.1080/09593985.2022.2163211)*"; "*The best structure of the Tampa Scale for Kinesiophobia for patients with chronic low back pain has two domains and nine items (https://doi.org/10.1177/02692155221128829)*"; "*Ten-*

Item Lower Extremity Functional Scale (LEFS-10): Instrument Reduction Based on Brazilian Patients With Lower Limb Dysfunction (https://doi.org/10.1016/j.apmr.2022.09.010)"; "*Women with fibromyalgia (ACR criteria) compared with women diagnosed by doctors and women with osteoarthritis: Cross-sectional study using functional and clinical variables (http://dx.doi.org/10.1111/1756-185X.14720)*"; "*Comparison between pain intensity, functionality, central sensitization, and self-efficacy in individuals with unilateral or bilateral knee osteoarthritis: a cross-sectional study (https://doi.org/10.1590/1806-9282.20220170)*"; "*The internal structure of Brazilian versions of disability questionnaires in patients with chronic low back pain: A cross-sectional study (https://doi.org/10.1016/j.msksp.2022.102587)*"; e "*The Short-Form Neck Disability index has adequate measurement properties in chronic neck pain patients (https://link.springer.com/article/10.1007/s00586-021-07019-4)*".

- Marcelo Cardoso de Souza, Universidade Federal do Rio Grande do Norte:

  Publicação dos artigos: "*What are the effects of dry cupping therapy combined with the McKenzie Method on clinical outcomes in chronic low back pain? A protocol for a randomized, sham-controlled trial*"; "*Dry cupping therapy has no effect on pain, function, or quality of life in women with knee osteoarthritis: Blind randomized placebo-controlled trial*"; "*Use of cupping therapy in musculoskeletal disorders: A cross-sectional study on the profile, training, and practice of Brazilian physical therapists (https://doi.org/10.1016/j.msksp.2024.102943)*"; "*Effects of insoles adapted in flip-flop sandals in patients with persistent plantar heel pain: A sham-controlled randomised trial (http://dx.doi.org/10.1177/02692155241267991)*"; "*Do the instruments used to assess fibromyalgia symptoms according to American College of Rheumatology criteria generate similar scores in other chronic musculoskeletal pain? (http://dx.doi.org/10.1186/s12891-023-06572-x)*"; "*Social variables for replication of studies using mean scores of social support, self-care, and fibromyalgia knowledge: a cross-sectional study*

(http://dx.doi.org/10.1007/s00296-023-05374-7)"; "*Effects of progressive intensity resistance training on the impact of fibromyalgia: protocol for a blinded randomized controlled trial (http://dx.doi.org/10.1186/s12891-023-06952-3)*"; e "*Measurement properties of the Brazilian online version of the Fibromyalgia Rapid Screening Tool (FiRST)* (http://dx.doi.org/10.1186/s42358-022-00271-2)".

- Josimari Melo De Santana, Universidade Federal de Sergipe:

  Publicação dos artigos: "*Do the instruments used to assess fibromyalgia symptoms according to American College of Rheumatology criteria generate similar scores in other chronic musculoskeletal pain? (http://dx.doi.org/10.1186/s12891-023-06572-x)*"; "*Social variables for replication of studies using mean scores of social support, self-care, and fibromyalgia knowledge: a cross-sectional study (http://dx.doi.org/10.1007/s00296-023-05374-7)*"; e "*Effects of progressive intensity resistance training on the impact of fibromyalgia: protocol for a blinded randomized controlled trial (http://dx.doi.org/10.1186/s12891-023-06952-3)*".

- Ana Claudia Muniz Renno, Universidade Federal de São Paulo:

  Publicação do artigo: "*Impact of an associated aerobic exercise protocol and photobiomodulation on pain and sleep quality in women with fibromyalgia: a randomized controlled trial.*

1.2.2 Parcerias internacionais

- Amaranta De Miguel-Rubio, University of Cordoba, Cordoba, Espanha:

  Publicação do artigo: "*Social variables for replication of studies using mean scores of social support, self-care, and fibromyalgia knowledge: a cross-sectional study (http://dx.doi.org/10.1007/s00296-023-05374-7)*".

1.3 Programa de Estágio Supervisionado em Capacitação Docente

Os estágios representaram uma etapa crucial deste percurso acadêmico, proporcionando uma oportunidade única de imersão em diferentes contextos acadêmicos:

a) Capacitação Docente em Fisioterapia II (FIT-516) na disciplina Recursos Eletrotermofototerapêuticos da UFSCar.

b) Capacitação Docente em Fisioterapia III (FIT-531) no estágio de Fisioterapia em Ortopedia e Traumatologia II da graduação em Fisioterapia da UFSCar.

1.4 Originalidade

Esta tese de doutorado se destaca por desenvolver estudos observacionais e experimentais para avaliar e tratar a fibromialgia por meio de métodos não-farmacológicos.

1.5 Contribuição dos resultados da pesquisa para o avanço científico

Os resultados desta tese propõem variáveis sociais para avaliar pessoas com fibromialgia e preenchem a lacuna sobre os efeitos de diferentes tipos de exercícios físicos sobre o impacto da doença.

1.6 Relevância social

A fibromialgia possui prevalência mundial e afeta negativamente a qualidade de vida das pessoas. Por meio de nossas descobertas, esta tese de doutorado fornece resultados importantes para uma avaliação contemplando o modelo biopsicossocial, estimula o apoio social para garantir a adesão ao tratamento proposto e propõe protocolos para o tratamento dessas pessoas com diferentes programas de exercícios físicos, considerando a preferência de cada um.

1.7 Lista de referências de artigos desenvolvidos pelo discente durante o Doutorado

ARTIGOS PUBLICADOS COM O GRUPO DE PESQUISA DA ORIENTADORA E COMO AUTOR SOLO – FIBROMIALGIA E DOR CRÔNICA

1. Strength training vs. walking on the fibromyalgia impact: a blinded randomized controlled trial. **Musculoskeletal Care**, 2026. Doi: https://dx.doi.org/10.1002/msc.70186 ;
2. Stretching exercises or walking did not produce clinically meaningful improvements in the quality of life of patients with fibromyalgia: A non-randomized controlled clinical trial. **Fisioterapia (Madrid. ed. impresa)**, 2026. Doi: https://doi.org/10.1016/j.ft.2026.01.001 ;

3. Acute responses of strength training and walking on experimental pain modulation in women with fibromyalgia: an exploratory quasi-experimental study. **Sport Sciences For Health**, 2026. Doi: http://dx.doi.org/10.1007/s11332-026-01678-w
4. Examining clinical and sociodemographic variables and social support on exercise adherence in women with fibromyalgia: A cohort study. **Sport Sciences for Health**, 2025. Doi: https://doi.org/10.1007/s11332-025-01386-x ;
5. Effects of strength training on conditioned pain modulation in patients with fibromyalgia: A Prospective Experimental Study. **Revista da Associação Médica Brasileira**, 2025. Doi: https://doi.org/10.1590/1806-9282.20250109 ;
6. Autonomic nervous system dysfunction may be associated with low self-efficacy in patients with nonspecific chronic low back pain: A cross-sectional inferential analysis. **Rehabilitación (Madrid. Ed. impresa)**, 2025. Doi: https://doi.org/10.1016/j.rh.2025.100912;
7. Do the instruments used to assess fibromyalgia symptoms according to American College of Rheumatology criteria generate similar scores in other chronic musculoskeletal pain? **BMC Musculoskeletal Disorders**, v. 24, n. 1, p. 467, 2023. Doi: https://doi.org/10.1186/s12891-023-06572-x ;
8. Social variables for replication of studies using mean scores of social support, self-care, and fibromyalgia knowledge: a cross-sectional study. **Rheumatology International**, v. 43, n. 9, p. 1705-1721, 2023. Doi: https://doi.org/10.1007/s00296-023-05374-7 ;
9. Effects of progressive intensity resistance training on the impact of fibromyalgia: protocol for a blinded randomized controlled trial. **BMC Musculoskeletal Disorders**, v. 24, n. 1, p. 816, 2023. Doi: https://doi.org/10.1186/s12891-023-06952-3 ;
10. The best structure of the Tampa Scale for Kinesiophobia for patients with chronic low back pain has two domains and nine items. **Clinical Rehabilitation**, v. 37, n. 3, p. 407-414, 2023. Doi: https://doi.org/10.1177/02692155221128829 ;
11. The internal structure of Brazilian versions of disability questionnaires in patients with chronic low back pain: a cross-sectional study. **Musculoskeletal Science and Practice**, v. 60, p. 102587, 2022. Doi: https://doi.org/10.1016/j.msksp.2022.102587 ;
12. The Short-Form Neck Disability index has adequate measurement properties in chronic neck pain patients. **European Spine Journal**, v. 30, p. 3593-3599, 2021. Doi: https://doi.org/10.1007/s00586-021-07019-4 ;
13. Assessment of the reliability of the leg lateral reach test to measure thoraco-lumbo-pelvic rotation in individuals with chronic low back pain. **Journal of Manipulative and**

Physiological Therapeutics, v. 44, n. 7, p. 566-572, 2021. Doi: https://doi.org/10.1016/j.jmpt.2021.12.001 ;

14. Effects of nature-based multisensory stimulation on pain mechanisms in fibromyalgia: randomized controlled trial discussion. **Pain Management Nursing**, v. 26 (2), p. 131-133, 2025. Doi: https://doi.org/10.1016/j.pmn.2024.08.009 ;
15. Comparison between pain intensity, functionality, central sensitization, and self-efficacy in individuals with unilateral or bilateral knee osteoarthritis: a cross-sectional study. **Revista da Associação Médica Brasileira**, v. 68, n. 8, p. 1048-1052, 2022. Doi: https://doi.org/10.1590/1806-9282.20220170 ;
16. Women with fibromyalgia (ACR criteria) compared with women diagnosed by doctors and women with osteoarthritis: Cross-sectional study using functional and clinical variables. **International Journal of Rheumatic Diseases**, v. 26, n. 11, p. 2278-2283, 2023. Doi: https://doi.org/10.1111/1756-185x.14720 ;
17. Measurement properties of the Brazilian online version of the Fibromyalgia Rapid Screening Tool (FiRST). **Advances in Rheumatology**, v. 62, p. 39, 2022. Doi: https://doi.org/10.1186/s42358-022-00271-2 ;
18. The 9-item Tampa Scale for Kinesiophobia (TSK-9) has adequate measurement properties in patients with chronic low back pain. **Clinical Rehabilitation**, 2025. Doi: https://dx.doi.org/10.1177/02692155251315060 ;
19. What are the effects of dry cupping therapy combined with the McKenzie Method on clinical outcomes in chronic low back pain? A protocol for a randomized, sham-controlled trial. **BMC Complementary Medicine and Therapies**, 2025. Doi: https://doi.org/10.1186/s12906-025-04940-9 ;
20. Dry cupping therapy has no effect on pain, function, or quality of life in women with knee osteoarthritis: Blind randomized placebo-controlled trial. **Brazilian Journal of Physical Therapy**, 2026. https://dx.doi.org/10.1016/j.bjpt.2025.101259 ;
21. Do Fibromyalgia Patients Have a Preferred Resistance Training Volume? Protocol for a Randomized Crossover Clinical Trial. **Physiotherapy Research International**. https://doi.org/10.1002/pri.70101 .

EDITORIAIS E CARTAS AO EDITOR

1. Are We Relaxing Muscles or Lowering Standards? Interpreting Pharmacological Effects in Fibromyalgia. **Regional Anesthesia and Pain Medicine**, 2026. Doi: http://dx.doi.org/10.1136/rapm-2025-107526 ;

2. Current Evidence on TNX-102 SL (Cyclobenzaprine HCl Sublingual) for Fibromyalgia: Strengths, Limitations, and Emerging Hypotheses. **Clinical Rheumatology**, 2026. Doi: http://dx.doi.org/10.1007/s10067-025-07903-0 ;
3. Exercise dose, measurement reliability, and mechanistic inference in fibromyalgia trials: a critical appraisal. Lancet Regional Health-Americas, 2026. Doi: http://dx.doi.org/10.1016/j.lana.2026.101384 ;
4. Is aquatic therapy more effective than land-based therapy for fibromyalgia? A randomised controlled trial discussion. **Physiotherapy**, v. 127, p. 101425, 2025. Doi: https://doi.org/10.1016/j.physio.2024.101425 ;
5. Dry needling is not superior to sham and/or no intervention for fibromyalgia when the trial is analyzed using the intention-to-treat principle and linear mixed models. **PM&R**. https://doi.org/10.1002/pmrj.70004 ;
6. Musculoskeletal rehabilitation in controlled trials: Is it correct to compare different types of exercise? **Sao Paulo Medical Journal**, 2025. Doi: https://doi.org/10.1590/1516-3180.2024.0374.29012025 ;
7. Fibromyalgia: a new set of diagnostic criteria based on the biopsychosocial model. **Rheumatology**, v. 63 (8), p. 2037-2039, 2024. Doi: https://doi.org/10.1093/rheumatology/keae074 ;
8. Is Pilates more effective than aerobic exercise in the treatment of fibromyalgia? Discussing a clinical trial. **European Journal of Pain**, v. 28 (7), p. 1242-1243, 2024. Doi: https://doi.org/10.1002/ejp.2264 ;
9. The ineffectiveness of stretching exercises in patients with fibromyalgia: a systematic review discussion. **Clinical Rheumatology**, v. 43 (12), p. 4021-4022, 2024. Doi: https://doi.org/10.1007/s10067-024-07197-8 ;
10. Diagnosis of fibromyalgia through the biopsychosocial model: combining the criteria written by Wolfe with those proposed by Pontes-Silva. **Clinical and experimental rheumatology**, 2024. Doi: https://doi.org/10.55563/clinexprheumatol/7r1qol ;
11. Fibromyalgia: Are we using the biopsychosocial model? **Autoimmunity reviews**, v. 22, n. 1, p. 103235, 2023. Doi: https://doi.org/10.1016/j.autrev.2022.103235 ;
12. We are looking at fibromyalgia as usual: a discussion of the meaning and consequences of fibromyalgia in the biomedical model. In: **Seminars in Arthritis and Rheumatism**. p. 152261-152261, 2023. Doi: https://doi.org/10.1016/j.semarthrit.2023.152261 ;

13. Evidence-based health: mathematical strategies for translating scientific findings into routine clinical care. **Revista da Associação Médica Brasileira**, v. 69, p. 1-2, 2023. Doi: http://dx.doi.org/10.1590/1806-9282.20230935 ;
14. Recommendations for randomised controlled trials on fibromyalgia and myalgic encephalomyelitis. **Autoimmunity reviews**, v. 21, n. 9, p. 103146, 2022. Doi: https://doi.org/10.1016/j.autrev.2022.103146 ;
15. A mathematical model to compare muscle-strengthening exercises in the musculoskeletal rehabilitation. **Musculoskeletal Science and Practice**, v. 6, p. 102635, 2022. Doi: http://dx.doi.org/10.1016/j.msksp.2022.102635.

ARTIGOS PUBLICADOS EM PARCERIA COM OUTROS GRUPOS DE PESQUISA E COMO AUTOR SOLO – MEDICINA, FISIOTERAPIA E EDUCAÇÃO FÍSICA

1. Brazilian version of the cognitive risk profile for pain scale: translation, cross-cultural adaptation, and validation. **Sao Paulo Medical Journal**, 2026. Doi: http://dx.doi.org/10.1590/1516-3180.2025.0007.R1.23092025 ;
2. Amygdala-Centered Mechanisms of Pain Amplification and Chronification in Fibromyalgia and Migraine: Narrative Review. Behavioural Brain Research, 2026. Doi: http://dx.doi.org/10.1016/j.bbr.2026.116071 ;
3. Use of Cupping Therapy in Musculoskeletal Disorders: A cross-sectional study on the Profile, Training, and Practice of Brazilian Physical Therapists. **Musculoskeletal Science and Practice**, v. 71, p. 1-6, 2024. Doi: http://dx.doi.org/10.1016/j.msksp.2024.102943 ;
4. 15-item Roland-Morris Disability Questionnaire (RMDQ-15): structural and criterion validity on patients with chronic low back pain. **BMC Musculoskeletal Disorders**, v. 23, p. 1-8, 2023. Doi: http://dx.doi.org/10.1186/s12891-022-05953-y ;
5. The Brazilian version of the Work Role Functioning Questionnaire 2.0 with 5 items (WRFQ-5) has adequate measurement properties. **Physiotherapy Theory and Practice**, v. 40, p. 880-886, 2023. Doi: http://dx.doi.org/10.1080/09593985.2022.2163211 ;
6. Ten-Item Lower Extremity Functional Scale (LEFS-10): Instrument Reduction Based on Brazilian Patients with Lower Limb Dysfunction. **Archives Of Physical Medicine and Rehabilitation**, v. 104, p. 438-443, 2023. Doi: http://dx.doi.org/10.1016/j.apmr.2022.09.010 ;
7. Effects of insoles adapted in flip-flop sandals in patients with persistent plantar heel pain: a sham-controlled randomised trial. **Clinical Rehabilitation**, v. 38, p. 1466-1480, 2024. Doi: http://dx.doi.org/10.1177/02692155241267991 ;

8. Magnesium deficiency and its interaction with the musculoskeletal system, exercise, and connective tissue: An evidence synthesis. **Sport Sciences for Health**, v. 20, p. 715-726, 2024. Doi: http://dx.doi.org/10.1007/s11332-024-01179-8 ;
9. The cerebellum and its connections to other brain structures involved in motor and non-motor functions: a comprehensive review. **Behavioural Brain Research**, v. 465, p. 1-13, 2024. Doi: http://dx.doi.org/10.1016/j.bbr.2024.114933 ;
10. Applied Physiology: Gut Microbiota and Antimicrobial Therapy. **European Journal of Applied Physiology**, v. 124, p. 1631-1643, 2024. Doi: http://dx.doi.org/10.1007/s00421-024-05496-1 ;
11. Gut Microbiota and Liver Regeneration: A Synthesis of Evidence on Structural Changes and Physiological Mechanisms. **Journal of Clinical and Experimental Hepatology**, v. 14, p. 1-16, 2024. Doi: http://dx.doi.org/10.1016/j.jceh.2024.101455 ;
12. Zinc Pathogenic Importance in Correcting Immunity and Restoring Public Health in the Post-Covid Period: An Overview. **Cytokine**, 2024. Doi: http://dx.doi.org/10.1016/j.cyto.2024.156761 ;
13. Tourette Syndrome and Obsessive-Compulsive Disorder: A Comprehensive Review of Structural Alterations and Neurological Mechanisms. **Behavioural Brain Research**, v. 453, p. 114606, 2023. Doi: http://dx.doi.org/10.1016/j.bbr.2023.114606 ;
14. Effects of the COVID-19 pandemic on the health of medical students transitioning from traditional education to distance learning: a prospective cohort. **BMC Medical Education**, 2025. Doi: http://dx.doi.org/10.1186/s12909-024-06407-w ;
15. Mathematical Model for Predicting Handgrip Strength in Quilombola Children and Adolescents: A Cross-Sectional Study. **Retos-Nuevas Tendencias En Educacion Fisica Deporte Y Recreacion**, v. 62, p. 26-30, 2025. Doi: http://dx.doi.org/10.47197/retos.v62.108681 ;
16. Work-related musculoskeletal disorders in vulnerable populations: what are the most common body parts affected?. BMC **Public Health**, v. 23, p. 1-6, 2023. Doi: http://dx.doi.org/10.1186/s12889-023-16570-2 ;
17. Physical inactivity level and lipid profile in traditional communities in the Legal Amazon: a cross-sectional study. BMC **Public Health**, v. 22, p. 1-9, 2022. Doi: http://dx.doi.org/10.1186/s12889-022-12973-9 ;
18. Anthropometric Profile of the Brazilian Male Judo Team: cross-sectional study. **Retos-Nuevas Tendencias En Educacion Fisica Deporte Y Recreacion**, v. 63, p. 44-54, 2025. Doi: http://dx.doi.org/10.47197/retos.v64.110475.

EDITORIAIS E CARTAS AO EDITOR

1. Aerobic, resistance, or combined exercise training and its outcomes on cardiovascular risk profile in overweight or obese adults via a CardioRACE trial: a gap. **European Heart Journal**, v. 45, p. 2456-2457, 2024. Doi: http://dx.doi.org/10.1093/eurheartj/ehae233 ;
2. Is morning exercise really better for you?. **The Journal of Physiology**, v. 602, p. 2677-2678, 2024. Doi: http://dx.doi.org/10.1113/JP286776 ;
3. Different Exercises Generate Similar Musculoskeletal Adaptations – The Difference Is in the Total Work. **Orthopaedic Journal of Sports Medicine**, v. 10, p. 1, 2023. Doi: http://dx.doi.org/10.1177/23259671231201123 ;
4. Total work equalization: a mathematical strategy for the comparison of different exercises in clinical trials. **Brazilian Journal of Physical Therapy**, 2026. Doi: https://doi.org/10.1016/j.bjpt.2025.101564 ;
5. Human metabolism and body composition: prospects for novel studies. **Nutrition Reviews**, v. 82, p. 5-8, 2023. Doi: http://dx.doi.org/10.1093/nutrit/nuad040 ;
6. Brazilian pulmonology guidelines on Delphi panel for post-coronavirus disease 2019: reflections on persons deprived of liberty. **Revista Da Associação Médica Brasileira**, v. 69, p. 1-4, 2023. Doi: http://dx.doi.org/10.1590/1806-9282.20230965 .

ARTIGOS SUBMETIDOS

1. Structure and cut-off point of the Short Form - Central Sensitization Inventory for Primary Dysmenorrhea (SF-SCI-PD).
2. Sleep disturbances are not a risk factor for treatment dropout among adults with fibromyalgia undergoing exercise-based interventions: A Case–Control Study
3. Higher Widespread Pain Index Scores May Reduce the Likelihood of Exercise-Based Treatment Dropout in adults with Fibromyalgia: A Case–Control Study

RESUMOS PUBLICADOS EM ANAIS DE EVENTOS

1. Alongamento É Semelhante Ao Treinamento De Força Com Intensidade Constante Na Redução De Impacto Da Fibromialgia: Estudo Clínico De Equivalência. In: V Congresso Brasileiro e Internacional da ABRAFITO - COBRAFITO, 2025, Florianópolis. Anais do evento, 2025.
2. Existe relação entre o volume do treino resistido e a preferência de mulheres com fibromialgia?. In: V Congresso Brasileiro e Internacional da ABRAFITO - COBRAFITO, 2025, Florianópolis. Anais do evento, 2025.

3. Exercícios De Alongamento São Ineficazes Para Reduzir O Impacto Da Fibromialgia: Uma Análise Experimental Com Um Grupo Controle-positivo. In: V Congresso Brasileiro e Internacional da ABRAFITO - COBRAFITO, 2025, Florianópolis. Anais do evento, 2025.
4. Como se comporta a intensidade da dor em mulheres com fibromialgia submetidas a diferentes volumes de treino resistido?. In: V Congresso Brasileiro e Internacional da ABRAFITO - COBRAFITO, 2025, Florianópolis. Anais do evento, 2025.
5. Bacharéis em Fisioterapia ou Educação Física não estão cientificamente preparados para a reabilitação musculoesquelética usando o exercício físico na reumatologia. In: V Congresso Brasileiro e Internacional da ABRAFITO - COBRAFITO, 2025, Florianópolis. Anais do evento, 2025.
6. Motivos para aderir e para abandonar o exercício físico: relatos de pacientes com fibromialgia. In: XXIX Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - 45 anos da Fisioterapia na UFSCar, 2024, São Carlos. Anais do evento, 2024.
7. Existe diferença significativa entre as analgesias induzidas por diferentes tipos de exercício físico? In: XXIX Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - 45 anos da Fisioterapia na UFSCar, 2024, São Carlos. Anais do evento, 2024.
8. Pacientes com fibromialgia se sentem acolhidas pelos seus parceiros amorosos e seus familiares? In: XXIX Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - 45 anos da Fisioterapia na UFSCar, 2024, São Carlos. Anais do evento, 2024.
9. Associação entre a Classificação Internacional de Funcionalidade (CIF) e os desfechos investigados na fibromialgia. In: XXIX Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - 45 anos da Fisioterapia na UFSCar, 2024, São Carlos. Anais do evento, 2024.
10. Modulação condicionada da dor antes e após três meses de exercício físico em pacientes com fibromialgia. In: XXIX Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - 45 anos da Fisioterapia na UFSCar, 2024, São Carlos. Anais do evento, 2024.
11. How Fibromyalgia Treatment and Diagnosis Are Performed in The City of São Carlos: A Cross-Sectional Study. In: 1st Student Scientific Conference of The Brazilian Association for Research and Postgraduate In Physiotherapy (ABRAPG-FT). Brazilian Journal of Physical Therapy, v. 28. p. 100634, 2024.
12. Do The Instruments Used to Assess Fibromyalgia Symptoms Generate Similar Scores In Other Chronic Musculoskeletal Pain? In: 1st Student Scientific Conference of The Brazilian

Association for Research and Postgraduate in Physiotherapy (ABRAPG-FT). Brazilian Journal of Physical Therapy, v. 28. p. 100635, 2024.

13. Conditioned pain modulation before and after three months of exercise in patients with fibromyalgia - Pain Science in Motion - University of Nevada, Las Vegas. In: Pain Science in Motion - University of Nevada, 2024, Las Vegas. Anais do evento, 2024.
14. Is there a significant difference between analgesia induced by different types of exercise in fibromyalgia? In: Pain Science in Motion - University of Nevada, 2024, Las Vegas. Anais do evento, 2024.
15. Modelo matemático para treinamento de força em indivíduos com disfunções musculoesqueléticas baseado em uma síntese de revisões sistemáticas. In: XIII Congresso Internacional de Educação Física e Motricidade Humana e XIX Simpósio Paulista de Educação Física, 2023, Rio Claro. Anais do evento, 2023.
16. Intensidade e volume de exercícios em pesquisas sobre disfunções musculoesqueléticas: variáveis esquecidas. In: 1º Congresso Científico Internacional de Educação Física (I CCIEF): Evidências para a prática profissional em exercício físico após a pandemia do COVID-19, 2022. Arquivos Brasileiros de Educação Física, 2022.
17. Avaliação de força muscular para carga máxima dinâmica em fibromiálgicos: desafios e perspectivas sobre o teste de 1-RM. In: XXVIII Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - Fisioterapia e Tecnologia: Estamos perto ou longe demais? 2022, São Carlos. Anais do evento, 2022.
18. Desfechos de diferentes exercícios em estudos sobre fibromialgia: nós estamos realizando comparações adequadas? In: XXVIII Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - Fisioterapia e Tecnologia: Estamos perto ou longe demais? 2022, São Carlos. Anais do evento, 2022.
19. Efeito do aeróbico em jejum na glicemia pós-prandial: ensaio clínico randomizado cruzado. In: 1º Congresso Científico Internacional de Educação Física (I CCIEF): Evidências para a prática profissional em exercício físico após a pandemia do COVID-19, 2022. Arquivos Brasileiros de Educação Física, 2022.
20. Avaliação do nível de atividade física, percepção da qualidade de vida e estresse em funcionários de uma escola pública em Miracema do Tocantins. In: 1º Congresso Científico Internacional de Educação Física (I CCIEF): Evidências para a prática profissional em exercício físico após a pandemia do COVID-19, 2022. Arquivos Brasileiros de Educação Física, 2022.

21. Fatores de risco para síndrome metabólica e percepção de qualidade de vida em um grupo de mulheres praticantes de exercício físico. In: 1º Congresso Científico Internacional de Educação Física (I CCIEF): Evidências para a prática profissional em exercício físico após a pandemia do COVID-19, 2022. Arquivos Brasileiros de Educação Física, 2022.
22. Avaliação nutricional e de desempenho em atletas de futebol de elite. In: 1º Congresso Científico Internacional de Educação Física (I CCIEF): Evidências para a prática profissional em exercício físico após a pandemia do COVID-19, 2022. Arquivos Brasileiros de Educação Física, 2022.
23. Relação da alimentação com a cognição no envelhecimento: um estudo piloto. In: 1º Congresso Científico Internacional de Educação Física (I CCIEF): Evidências para a prática profissional em exercício físico após a pandemia do COVID-19, 2022. Arquivos Brasileiros de Educação Física, 2022.

PRÊMIO

1. Melhor trabalho do I Congresso Científico Internacional de Educação Física (I CCIEF). Intensidade e volume de exercícios em pesquisas sobre disfunções musculoesqueléticas: variáveis esquecidas. In: 1º Congresso Científico Internacional de Educação Física: Evidências para a prática profissional em exercício físico após a pandemia do COVID-19, 2022. Arquivos Brasileiros de Educação Física, 2022.

PARTICIPAÇÃO EM EVENTOS, CONGRESSOS, EXPOSIÇÕES E FEIRAS

1. V Congresso Brasileiro e Internacional da ABRAFITO - COBRAFITO, Florianópolis, 2025.
2. Pain Science in Motion - University of Nevada, Las Vegas, USA - participante com exposição de resumo simples. 2024.
3. XXX Congresso de Iniciação Científica, XV Congresso de Iniciação Científica em Desenvolvimento Tecnológico e Inovação e III Congresso de Iniciação Científica do Ensino Médio - Universidade Federal de São Carlos (UFSCar) - participante com exposição de resumo simples. 2024.
4. 16º Congresso Brasileiro de Dor (CBDor) - participante com exposição de resumo simples. 2023.
5. I Fórum Discente da Associação Brasileira de Pós-graduação em Fisioterapia - participante com exposição de resumo simples. 2023.
6. XIII Congresso Internacional de Educação Física e Motricidade Humana e XIX Simpósio Paulista de Educação Física. Evento realizado na UNESP - Instituto de Biociências, Campus de Rio Claro (SP) - participante com apresentação oral. 2023.

7. XXIX Congresso de Iniciação Científica, XIV Congresso de Iniciação em Desenvolvimento Tecnológico e Inovação e II Congresso de Iniciação Científica do Ensino Médio, Universidade Federal de São Carlos (UFSCar) - participante com exposição de resumo simples. 2023.
8. XXIX Simpósio de Fisioterapia da Universidade Federal de São Carlos (UFSCar) - 45 anos da Fisioterapia na UFSCar - participante com apresentação oral. 2023.
9. XIII Congresso Internacional de Educação Física e Motricidade Humana e XIX Simpósio Paulista de Educação Física. Evento realizado na UNESP - Instituto de Biociências, Campus de Rio Claro (SP) - participante com apresentação oral. 2023.
10. XXVIII Simpósio de Fisioterapia da Universidade Federal de São Carlos - participante com apresentação oral. 2022.
11. I Congresso Científico Internacional de Educação Física (I CCIEF): Evidências para a prática profissional em exercício físico após a pandemia do COVID-19 - participante com exposição de resumo simples. 2022.

DEMAIS ATIVIDADES E PRODUTOS DESENVOLVIDOS PELO DISCENTE

1. **Cargo e/ou função:**

- Representante discente do Programa de Pós-Graduação em Fisioterapia (doutorado), 2022.
- Membro da Comissão de Autoavaliação do Programa de Pós-Graduação em Fisioterapia (mestrado e doutorado), 2022.

2. **Livro:**

- Dor: abordagens biomédica e biopsicossocial. 1. ed. Curitiba: CRV, 2022.

3. **Capítulo de livro:**

- Questionários e escalas de avaliação da dor cervical e lombar. In: Marcelo Faria Silva; Rafael Inácio Barbosa. (Org.). Programa de Atualização em Fisioterapia Traumato-ortopédica (PROFISIO). 4ed.Porto Alegre: Artmed Panamericana, 2023, v. 6, p. 67-92.
- Avaliação da pessoa com fibromialgia. In: Mariana Arias Avila; Cid André Fidelis-de-Paula-Gomes; Almir Vieira Dibai-Filho. (Org.). Métodos e técnicas de avaliação em dor crônica: abordagem prática. 1ed.Barueri: Manole, 2023, v. 1, p. 240-253.

4. **Aula/palestra ministrada:** Workshop de escrita científica: teoria e prática. Apresentação online para o Programa de Pós-Graduação em Ensino em Ciências e Saúde (PPGECS) da Universidade Federal do Tocantins. 2022.
5. **Editor de periódico científico (2023 – atual):**

- BMC Musculoskeletal Disorders;
- PLoS One;

- Discover Mental Health.

6. **Parecerista de periódico científico (2022 – atual):**

- Journal of Biomechanics;
- Archives of Physical Medicine and Rehabilitation;
- Indian Journal of Community Medicine;
- Scientific Reports;
- Health and Quality of Life Outcomes;
- Patient Preference and Adherence;
- Brazilian Journal of Pain;
- Journal of Pain Research;
- Jacc-Clinical Electrophysiology;
- Medical Devices-Evidence and Research;
- BMJ Open;
- Disability And Rehabilitation;
- Dementia & Neuropsychologia;
- Journal Of Bodywork and Movement Therapies;
- Science Progress;
- Psychology Research and Behavior Management;
- Annals Of Medicine;
- Open Access Journal of Sports Medicine;
- Physiotherapy Research International;
- Pflugers Archiv-European Journal of Physiology;
- Clinical Interventions in Aging;
- Rheumatology International;
- BMC Medical Education;
- Current Medical Research and Opinion;
- BMC Health Services Research;
- Medicine – Baltimore;
- Open Access Rheumatology-Research and Reviews;
- Lancet Regional Health-Americas;
- European Journal of Clinical and Experimental Medicine;
- Obesity Research & Clinical Practice;
- Brazilian Journal of Physical Therapy;

- Frontiers In Medicine;
- Journal Physical Therapy Education;
- Pain And Therapy;
- Sao Paulo Medical Journal;
- International Journal of Therapy and Rehabilitation;
- Journal of Musculoskeletal Surgery and Research;
- Otjr-Occupation Participation and Health;
- Journal Of Manipulative and Physiological Therapeutics;
- Journal Of Multidisciplinary Healthcare;
- Journal Of Pain;
- European Journal Of Pain;
- Sport Sciences for Health;
- Experimental Physiology;
- Journal of Orthopaedic Surgery and Research;
- Expert Review of Clinical Immunology;
- International Journal of Women's Health;
- International Archives of Occupational and Environmental Health;
- Retos-Nuevas Tendencias En Educacion Fisica Deporte Y Recreacion;
- Physiotherapy Theory And Practice;
- Journal of Human Kinetics;
- International Journal of Nursing Practice;
- Physical Medicine & Rehabilitation Journal;
- Cognitive Neuropsychiatry;
- JOSPT Open;
- Health Science Reports;
- Journal Of Back and Musculoskeletal Rehabilitation;
- The European Journal of Health Economics;
- Journal Of International Medical Research;
- Pain Management;
- Health Professions Education;
- BMC Complementary Medicine and Therapies;
- Clinical Rehabilitation;
- Archives of Public Health;

- Pain Research & Management;
- CLINICS;
- Medical Hypotheses.

7. **Orientação de trabalho de conclusão de graduação (concluído):** Aliny da Silva de Araujo. Ponto de corte para diagnosticar hipomobilidade da amplitude de rotação tóraco-lombo-pélvica por meio do leg lateral reach test (LLRT) em dor lombar crônica. Trabalho de Conclusão de Curso (Graduação em Fisioterapia) - Faculdade Santa Terezinha – CEST, 2024.
8. **Coorientação de trabalho de conclusão de graduação (concluído):**

- Bernard Romano Farani. Discrepância no comprimento dos membros inferiores é um fator de risco para o aumento da curvatura na escoliose idiopática do adolescente? Uma revisão sistemática. Trabalho de Conclusão de Curso (Graduação em Educação Física Bacharelado) - Universidade Federal de São Carlos, 2025.
- Thayná Soares de Melo. Efeitos de diferentes exercícios sobre a modulação da dor em pacientes com fibromialgia: um estudo experimental. Trabalho de Conclusão de Curso (Graduação em Fisioterapia) - Universidade Federal de São Carlos, Fundação de Amparo à Pesquisa do Estado de São Paulo, 2024.
- Giovanna Ferranti de Castro. Quais são as variáveis preditoras para a adesão aos exercícios aeróbio e resistido de pacientes com fibromialgia? Trabalho de Conclusão de Curso (Graduação em Fisioterapia) - Universidade Federal de São Carlos, Conselho Nacional de Desenvolvimento Científico e Tecnológico, 2024.

9. **Coorientação de trabalho de iniciação científica (concluído):**

- Thayná Soares de Melo. Efeitos de diferentes exercícios sobre a modulação da dor em pacientes com fibromialgia: um estudo experimental. 2023. Iniciação Científica. (Graduando em Fisioterapia) - Universidade Federal de São Carlos, Conselho Nacional de Desenvolvimento Científico e Tecnológico.
- Leticia Menegalli Santos. Controle inibitório nocivo difuso após três meses de exercício físico em pacientes com fibromialgia: um ensaio clínico controlado. 2023. Iniciação Científica. (Graduando em Fisioterapia) - Universidade Federal de São Carlos.
- Thayná Soares de Melo. Efeitos de diferentes exercícios sobre a modulação da dor em pacientes com fibromialgia: um estudo experimental. 2024. Iniciação Científica. (Graduando em Fisioterapia) - Universidade Federal de São Carlos, Fundação de Amparo à Pesquisa do Estado de São Paulo.

- Giovanna Ferranti de Castro. O apoio social é um fator de proteção para a adesão ao exercício em mulheres com fibromialgia: um estudo prospectivo. 2024. Iniciação Científica. (Graduando em Fisioterapia) - Universidade Federal de São Carlos, Conselho Nacional de Desenvolvimento Científico e Tecnológico.
- Letícia Menegalli Santos. Controle inibitório nóxio difuso após três meses de treinamento de força em pacientes com fibromialgia: estudo longitudinal. 2024. Iniciação Científica. (Graduando em Fisioterapia) - Universidade Federal de São Carlos, Fundação de Amparo à Pesquisa do Estado de São Paulo.

1.8 Link do currículo e demais plataformas acadêmicas do pesquisador (Pontes-Silva A.)

Curriculum (Lattes): http://lattes.cnpq.br/3835052088266167 ;

ORCID: https://orcid.org/0000-0002-3983-5342 ;

Scopus: http://www.scopus.com/inward/57222602583;

Google Acadêmico: https://scholar.google.com.br/X1vpqXYAAAAJ&hl ;

FAPESP: https://bv.fapesp.br/pt/pesquisador/726141/Andre-Pontes-Silva/.

1.9 Descrição da tese para o público leigo

Esta tese de doutorado identificou e sugeriu estratégias que devem ser usadas para avaliar pessoas com fibromialgia. Além disso, ela testou e propôs diferentes programas de exercício físico capazes de gerar benefícios clínicos e melhorar a qualidade de vida das pessoas. Portanto, os estudos produzidos nesta tese subsidiam e orientam a avaliação, a adesão ao tratamento não-farmacológico e o acompanhamento das pessoas com fibromialgia durante e após a intervenção utilizada pelo profissional de saúde responsável pelos cuidados oferecidos para promover, proteger e recuperar a saúde.

2 REVISÃO DA LITERATURA

A revisão da literatura desta tese será apresentada em uma estrutura organizada que possibilitará a compreensão dos assuntos relevantes que nortearam o desenvolvimento das cinco pesquisas apresentadas.

2.1 Fibromialgia

A fibromialgia (CID M79.7) é uma disfunção musculoesquelética crônica que afeta principalmente mulheres (JONES *et al.*, 2024). Caracteriza-se por dor crônica generalizada e vários sintomas somáticos e psicológicos, como fadiga, distúrbios do sono, ansiedade e depressão (MACFARLANE *et al.*, 2017). A fibromialgia tem característica multifatorial e o seu mecanismo fisiopatológico, bem como a sua etiologia, permanecem incertos, incluindo sinalização anormal da dor, predisposições genéticas e atividades neurológicas (GYORFI; RUPP; ABD-ELSAYED, 2022).

Em outras palavras, as evidências científicas mais recentes não fornecem uma descrição clara sobre a patogênese da fibromialgia (CLAUW *et al.*, 2024). Além disso, devido à sua complexidade, pode ser impossível identificar um único fator etiológico (JONES *et al.*, 2024). No entanto, espera-se que, no futuro, seja possível reconhecer diferentes subgrupos de pessoas com fibromialgia, nos quais um ou mais elementos específicos predominem, ajudando pesquisadores e clínicos a compreenderem melhor esse fenômeno (CLAUW *et al.*, 2024).

Na revisão de Marques *et al.*, a literatura indicou valores de prevalência de fibromialgia na população geral entre 0,2 e 6,6%; valores entre 2,4 e 6,8% em mulheres; entre 0,7 e 11,4% em áreas urbanas e entre 0,1 e 5,2% em áreas rurais (MARQUES *et al.*, 2017). Entretanto, o estudo foi publicado em 2017, próximo ao lançamento dos critérios para o diagnóstico da fibromialgia em 2016, cuja proposta gerou novas pesquisas sobre a doença e colocou novos dados na literatura (WOLFE *et al.*, 2016). Diante disso, permanecem incertezas sobre a prevalência e as despesas relacionadas à fibromialgia (CABO-MESEGUER; CERDÁ-OLMEDO; TRILLO-MATA, 2017).

Atualmente, sabe-se que a fibromialgia representa um fardo econômico substancial para os pacientes, suas famílias e para os sistemas de saúde. Estimativas de custos anuais totais diretos por pessoa variam de US$ 1.750 a US$ 35.920 nos Estados Unidos e de US$ 1.250 a US$ 8.504 na Europa. Pessoas com fibromialgia têm custos diretos e indiretos consideráveis associados à doença. Por isso, pesquisas que promovam uma melhor compreensão sobre a fibromialgia podem levar a um tratamento mais econômico (D'ONGHIA *et al*., 2022).

Neste contexto, a literatura sugere uma possível associação entre a gravidade da doença e os custos. Diante disso, acredita-se que uma introdução precoce da terapia pode contribuir para reduzir os custos diretos e indiretos. Assim, estudos que explorem todas as dimensões da fibromialgia continuam sendo relevantes, uma vez que a desmistificação dessa condição pode não apenas melhorar a qualidade de vida das pessoas com fibromialgia, mas também reduzir os custos associados à doença e possibilitar um diagnóstico rápido (D'ONGHIA *et al*., 2022).

2.2 Diagnóstico de fibromialgia: uma batalha entre os modelos biomédico e biopsicossocial

As ciências da saúde apresentam o modelo biopsicossocial como uma maneira de ajudar a compreender a experiência das pessoas que sofrem com disfunção musculoesquelética, afirmando que elementos biológicos, neuropsicológicos e sociais desempenham um papel importante nos processos relacionados à dor crônica (CHILDERHOSE *et al*., 2023). Essa discussão foi apresentada na definição de saúde proposta pela Organização Mundial da Saúde (OMS) em 1948, que afirma: saúde é um estado de completo bem-estar físico, mental e social, e não apenas a ausência de doença (ROSIGNOLI *et al*., 2022).

O modelo biopsicossocial foi então aprimorado pela OMS com a Classificação Internacional de Funcionalidade, Incapacidade e Saúde, que aborda a complexa interação entre as condições de saúde, as pessoas e o ambiente em que as pessoas vivem, visando compreender os desfechos de saúde em termos de incapacidade (ROSIGNOLI *et al*., 2022). Por isso, o modelo biopsicossocial superou o modelo biomédico, que se concentra em mecanismos puramente biológicos (CHILDERHOSE *et al*.,

2023). No entanto, o modelo de avaliação biopsicossocial para pessoas com fibromialgia foi negligenciado ao longo do processo histórico de elaboração de diretrizes diagnósticas (PONTES-SILVA *et al*., 2023a).

Em 1990, foram publicados os primeiros critérios diagnósticos para fibromialgia, quais sejam, dor generalizada combinada com sensibilidade em onze ou mais dos dezoito pontos dolorosos específicos (WOLFE *et al*., 1990). Além disso, era necessário haver uma história de pelo menos três meses de dor generalizada em algumas regiões do esqueleto axial e em pelo menos três dos quatro quadrantes do corpo (ou, excepcionalmente, em dois opostos em relação aos dois eixos de divisão corporal) (MACFARLANE *et al*., 2017). Esse tipo de avaliação caracteriza um modelo biomédico para o diagnóstico da fibromialgia, pois desconsidera os fatores psicológicos e sociais sugeridos pela OMS (PONTES-SILVA, 2024a).

Em 2010, surgiu uma nova versão dos critérios diagnósticos baseada no índice de dor generalizada e na escala de severidade dos sintomas (WOLFE *et al*., 2010). O índice de dor generalizada inclui uma lista de 19 áreas dolorosas, e a escala de gravidade dos sintomas avalia a fadiga, o despertar não revigorado e os sintomas cognitivos, bem como uma lista de verificação de 41 sintomas adicionais. Esse tipo de avaliação caracteriza novamente um modelo biomédico para o diagnóstico da fibromialgia, pois não considera os fatores sociais sugeridos pela OMS (CHILDERHOSE *et al*., 2023).

Em 2011, Wolfe *et al*. modificaram os critérios diagnósticos de 2010, substituindo a estimativa do médico sobre a gravidade dos sintomas somáticos pela soma de três sintomas específicos autorrelatados, pois a exigência de um exame médico representava uma grande barreira para a compreensão das características associadas à fibromialgia (WOLFE *et al*., 2011; WOLFE; HÄUSER, 2011). Por isso, as semelhanças entre os critérios de 2010 e 2011 destacam novamente o modelo biomédico (PONTES-SILVA, 2024a).

Em 2016, os critérios foram atualizados novamente (WOLFE *et al*., 2016). Desta vez, a dor generalizada deveria estar presente em pelo menos quatro das cinco regiões do corpo, deveria haver

sintomas em um nível semelhante há pelo menos três meses, deveria haver sete pontos no índice de dor generalizada somados a cinco pontos na escala de severidade dos sintomas (ou a combinação de quatro pontos de dor e nove de severidade). Embora essa atualização tenha sido relevante para incluir variáveis cognitivas na avaliação da fibromialgia, as variáveis sociais permaneceram fora da análise (PONTES-SILVA, 2024a).

Em 2019, a Sociedade Americana de Dor propôs um novo sistema de diagnóstico da fibromialgia (ARNOLD *et al*., 2019). Nesta proposta, outras condições devem ser descartadas como a principal razão explicativa para os sintomas (GALVEZ-SÁNCHEZ; REYES DEL PASO, 2020). Também é necessário que a pessoa apresente dor em seis ou mais dos nove possíveis pontos de dor, distúrbios de sono e fadiga por pelo menos três meses. Além disso, deve-se observar a presença de sensibilidade, disfunção cognitiva, rigidez musculoesquelética e hipervigilância (ARNOLD *et al*., 2019). Novamente, nota-se uma avaliação pautada no modelo biomédico.

Em 2024, Pontes-Silva propôs novos critérios para o diagnóstico da fibromialgia, usando o modelo biopsicossocial, que inclui a avaliação do componente social por meio da socialização da pessoa com fibromialgia e de suas percepções e sentimentos a respeito do contexto (PONTES-SILVA, 2024a). O artigo foi publicado pelo grupo Oxford na revista oficial da Sociedade Britânica de Reumatologia. De acordo com esses critérios, as pessoas diagnosticados com fibromialgia devem ser divididos em dois subgrupos: pessoas com fibromialgia e componente social afetado; e pessoas com fibromialgia e componente social não afetado (PONTES-SILVA, 2024b).

2.3 Exercício físico: um tratamento não-farmacológico para a fibromialgia

As recomendações atuais para o tratamento da fibromialgia incluem uma abordagem multidisciplinar que abrange psicoterapia, exercício físico e uso de medicamentos (JONES *et al.*, 2024). Neste contexto, estudos mostram que os tratamentos para fibromialgia que incluem exercícios físicos são mais eficazes e melhoram a saúde de maneira geral (BUSCH *et al*., 2013), pois os

benefícios se estendem para além da melhora dos parâmetros musculoesqueléticos (AMBROSE; GOLIGHTLY, 2015).

Postula-se que a analgesia proveniente do exercício físico ocorre por meio de diversos mecanismos, como redução da presença de citocinas anti-inflamatórias; regulação da liberação de alguns neurotransmissores que podem estar reduzidos em pessoas com dor crônica (SLUKA; FREY-LAW; HOEGER BEMENT, 2018; TAJERIAN; CLARK, 2017); e reorganização cortical (PUENTEDURA; FLYNN, 2016). Entretanto, a analgesia induzida pelo exercício físico ainda não é completamente compreendida em pessoas com dor crônica (DAENEN *et al*., 2015; NIJS *et al*., 2012; SLUKA; FREY-LAW; HOEGER BEMENT, 2018), interferindo diretamente na adesão ao tratamento (DAENEN *et al*., 2015; LIMA; ABNER; SLUKA, 2017; NAUGLE; FILLINGIM; RILEY, 2012).

Algumas revisões sistemáticas investigaram diferentes tipos de exercícios físicos em pessoas com fibromialgia, como os de flexibilidade (BUSCH *et al*., 2007; KIM *et al*., 2019), os mistos (BIDONDE *et al*., 2019), o treinamento de força (BUSCH *et al*., 2013), o aquático (BIDONDE *et al*., 2014) e o aeróbico (BIDONDE *et al*., 2017). Conforme pesquisas, sabe-se que o treinamento de força é mais eficaz do que os de flexibilidade para melhorias na dor e na função multidimensional, e que o exercício aeróbico (como caminhada) é um dos mais referenciados na literatura. Contudo, até aquele momento, os estudos não forneciam detalhes sobre as variáveis mais relevantes para o planejamento da intervenção (BIDONDE *et al*., 2017).

A prática baseada em evidências aponta que devemos seguir um tripé para intervenções em saúde: evidência, conhecimento e preferência. Ou seja, a melhor evidência disponível, geralmente descrita em revisões sistemáticas e ensaios controlados randomizados, a capacidade do profissional de saúde de utilizar a melhor evidência e tomar a melhor decisão clínica e a preferência da pessoa em relação ao tratamento proposto (HAYNES; DEVEREAUX; GUYATT, 2002; MONTORI; BRITO; MURAD, 2013).

Nesse contexto, Andersson *et al.* (2021) verificaram que mulheres com fibromialgia preferem treinamento de força com intensidade ajustada por meio de pesos livres (musculação), pois quanto maior a carga utilizada na resistência do movimento, menor o tempo sob tensão muscular. Consequentemente, os níveis de estresse e fadiga muscular são menores durante e após o exercício físico. Contudo, apenas dois estudos (revisões sistemáticas) investigaram o cenário de intensidade ajustada por meio de pesos livres: um sobre exercício resistido (BUSCH *et al.*, 2013) e outro sobre variáveis do treinamento de força para pessoas com fibromialgia (DA-SILVA *et al.*, 2021).

Esse referencial teórico sustenta seis pilares que justificam e respaldam a condução dos cinco estudos presentes nesta tese:

- I) as recomendações de exercício físico para o tratamento da fibromialgia;
- II) as evidências de que pessoas com fibromialgia podem praticar treinamento de força com intensidades moderada e/ou alta;
- III) a lacuna sobre a comparação de intensidades de exercícios nesta população (progressiva vs. constante);
- IV) a plausibilidade biológica de que a progressão da intensidade gera maiores benefícios às pessoas com fibromialgia sob tratamento não-farmacológico;
- V) a recomendação internacional para a condução de novos estudos sobre treinamento de força para pessoas com fibromialgia;
- VI) a necessidade e importância de uma avaliação biopsicossocial e tratamento não-farmacológico da pessoa com fibromialgia.

2.4 Avaliação biopsicossocial e tratamento não-farmacológico da pessoa com fibromialgia

A avaliação biopsicossocial e o tratamento não-farmacológico da fibromialgia são discutidos nos cinco artigos científicos produzidos nesta tese. Esses artigos abordam variáveis que suportam a avaliação do modelo biopsicossocial e o acompanhamento do tratamento não-farmacológico da pessoa com fibromialgia, além de testar os instrumentos utilizados para o diagnóstico da doença e o

relatório de um ensaio clínico que comparou diferentes exercícios para avaliar seu impacto. Dessa forma, esta tese responde às seguintes perguntas de pesquisa:

- Pesquisa 1 – Os instrumentos utilizados para avaliar os sintomas da fibromialgia segundo os critérios do Colégio Americano de Reumatologia geram pontuações semelhantes às obtidas em outras dores musculoesqueléticas crônicas?
- Pesquisa 2 – O treinamento de força com intensidade progressiva, comparado à intensidade constante, promove uma maior redução no nível de impacto da fibromialgia?
- Pesquisa 3 – Quais variáveis sociais conseguem predizer os escores médios de apoio social, autocuidado e conhecimento sobre fibromialgia?
- Pesquisa 4 – Existe um fator de proteção para a adesão ao exercício por mulheres com fibromialgia?

3 OBJETIVOS GERAIS

1. Comparar os sintomas de fibromialgia aos de outras dores musculoesqueléticas crônicas por meio dos instrumentos propostos pelo Colégio Americano de Reumatologia.
2. Comparar o efeito de 24 sessões de treinamento de força no impacto da na fibromialgia, qualidade do sono, ansiedade, depressão e capacidade de caminhar.
3. Investigar variáveis biopsicossociais que contribuem para explicar o apoio social, o autocuidado e o conhecimento sobre fibromialgia em pessoas com fibromialgia.
4. Examinar variáveis clínicas e sociodemográficas que influenciam a adesão ao exercício em mulheres com fibromialgia.

4 ARTIGOS CIENTÍFICOS DA TESE

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Os artigos incluídos nesta tese atendem às políticas editoriais das respectivas revistas. Para os artigos publicados em acesso aberto, foram mantidas as versões finais no idioma original da publicação, conforme a licença relevante. Para os artigos publicados com acesso restrito, foram incluídos apenas o título, o resumo e as palavras-chave, conforme a Resolução Conjunta Co/SIBi/CoPG n° 1/2025 da UFSCar.

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Esta tese foi elaborada na forma de compilação de trabalhos completos publicados, em conformidade com a Resolução Conjunta Co/SIBi/CoPG nº 1, de 07 de novembro de 2025, da Universidade Federal de São Carlos. A seguir, apresenta-se a situação editorial de cada manuscrito incluído, bem como as condições de compartilhamento observadas junto às respectivas publicações.

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Link de acesso: https://dx.doi.org/10.1007/s11332-025-01386-x

Declaro que todos os trabalhos incluídos nesta tese respeitam as políticas de direitos autorais das respectivas revistas científicas.

4.1 Artigo 1 (publicado, A3 [acesso aberto]) – Efeitos do treinamento de força com intensidade progressiva no impacto da fibromialgia: protocolo para um ensaio clínico randomizado cego.

RESUMO – Objetivo: comparar os efeitos de 24 sessões de treinamento resistido (intensidade progressiva versus intensidade constante) sobre o impacto da fibromialgia, a qualidade do sono, a ansiedade, a depressão, a dor, a capacidade de caminhada e a capacidade musculoesquelética. **Métodos:** Trata-se de um protocolo de ensaio clínico randomizado e cego. A amostra será aleatoriamente dividida em três grupos: grupo 1 (intensidade progressiva, experimental), grupo 2 (intensidade constante, controle A) e grupo 3 (caminhada, controle B). O grupo 1 realizará treinamento resistido em intensidade moderada (50% da força dinâmica máxima), previamente determinada por meio do teste de uma repetição máxima (1-RM) nos exercícios propostos. A força de cada participante será reavaliada a cada quatro semanas (por meio do teste de uma repetição máxima — 1-RM) e a intensidade de cada exercício será ajustada positivamente em 20% do valor observado em quilogramas. Ou seja: primeiro mês, 50%; segundo mês, 70%; terceiro mês, 90%. O grupo 2 realizará o mesmo procedimento, mas a intensidade será mantida em 50% da força dinâmica máxima durante todo o período de intervenção (ou seja, intensidade constante do primeiro ao terceiro mês). O grupo 3 realizará caminhada em esteira por 40 minutos em baixa intensidade, definida por uma velocidade correspondente a 60-70% da frequência cardíaca máxima, monitorada por um monitor de frequência cardíaca. Antes do início do programa de exercícios, todos os grupos receberão uma sessão de educação sobre dor, com duração de 45 minutos. Nela, serão abordados os mecanismos fisiopatológicos da dor crônica, estratégias de enfrentamento da dor, a evitação da hipervigilância e a desconstrução de crenças e mitos relacionados à dor crônica. **Discussão:** Os resultados do presente estudo poderão auxiliar os profissionais da saúde a ajustarem a intensidade do treinamento resistido e, consequentemente, a planejarem a intervenção mais eficaz (intensidade progressiva ou constante) para reduzir o impacto da fibromialgia na vida dos pacientes.

Palavras-chave: Fibromialgia. Dor Crônica. Exercício Físico. Qualidade de Vida.

Registro do ensaio: Registro Brasileiro de Ensaios Clínicos (ReBEC), ID: RBR-9pbq9fg, data de registro: 6 de outubro de 2022.

Publicação do protocolo: *BMC Musculoskeletal Disorders*, volume 24, artigo 816, 14 de outubro, 2023.

Referência bibliográfica: Pontes-Silva A., et al. Effects of progressive intensity resistance training on the impact of fibromyalgia: protocol for a blinded randomized controlled trial. *BMC Musculoskeletal Disorders*, 2023.

Disponível em: http://dx.doi.org/10.1186/s12891-023-06952-3.

Versão completa no idioma original da publicação (inglês) – Effects of progressive intensity resistance training on the impact of fibromyalgia: protocol for a blinded randomized controlled trial.

ABSTRACT – Objective: To compare the effect of 24 sessions of resistance training (progressive vs. constant intensity) on impact of fibromyalgia, sleep quality, anxiety, depression, pain, walking ability, and musculoskeletal capacity. **Methods:** A protocol for a blinded randomized controlled trial. The sample will be randomized into three groups: group 1 (progressive intensity, experimental), group 2 (constant intensity, control A), and group 3 (walking, control B). Group 1 will perform resistance training at moderate intensity (50% of maximum dynamic strength), previously determined by the 1 repetition maximum (1-RM) test in the proposed exercises. The strength of each individual will be reassessed every 4 weeks (by 1-RM) and the intensity of each exercise will be positively adjusted by 20% of the value observed in kg (i.e., first month 50%; second month 70%; third month 90% of the maximum dynamic strength). Group 2 will perform the same procedure, but the intensity will be maintained at 50% of the maximum dynamic strength throughout the treatment (i.e., constant intensity from the first to the third month). Group 3 will perform a 40-minute treadmill walk at low intensity, defined by a walking speed corresponding to 60%-70% of the maximum heart rate, which we will control with a heart rate monitor. All groups will receive a 45-minute pain education session prior to the exercise program, covering the pathophysiologic mechanisms of chronic pain, strategies for coping with pain, avoiding hypervigilance, and deconstructing beliefs and myths about chronic pain. **Discussion:** The results of the present study may help health care professionals adjust the intensity of resistance training and thus plan the most effective intervention (progressive or constant intensity) to reduce the impact of fibromyalgia on patients' lives.

Trial registration: Brazilian Registry of Clinical Trials (ReBEC) ID: RBR-9pbq9fg, date of registration: October 06, 2022

Keywords: Fibromyalgia. Chronic Pain. Exercise. Quality of Life.

INTRODUCTION

Fibromyalgia is a chronic condition characterized by widespread pain and complex symptoms, including fatigue, sleep disturbance, autonomic dysfunction, mood disturbance, and functional symptoms (those not explained by structural changes) (ALBUQUERQUE et al., 2022; VILARINO et al., 2021). The prevalence varies from 2% to 6% in the world population and is more prevalent in women aged 20 to 55 years (SARZI-PUTTINI et al., 2020).

Treatment recommendations are divided into pharmacologic and nonpharmacologic (MACFARLANE et al., 2017). Pharmacological interventions include drugs with neurological (amitriptyline, duloxetine, milnacipran, pregabalin), analgesic (tramadol), and muscle (cyclobenzaprine) effects. Nonpharmacologic interventions focus on physical therapies (acupuncture, hydrotherapy), meditative (qigong, yoga, tai chi, mindfulness), cognitive-behavioral, and physical exercise (aerobic and/or resistance training) (MACFARLANE et al., 2017).

Exercise-induced analgesia has been postulated to occur through several mechanisms: reduction of anti-inflammatory cytokines (SLUKA; FREY-LAW; HOEGER BEMENT, 2018); regulation of the release of some neurotransmitters that may be reduced in people with chronic pain (e.g., serotonin(SLUKA; FREY-LAW; HOEGER BEMENT, 2018), dopamine, and norepinephrine) (TAJERIAN; CLARK, 2017); and cortical reorganization (PUENTEDURA; FLYNN, 2016). However, exercise-induced analgesia may not occur (or occur in a dysfunctional manner) in people with chronic pain (DAENEN et al., 2015; NIJS et al., 2012; SLUKA; FREY-LAW; HOEGER BEMENT, 2018), which may affect these patients' adherence to treatment (DAENEN et al., 2015; LIMA; ABNER; SLUKA, 2017; NAUGLE; FILLINGIM; RILEY, 2012).

Some systematic reviews have examined different types of exercise in patients with fibromyalgia, such as flexibility (BUSCH et al., 2007; KIM et al., 2019), mixed (BIDONDE et al., 2019), resistance training (ALBUQUERQUE et al., 2022; VILARINO et al., 2021), aquatic (BIDONDE et al., 2014), and aerobic (BIDONDE et al., 2017). For example, resistance training is known to be more effective than flexibility (on pain and physical function) (BUSCH et al., 2013),

and aerobic exercise (e.g., walking) is one of the most referenced in the literature (BIDONDE et al., 2017). However, studies do not provide details on the appropriate procedure for adjusting the intensity of resistance training.

Evidence-based practice suggests that we should follow a tripod for health interventions: scientific evidence, professional knowledge, and patient preference (HAYNES; DEVEREAUX; GUYATT, 2002; MONTORI; BRITO; MURAD, 2013). In this context, Andersson et al. (ANDERSSON et al., 2021) found that women with fibromyalgia prefer resistance exercises with adjusted intensity using free weights (i.e., resistance training), because the higher the load in kg (intensity) used to resist the movement, the shorter the time under muscle tension, and consequently the lower the level of stress and muscle fatigue (during and after exercise). High-intensity resistance training is also safe for people with fibromyalgia (BUSCH et al., 2013; DA-SILVA et al., 2021).

However, only two systematic reviews have examined this scenario. The first study (BUSCH et al., 2013) suggests that resistance training at moderate or high intensity improves physical function in women with fibromyalgia. The second study (DA-SILVA et al., 2021) suggests the frequency (twice a week), intensity (40% to 80% of maximum dynamic strength), volume (1 to 2 sets of 4 to 12 repetitions of the movement), and target muscle group (gastrocnemius, quadriceps, hamstrings, pectorals, latissimus dorsi, rhomboids, deltoid, biceps, and triceps).

It is important to note that although exercise has not been shown to increase pain during its performance (ANDRADE et al., 2018), muscle contraction can cause pain (KADETOFF; KOSEK, 2007), and greater exercise intensity can elicit greater pain sensations, which may interfere with treatment adherence (HOTFIEL et al., 2018). An alternative to reduce this side effect is to progressively increase exercise intensity, with loads gradually added according to biological adaptations (KRISTENSEN; FRANKLYN-MILLER, 2012). Some studies have used this strategy in patients with fibromyalgia (ANDRADE et al., 2018; ERNBERG et al., 2016, 2018; LARSSON et al., 2015), but the results are controversial (ERICSSON et al., 2016; ERNBERG et al., 2016, 2018; JABLOCHKOVA et al., 2019; LARSSON; FELDTHUSEN; MANNERKORPI, 2020; PALSTAM

et al., 2016) and the comparison between groups did not control for the progression of exercise intensity (ERICSSON et al., 2016; ERNBERG et al., 2016, 2018; JABLOCHKOVA et al., 2019; LARSSON; FELDTHUSEN; MANNERKORPI, 2020; PALSTAM et al., 2016). Studies that have used progressive intensity resistance training in patients with fibromyalgia have found reductions in disability (PALSTAM et al., 2016) and fatigue (ERICSSON et al., 2016).

However, the same comparison between intensities (progressive vs. constant) has not yet been performed in research on fibromyalgia, which leads to the question: does resistance training with progressive intensity, compared to constant intensity (on walking and resistance training), promote a greater reduction in the level of fibromyalgia impact? The answer to this question will characterize the scientific and social feedback of this research, which will provide subsidies to health professionals to adjust the intensity of resistance training and thus plan the most effective intervention (progressive or constant intensity; walking or resistance training) to reduce the impact of fibromyalgia in the lives of the patients.

The hypothesis is that progressive intensity resistance training in patients with fibromyalgia will produce a greater reduction in impact of fibromyalgia than constant intensity exercise (walking and resistance training). Thus, the aim of the study is to compare the effect of 24 sessions of resistance training (progressive intensity vs. constant-intensity) on impact of fibromyalgia after 24 sessions of resistance training, as well as the global perceived effect regarding treatment and impact of fibromyalgia during the intervention and after 3 months of non-exercise follow-up.

METHODS

Trial design

This is a protocol for a blinded randomized controlled trial reported according to the Standard Protocol Items Recommendations For Interventional Trials (CHAN et al., 2013). We used the Template for Intervention Description and Replication (HOFFMANN et al., 2014) to describe the proposed intervention.

Ethics

The research will be conducted at the Federal University of São Carlos. All procedures of this project have been approved by the Ethics Committee for Human Research of the aforementioned institution (report number: 5.499.078) and by the Brazilian Registry of Clinical Trials (ReBEC), under number RBR-9pbq9fg (available at: https://ensaiosclinicos.gov.br/rg/RBR-9pbq9fg), date of registration: October 06, 2022. We will publicize the research through social media (WhatsApp®, Facebook®, Instagram®, Twitter®) and through the University's means of dissemination, in addition to brochures and posters in public health services in the city of São Carlos.

Participants and settings

We will recruit individuals between the ages of 20 and 55 (which will provide greater external validity) to participate in the research through free, prior, and informed consent. Inclusion criteria: I) Diagnosis of fibromyalgia according to the recommendations of the American College of Rheumatology (WOLFE et al., 2016). Non-inclusion criteria: I) neurological conditions that would interfere with the assessments, such as paralysis, major sensory changes, and level of consciousness/understanding; II) advanced joint disease; III) suspected thrombosis, heart disease, and immediate postoperative period; IV) pregnancy; V) abuse of alcohol and illicit substances; VI) active cancer.

Sample size

We performed the sampling using Ene 3.0 and G*Power 3.1.9.7 software, considering the comparison of three independent groups (progressive intensity [n = 21]), group 2 (constant intensity [n = 21]), and group 3 (walking [n = 21]) at four different stages (before, during the intervention, after 24 exercise sessions, and 3 months after the end of treatment) by ANOVA for repeated measures. We chose impact of fibromyalgia as the primary outcome variable, measured by the Revised

Fibromyalgia Impact Questionnaire (FIQ-R). We based the calculation on detecting the minimum clinically important difference of 27 points between independent groups (Ene) (SURENDRAN; MITHUN, 2018), standard-deviation of 16.3 points (Ene) (FONSECA et al., 2021), statistical power of 95% (G*Power), significance of 5% (both), effect size of 0.41 (G*Power) (KUNDAKCI et al., 2022; SERRAT et al., 2021), and sample loss of 15% (Ene). Thus, the sample must contain 21 individuals per group (total = 63).

Randomization, allocation, and blinding

We will randomize the sample to assign individuals to three groups: group 1 (progressive intensity, experimental), group 2 (constant intensity, control A), and group 3 (walking, control B). The researcher responsible for recruitment, eligibility, and evaluation, as well as the statistician, will not know which group the individual is assigned to (blinding of the evaluator and statistician). The researcher responsible for administering the exercises will only open the envelopes at the time of the intervention to identify the individual and the exercise. The researcher who will have access to the final dataset of the study will not be involved in the evaluations, randomization or intervention. The database will be set up in a restricted access link and the person responsible for the data will only communicate with the evaluator.

Once enrolled, baseline assessments will be conducted before participants are randomized (1:1:1) to three groups (progressive intensity, constant intensity, and walking) using simple randomization (via the website randomization.com) and allocation concealment, through opaque, sealed, and sequentially numbered envelopes, by an investigator who is not involved in the recruitment and treatment of participants (**Figure 1**).

Sixty-three pieces of paper corresponding to the three groups will be placed in opaque sealed envelopes. All raters will be blinded to participant allocation. The therapist responsible for the interventions will not know the outcome of the evaluations and will only open the envelopes at the time of the intervention. Due to the proposed intervention (physical exercise), the therapist and

participants will not be blinded to the intervention. Statistical analysis will be performed by a researcher blinded to the aims of the study. Participants will be instructed not to share information about the interventions with other participants and/or researchers.

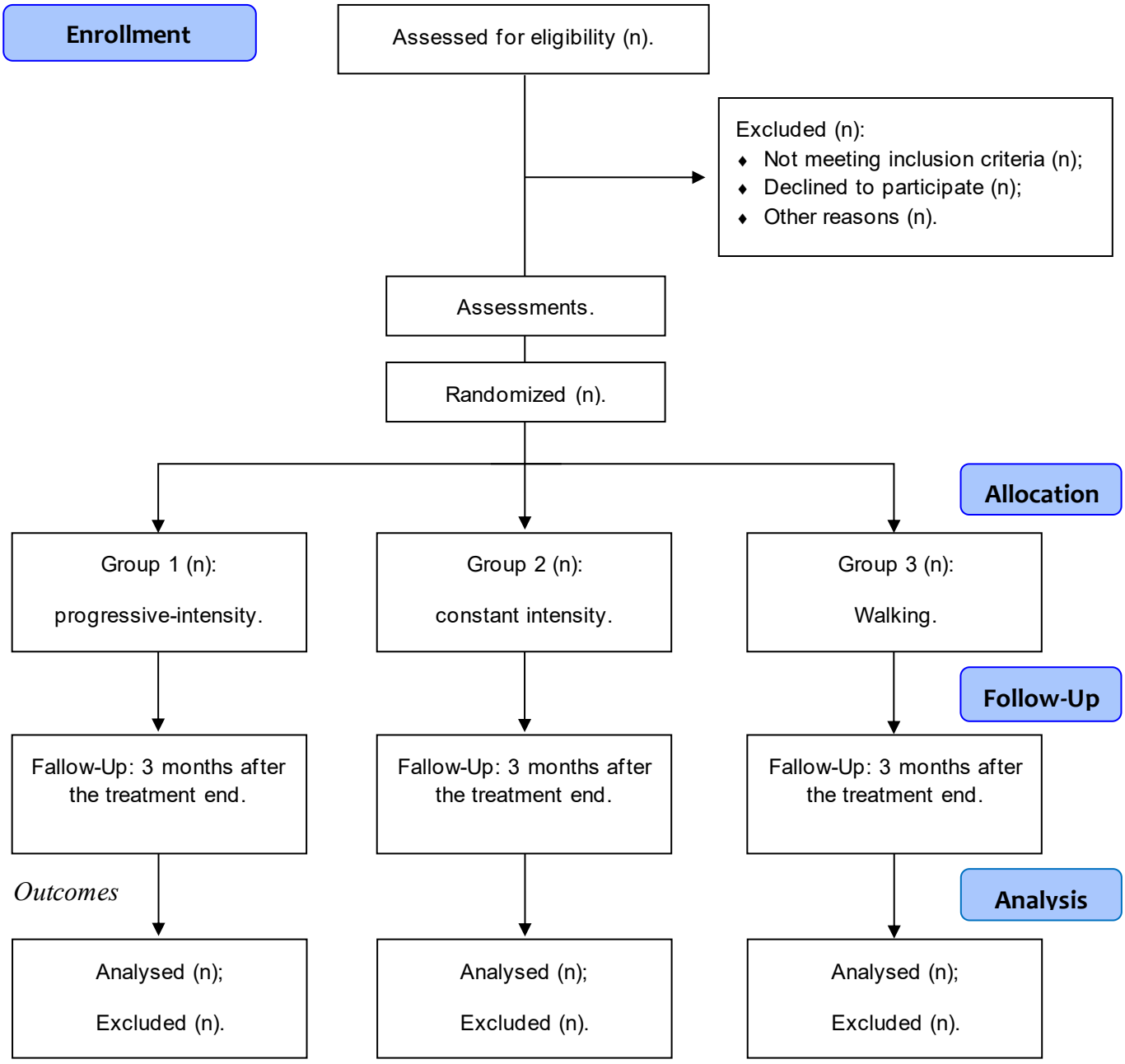

Figure 1 – Flowchart of study.

Outcomes

Primary outcome will be the comparison (among groups) of the effect of 24 sessions of resistance training (progressive intensity vs. constant intensity) on impact of fibromyalgia. Secondary outcomes will be to evaluate changes in sleep quality, anxiety, depression, cutaneous sensory threshold, wind-up mechanism, diffuse nociceptive inhibitory control, walking ability, musculoskeletal capacity after 24 sessions of resistance training, as well as global perceived effect and adherence regarding treatment and impact of fibromyalgia during the intervention and after 3 months of non-exercise follow-up (**Figure 2**).

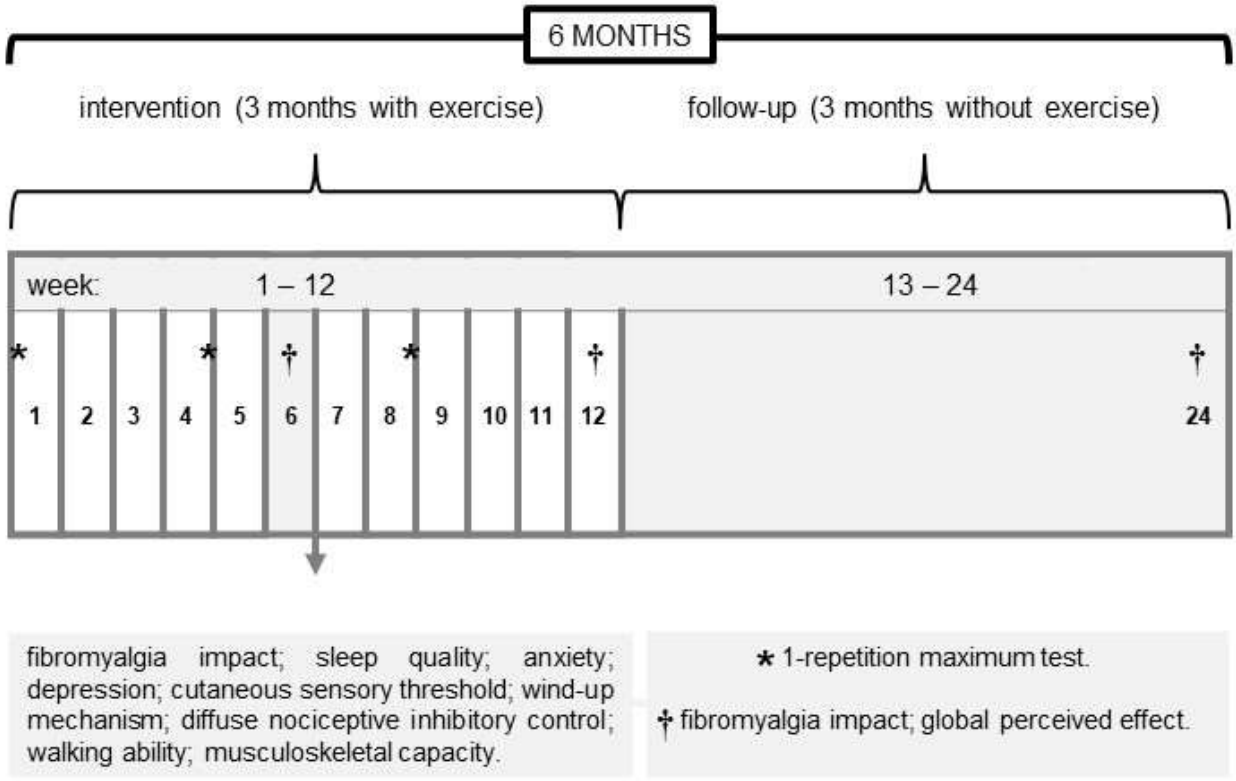

Figure 2 – Flowchart of assessments before, during, and after 24 exercise sessions, as well as after three months of non-exercise follow-up. *Evaluation of maximal dynamic strength for exercise load, a procedure used to adjust resistance training intensity every 4 weeks (1st, 4th, and 8th week). †Assessment of the impact of fibromyalgia, as well as global perceived effect regarding treatment (6th, 12th, and 24th week).

Assessments

After obtaining free, prior and informed consent, we will collect information for sample characterization. As such, initial assessment, body mass, stature, waist circumference, sex, age, comorbidities, family history, medication use, education, occupation, and impact of the Covid-19 pandemic (**Table 1**). In addition, we will use the instruments and tests (below) to obtain the variables mentioned in the primary and secondary outcomes.

Table 1. Instruments and tests to assess the participants.

Outcome	Assessment (questionnaire or test)	MCID
Initial assessment	Clinical and anthropometric characteristics	n/a
Fibromyalgia screening (score)	Fibromyalgia Rapid Screening Tool	n/a
Impact of fibromyalgia (score)[a,b]	Revised Fibromyalgia Impact Questionnaire	27
Pain level (score)[b]	Numeric Pain Rating Scale	2
Sleep quality (score)[b]	Pittsburgh Sleep Quality Index	n/a
Anxiety and depression (score)[b]	Hospital Anxiety and Depression Scale	n/a
Cutaneous sensory threshold (score)[b]	Esthesiometry test	n/a
Wind-up (score)[b]	Temporal summation test	n/a
Diffuse noxious inhibitory controls (score)[b]	Conditioned pain modulation test	n/a
Ability to walk (m)[b]	6-Minute Walk Test	156-167
Musculoskeletal capacity (Newtons)[b]	Isokinetic dynamometer	n/a
Maximal dynamic strength for exercise load (kg)[*]	1-repetition maximum test	n/a
Global perceived effect regarding treatment (score) [b,†]	Global Perceived Effect	3

MCID: Clinically Important Minimal Difference; n/a: Not Applicable. a: Primary outcome – comparison (among groups) of the effect of 24 sessions of resistance training (progressive intensity vs constant-intensity) on impact of fibromyalgia. b: Secondary outcome – changes after 24 sessions of resistance training, as well as the global perceived effect regarding treatment and impact of fibromyalgia during the intervention and after three months of nonexercise follow-up. *Evaluation of maximal dynamic strength for exercise load, a procedure used to adjust resistance training intensity every 4 weeks (1st, 4th, and 8th week). †Assessment of the impact of fibromyalgia, as well as global perceived effect regarding treatment (6th, 12th, and 24th week).

Fibromyalgia screening

We will screen for fibromyalgia using the Fibromyalgia Rapid Screening Tool (FiRST) (PERROT; BOUHASSIRA; FERMANIAN, 2010). This is an instrument validated by de Sousa et al. (2022) (DE SOUSA et al., 2022) for the Brazilian population, with adequate reliability and internal consistency. It is a self-administered instrument consisting of six items with the answer options "yes" or "no", with a cut-off score of 5 points, meaning that people who score 5 or 6 are likely to have fibromyalgia.

Impact of Fibromyalgia

We will assess the impact of fibromyalgia using the FIQ-R, an instrument validated for the Brazilian population by Lupi et al. (2016) (LUPI et al., 2017), with adequate reliability and internal consistency (LEE, 2021). The FIQ-R is used for assessments at week 1, 6, 12, and 24. It consists of 21 items assessing function (items 1-9), global impact (items 10-11), and symptoms (items 12-21). All questions relate to experiences during the past 7 days and are presented on an 11-point numerical rating scale (from 0 to 10). A normalization factor is applied to each of the three domain scores: the functional domain score is divided by 3, the global impact domain score is divided by 1, and the symptom domain score is divided by 2. The total FIQ-R score (from 0 to 100) is obtained by summing the three normalized domain scores. Thus, the lower the score, the lower the impact of fibromyalgia on the individual's overall quality of life. A reduction of 27 points is considered to be the minimum clinically important difference (SURENDRAN; MITHUN, 2018), although this may change in new studies (LEE, 2021).

Pain

We will assess pain with different instruments and tests. We will assess pain intensity with the Numeric Pain Rating Scale (NPRS), a self-report instrument validated in Portuguese by Ferreira-Valente et al. (2011) (FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011) NPRS has a sequence of numbers (from 0 to 10), where 0 represents "no pain" and 10 represents "the worst pain imaginable". This instrument is used in tests of temporal summation (wind-up mechanism) and conditioned pain modulation (diffuse nociceptive inhibitory control). A 2-point reduction (FARRAR et al., 2010) in pain intensity is considered a clinically important minimal difference (FARRAR et al., 2001).

We will assess the cutaneous sensory threshold by means of an esthesiometry test using a set of von Frey filaments (North Coast®, Gilroy, CA, USA) in the trapezius, supraspinatus and sternocleidomastoid muscles (SANCHEZ et al., 2019). The filaments have increasing values of

compressive force (in mN), which will be tested by calibration on a precision analytical balance (CQA®, Paulínia, SP, Brazil). All subjects are blindfolded and each filament, in order of increasing force, is positioned perpendicular to the subject's skin, gently pressed until its initial curvature, and then removed. The first filament that the individual reports having perceived touch will be considered as the cutaneous sensory threshold, so we will record the pressure force value corresponding to the reported threshold (WYLDE et al., 2011).

We evaluate the wind-up mechanism by means of the temporal summation test using a digital pressure algometer (ITO® brand, Tokyo, Japan), whose reliability has already been tested (Intraclass Correlation Coefficient [ICC] = 0.815) (KNAPSTAD et al., 2018). The test verifies the wind-up mechanism, which is characterized by the progressive and frequency-dependent facilitation of a neuron's responses observed during the application of repetitive or continuous stimuli of constant intensity (HERRERO; LAIRD; LÓPEZ-GARCÍA, 2000). A pressure of 2.5 kg is applied to the anterior surface of the subject's right forearm (7.5 cm from the distal crease of the wrist). This pressure is maintained for 30 seconds; during the continuous stimulus, the individual is asked about the intensity of pain felt at the 1st, 10th, 20th, and 30th second of stimulus application (using the NPRS) (VASE et al., 2011).

We will assess diffuse noxious inhibitory control using the conditioned pain modulation test (VAN WIJK; VELDHUIJZEN, 2010), which is a phenomenon in which, under normal conditions, the perception of pain to a tested stimulus is reduced by the application of another painful stimulus (conditioned stimulus) (YARNITSKY, 2010). The test will be divided into three stages: First, we will measure the pressure pain threshold on the anterior surface of the subject's right forearm, 7.5 cm from the distal wrist crease, using a pressure algometer (ICC = 0.815) (KNAPSTAD et al., 2018) to stimulate a level 4 pain (via NPRS). Second, ischemic compression (conditioned stimulus) is applied to the subject's left arm using an analog sphygmomanometer placed 3 cm proximal to the cubital fossa. When 250 mmHg of pressure is reached, the individual is asked about the intensity using the NPRS. If the individual reports pain < 5, we will ask for flexion and extension of the elbow so that

the pain increases to a level ≥ 5, and then we will reassess the pressure pain threshold on the anterior surface of the individual's right forearm (using the pressure algometer to stimulate a level 4 pain simultaneously with the conditioned stimulus). Finally, after measuring the pressure pain threshold during the ischemic stimulus, we will remove the compression and after 30 seconds and then after 5 minutes, we will measure and record the pressure pain threshold again (using a pressure algometer to stimulate a level 4 pain on the anterior surface of the individual's right forearm) (ARENDT-NIELSEN et al., 2010).

Sleep Quality

We will assess sleep quality using the Pittsburgh Sleep Quality Index (PSQI) for sleep quality, adapted for Brazilians by Bertolazi et al. (2011) (BERTOLAZI et al., 2011) It is a reliable instrument (ICC = 0.65) (PASSOS et al., 2017) that assesses seven sleep components: subjective quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, medication use, and daily dysfunction. For each component, the score varies from 0 to 3, and the sum gives a maximum score of 21. Scores above 5 indicate poor sleep quality.

Anxiety and depression

We will assess anxiety and depression using the Hospital Anxiety and Depression Scale (HADS), validated for Brazilians (MARCOLINO et al., 2007). It consists of 14 items divided into two domains (depression and anxiety) with seven items each. The items have a 4-point Likert scale (from 0 to 3), resulting in total scores ranging from 0 to 21, both for anxiety and depression. The cut off points indicating moderate to severe symptoms are: anxiety domain ≥ 8 and depression domain ≥ 9.

Ability to walk

We will assess walking ability using the 6-minute walk test (6MWT) (CCI > 0.90) (PANKOFF et al., 2000). We will instruct the individual to walk at the highest possible speed during the 6 minutes and to stop the test if they feel uncomfortable. Before and after the session, the following variables will be monitored: systemic blood pressure, heart rate, peripheral oxygen saturation, and respiratory rate. During the session, fatigue levels (leg and respiratory) are monitored using the Borg scale. An increase of 156 to 167 meters in distance walked is considered a clinically important minimum difference in individuals with fibromyalgia (KALETH; SLAVEN; ANG, 2016). This test will be done before and after treatment (week 1 and week 12).

Isokinetic dynamometry

The individuals will be positioned with the hip angle at 100º (trunk, pelvis, and thigh will be stabilized with straps). The axis of rotation of the dynamometer will be aligned with the axis of the knee, at the level of the lateral epicondyle of the femur, fixed to the distal part of the leg, approximately 5 cm above the medial malleolus. Correction for the effect of gravity will be calculated with the limb at 60° of flexion (according to the equipment instructions). We will evaluate these variables using the isokinetic dynamometer (Biodex Medical Systems 3®, Shirley, New York, USA).

A familiarization series of three submaximal isokinetic contractions is performed prior to the isokinetic assessment. 3 minutes after the familiarization, the subjects will perform five concentric isokinetic contractions of knee extension, from 90° to 15° (considering 0° as full extension), with a total range of motion of 75°, at an angular velocity of 60º/s (series of five repetitions), for the analysis of the variables torque peak normalized by body mass, power and work (TAVARES et al., 2020).

Verbal encouragement, as well as visual feedback from the equipment, will be given in an attempt to reach the maximum level of voluntary effort during all the contractions that each subject will perform. The same procedure will be repeated with the contralateral limb 5 minutes after the end of the dominant limb (AVILA; BRASILEIRO; SALVINI, 2008). This test will be performed before and after treatment (week 1 and week 12).

Maximal dynamic strength for exercise load

We will determine the maximum dynamic strength for exercise load using the 1 repetition maximum (1-RM) test (NAUGLE; FILLINGIM; RILEY, 2012). The results of this test, in addition to being reliable (CCI > 0.90) (GRGIC et al., 2020), are widely used to control the intensity of resistance exercises based on the percentage of maximal dynamic strength in individuals with fibromyalgia. The individual will perform 10 repetitions of the movement (without load) for the purpose of musculoskeletal warm-up and understanding of technique. After 1 minute of rest, they will perform 3 to 5 self-reported maximum repetitions, then after 3 minutes of rest, they will perform the 1-RM test (RIBEIRO et al., 2018).

In addition, as an alternative to confirm the test result, we will estimate the maximum dynamic strength using the mathematical equation proposed by Brzycki (BRZYCKI, 1993): 1-RM = submaximal load in kg / (1.0278 - 0.0278 × number of repetitions). The test is used for evaluations at week 1, week 4, and week 8 to adjust the intensity of resistance training.

Global perceived effect regarding treatment

We will assess the self-reported global perceived effect of treatment using the Global Perceived Effect (GPE) scale, an instrument validated for the Brazilian population by Costa et al (COSTA et al., 2008). It is an 11-point descriptive scale in which the progression (or regression) of the individual's clinical condition is classified according to their score at a given time. Thus, the individual will report their perception of improvement in the face of the intervention through a score classified as: -5 (much worse), 0 (no change), and +5 (fully recovered). We will use the GPE at three assessments (6th, 12th, and 24th week). A change of 3 points is considered a clinically important minimum difference.

Intervention overview

All groups will receive a 45-minute pain education session prior to the exercise program that addresses the pathophysiological mechanisms of chronic pain, strategies for coping with pain, avoiding hypervigilance, and deconstructing beliefs and myths about chronic pain (e.g., the degree of diagnostic uncertainty of the imaging exams) (MARTINS-DE-SOUSA et al., 2020).

Before the first resistance training session, there will be a period of familiarization, followed by the 1-RM test in each of the exercises proposed in the resistance training program (**Figure 3**). All sessions will take place individually, in a private room with lighting and air conditioning at 23°C. All exercises will be performed by a Bachelor of Physical Education with experience in exercising individuals with chronic pain. Individuals will receive 24 exercise sessions. Two sessions per week, for 40 minutes and 10 minutes of rest after the exercise session, according to the guidelines of the American College of Sports Medicine (GARBER et al., 2011), as well as clinical trials that tested this guideline in individuals with fibromyalgia (BIDONDE et al., 2017; BUSCH et al., 2013).

Each individual is instructed to discontinue the intervention at any time if they do not wish to continue with the proposed exercise session. In addition, before and after the exercise session, blood pressure (using a sphygmomanometer and stethoscope), heart rate and peripheral oxygen saturation (using an oximeter), generalized pain intensity (using the NPRS), and subjective perception (using the Borg scale) will be monitored (BORG, 1982).

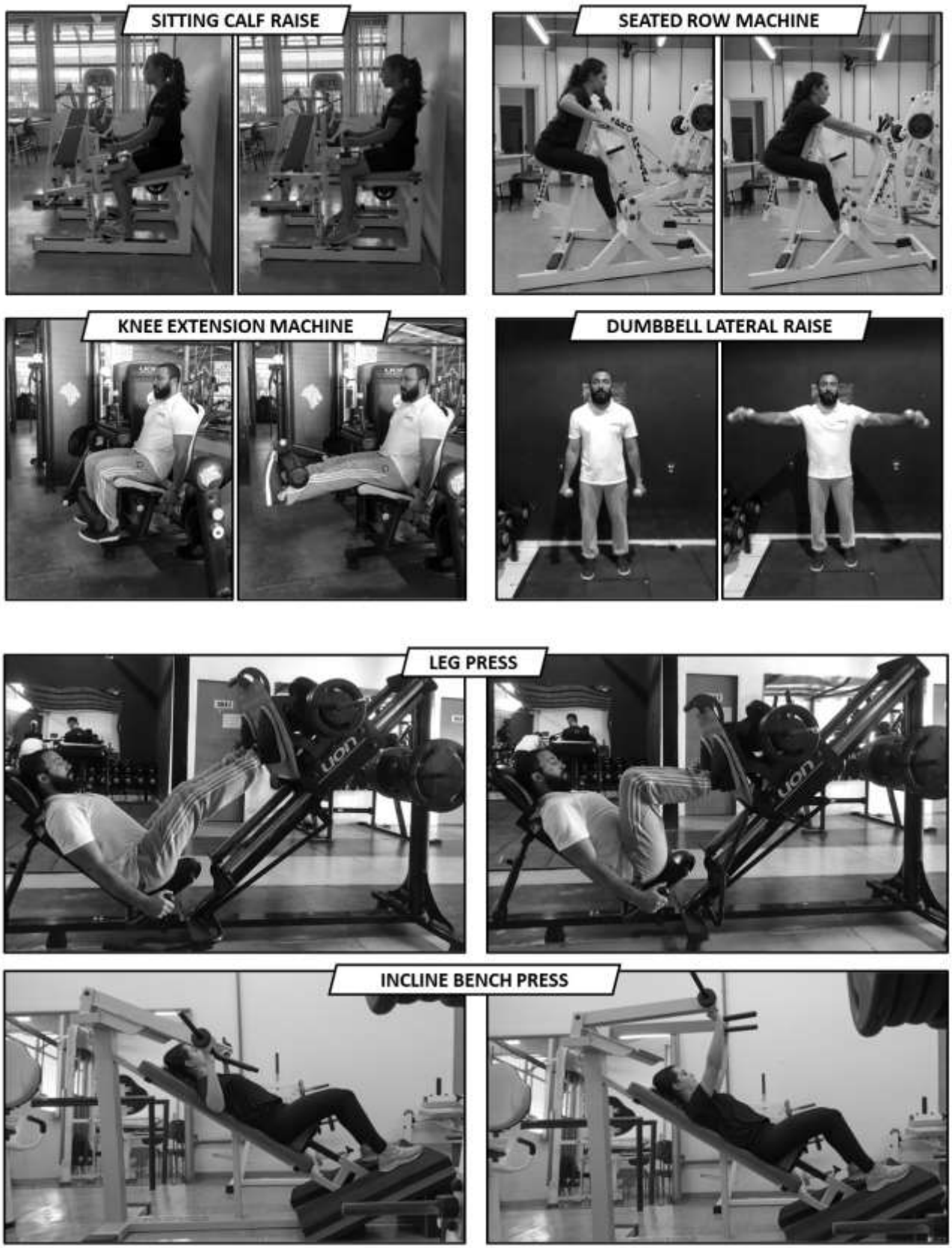

Figure 3 – Proposed exercises.

Group 1 (progressive intensity, experimental)

Firstly, individuals will perform a global warm-up of four exercises (**Figure 3**) without load: seated calf raise (1 minute), lateral dumbbell raise (1 minute), leg press (1 minute), and incline bench press (1 minute) (GENEEN et al., 2017; HAYDEE; NEWTON-JOHN; SHIRES, 2021). They will then perform moderate intensity resistance training (50% of maximum dynamic strength). Individuals work nine muscle groups (gluteus, quadriceps, hamstrings, biceps brachii, triceps brachii, pectoralis major, calf, deltoid, and latissimus dorsi) through six different exercises in the following order: seated calf raise, knee extension machine, seated row machine, dumbbell lateral raise, leg press, and incline bench press (DA-SILVA et al., 2021).

Based on 50% of the maximum dynamic strength as the initial parameter for moderate intensity in resistance training (BUSCH et al., 2013; DA-SILVA et al., 2021), the load in kg will be previously identified through the 1-RM test in the proposed exercises. The individual's muscular strength will be individually reassessed every 4 weeks (via 1-RM) and the intensity of each exercise will receive a positive adjustment of 20% of the value observed in kg (i.e., first month 50%; second month 70%; third month 90% of the maximal dynamic strength – **Table 2**) (BUSCH et al., 2013; DA-SILVA et al., 2021).

The intensity of the exercises (total load in kg), the interval between sets (rest in seconds), the volume (number of sets, repetitions and time under tension) as well as the frequency of the resistance training will be controlled by the researcher with experience in chronic pain. Twice a week (for 3 months), individuals with fibromyalgia will perform three sets of each exercise: 10 repetitions, 40 seconds of muscle tension, full range of motion, inspiration during the eccentric phase of the movement, and 60 seconds of rest among sets (PONTES-SILVA, 2022d). In order to maintain the same volume of exercises in resistance training (according to the intensity progression), we will add 20 seconds of rest to the rest among sets (i.e., first month 60; second month 80; third month 100 seconds of interval), because higher intensities, while maintaining the same volume of work (sets, repetitions, and time under tension), require longer intervals of rest (PONTES-SILVA, 2022c).

Group 2 (constant intensity, control A)

Firstly, individuals will perform a global warm-up of four unloaded exercises: seated calf raise (1 minute), lateral dumbbell raise (1 minute), leg press (1 minute), and incline bench press (1 minute) (GENEEN et al., 2017; HAYDEE; NEWTON-JOHN; SHIRES, 2021). They will then perform moderate intensity resistance training (50% of maximum dynamic strength). Individuals will work nine muscle groups (gluteus, quadriceps, hamstrings, biceps brachii, triceps brachialis, pectoralis, calf, deltoid, and latissimus dorsi) through six different exercises in the following order: seated calf raise, knee extension machine, leg press, incline bench press, seated row machine, and dumbbell lateral raise (DA-SILVA et al., 2021).

Based on 50% of the maximum dynamic strength as the initial parameter for moderate intensity in resistance training, the load in kg will be previously identified through the 1-RM test in the proposed exercises. The muscular strength of each individual will be individually reassessed every 4 weeks (via 1-RM) and the intensity (total load in kg) will be maintained at 50% of the maximum dynamic strength until the end of the complete treatment (i.e., constant intensity from month 1 to month 3 – **Table 2**) (BUSCH et al., 2013; DA-SILVA et al., 2021).

The intensity of the exercises (total load in kg), the interval among sets (rest in seconds), the volume (number of sets, repetitions and time under tension) as well as the frequency of the resistance training will be controlled by the researcher with experience in chronic pain. Twice a week (for 3 months), individuals with fibromyalgia will perform three sets of each exercise: 10 repetitions, 40 seconds of muscle tension, full range of motion, inspiration during the eccentric phase of the movement, and 60 seconds of rest among sets. (PONTES-SILVA, 2022d).

Group 3 (walking, control B)

Individuals will walk on the treadmill for 40 minutes at an intensity determined by the walking speed corresponding to 60%-70% of the maximum heart rate (HRmax), which will be estimated (in advance for each individual) by the mathematical equation: HRmax = 220 - age (in years) and

recalculated if the individual has a birthday during the treatment period (GARBER et al., 2011). As such, the individual is verbally motivated to walk at a constant pace to keep the heart rate around 60%-70% of HRmax (**Table 2**).

To ensure stabilization of low intensity, if the individual exceeds 60-70% of HRmax, we slowly reduce the treadmill speed until the heartbeats reach 60%-70% of HRmax (considering the standard error of estimation of up to 10 heartbeats for more or less) (GARBER et al., 2011). Heart rate is monitored using a Polar V800 heart rate monitor (Polar Electro OU®, Kempele, Finland) with a sensor attached to the subject's chest. This device has been used in studies of chronic pain (GODOY; TAKAKURA; CORREA, 2005; SANTOS-DE-ARAÚJO et al., 2019).

Table 2. Description of the intensity of physical exercise programs.

Group (intensity)	1st Month	2nd Month	3rd Month	Follow-up
1. Progressive intensity (experimental)	50% (1-RM test)	70% (1-RM test)	90% (1-RM test)	Nonexercise
2. Constant intensity (control A)	50% (1-RM test)	50% (1-RM test)	50% (1-RM test)	Nonexercise
3. Walking (control B)	60%-70% (HRmax)	60%-70% (HRmax)	60%-70% (HRmax)	Nonexercise

1-RM test: 1-repetition maximum test; HRmax: maximum heart rate. The external load (intensity) will be adjusted on the basis of the new values observed in the 1-RM (every 4 weeks).

Statistical analysis

We will perform statistical analysis based on intention-to-treat analysis. We will use histograms and normality tests to verify the distribution of the data. Comparisons will be made through mixed linear models using interaction between factors time (before, during the intervention, after 24 exercise sessions, and 3 months after the end of treatment) and group (progressive intensity, constant intensity, and walking), besides, the baseline will be used as a covariate in the analyses (MARTINS-DE-SOUSA et al., 2022). Data will be presented as mean, standard-deviation, difference between means, confidence interval (95%) of these differences, and effect size (Cohen d). We will consider a significance level of 5% on the SPSS® software, version 17.0 (Chicago, IL, EUA) (PONTES-SILVA, 2022a).

DISCUSSION

Potential impact and significance of the study

Exercise science has shown that progressive intensity resistance training generates better musculoskeletal adaptations than constant-intensity resistance training (HELLEBRANDT; HOUTZ, 1956; SUCHOMEL et al., 2021). These adaptations contribute positively to the physical function (BUSCH et al., 2007, 2013), cognitive performance (MACFARLANE et al., 2017; THEADOM et al., 2015), and patient quality of life (MACFARLANE et al., 2017). However, these interventions (HELLEBRANDT; HOUTZ, 1956; SUCHOMEL et al., 2021) and outcomes (MACFARLANE et al., 2017) have not yet been studied in patients with fibromyalgia (BUSCH et al., 2007, 2013).

To our knowledge, this study will be the first clinical trial to compare resistance training intensity (progressive vs. constant) in patients with fibromyalgia. Therefore, the results will show the effectiveness (or not) of this proposal. In addition, as a randomized clinical trial, it will contribute to novel evidence syntheses in systematic reviews (BUSCH et al., 2013), as well as guidelines (MACFARLANE et al., 2017), generating more perspectives for evidence-based health (HAYNES; DEVEREAUX; GUYATT, 2002; MONTORI; BRITO; MURAD, 2013). Besides, this study compares progressive intensity to two types of exercise (resistance and aerobic), thus filling two gaps simultaneously.

Contribution to professionals and patients

This study will provide health professionals with guidance in planning/applying resistance training (BUSCH et al., 2013) (with progressive intensity (SUCHOMEL et al., 2021) or not) to reduce the impact of fibromyalgia (LUPI et al., 2017), as we will find out if gradual exposure to resistance training (BUSCH et al., 2013) is more effective than constant exposure (to resistance training and/or walking) on patients' rehabilitation. In addition, the results will also contribute to patients' knowledge about non-pharmacological treatment of fibromyalgia (MACFARLANE et al., 2017) and whether the proposed types of exercise are significantly different on the primary outcome (impact of fibromyalgia (LUPI et al., 2017)). In fact, if the results show insignificant differences (PONTES-SILVA, 2022b)

among the proposed exercises, patients with fibromyalgia will be able to choose the type and intensity of exercise according to their preferences (ANDERSSON et al., 2021; HAYNES; DEVEREAUX; GUYATT, 2002).

Strengths and weaknesses of the study

The strength of this study will be the comparison of the progressive intensity of resistance training with the constant intensity of two types of exercise (resistance training and walking). In contrast, the weakness of this research will be the impossibility of blinding the therapist and the patient during the treatment, considering that the intervention type (physical exercise) will be observed by both.

Prospects for future research

Although this study focuses on the investigation of exercise intensity on the impact of fibromyalgia (LUPI et al., 2017), there is still a need for future studies to propose ways to compare different types of exercise (e.g., resistance training vs. walking), as we know that musculoskeletal adaptations result from the physical effort performed (not the type of exercise proposed) (PONTES-SILVA, 2022d). This means that further studies investigating different exercise types should develop strategies or methods to monitor the total physical effort performed in each exercise program (PONTES-SILVA, 2022c).

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4.2 Artigo 2 (publicado, A3 [acesso aberto]) – Treinamento de força versus caminhada no impacto da fibromialgia: ensaio clínico controlado aleatorizado cego.

RESUMO – Objetivo: Comparar o efeito de 24 sessões de treinamento de força com intensidade progressiva no impacto da fibromialgia (desfecho primário). Adicionalmente, avaliamos seus efeitos na qualidade do sono, ansiedade, depressão, mecanismo *wind-up*, modulação condicionada, limiar sensitivo cutâneo, desempenho musculoesquelético, habilidade de caminhar, percepção de melhora e adesão ao tratamento (desfecho secundário). **Métodos:** Após as avaliações cegas dos desfechos, 66 pessoas com fibromialgia foram randomizadas e alocadas ocultamente para os grupos de treinamento de força com intensidade progressiva (n = 22), constante (n = 22) ou caminhada (n = 22). No grupo de progressão, a intensidade do exercício aumentou 20% da força máxima a cada mês: 50% no primeiro mês, 70% no segundo mês e 90% no terceiro mês. Nos grupos de treinamento constante ou caminhada, a intensidade moderada foi mantida até o final do tratamento. Cada pessoa recebeu 24 sessões de exercício individualmente (2x/semana), sendo três meses de exercício e três de *follow-up* sem exercício. Reavaliamos e analisamos a estatística baseada no princípio da intenção de tratar, com comparações de interação entre os fatores tempo e grupo: baselines, 6ª, 12ª e/ou 24ª semana (*follow-up*). **Resultados:** Os grupos foram semelhantes no baseline e não houve diferença significativa intergrupo em nenhum dos momentos do desfecho primário. Nas comparações intragrupo, observamos diferenças significativas indicando que os três tipos de exercícios reduziram os sintomas globais de fibromialgia. Entretanto, nenhum deles atingiu uma diferença mínima clinicamente importante. Nas comparações intergrupo do desfecho secundário, os grupos relataram uma percepção positiva de melhora, porém, a maior parte de cada grupo não aderiu e/ou não respondeu sobre a adesão ao tratamento após o *follow-up* sem exercício. Não houve diferença significativa entre esses relatos. Por fim, as comparações intragrupo mostraram melhoras significativas do desfecho secundário, mas nenhuma variável atingiu uma diferença mínima clinicamente importante. **Conclusão:** Vinte e quatro sessões de treinamento de força com intensidade progressiva não promovem maior redução nos níveis de impacto da fibromialgia em comparação à intensidade constante ou à caminhada.

Palavras-Chave: Dor. Fibromialgia. Qualidade de vida. Exercício físico. Sistema musculoesquelético.

Registro do ensaio: Registro Brasileiro de Ensaios Clínicos (ReBEC), ID: RBR-9pbq9fg, data de registro: 6 de outubro de 2022.

Publicação do protocolo: *BMC Musculoskeletal Disorders*, volume 24, artigo 816, 14 de outubro, 2023.

Referência bibliográfica: Pontes-Silva A., et al. Strength training vs. walking on the fibromyalgia impact: a blinded randomized controlled trial. *BMC Musculoskeletal Care*, 2026.

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Versão completa no idioma original da publicação (inglês) – Strength training vs. walking on the fibromyalgia impact: a blinded randomized controlled trial.

ABSTRACT – Objective: To compare the effect of 24 sessions of progressive intensity strength training on the fibromyalgia impact (primary outcome). Furthermore, we evaluated its effects on sleep, anxiety, depression, wind-up mechanism, conditioned pain modulation, cutaneous sensory threshold, musculoskeletal performance, walking ability, perceived improvement, and treatment adherence (secondary outcomes). **Methods:** A blinded randomized controlled trial. After blinded outcome assessments, 66 people were randomized and concealed allocated to progressive (n = 22), constant (n = 22), or walking (n = 22) strength training groups. We included people with fibromyalgia. In the progressive group, exercise intensity increased by 20% of maximum strength each month: 50% in the first month, 70% in the second month, and 90% in the third month. In the constant or walking exercise groups, moderate intensity was maintained until the end of the treatment. Each person received 24 individual exercise sessions (2x/week), with three months of exercise and three months of no exercise. The main outcome measure was fibromyalgia impact. **Results:** Groups were similar at baseline. There were no significant between-group differences in the primary outcome at any time point. In within-group comparisons, we observed significant differences indicating that all three types of exercise reduced fibromyalgia symptoms, however, no variable achieved a minimal clinically important difference. In between-group comparisons for the secondary outcomes, groups reported a positive perception of improvement, but most of each group did not adhere to treatment and/or did not answer about adherence after follow-up without exercise. **Conclusion:** Twenty-four sessions of progressive intensity strength training do not provide a greater reduction in the fibromyalgia impact than constant intensity or walking exercises.

Keywords: Pain. Quality of Life. Aerobic Exercise. Musculoskeletal System. Rehabilitation.

INTRODUCTION

Fibromyalgia is a chronic condition characterized by widespread pain and complex symptoms, including fatigue, mood disturbances, and functional symptoms (PONTES-SILVA et al., 2023a). To date, non-pharmacologic treatment recommendations that suggest physical exercise are based on systematic reviews that have examined different types of exercise, such as flexibility (KIM et al., 2019), mixed exercise (BIDONDE et al., 2019), strength training (ALBUQUERQUE et al., 2022; VILARINO et al., 2021), aquatic exercise (BIDONDE et al., 2014), and walking (BIDONDE et al., 2017). In terms of evidence, it is known that strength training is more effective than flexibility training in improving fibromyalgia symptoms (BUSCH et al., 2013). It is also known that walking is one of the most cited exercises in the literature for the treatment of fibromyalgia (BIDONDE et al., 2017). However, studies are unclear about strategies for adapting exercise intensity to the biological adaptations of people with fibromyalgia, making it difficult to apply the findings clinically (PONTES-SILVA et al., 2023a).

Current scientific evidence suggests that high-intensity strength training is safe for people with fibromyalgia; however, there is a lack of guidance in the literature on methods of load progression to achieve such intensities (BUSCH et al., 2013; DA-SILVA et al., 2021). In this regard, there are two systematic reviews that examined variables related to strength training for people with fibromyalgia (BUSCH et al., 2013; DA-SILVA et al., 2021). The first review suggests that strength training should be performed at moderate or high intensity for people with fibromyalgia (BUSCH et al., 2013). The second review describes some planning parameters, such as, frequency of twice a week, intensity of 40% to 80% of maximum strength, and volume of one to two sets of four to twelve movements for the relevant muscle groups: gastrocnemius, quadriceps, hamstrings, pectorals, latissimus dorsi, rhomboids, deltoids, biceps, and triceps (DA-SILVA et al., 2021).

However, previous studies using these parameters have produced controversial results, raising further doubts about their effects on the fibromyalgia impact (ANDRADE et al., 2018; ERNBERG et al., 2016, 2018). Another weakness is that the comparisons between-groups studied did not show the

progression of strength training intensity (PONTES-SILVA et al., 2023a). In addition, studies that used strength training selected only one type of intensity in the research (progressive or constant), which increases the gap regarding the effects of each of the intensities on fibromyalgia and justifies the conduct of this study (PONTES-SILVA et al., 2023a). Given this finding, the following question arises: does progressive intensity strength training promote a greater reduction in the levels of fibromyalgia impact? Our hypothesis is that progressive intensity strength training produces a greater reduction in fibromyalgia impact than other constant intensity exercises (e.g., walking or the same strength training program).

Therefore, as a primary outcome, we aimed to compare the effect of 24 sessions of progressive intensity strength training (compared to constant intensities) on the fibromyalgia impact. Furthermore, as secondary outcomes, we evaluated its effects on sleep, anxiety, depression, wind-up mechanism, conditioned pain modulation, cutaneous sensory threshold, musculoskeletal performance, walking ability, perceived improvement, and treatment adherence.

METHODS

Trial design and ethical aspects

A blinded randomized controlled trial described according to the consolidated standards for reporting clinical trials (CONSORT) and template for intervention description and replication (TIDieR). The research was conducted at the Federal University of São Carlos between June 2022 and January 2025. All procedures of this study were previously approved by the Human Research Ethics Committee of the aforementioned institution (report number: 5.499.078).

Prior to the start of data collection, the study was also approved by the Brazilian Clinical Trials Registry (report number: RBR-9pbq9fg). Subsequently, the research was publicized through social media (WhatsApp™, Facebook™, Instagram™, Twitter™), through the university's dissemination channels, and through flyers and posters in public health services in the city of São Carlos (SP), Brazil. In addition, the protocol of this clinical trial was published in the format of an

open-access scientific article, with all the details for public consultation (PONTES-SILVA et al., 2023a).

Sample size

We used Ene 3.0™ and G*Power 3.1.9.7™ software for sampling, considering an analysis of variance in the comparison among three independent groups in repeated measures: before and after 24 exercise sessions. We chose the fibromyalgia impact as the primary outcome variable. The calculation was based on detecting the minimal clinically important difference of 27 points between independent groups, standard deviation of 16.3 points, statistical power of 95%, significance of 5%, effect size of 0.41, and dropout rate of 15%. Thus, the sample should contain 21 people per group, for a total of 63 people with fibromyalgia (PONTES-SILVA et al., 2023a).

Participants

People with fibromyalgia who were interested in participating in the study contacted the researchers via the WhatsApp™ provided. During the contact, they were instructed to read the digitally available consent form for signature and download, ask questions of the researcher in charge of the assessments, and carefully fill out a form on Google Forms™ that included the fibromyalgia screening, eligibility criteria, sample characterization, and self-report instruments for this study (PONTES-SILVA et al., 2023a).

We recruited individuals aging from 20 to 55 years to participate in the study by giving free, prior, and informed consent. Inclusion criteria were: diagnosis of fibromyalgia according to the 2016 recommendations (WOLFE et al., 2016). Exclusion criteria were: neurological conditions that interfered with the assessments, such as paralysis, significant sensory changes and level of consciousness/understanding; advanced joint disease; suspected thrombosis, heart disease and immediate postoperative period; pregnancy; alcohol and illicit substance abuse; active cancer (PONTES-SILVA et al., 2023a).

Randomization, allocation concealment, and blinding

The sample was randomized into three groups: group 1, which received progressive intensity strength training (experimental); group 2, which received constant intensity strength training (control A); and group 3, which received constant intensity walking (control B). The researcher responsible for recruitment, eligibility, and assessments was blinded to the interventions, as she did not know which group each person with fibromyalgia was assigned to (allocation concealment) (PONTES-SILVA et al., 2023a).

After all assessments, the bachelor of physical education (therapist, with seven years of experience), who was blinded to the assessments, handed out an opaque, sealed envelope containing 66 sequentially numbered pieces of paper describing one of the three groups. The person with fibromyalgia then drew a single piece of paper, without any influence from the researchers, and was thus randomly assigned. Finally, people with fibromyalgia were instructed not to share information about the assessments and interventions with anyone involved in the research (PONTES-SILVA et al., 2023a).

Outcomes

Primary outcome of this study was the fibromyalgia impact, as this is the most commonly assessed self-reported measure in people with fibromyalgia. Therefore, this study focused on comparing the effect of 24 sessions of progressive intensity strength training versus constant intensity (e.g., walking or the same strength training program) on the primary outcome.

As a secondary outcome, this study focused on evaluating the effects of the intervention on other measures relevant to people with fibromyalgia, such as sleep quality, anxiety, depression, wind-up mechanism, conditioned pain modulation, cutaneous sensory threshold, musculoskeletal performance through isokinetic dynamometry, walking ability, perception of improvement (weeks 6 and 12), and adherence to treatment through a three-month follow-up without exercise (week 24).

Assessments

After voluntary and informed completion of the Google Forms™, each person with fibromyalgia was individually invited to participate in the in-person assessments, which included handgrip strength, sample characterization, and other tests to obtain the secondary outcome variables.

Fibromyalgia rapid screening

We used the fibromyalgia rapid screening tool to screen for the disease (PERROT; BOUHASSIRA; FERMANIAN, 2010). This instrument was validated by Sousa et al. for the Brazilian population, with an adequate intraclass correlation coefficient and internal consistency. It is a self-administered instrument consisting of six items with the response options "yes" or "no", with a cut-off point of five points, indicating that people scoring five or six points are more likely to have fibromyalgia (DE SOUSA et al., 2022).

Fibromyalgia impact

We assessed the fibromyalgia impact using the revised fibromyalgia impact questionnaire, which was validated for the Brazilian population by Lupi et al. and has adequate reliability and internal consistency (LUPI et al., 2017). The instrument was used for the first, sixth, twelfth-, and twenty-fourth-week assessments. The questionnaire contains twenty-one items assessing function, global impact, and symptoms of fibromyalgia. All questions relate to experiences in the past seven days and are presented on a numerical rating scale from zero to ten points. The score from zero to one hundred points is obtained by adding the three normalized domain scores. The lower the score, the lower the fibromyalgia impact. A difference of 27 points in the total score was considered a minimal clinically important difference between independent groups (SURENDRAN; MITHUN, 2018).

Sleep

Sleep quality was assessed using the Pittsburgh sleep quality index. This instrument is reliable (PASSOS et al., 2017) and was adapted for Brazilians by Bertolazi et al. It assesses seven sleep components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Scores range from zero to three for each component, with a maximum score of twenty-one. Scores above five indicate poor sleep quality (BERTOLAZI et al., 2011).

Anxiety and depression

We assessed anxiety and depression using the hospital anxiety and depression scale, validated for Brazilians by Marcolino et al. This scale consists of fourteen items divided into two domains: anxiety and depression, each with seven items. The items have a Likert scale with four numerical values, resulting in total scores ranging from zero to twenty-one for the two domains. The cut-off points indicating moderate to severe symptoms are equal to or greater than eight for anxiety and equal to or greater than nine for depression (MARCOLINO et al., 2007).

Pain

Pain was assessed with different instruments and tests. Pain intensity was assessed with the numerical pain rating scale, validated for Portuguese by Ferreira-Valente et al. It has a sequence of numbers between zero and ten. This instrument was used in the temporal summation (wind-up mechanism) and conditioned pain modulation tests (FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011). A two-point reduction in pain intensity is considered a minimal clinically important difference (FARRAR et al., 2001).

We evaluated the winding mechanism by means of the temporal summation test using a digital pressure algometer (ITO®, Tokyo, Japan), the reliability of which has already been demonstrated. The test verifies the progressive and frequency-dependent facilitation of a neuron's responses

observed during the application of repetitive or constant intensity stimuli. A pressure of 2.5 kg was applied to the anterior surface of the right forearm of the person with fibromyalgia, 7.5 cm from the distal wrist crease, and maintained for thirty seconds. During this time, the person with fibromyalgia self-reported the intensity of pain perceived at the first, tenth, twentieth, and thirtieth seconds of stimulus application (PONTES-SILVA et al., 2023a).

We evaluated conditioned pain modulation, which consists of reducing pain in response to another painful stimulus (conditioned stimulus). The test was divided into four steps: first, we measured the pressure pain threshold using the same positioning as in the temporal summation test to stimulate intensity four pain. Second, we applied ischemic compression of 250 mmHg to the left arm using an analog sphygmomanometer to stimulate intensity five pain. Third, we repeated the first phase of the test, but during the conditioned stimulus. Fourth, five minutes after the conditioned stimulus was removed, we repeated the first phase of the test (PONTES-SILVA et al., 2023a).

We assessed cutaneous sensory threshold using a set of von Frey filaments in the trapezius, supraspinatus, and sternocleidomastoid muscles. The person with fibromyalgia was blindfolded during the test. In order of increasing gram-force, each filament was positioned perpendicular to the skin and gently squeezed to its initial bend and then removed. The first filament where the person reported feeling touch was considered the cutaneous sensation threshold (PONTES-SILVA et al., 2023a).

Musculoskeletal performance: isokinetic dynamometry

We used a Biodex Medical Systems 3™ (Shirley, New York, USA) for this evaluation. The person with fibromyalgia was positioned with the hip angle at 100° and the trunk, pelvis and thigh were stabilized with straps. The axis of rotation of the dynamometer was aligned with the axis of the knee, at the level of the lateral epicondyle of the femur, fixed to the distal part of the leg, five centimeters above the medial malleolus. Correction for the effect of gravity was calculated with the limb flexed at 60° (PONTES-SILVA et al., 2023a).

Prior to the isokinetic assessment, we performed a familiarization series of five submaximal isokinetic contractions. Three minutes after familiarization, participants performed ten concentric isokinetic knee extension contractions ranging from 90° to 15° with a total amplitude of 75° at an angular velocity of 60°/second. During all contractions performed on the right lower limb, verbal encouragement and visual feedback from the device were provided in an attempt to achieve maximum voluntary effort (PONTES-SILVA et al., 2023a).

Walking ability

We assessed walking ability using the six-minute walk test, which has been shown to be reliable (PANKOFF et al., 2000). We instructed the person with fibromyalgia to walk as fast as possible for the six minutes and to stop the test if they felt uncomfortable. Before and after the session, we monitored blood pressure, heart rate, oxygen saturation, and respiratory rate. The level of exertion during the test was monitored using the Borg scale. An increase of one hundred and fifty-six meters in the distance walked is considered a minimal clinically important difference in fibromyalgia (KALETH; SLAVEN; ANG, 2016).

Muscle strength for maximum dynamic load when exercising

Maximum muscular strength for the exercise load in strength training groups was determined using the one-repetition maximum test. The results of this test, in addition to being reliable (GRGIC et al., 2020), are widely used to identify the amount of kg based on the percentage of strength observed. The person with fibromyalgia performed ten repetitions of the movement without load to warm up the musculoskeletal system and to understand the technique. After one minute of rest, three to five maximum repetitions were performed, observed by the evaluator and self-reported by the subject. After three minutes of rest, the one-repetition maximum test was performed (RIBEIRO et al., 2018).

The load used in the one-repetition maximum test was determined by the maximum number of repetitions observed by the evaluator and reported by the person with fibromyalgia. The number of maximum repetitions was entered into the mathematical equation proposed by Brzycki, in which one maximum repetition is equal to the submaximal load in kg divided by (1.0278 – 0.0278 × number of repetitions performed). The test was used to adjust the intensity of strength training in the first, fourth and eighth weeks (PONTES-SILVA et al., 2023a).

Global perceived effect related to treatment

We assessed self-reported global perceived effect of treatment using the global perceived effect, an instrument validated for the Brazilian population. this is an eleven-point descriptive scale in which the individual's perception is classified according to their score at a given time. thus, the person with fibromyalgia reported their perception of improvement in relation to the treatment using a score ranging from –5 to +5 and classified as: much worse, no change or fully recovered. a change of three points is considered a minimal clinically important difference (COSTA et al., 2008).

Intervention

All groups received a 45-minute pain education session prior to the exercise program, and all exercise sessions took place individually in a private room. The person with fibromyalgia received 24 exercise sessions, with two forty-minute sessions per week, and a ten-minute rest period after each session. The person with fibromyalgia was instructed to stop the intervention at any time without having to give a reason. In addition, blood pressure, heart rate, peripheral oxygen saturation, intensity of widespread pain, and subjective perception of exertion were monitored before and after the session. Additionally, throughout the treatment, the researcher responsible for the intervention maintained weekly contact via WhatsApp™ with each person with fibromyalgia, twice a week (PONTES-SILVA et al., 2023a).

Group 1: progressive intensity strength training

The person with fibromyalgia performed a four-minute global warm-up divided into four unloaded exercises: seated calf raises, lateral raise with dumbbells, leg press, and incline bench press. This was followed by strength training at moderate intensity (50% of maximum strength), which involved nine muscle groups: glutes, quadriceps, hamstrings, biceps brachii, triceps brachii, pectoralis major, calf, deltoid, and latissimus dorsi. In this protocol, six exercises were used, divided between the upper and lower limbs: 1) leg extension, 2) leg press, 3) seated machine calf raise, 4) incline bench press, 5) seated machine row, and 6) dumbbell lateral raise (PONTES-SILVA et al., 2023a).

Moderate intensity (50% of maximum strength) was previously determined by one-repetition maximum test in each of the six proposed exercises (**Figure 1**). Muscle strength was individually reassessed every 4 weeks and the intensity of each exercise was increased by 20% of the observed value in kg, i.e., 50% in the first month, 70% in the second month and 90% in the third month (PONTES-SILVA et al., 2023a).

The intensity of the exercises (kg), rest between sets, number of sets, repetitions, time under tension and frequency of strength training were planned and supervised by a bachelor in physical education with experience in chronic pain. Twice a week for three months, the person with fibromyalgia performed three sets of each exercise, with ten repetitions, forty seconds of muscle tension, full range of motion, inhalation in the eccentric phase, and sixty seconds of rest between sets (PONTES-SILVA et al., 2023a).

To maintain the same volume of work in strength training, add twenty seconds of rest between sets each month according to the progression of intensity. Namely, sixty seconds in the first month, eighty seconds in the second month, and one hundred seconds in the third month, since higher intensities require longer rest periods to maintain the same volume of work (number of sets, repetitions, and time under tension) (PONTES-SILVA et al., 2023b).

Group 2: constant intensity strength training

Moderate intensity (50% of maximum strength) was previously determined by testing one maximum repetition of each of the six suggested exercises (**Figure 1**). Muscle strength was also individually reassessed every four weeks. However, in this group, the intensity of each exercise was maintained at 50% of maximum strength until the end of treatment. Therefore, a constant intensity and sixty seconds rest between sets were maintained from the first to the third month. The other procedures were exactly the same (PONTES-SILVA et al., 2023a).

Group 3: constant intensity walking

The person with fibromyalgia walked on the treadmill for forty minutes at a moderate intensity, determined by the speed corresponding to a rate of 60% to 70% of the maximum heart rate monitored by a portable oximeter (**Figure 1**). We estimated the maximum heart rate by age in years, taking into account the standard error of ten heartbeats according to Garber et al (GARBER et al., 2011). Therefore, if the person with fibromyalgia exceeded 60-70% of the maximum heart rate, the treadmill speed was slowly reduced until the heart rate reached the suggested rate of 60-70% (PONTES-SILVA et al., 2023a).

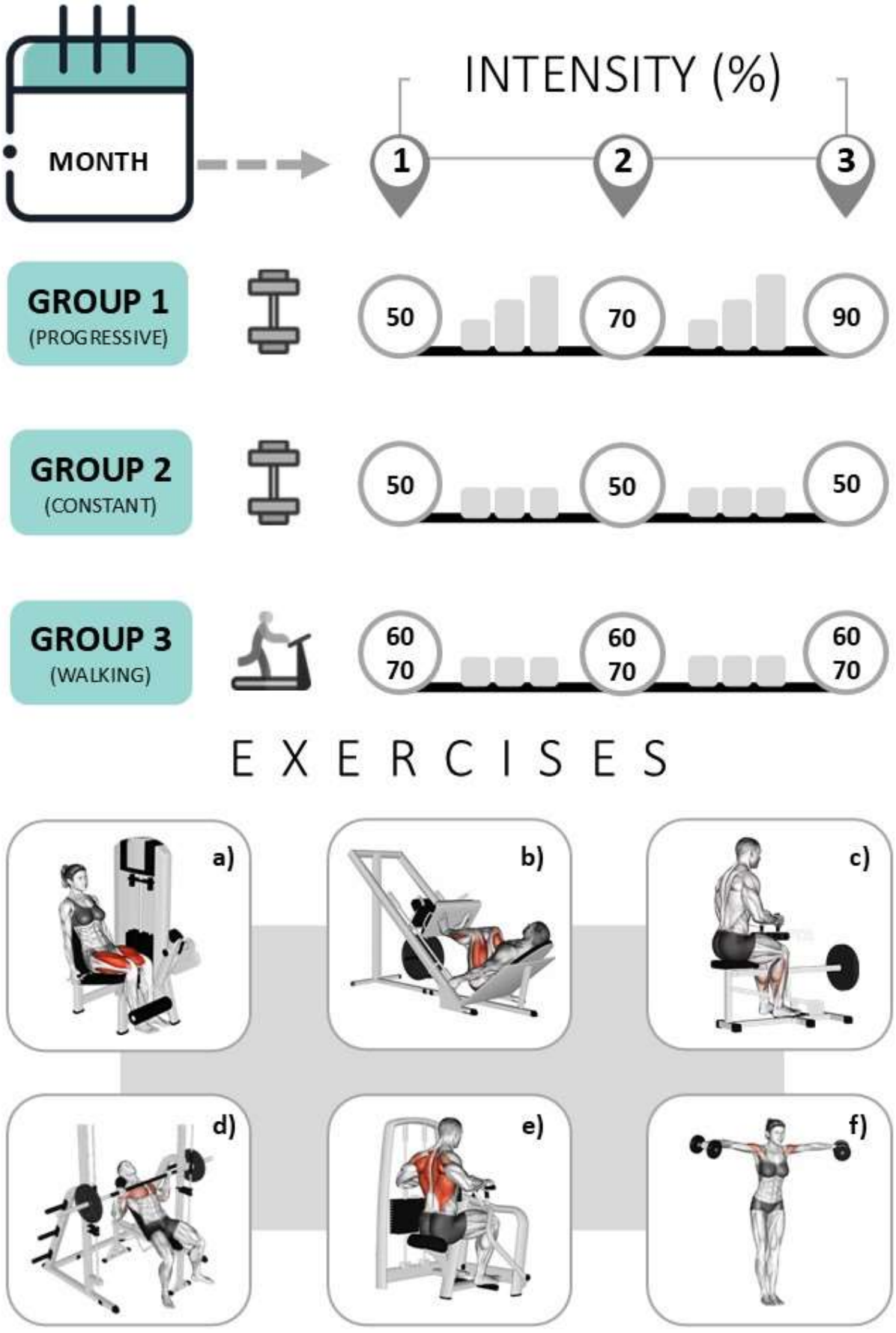

Figure 1. Exercises and their intensities throughout the treatment period.

Statistical analysis

Statistical analyses were performed according to the intention-to-treat principle (NAGEL; HAUSSEN; NOGUEIRA, 2020). Numerical comparisons were performed using linear mixed models, taking into account the interaction between time × group factors, with Bonferroni adjustment for multiple comparisons. Categorical comparisons were performed using chi-squared and Fisher's exact tests. For significant differences between means, we calculated the effect size using Cohen's d, with the following classification: small (.2), medium (.5), and large (.8) (PONTES-SILVA et al., 2023a). Thus, data were presented as mean, standard deviation, adjusted difference between means, and 95% confidence interval (95%CI). We used a 5% significance level in all analyses, which were performed using SPSS® software, version 17 (Chicago, IL, USA).

RESULTS

After the study was announced, 250 people completed the form expressing interest in participating (**Figure 2**). Of these, 184 were not enrolled because they did not meet the inclusion criteria. However, these people received a pain education booklet. The final sample of 66 people with fibromyalgia was randomized and concealed allocation three groups: progressive (n = 22), constant (n = 22), and walking (n = 22). **Table 1** describes the characteristics' sample and dropout rates in each group. Non-significant differences were observed in all comparisons ($p \geq .05$).

Table 2 shows the descriptive values and between-group comparisons for the primary outcome at each study time point: group vs. group at baseline and at weeks 6, 12, and 24 (follow-up). Although we observed a significant difference ($p \leq .05$) between the progressive and walking groups at baseline in the impact domain, the difference (4.90 [95% CI: .94; 8.86]) has a medium effect size (d = .57). The primary outcome and the a priori sampling were planned using the sum of all domains of the Revised Fibromyalgia Impact Questionnaire (total score: 0–100). In this questionnaire, all groups are similar ($p \geq .05$), and none of them reached the minimal clinically important difference of 27 points.

Table 3 shows the delta comparisons between groups for the primary outcome at all study time points (time–time vs. group–group). We observed a significant difference ($p \leq .05$) between the progressive and walking groups at both baseline (-5.30 [95% CI: -9.58; -1.03], d = .94]) and week 12 follow-up (-3.30 [95% CI: -6.59; -.01], d = .72). These results indicate that constant-intensity walking produced greater reductions in impact domain scores on the Revised Fibromyalgia Impact Questionnaire than progressive-intensity strength training.

Table 4 shows the within-group comparisons for the primary outcome at all study time points. Specifically, the comparisons are between time points: baseline–week 6, baseline–week 12, baseline–follow-up, week 6–week 12, week 6–follow-up, and week 12–follow-up. Considering all the observations in **Table 4**, we found a significant difference ($p \leq .05$, $d > .5$) in the total score of the Revised Fibromyalgia Impact Questionnaire at baseline and week 6 and at baseline and week 12. This indicates that the three types of exercises reduced global fibromyalgia symptoms. However, none of the exercises reached the minimal clinically important difference of 27 points.

Although no group reached the traditional minimal clinically important difference of 27 points for the primary outcome, all groups showed reductions of sufficient magnitude to call into question the validity of the minimum clinically important difference. This is based on the observed mean values.

Tables 5-6 shows the descriptive values and the between-group comparisons for the secondary outcome at baseline and at week 12 (group vs. group). No variable reached a minimal clinically important difference proposed a priori in the protocol. The groups reported a positive perception of improvement related to treatment, but there was no significant difference between the reports ($p \geq .05$). The majority of each group did not adhere and/or did not respond about adherence after the follow-up without exercise, but there was also no significant difference between the reports ($p \geq .05$). We observed a significant difference ($p \leq .05$) between the progressive and constant groups in the baseline cutaneous sensory threshold of the supraspinatus muscle (.75 [95%CI: .00; 1.50], d = .71), indicating that the progressive group had greater sensitivity in this body region. Finally, at week

12, we observed significant differences ($p \leq .05$) between the progressive and walking groups (-6.80 [95% CI: -13.16; -.44], d = .75) as well as between the constant and walking groups (-6.97 [95%CI: -13.33; -.61], d = .87) in right handgrip strength, suggesting that walking produces smaller strength gains compared to strength training.

Table 7 describes the between-group delta comparisons for the secondary outcome baseline–week 12 (time–time vs. group–group). We observed a significant difference ($p \leq .05$) between the progressive and constant groups in supraspinatus muscle cutaneous sensory threshold (-1.00 [95%CI: -1.81; -.19], d = .95) and knee extension strength (-14.61 [95%CI: -29.10; -.12], d = .84), confirming that the progressive group had greater sensitivity and achieved greater strength gains. The deltas also confirmed by significant difference ($p \leq .05$) that walking produced smaller gains in right handgrip strength compared to progressive (-8.29 [95%CI: -16.37; -.22], d = .79) or constant (-9.70 [95%CI: -17.78; -1.63], d = .89) intensity strength training.

Table 8 shows the within-group comparisons for the secondary outcomes. Significant differences were observed in all groups ($p \leq .05$, $d > .5$) in terms of sleep quality, anxiety, depression, wind-up mechanism, conditioned pain modulation, cutaneous sensory threshold, musculoskeletal performance, walking ability, and perceived improvement. However, none of the variables achieved a minimal clinically important difference.

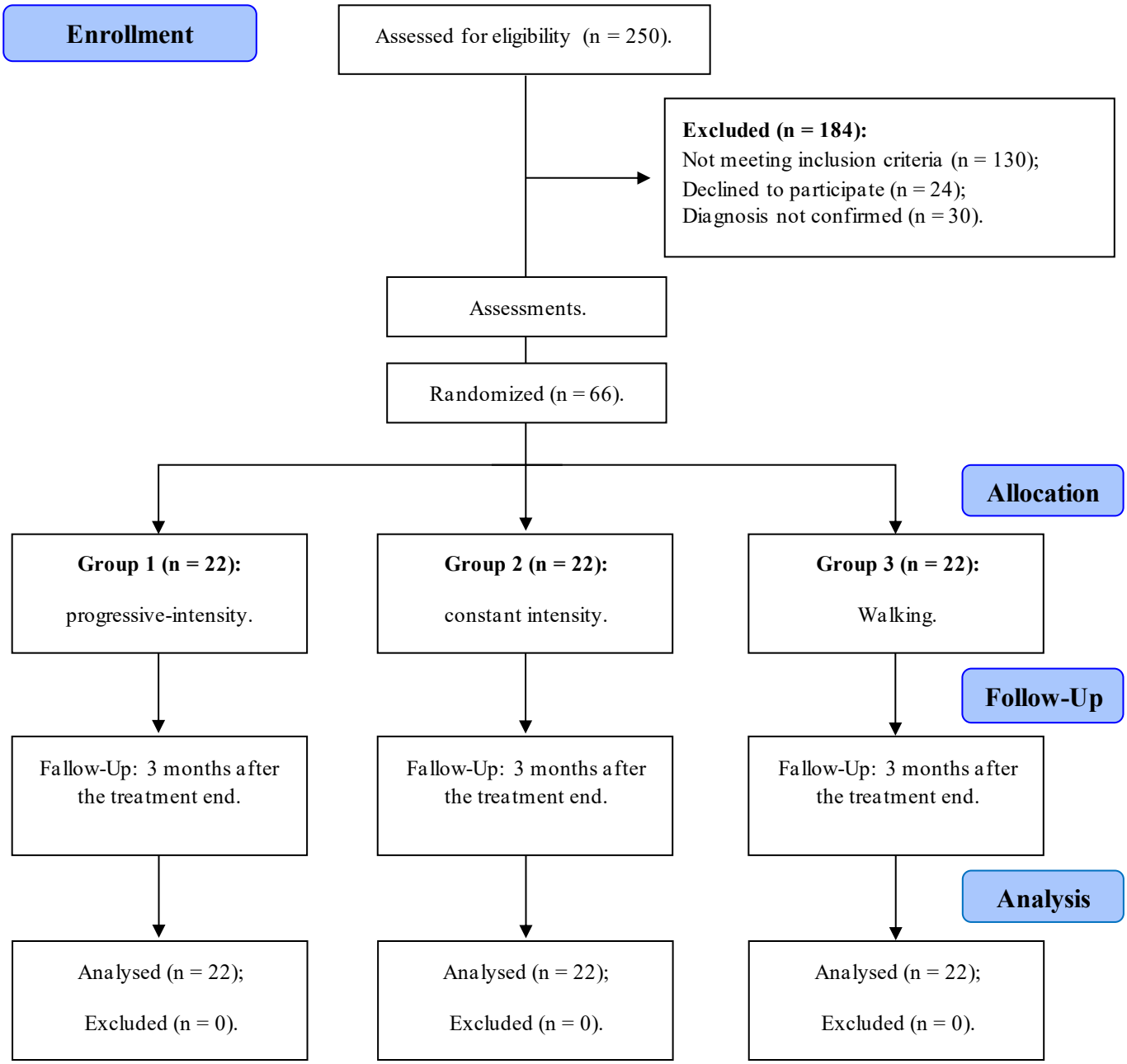

Figure 2. Flowchart.

Table 1. Sample characterization. Mean (standard deviation) or number (%).

Initial assessment variables	Progressive (n = 22)	Constant (n = 22)	Walking (n = 22)
Age (years)	44.77 (7.70)	42.31 (8.99)	42.95 (9.60)
Body mass (kg)	78.78 (15.06)	81.19 (18.46)	75.43 (14.73)
Stature (m)	1.63 (.06)	1.61 (.07)	1.64 (.07)
Body mass index (m/kg^2)	29.68 (5.74)	30.98 (6.46)	27.96 (5.60)
Fibromyalgia rapid screening (0-6)	5.59 (.66)	5.36 (.90)	5.40 (1.33)
Sex (female)	21 (95.4%)	21 (95.4%)	20 (90.9%)
Medication usage (yes)	15 (68.1%)	16 (72.7%)	17 (77.2%)
Ethnicity (self-reported)			
White	18 (81.8%)	17 (77.2%)	13 (59.1%)
Brown	3 (13.6%)	4 (18.1%)	9 (40.9%)
Black	1 (4.5%)	1 (4.5%)	0
Dropout rate (n = 19/66)	5 (22.7%)	9 (40.9%)	5 (22.7%)

Insignificant difference observed through linear mixed models or chi-square ($p \geq .05$).

Table 2. Descriptive values and between-group comparisons at all study time points (group vs. group). Revised fibromyalgia impact questionnaire (primary outcome).

Primary outcome (descriptive)	Progressive (n = 22)	Constant (n = 22)	Walking (n = 22)
Function (0-30)	Mean (95% confidence interval)		
Baseline	17.01 (13.72, 20.30)	17.90 (14.61, 21.20)	21.04 (17.75, 24.33)
6th week	12.91 (10.11, 15.71)	14.06 (11.26, 16.86)	15.08 (12.27, 17.88)
12th week	11.19 (8.28, 14.09)	13.09 (10.18, 16)	14.84 (11.93, 17.75)
Follow-up (24th week)	12.72 (10.26, 15.17)	11.46 (9.01, 13.92)	12.74 (10.29, 15.20)
Impact (0-20)			
Baseline	11.50 (9.22, 13.77)	13.09 (10.81, 15.36)	16.40 (14.13, 18.68)
6th week	8.30 (6.04, 10.57)	9.85 (7.58, 12.11)	10.19 (7.93, 12.45)
12th week	8.06 (5.71, 10.42)	8.84 (6.49, 11.20)	10.97 (8.62, 13.33)
Follow-up (24th week)	9.53 (7.64, 11.42)	8.19 (6.30, 10.07)	9.13 (7.25, 11.02)
Symptoms (0-50)			
Baseline	34.52 (30.87, 38.17)	36.47 (32.82, 40.12)	39.86 (36.21, 43.51)
6th week	28.08 (24.27, 31.89)	29.69 (25.88, 33.50)	29.10 (25.29, 32.91)
12th week	26.89 (23.13, 30.65)	29.56 (25.81, 33.32)	29.71 (25.95, 33.46)
Follow-up (24th week)	30.45 (26.59, 34.31)	28.77 (24.91, 32.63)	30.61 (26.75, 34.47)
Total (0-100)			
Baseline	63.03 (54.72, 71.34)	67.47 (59.16, 75.78)	77.31 (69, 85.62)
6th week	49.30 (41.26, 57.34)	53.61 (45.57, 61.64)	54.37 (46.34, 62.41)
12th week	46.15 (37.58, 54.72)	51.51 (42.94, 60.08)	55.53 (46.96, 64.09)
Follow-up (24th week)	52.71 (45.14, 60.27)	48.43 (40.86, 55.99)	52.49 (44.93, 60.06)
Between-group comparisons	Progressive – Constant	Progressive – Walking	Constant – Walking
Function (0-30)	Estimated mean difference (95% confidence interval)		
Baseline	.89 (-4.83, 6.62)	4.03 (-1.69, 9.75)	3.13 (-2.59, 8.86)
6th week	1.15 (-3.72, 6.03)	2.16 (-2.70, 7.04)	1.01 (-3.86, 5.89)
12th week	1.90 (-3.15, 6.96)	3.65 (-1.40, 8.71)	1.75 (-3.31, 6.81)
Follow-up (24th week)	-1.25 (-5.52, 3.01)	.02 (-4.24, 4.29)	1.27 (-2.99, 5.54)
Impact (0-20)			
Baseline	1.59 (-2.36, 5.55)	4.90 (.94, 8.86) *	3.31 (-.64, 7.27)
6th week	1.54 (-2.39, 5.47)	1.88 (-2.05, 5.82)	.34 (-3.59, 4.27)
12th week	.78 (-3.31, 4.88)	2.90 (-1.19, 7.01)	2.12 (-1.97, 6.22)
Follow-up (24th week)	-1.34 (-4.62, 1.94)	-.39 (-3.68, 2.88)	.94 (-2.33, 4.23)
Symptoms (0-50)			
Baseline	1.95 (-4.39, 8.30)	5.34 (-1, 11.69)	3.38 (-2.96, 9.73)
6th week	1.61 (-5.02, 8.24)	1.02 (-5.61, 7.66)	-.58 (-7.22, 6.05)
12th week	2.67 (-3.86, 9.21)	2.81 (-3.72, 9.36)	.14 (-6.40, 6.68)
Follow-up (24th week)	-1.68 (-8.39, 5.03)	.15 (-6.55, 6.87)	1.84 (-4.87, 8.55)
Total (0-100)			
Baseline	4.43 (-10.02, 18.90)	14.28 (-.18, 28.74)	9.84 (-4.62, 24.30)
6th week	4.30 (-9.68, 18.29)	5.07 (-8.91, 19.06)	.76 (-13.22, 14.75)
12th week	5.36 (-9.55, 20.27)	9.37 (-5.53, 24.29)	4.01 (-10.89, 18.93)
Follow-up (24th week)	-4.28 (-17.44, 8.88)	-.21 (-13.38, 12.95)	4.06 (-9.10, 17.23)

Baseline: Sample characteristics before treatment. 6th week: Sample characteristics after twelve exercise sessions. 12th week: Sample characteristics after twenty-four exercise sessions. Follow-up: Sample characteristics after three months without exercise, i.e., at the twenty-fourth week in relation to the baseline. * Significant difference observed through linear mixed models ($p \leq .05$).

Table 3. Between-group delta comparisons: time–time vs. group–group. Revised Fibromyalgia Impact Questionnaire (primary outcome).

Primary outcome (Δ)	Progressive – Constant	Progressive – Walking	Constant – Walking
Function (0–30)	Estimated mean difference (95% confidence interval)		
Baseline – 6th week	.25 (–5.14, 5.66)	–1.86 (–7.26, 3.54)	–2.12 (–7.52, 3.28)
Baseline – 12th week	1.00 (–5.52, 7.54)	–.37 (–6.91, 6.15)	–1.38 (–7.92, 5.15)
Baseline – Follow–up	–2.14 (–8.14, 3.85)	–4.00 (–10.00, 1.99)	–1.85 (–7.85, 4.14)
6th week – 12th week	.74 (–3.63, 5.13)	1.48 (–2.90, 5.86)	.73 (–3.64, 5.12)
6th week – Follow–up	–2.40 (–6.36, 1.54)	–2.14 (–6.10, 1.81)	.26 (–3.69, 4.22)
12th week – Follow–up	–3.15 (–7.69, 1.37)	–3.62 (–8.16, .90)	–.47 (–5.00, 4.06)
Impact (0–20)			
Baseline – 6th week	–.05 (–4.09, 3.99)	–3.02 (–7.06, 1.01)	–2.97 (–7.01, 1.06)
Baseline – 12th week	–.80 (–5.35, 3.73)	–2.00 (–6.54, 2.54)	–1.19 (–5.73, 3.35)
Baseline – Follow–up	–2.93 (–7.20, 1.34)	–5.30 (–9.58, –1.03) *	–2.37 (–6.64, 1.90)
6th week – 12th week	–.76 (–4.34, 2.82)	1.02 (–2.56, 4.61)	1.78 (–1.80, 5.37)
6th week – Follow–up	–2.88 (–6.04, .27)	–2.28 (–5.44, .88)	.60 (–2.55, 3.76)
12th week – Follow–up	–2.12 (–5.41, 1.17)	–3.30 (–6.59, –.01) *	–1.18 (–4.47, 2.11)
Symptoms (0–50)			
Baseline – 6th week	–.34 (–7.24, 6.55)	–4.32 (–11.21, 2.57)	–3.97 (–10.87, 2.92)
Baseline – 12th week	.72 (–7.02, 8.46)	–2.52 (–10.26, 5.22)	–3.24 (–10.98, 4.49)
Baseline – Follow–up	–3.63 (–11.96, 4.69)	–5.18 (–13.50, 3.14)	–1.54 (–9.87, 6.78)
6th week – 12th week	1.06 (–4.78, 6.91)	1.79 (–4.05, 7.64)	.73 (–5.12, 6.58)
6th week – Follow–up	–3.29 (–9.28, 2.70)	–.86 (–6.85, 5.13)	2.43 (–3.56, 8.42)
12th week – Follow–up	–4.35 (–10.12, 1.40)	–2.65 (–8.42, 3.10)	1.70 (–4.06, 7.46)
Total (0–100)			
Baseline – 6th week	–.13 (–14.58, 14.31)	–9.20 (–23.65, 5.24)	–9.07 (–23.52, 5.37)
Baseline – 12th week	.92 (–16.59, 18.43)	–4.90 (–22.41, 12.61)	–5.82 (–23.33, 11.69)
Baseline – Follow–up	–8.71 (–25.79, 8.35)	–14.49 (–31.57, 2.58)	–5.77 (–22.85, 11.30)
6th week – 12th week	1.05 (–11.27, 13.38)	4.30 (–8.02, 16.63)	3.25 (–9.08, 15.58)
6th week – Follow–up	–8.58 (–19.72, 2.55)	–5.28 (–16.42, 5.85)	3.29 (–7.83, 14.43)
12th week – Follow–up	–9.64 (–21.90, 2.62)	–9.59 (–21.85, 2.67)	.04 (–12.21, 12.31)

Baseline: Sample characteristics before treatment. 6th week: Sample characteristics after twelve exercise sessions. 12th week: Sample characteristics after twenty-four exercise sessions. Follow-up: Sample characteristics after three months without exercise, i.e., at the twenty-fourth week in relation to the baseline. * Significant difference observed through linear mixed models ($p \leq .05$).

Table 4. Primary outcome within-group comparisons (time *vs.* time). Revised fibromyalgia impact questionnaire.

Primary outcome	Baseline – 6th week	Baseline – 12th week	Baseline – Follow–up	6th – 12th week	6th week – Follow–up	12th week – Follow–up
Function (0–30)	Estimated mean difference (95% confidence interval)					
Progressive	4.10 (–.13, 8.33)	5.82 (.70, 10.94) *	4.29 (–.40, 8.99)	1.72 (–1.71, 5.15)	.19 (–2.90, 3.28)	–1.53 (–5.08, 2.02)
Constant	3.84 (–.39, 8.07)	4.81 (–.30, 9.93)	6.44 (1.74, 11.14) *	.97 (–2.46, 4.40)	2.59 (–.50, 5.69)	1.62 (–1.92, 5.17)
Walking	5.96 (1.73, 10.19) *	6.20 (1.08, 11.32) *	8.30 (3.60, 12.99) *	.237 (–3.197, 3.671)	2.33 (–.76, 5.43)	2.09 (–1.45, 5.64)
Impact (0–20)						
Progressive	3.19 (.02, 6.35) *	3.43 (–.12, 6.99)	1.96 (–1.38, 5.31)	.24 (–2.56, 3.05)	–1.25 (–3.70, 1.25)	–1.46 (–4.04, 1.11)
Constant	3.24 (.07, 6.40) *	4.24 (.68, 7.80) *	4.90 (1.55, 8.24) *	1 (–1.80, 3.81)	1.65 (–.81, 4.13)	.65 (–1.92, 3.23)
Walking	6.21 (3.05, 9.38) *	5.43 (1.87, 8.99) *	7.27 (3.92, 10.62) *	–.78 (–3.59, 2.02)	1.05 (–1.42, 3.53)	1.83 (–.74, 4.41)
Symptoms (0–50)						
Progressive	6.43 (1.03, 11.84) *	7.63 (1.56, 13.69) *	4.06 (–2.45, 10.58)	1.19 (–3.39, 5.77)	–2.37 (–7.06, 2.32)	–3.56 (–8.07, .95)
Constant	6.78 (1.38, 12.18) *	6.90 (.84, 12.97) *	7.70 (1.18, 14.22) *	.12 (–4.45, 4.70)	.92 (–3.77, 5.61)	.79 (–3.71, 5.30)
Walking	10.75 (5.356, 16.16) *	10.15 (4.09, 16.21) *	9.25 (2.72, 15.77) *	–.60 (–5.18, 3.97)	–1.50 (–6.20, 3.18)	–.90 (–5.41, 3.60)
Total (0–100)						
Progressive	13.73 (2.41, 25.05) *	16.88 (3.17, 30.60) *	10.32 (–3.04, 23.70)	3.15 (–6.50, 12.81)	–3.40 (–12.12, 5.31)	–6.56 (–16.16, 3.04)
Constant	13.86 (2.54, 25.18) *	15.96 (2.25, 29.68) *	19.04 (5.67, 32.42) *	2.09 (–7.55, 11.75)	5.17 (–3.54, 13.90)	3.08 (–6.52, 12.68)
Walking	22.94 (11.62, 34.25) *	21.78 (8.07, 35.50) *	24.82 (11.44, 38.19) *	–1.15 (–10.80, 8.50)	1.88 (–6.84, 10.60)	3.03 (–6.57, 12.63)

Baseline: Sample characteristics before treatment. 6th week: Sample characteristics after twelve exercise sessions. 12th week: Sample characteristics after twenty-four exercise sessions. Follow-up: Sample characteristics after three months without exercise, i.e., at the twenty-fourth week in relation to the baseline. * Significant difference observed through linear mixed models ($p \leq .05$).

Table 5. Secondary outcome descriptive values.

Secondary outcome	Progressive (n = 22)	Constant (n = 22)	Walking (n = 22)
Widespread pain index (0-19)		Mean (95% confidence interval)	
Baseline	9.68 (8.46, 10.90)	11.59 (10.37, 12.81)	11.31 (10.09, 12.53)
12th week	5.81 (4.40, 7.21)	7.22 (5.82, 8.62)	7.26 (5.86, 8.66)
Symptom severity scale (0-12)			
Baseline	6.27 (5.75, 6.79)	6.36 (5.84, 6.88)	6.31 (5.79, 6.83)
12th week	5.06 (4.30, 5.81)	5.47 (4.72, 6.23)	5.29 (4.53, 6.04)
Pittsburgh Sleep Quality Index (score)			
Subjective sleep quality (0-3)			
Baseline	2.22 (1.94, 2.50)	2.22 (1.94, 2.50)	2.45 (2.17, 2.73)
12th week	1.88 (1.58, 2.18)	1.91 (1.61, 2.20)	1.88 (1.58, 2.18)
Sleep latency (0-3)			
Baseline	2.40 (2.06, 2.75)	2.22 (1.88, 2.56)	2.18 (1.84, 2.52)
12th week	2.32 (2.01, 2.63)	2.22 (1.91, 2.53)	2.09 (1.78, 2.40)
Sleep duration (0-3)			
Baseline	1.86 (1.40, 2.32)	1.50 (1.04, 1.96)	1.40 (.94, 1.86)
12th week	1.70 (1.34, 2.06)	1.39 (1.03, 1.74)	1.43 (1.07, 1.79)
Habitual sleep efficiency (0-3)			
Baseline	2.40 (1.89, 2.92)	2.59 (2.07, 3.10)	2.09 (1.57, 2.60)
12th week	2.99 (2.94, 3.04)	2.94 (2.89, 2.99)	2.99 (2.94, 3.04)
Sleep disturbances (0-3)			
Baseline	2.45 (2.18, 2.72)	2.50 (2.23, 2.76)	2.45 (2.18, 2.72)
12th week	2.24 (2.02, 2.46)	2.29 (2.07, 2.51)	2.29 (2.06, 2.51)
Use of sleep medication (0-3)			
Baseline	2.13 (1.55, 2.71)	2.00 (1.42, 2.57)	2.04 (1.46, 2.62)
12th week	1.51 (1.00, 2.02)	1.58 (1.08, 2.09)	1.87 (1.37, 2.38)
Daytime dysfunction (0-3)			
Baseline	1.77 (1.43, 2.11)	2.09 (1.75, 2.43)	2.31 (1.97, 2.66)
12th week	1.68 (1.35, 2.01)	1.83 (1.50, 2.17)	1.96 (1.63, 2.29)
Total (0-21)			
Baseline	15.27 (13.68, 16.86)	15.13 (13.54, 16.72)	14.95 (13.36, 16.54)
12th week	14.35 (13.08, 15.62)	14.19 (12.91, 15.46)	14.53 (13.26, 15.81)
Anxiety (HADS, 0-21)			
Baseline	11.90 (10.25, 13.56)	12.59 (10.94, 14.24)	14.36 (12.71, 16.01)
12th week	10.60 (9.04, 12.17)	10.59 (9.03, 12.15)	10.83 (9.27, 12.39)
Depression (HADS, 0-21)			
Baseline	11.04 (9.31, 12.77)	10.86 (9.13, 12.59)	13.09 (11.36, 14.82)
12th week	9.61 (7.94, 11.27)	8.62 (6.96, 10.28)	9.01 (7.35, 10.68)
Wind-up (TS: pressure = 2.5 kg)			
0 seconds (NPRS, 0-10)			
Baseline	4.72 (3.55, 5.89)	4.68 (3.50, 5.85)	5.22 (4.05, 6.40)
12th week	3.76 (2.92, 4.60)	4.49 (3.65, 5.33)	4.52 (3.68, 5.37)
10 seconds (NPRS, 0-10)			
Baseline	5.79 (4.64, 6.93)	6.13 (4.99, 7.28)	7.13 (5.99, 8.28)
12th week	5.13 (4.21, 6.04)	5.77 (4.86, 6.69)	5.75 (4.83, 6.66)
20 seconds (NPRS, 0-10)			
Baseline	6.55 (5.44, 7.67)	7.27 (6.15, 8.38)	8.13 (7.02, 9.25)
12th week	5.89 (4.94, 6.83)	6.54 (5.60, 7.48)	6.66 (5.72, 7.60)
30 seconds (NPRS, 0-10)			
Baseline	7.04 (6.02, 8.06)	8.00 (6.98, 9.01)	8.40 (7.39, 9.42)
12th week	6.64 (5.64, 7.63)	7.02 (6.02, 8.02)	6.94 (5.94, 7.93)
Conditioned pain modulation (≥ 100)			
Baseline	154.12 (105.72, 202.52)	115.89 (67.50, 164.29)	122.45 (74.05, 170.85)
12th week	185.09 (106.81, 263.37)	118.95 (40.67, 197.23)	106.11 (27.83, 184.39)
Cutaneous sensory threshold (gf)			
Trapezius			
Baseline	1.21 (.57, 1.86)	1.43 (.78, 2.07)	.93 (.28, 1.57)
12th week	1.32 (.72, 1.91)	1.25 (.66, 1.85)	1.45 (.86, 2.06)
Supraspinatus			
Baseline	.76 (.33, 1.19)	1.51 (1.08, 1.94)	1.16 (.73, 1.59)
12th week	1.20 (.86, 1.53)	.94 (.60, 1.28)	1.07 (.73, 1.41)
Sternocleidomastoid			
Baseline	.22 (-.15, .60)	.83 (.45, 1.21)	.58 (.20, .96)
12th week	.42 (.16, .68)	.53 (.27, .78)	.74 (.48, 1.00)
Walking ability (6MWT, m)			
Baseline	455.71 (416.23, 495.19)	408.30 (368.82, 447.78)	395.33 (355.84, 434.81)

12th week	455.10 (436.43, 473.76)	455.40 (436.73, 474.07)	446.02 (427.35, 464.68)
Knee extension (Dynamometry)			
Peak torque (Nm)			
Baseline	80.42 (68.29, 92.54)	93.33 (81.49, 105.18)	81.70 (69.85, 93.54)
12th week	102.71 (96.97, 108.46)	96.14 (90.53, 101.76)	96.63 (91.02, 102.25)
Total work (J)			
Baseline	691.25 (584.89, 797.60)	785.36 (681.45, 889.27)	688.16 (584.26, 792.07)
12th week	875.89 (827.55, 924.24)	814.17 (766.94, 861.40)	817.94 (770.71, 865.17)
Strength (W)			
Baseline	53.70 (44.93, 62.46)	63.64 (55.08, 72.21)	54.94 (46.38, 63.50)
12th week	69.17 (64.59, 73.74)	63.84 (59.38, 68.31)	65.01 (60.54, 69.48)
Knee flexion (Dynamometry)			
Peak torque (Nm)			
Baseline	23.45 (16.94, 29.954)	29.98 (23.63, 36.338)	25.33 (18.97, 31.684)
12th week	32.94 (28.84, 37.045)	28.54 (24.54, 32.556)	31.84 (27.83, 35.853)
Total work (J)			
Baseline	190.14 (133.50, 246.789)	238.87 (183.53, 294.215)	196.69 (141.35, 252.035)
12th week	283.82 (243.65, 323.991)	240.30 (201.05, 279.551)	271.72 (232.48, 310.972)
Strength (W)			
Baseline	14.62 (10.05, 19.19)	18.76 (14.30, 23.235)	15.65 (11.19, 20.124)
12th week	21.28 (18.17, 24.39)	17.95 (14.91, 20.99)	20.40 (17.36, 23.446)
Right handgrip strength (kg)			
Baseline	20 (14.59, 25.41)	18.76 (13.35, 24.17)	21.49 (16.08, 26.90)
12th week	23.96 (20.30, 27.61)	24.13 (20.47, 27.78)	17.15 (13.50, 20.81)
Left handgrip strength (kg)			
Baseline	21.25 (15.90, 26.61)	20.07 (14.72, 25.42)	21.87 (16.52, 27.23)
12th week	26.84 (22.70, 30.97)	26.62 (22.49, 30.75)	20.76 (16.62, 24.89)
Global perceived effect (–5, +5)			
6th week	1.71 (.97, 2.45)	1.59 (.85, 2.32)	1.69 (.95, 2.43)
12th week	1.86 (.85, 2.87)	.72 (-.28, 1.73)	1.04 (.04, 2.05)
Follow-up (24th week)	1.31 (.50, 2.11)	1.07 (.27, 1.88)	.57 (-.22, 1.38)
Exercise adherence (24th week)			
Not (n = 25/66)	10 (45.5%)	7 (31.8%)	8 (36.4%)
Yes (n = 14/66)	5 (22.7%)	5 (22.7%)	4 (18.2%)
Unanswered (n = 27/66)	7 (31.8%)	10 (45.5%)	10 (45.5%)

HADS: Hospital Anxiety and Depression Scale. NPRS: Numerical Pain Rating Scale. 6MWT: Six-Minute Walk Test. TS: Temporal summation at a constant pressure of 2.5 kg for 30 seconds. Baseline: Sample characteristics before treatment. 6th week: Sample characteristics after twelve exercise sessions. 12th week: Sample characteristics after twenty-four exercise sessions. Follow-up: Sample characteristics after three months without exercise, i.e., at the twenty-fourth week in relation to the baseline.

Table 6. Secondary outcome between-group comparisons (group vs. group).

Secondary outcome	Progressive – Constant	Progressive – Walking	Constant – Walking
Widespread pain index (0–19)	Estimated mean difference (95% confidence interval)		
Baseline	1.90 (–.21, 4.03)	1.63 (–.48, 3.76)	–.27 (–2.39, 1.85)
12th week	1.41 (–1.02, 3.85)	1.45 (–.98, 3.89)	.04 (–2.39, 2.48)
Symptom severity scale (0–12)			
Baseline	.09 (–.81, .99)	.04 (–.86, .95)	–.04 (–.95, .86)
12th week	.41 (–.89, 1.72)	.22 (–1.08, 1.54)	–.18 (–1.50, 1.12)
Pittsburgh Sleep Quality Index (score)			
Subjective sleep quality (0–3)			
Baseline	.66 (–.48, .48)	.22 (–.26, .71)	.22 (–.26, .71)
12th week	.02 (–.49, .54)	–.88 (–.51, .51)	–.02 (–.54, .49)
Sleep latency (0–3)			
Baseline	–.18 (–.77, .41)	–.22 (–.82, .36)	–.04 (–.64, .54)
12th week	–.09 (–.63, .44)	–.22 (–.76, .31)	–.13 (–.66, .41)
Sleep duration (0–3)			
Baseline	–.36 (–1.16, .43)	–.45 (–1.25, .34)	–.09 (–.89, .71)
12th week	–.31 (–.93, .30)	–.27 (–.89, .35)	.04 (–.57, .66)
Habitual sleep efficiency (0–3)			
Baseline	.18 (–.71, 1.08)	–.31 (–1.21, .58)	–.50 (–1.39, .39)
12th week	–.04 (–.14, .04)	.98 (–.09, .09)	.04 (–.04, .14)
Sleep disturbances (0–3)			
Baseline	.04 (–.41, .50)	.031 (–.46, .46)	–.04 (–.50, .41)
12th week	.05 (–.33, .44)	.04 (–.34, .43)	–.00 (–.39, .38)
Use of sleep medication (0–3)			
Baseline	–.13 (–1.14, .86)	–.09 (–1.09, .91)	.04 (–.95, 1.05)
12th week	.07 (–.80, .95)	.36 (–.51, 1.24)	.28 (–.59, 1.17)
Daytime dysfunction (0–3)			
Baseline	.31 (–.27, .91)	.54 (–.04, 1.14)	.22 (–.36, .82)
12th week	.15 (–.42, .72)	.27 (–.30, .84)	.12 (–.45, .69)
Total (0–21)			
Baseline	–.13 (–2.90, 2.62)	–.31 (–3.08, 2.44)	–.18 (–2.94, 2.58)
12th week	–.16 (–2.38, 2.05)	.18 (–2.03, 2.40)	.34 (–1.87, 2.56)
Anxiety (HADS, 0–21)			
Baseline	.68 (–2.19, 3.55)	2.45 (–.41, 5.32)	1.77 (–1.10, 4.64)
12th week	–.01 (–2.72, 2.70)	.22 (–2.48, 2.94)	.24 (–2.47, 2.95)
Depression (HADS, 0–21)			
Baseline	–.18 (–3.19, 2.83)	2.04 (–.96, 5.05)	2.22 (–.78, 5.23)
12th week	–.98 (–3.87, 1.90)	–.59 (–3.48, 2.30)	.39 (–2.50, 3.28)
Wind–up (TS: pressure = 2.5 kg)			
0 seconds (NPRS, 0–10)			
Baseline	–.04 (–2.08, 2.00)	.50 (–1.54, 2.54)	.54 (–1.50, 2.59)
12th week	.73 (–.73, 2.19)	.76 (–.70, 2.23)	.03 (–1.43, 1.50)
10 seconds (NPRS, 0–10)			
Baseline	.34 (–1.64, 2.33)	1.34 (–.64, 3.33)	1.00 (–.99, 2.99)
12th week	.64 (–.94, 2.23)	.62 (–.96, 2.21)	–.02 (–1.61, 1.56)
20 seconds (NPRS, 0–10)			
Baseline	.71 (–1.22, 2.65)	1.57 (–.36, 3.51)	.86 (–1.07, 2.80)
12th week	.65 (–.98, 2.29)	.77 (–.86, 2.41)	.12 (–1.51, 1.75)
30 seconds (NPRS, 0–10)			
Baseline	.95 (–.82, 2.72)	1.36 (–.41, 3.13)	.40 (–1.36, 2.18)
12th week	.38 (–1.35, 2.12)	.30 (–1.43, 2.04)	–.08 (–1.82, 1.65)
Conditioned pain modulation (≥ 100)			
Baseline	–38.22 (–122.47, 46.01)	–31.67 (–115.91, 52.57)	6.55 (–77.69, 90.79)
12th week	–66.13 (–202.39, 70.12)	–78.97 (–215.23, 57.28)	–12.84 (–149.10, 123.41)
Cutaneous sensory threshold (gf)			
Trapezius			
Baseline	.21 (–.91, 1.33)	–.28 (–1.41, .83)	–.50 (–1.62, .62)
12th week	–.06 (–1.09, .97)	.14 (–.89, 1.18)	.20 (–.83, 1.24)
Supraspinatus			
Baseline	.75 (.00, 1.50) *	.40 (–.35, 1.15)	–.35 (–1.10, .40)
12th week	–.25 (–.84, .33)	–.12 (–.71, .46)	.13 (–.46, .72)
Sternocleidomastoid			
Baseline	.60 (–.05, 1.26)	.35 (–.30, 1.01)	–.24 (–.90, .41)
12th week	.10 (–.34, .55)	.31 (–.13, .76)	.21 (–.23, .66)
Walking ability (6MWT, m)			
Baseline	–47.40 (–116.13, 21.31)	–60.38 (–129.10, 8.34)	–12.97 (–81.69, 55.74)

12th week	.30 (–32.18, 32.79)	–9.08 (–41.57, 23.41)	–9.38 (–41.87, 23.10)
Knee extension (Dynamometry)			
Peak torque (Nm)			
Baseline	12.91 (–7.89, 33.72)	1.28 (–19.52, 22.08)	–11.63 (–32.20, 8.92)
12th week	–6.57 (–16.43, 3.28)	–6.08 (–15.94, 3.78)	.49 (–9.25, 10.23)
Total work (J)			
Baseline	94.11 (–88.41, 276.64)	–3.08 (–185.61, 179.44)	–97.19 (–277.59, 83.19)
12th week	–61.72 (–144.69, 21.24)	–57.95 (–140.92, 25.01)	3.77 (–78.22, 85.77)
Strength (W)			
Baseline	9.94 (–5.09, 24.98)	1.24 (–13.79, 16.28)	–8.70 (–23.56, 6.16)
12th week	–5.32 (–13.16, 2.52)	–4.15 (–12.00, 3.69)	1.16 (–6.59, 8.92)
Knee flexion (Dynamometry)			
Peak torque (Nm)			
Baseline	6.53 (–4.62, 17.69)	1.87 (–9.28, 13.04)	–4.65 (–15.68, 6.37)
12th week	–4.39 (–11.43, 2.64)	–1.09 (–8.13, 5.94)	3.29 (–3.65, 10.25)
Total work (J)			
Baseline	48.72 (–48.48, 145.93)	6.54 (–90.66, 103.75)	–42.18 (–138.25, 53.89)
12th week	–43.51 (–112.45, 25.42)	–12.09 (–81.03, 56.84)	31.42 (–36.71, 99.55)
Strength (W)			
Baseline	4.14 (–3.69, 11.99)	1.03 (–6.80, 8.88)	–3.11 (–10.86, 4.64)
12th week	–3.32 (–8.67, 2.01)	–.87 (–6.21, 4.46)	2.45 (–2.82, 7.73)
Right handgrip strength (kg)			
Baseline	–1.24 (–10.65, 8.17)	1.49 (–7.92, 10.90)	2.73 (–6.68, 12.15)
12th week	.16 (–6.19, 6.52)	–6.80 (–13.16, –.44) *	–6.97 (–13.33, –.61) *
Left handgrip strength (kg)			
Baseline	–1.18 (–10.50, 8.13)	.62 (–8.69, 9.93)	1.80 (–7.51, 11.12)
12th week	–.21 (–7.40, 6.97)	–6.08 (–13.27, 1.11)	–5.86 (–13.05, 1.32)
Global perceived effect (–5, +5)			
6th week	–.12 (–1.40, 1.16)	–.01 (–1.30, 1.27)	.10 (–1.17, 1.39)
12th week	–1.14 (–2.89, .61)	–.81 (–2.57, .93)	.32 (–1.43, 2.07)
Follow–up (24th week)	–.23 (–1.63, 1.17)	–.73 (–2.13, .67)	–.50 (–1.90, .90)
Exercise adherence (24th week)			
No	13.7%	9.1%	4.6%
Yes	0	4.5%	4.5%
Unanswered	13.7%	13.7%	0

HADS: Hospital Anxiety and Depression Scale. NPRS: Numerical Pain Rating Scale. 6MWT: Six-Minute Walk Test. TS: Temporal summation at a constant pressure of 2.5 kg for 30 seconds. Baseline: Sample characteristics before treatment. 6th week: Sample characteristics after twelve exercise sessions. 12th week: Sample characteristics after twenty-four exercise sessions. Follow-up: Sample characteristics after three months without exercise, i.e., at the twenty-fourth week in relation to the baseline. * Significant difference observed through linear mixed models ($p \leq .05$).

Table 7. Between-group delta comparisons: time–time vs. group–group (secondary outcome).

Secondary outcome (Δ)	Progressive – Constant	Progressive – Walking	Constant – Walking
Baseline – 12th week	Estimated mean difference (95% confidence interval)		
Widespread pain index (0–19)	–.49 (–3.00, 2.00)	–.18 (–2.68, 2.32)	.31 (–2.19, 2.82)
Symptom severity scale (0–12)	.32 (–1.11, 1.75)	.18 (–1.25, 1.61)	–.14 (–1.57, 1.29)
Pittsburgh Sleep Quality Index (score)			
Subjective sleep quality (0–3)	.02 (–.61, .67)	–.22 (–.87, .41)	–.25 (–.89, .39)
Sleep latency (0–3)	.08 (–.48, .65)	.05 (–.57, .57)	–.08 (–.65, .48)
Sleep duration (0–3)	.04 (–.66, .76)	.18 (–.53, .89)	.13 (–.58, .85)
Habitual sleep efficiency (0–3)	–.23 (–1.13, .67)	.31 (–.58, 1.22)	.54 (–.35, 1.45)
Sleep disturbances (0–3)	.00 (–.51, .52)	.04 (–.47, .56)	.04 (–.48, .56)
Use of sleep medication (0–3)	.21 (–.86, 1.28)	.45 (–.62, 1.53)	.24 (–.83, 1.32)
Daytime dysfunction (0–3)	–.16 (–.85, .52)	–.27 (–.96, .41)	–.10 (–.79, .58)
Total (0–21)	–.02 (–3.11, 3.06)	.50 (–2.59, 3.59)	.52 (–2.56, 3.61)
Anxiety (HADS, 0–21)	–.69 (–3.57, 2.18)	–2.22 (–5.11, .65)	–1.53 (–4.41, 1.35)
Depression (HADS, 0–21)	–.80 (–3.95, 2.34)	–2.63 (–5.78, .51)	–1.83 (–4.98, 1.31)
Wind–up (TS: pressure = 2.5 kg)			
0 seconds (NPRS, 0–10)	.77 (–.96, 2.51)	.26 (–1.48, 2.00)	–.51 (–2.25, 1.22)
10 seconds (NPRS, 0–10)	.30 (–1.41, 2.01)	–.72 (–2.43, .98)	–1.02 (–2.73, .68)
20 seconds (NPRS, 0–10)	–.05 (–1.80, 1.69)	–.80 (–2.55, .95)	–.74 (–2.49, 1.00)
30 seconds (NPRS, 0–10)	–.56 (–2.31, 1.18)	–1.06 (–2.80, .68)	–.49 (–2.24, 1.25)
Conditioned pain modulation (≥ 100)	–27.90 (–91.04, 35.23)	–47.30 (–110.44, 15.83)	–19.39 (–82.53, 43.74)
Cutaneous sensory threshold (gf)			
Trapezius	–.27 (–1.77, 1.22)	.43 (–1.06, 1.93)	.70 (–.79, 2.20)
Supraspinatus	–1.00 (–1.81, –.19) *	–.52 (–1.33, .28)	.48 (–.32, 1.28)
Sternocleidomastoid	–.50 (–1.29, .29)	–.03 (–.83, .76)	.46 (–.33, 1.26)
Walking ability (6MWT, m)	47.71 (–13.96, 109.38)	51.30 (–10.37, 112.97)	3.58 (–58.08, 65.26)
Knee extension (Dynamometry)			
Peak torque (Nm)	–18.46 (–37.75, .83)	–6.33 (–25.62, 12.95)	12.12 (–7.16, 31.41)
Total work (J)	–146.80 (–317.70, 24.08)	–45.83 (–216.73, 125.05)	100.97 (–69.92, 271.86)
Strength (W)	–14.61 (–29.10, –.12) *	–4.74 (–19.23, 9.73)	9.86 (–4.61, 24.35)
Knee flexion (Dynamometry)			
Peak torque (Nm)	–9.77 (–19.98, .43)	–1.82 (–12.03, 8.39)	7.95 (–2.26, 18.16)
Total work (J)	–82.31 (–175.80, 11.17)	–8.71 (–102.20, 84.77)	73.60 (–19.88, 167.09)
Strength (W)	–6.79 (–14.29, .70)	–1.23 (–8.73, 6.26)	5.56 (–1.93, 13.06)
Right handgrip strength (kg)	1.40 (–6.66, 9.48)	–8.29 (–16.37, –.22) *	–9.70 (–17.78, –1.63) *
Left handgrip strength (kg)	.96 (–7.12, 9.06)	–6.70 (–14.79, 1.39)	–7.66 (–15.76, .42)
Global perceived effect (–5, +5)			
6th – 12th week	–1.02 (–2.87, .83)	–.80 (–2.65, 1.05)	.21 (–1.63, 2.07)
6th week – Follow–up	–.11 (–1.45, 1.23)	–.71 (–2.06, .63)	–.60 (–1.95, .74)
12th week – Follow–up	.91 (–.89, 2.72)	.08 (–1.72, 1.89)	–.82 (–2.63, .98)

HADS: Hospital Anxiety and Depression Scale. NPRS: Numerical Pain Rating Scale. 6MWT: Six-Minute Walk Test. TS: Temporal summation at a constant pressure of 2.5 kg for 30 seconds. Baseline: Sample characteristics before treatment. 6th week: Sample characteristics after twelve exercise sessions. 12th week: Sample characteristics after twenty-four exercise sessions. Follow-up: Sample characteristics after three months without exercise, i.e., at the twenty-fourth week in relation to the baseline. * Significant difference observed through linear mixed models ($p \leq .05$).

Table 8. Secondary outcome within-group comparisons (time *vs.* time).

Secondary outcome (Δ)	Progressive	Constant	Walking
Baseline – 12th week	Estimated mean difference (95% confidence interval)		
Widespread pain index (0–19)	3.87 (2.43, 5.31) *	4.36 (2.92, 5.80) *	4.05 (2.61, 5.49) *
Symptom severity scale (0–12)	1.21 (.38, 2.03) *	.88 (.06, 1.71) *	1.02 (.20, 1.85) *
Pittsburgh Sleep Quality Index (score)			
Subjective sleep quality (0–3)	.34 (–.02, .71)	.31 (–.05, .68)	.57 (.20, .93) *
Sleep latency (0–3)	.08 (–.24, .41)	.00 (–.32, .33)	.08 (–.24, .41)
Sleep duration (0–3)	.15 (–.25, .56)	.10 (–.30, .52)	–.02 (–.43, .38)
Habitual sleep efficiency (0–3)	–.58 (–1.10, –.06) *	–.35 (–.87, .16)	–.90 (–1.42, –.38) *
Sleep disturbances (0–3)	.21 (–.09, .51)	.20 (–.09, .50)	.16 (–.13, .46)
Use of sleep medication (0–3)	.62 (.00, 1.24) *	.41 (–.20, 1.03)	.16 (–.45, .78)
Daytime dysfunction (0–3)	.08 (–.31, .47)	.25 (–.14, .64)	.35 (–.03, .75)
Total (0–21)	.91 (–.85, 2.69)	.94 (–.83, 2.71)	.41 (–1.35, 2.19)
Anxiety (HADS, 0–21)	1.30 (–.35, 2.95)	1.99 (.33, 3.65) *	3.52 (1.87, 5.18) *
Depression (HADS, 0–21)	1.43 (–.37, 3.24)	2.23 (.42, 4.04) *	4.07 (2.26, 5.88) *
Wind–up (TS: pressure = 2.5 kg)			
0 seconds (NPRS, 0–10)	.95 (–.04, 1.95)	.18 (–.81, 1.18)	.69 (–.30, 1.69)
10 seconds (NPRS, 0–10)	.66 (–.32, 1.64)	.36 (–.62, 1.34)	1.38 (.40, 2.36) *
20 seconds (NPRS, 0–10)	.66 (–.33, 1.67)	.72 (–.28, 1.73)	1.46 (.46, 2.47) *
30 seconds (NPRS, 0–10)	.40 (–.59, 1.41)	.97 (–.02, 1.97)	1.46 (.46, 2.47) *
Conditioned pain modulation (≥ 100)	–30.96 (–67.23, 5.31)	–3.05 (–39.32, 33.21)	16.34 (–19.93, 52.61)
Cutaneous sensory threshold (gf)			
Trapezius	–.10 (–.96, .75)	.17 (–.69, 1.03)	–.53 (–1.39, .32)
Supraspinatus	–.43 (–.90, .02)	.56 (.10, 1.03) *	.08 (–.37, .55)
Sternocleidomastoid	–.20 (–.65, .25)	.30 (–.15, .76)	–.16 (–.62, .29)
Walking ability (6MWT, m)	.61 (–34.82, 36.04)	–47.10 (–82.53, –11.67) *	–50.69 (–86.12, –15.25) *
Knee extension (Dynamometry)			
Peak torque (Nm)	–22.29 (–33.66, –10.92) *	–2.80 (–13.92, 8.30)	–14.93 (–26.04, –3.82) *
Total work (J)	–184.64 (–285.40, –83.88) *	–28.80 (–127.24, 69.63)	–129.77 (–228.21, –31.33) *
Strength (W)	–15.47 (–24.02, –6.91) *	–.20 (–8.55, 8.15)	–10.06 (–18.42, –1.71) *
Knee flexion (Dynamometry)			
Peak torque (Nm)	–9.49 (–15.39, –3.59) *	1.43 (–4.32, 7.19)	–6.51 (–12.27, –.75) *
Total work (J)	–93.67 (–147.83, –39.51) *	–1.42 (–54.34, 51.48)	–75.02 (–127.94, –22.11) *
Strength (W)	–6.65 (–11.03, –2.28) *	.81 (–3.45, 5.08)	–4.74 (–9.01, –.47) *
Right handgrip strength (kg)	–3.96 (–8.59, .67)	–5.37 (–10.00, –.73) *	4.33 (–.30, 8.97)
Left handgrip strength (kg)	–5.58 (–10.23, –.93) *	–6.55 (–11.20, –1.90) *	1.11 (–3.53, 5.76)
Global perceived effect (–5, +5)			
6th – 12th week	–.15 (–1.46, 1.15)	.86 (–.44, 2.17)	.64 (–.66, 1.95)
6th week – Follow–up	.40 (–.55, 1.35)	.51 (–.44, 1.46)	1.11 (.16, 2.07) *
12th week – Follow–up	.55 (–.72, 1.83)	–.35 (–1.63, .92)	.47 (–.80, 1.74)

HADS: Hospital Anxiety and Depression Scale. NPRS: Numerical Pain Rating Scale. 6MWT: Six-Minute Walk Test. TS: Temporal summation at a constant pressure of 2.5 kg for 30 seconds. Baseline: Sample characteristics before treatment. 6th week: Sample characteristics after twelve exercise sessions. 12th week: Sample characteristics after twenty-four exercise sessions. Follow-up: Sample characteristics after three months without exercise, i.e., at the twenty-fourth week in relation to the baseline. * Significant difference observed through linear mixed models ($p \leq .05$).

DISCUSSION

Primary outcome discussion: baseline, 6th, 12th week, and follow-up

Although the total score of the revised fibromyalgia impact questionnaire (0-100) is the most commonly used score in fibromyalgia studies, there is still controversy about the real minimal clinically important difference to identify the effectiveness of an intervention. Bennett et al. suggested a 14% reduction in the total score of the traditional questionnaire (BENNETT et al., 2009), while Surendran and Mithun suggested a 45.5% reduction in the revised questionnaire (SURENDRAN; MITHUN, 2018). Recently, Lee highlighted some limitations in the measurement properties related to the sum of the domains of the revised questionnaire and emphasized that there is still no consistent data on its minimal clinically important difference (LEE, 2021). In light of this finding and considering the 27-item proposal (SURENDRAN; MITHUN, 2018), our results did not reach the minimum clinically important difference at any of the time points evaluated (baseline, 6, 12, and/or 24 weeks), indicating that there is no better exercise than the other.

When analyzing the comparisons between the impact domains of the instrument, walking appears to be superior to progressive intensity strength training at baseline–follow-up and at week 12–follow-up. However, there is still no scientific evidence that this difference is clinically important. In addition, these groups were different at baseline and the a priori predicted primary outcome did not account for analyses by domain. Anyway, this finding supports the literature recommending this type of exercise for people with fibromyalgia, as Casanova-Rodríguez et al. (2025) found that most of the studies summarized in a systematic review showed significant differences in favor of aerobic exercise (-.49 [95%CI: -.90, -.08]), with moderate to low heterogeneity in the analyses of subgroups of people with fibromyalgia.

Recently, substantial advances have been made in the exercise literature for fibromyalgia, with several high-quality trials and reviews having been published in recent years. Rodriguez-Almagro et al., (2023) demonstrated in their meta-analysis that both aerobic and strengthening protocols consistently reduce pain and improve physical function, with effect sizes comparable across

modalities. Similarly, a recent network meta-analysis by Rodríguez-Domínguez et al. showed that a wide range of therapeutic exercise modalities—including resistance training, aquatic exercise, and mind–body approaches—are effective in reducing pain intensity, with no single modality consistently outperforming the others (RODRÍGUEZ-DOMÍNGUEZ et al., 2025).

In this context, Zure et al. (2025) reported that low-load blood-flow-restriction strength training produces clinically meaningful improvements while requiring reduced mechanical stress—an important consideration for patients with low exercise tolerance. These contemporary findings also highlight the growing use of digital adherence strategies, which have shown promising effects on symptom burden and continuity of exercise practice. Taken together, this evolving body of evidence helps explain our results: the absence of between-group differences, the non-achievement of the 27 points minimal clinically important difference, and the unexpected superiority of walking in certain pain domains are all consistent with recent data suggesting that symptom improvement may be driven more by non-specific exercise effects, patient tolerance, and behavioral engagement than by the specific training modality itself.

Secondary outcome discussion: baseline, 12h week, and follow-up

The comparisons of secondary outcomes confirm that no exercise is superior to the other, as no analysis reached a minimal clinically important difference between-group. However, it is important to note the significant difference in right handgrip strength between the progressive and walking groups, as well as between the constant and walking groups. Although it is plausible to conclude that walking produces smaller strength gains compared to strength training, it must be considered that higher scores on the total score of the revised fibromyalgia impact questionnaire are associated with lower handgrip strength performance in people with fibromyalgia (SALAFFI; FARAH; DI CARLO, 2020). Our results do not show significant differences among the three total scores, but it should be considered that the walking group showed higher descriptive values of this variable during the intervention.

It should also be noted that the progressive intensity strength training group showed greater musculoskeletal performance compared to the constant intensity group in terms of knee extension strength as assessed by isokinetic dynamometry. In an evaluation similar to our study, Tavares et al. showed that women with fibromyalgia had 7.04% lower knee extension strength than healthy women (TAVARES et al., 2020). Our results suggest that 24 sessions of progressive intensity strength training increase the musculoskeletal performance of people with fibromyalgia so that knee extension strength becomes equal to or greater than that of physically inactive healthy women, as we observed an increase of 22.36% after the intervention. This finding also confirms the overload principle in people with fibromyalgia, whose biological plausibility indicates that the muscle adapts to withstand greater resistance (LIEVENS; BOURGOIS; BOONE, 2021).

Our study had a dropout rate of 28.78% distributed among the three groups as demonstrated in the results. Although this loss of sample prevents us from evaluating the eighth item of the PEDro scale (PONTES-SILVA et al., 2023a), these results are consistent with other clinical trials that have studied people with fibromyalgia undergoing non-pharmacological treatment. Such as, Sousa et al. reported sample loss of 24.44% (SOUSA et al., 2024), Avila et al. 28.57% (AVILA et al., 2017), and Trevisan et al. 68% (TREVISAN et al., 2015). In fact, the pattern of dropout from interventions in people with fibromyalgia is still poorly understood scientifically, although more than three thousand people with fibromyalgia were analyzed in a systematic review of dropout from exercise interventions (VANCAMPFORT et al., 2024).

In any case, this dropout rate allows us to observe the behavior of people with fibromyalgia under a clinical treatment routine. Therefore, intention-to-treat analysis is essential in clinical trials such as ours, and all patients in all groups must be maintained until the end of treatment, regardless of what happens to each of them (NAGEL; HAUSSEN; NOGUEIRA, 2020). Studies that violate the intention-to-treat principle produce results without external validity, such as the study by Alves et al. that excluded five participants (LOPES ALVES et al., 2024), or the study by Serrano et al. that assigned 22 people to a group and analyzed 24 after the intervention (SERRANO et al., 2022).

Although the between-group comparison of dropout rates was not statistically significant, the overall attrition rate in this trial was 28.8% (19 out of 66 participants), and the attrition rate was particularly high in the constant-intensity strength group (40.9%). These results represent important methodological limitations. High attrition reduces statistical power, increases uncertainty around effect estimates, and may introduce attrition bias, even when applying intention-to-treat principles. Furthermore, differential dropout, especially concentrated in a single intervention arm, may reflect lower tolerability, acceptability, or perceived benefit of that modality and deserves careful consideration. These patterns are consistent with the well-documented difficulty of retaining individuals with fibromyalgia in long-term exercise programs. Nonetheless, these patterns limit the robustness and generalizability of our findings.

Another variable that has been widely discussed among fibromyalgia researchers is exercise adherence (HAN et al., 2024). According to Serrat et al., exercise adherence in people with fibromyalgia can be explained by adjusting the intensity: if the intensity is too low, the exercise becomes ineffective and the patient becomes demotivated; in contrast, if the intensity is too high, the overload also demotivates the patient and reduces adherence. Thus, the ideal would be a balance between minimum and maximum, combined with contact with patients (by phone or e-mail) during the intervention period (SERRAT et al., 2021). Our results refute this assumption because we maintained individual contact with our patients throughout the treatment and tested different exercise intensities, i.e., progressive or constant intensity, strength training or walking. The results did not differ from those described in the literature.

The literature also highlights the difficulties of long-term treatment of fibromyalgia (HÄUSER et al., 2015). Hauser et al. describe that the positive results achieved during non-pharmacological treatment are often lost in the first twelve months after the end of the intervention. In addition, the poor adherence of people with fibromyalgia is a challenge for clinicians and researchers (HÄUSER et al., 2015). Our results confirm this information and add new evidence. Although all groups in our study reported a positive perception of improvement related to the

treatment, the majority of each group did not adhere to the treatment and/or did not respond about adherence after the three-month follow-up without exercise.

Furthermore, we observed that the positive results obtained during treatment seem to stabilize after the sixth week, which may be one of the reasons why patients begin to dropout. To the best of our knowledge, there is still no explanation for this phenomenon, but there is evidence that people with fibromyalgia who receive social support have greater fibromyalgia knowledge and cope better with the adversities of symptoms. Therefore, there is a need for studies that examine the relationship between social support and exercise adherence in people with fibromyalgia.

Study strengths: clinical and scientific implications

The results of this study have relevant clinical applicability in the treatment of people with fibromyalgia. Although the differences observed did not reach an adequate level of clinical relevance, it is important to emphasize that most results do not yet represent a minimal clinically important difference that has been consolidated in the literature. Nevertheless, knowing that walking or strength training improves the quality of life of these people, the health care professional can choose the type of exercise that meets the patient's preference, according to evidence-based health recommendations (ALDINGTON; ECCLESTON, 2019).

Our results also reinforce the applicability of the second law of the thermodynamics to musculoskeletal rehabilitation, where the efficiency of muscle work resulting from exercise is the determining factor in the generation of entropy in the homeostasis of people with fibromyalgia (KOCH; BRITTON, 2022). Since the rate of entropy generation increases with the amount of physical exercise, the biological adaptations resulting from the random disorder balance the outcomes related to fibromyalgia symptoms (KOCH; BRITTON, 2022). This explains why people with fibromyalgia who underwent 24 sessions of physical exercise showed improvements in sleep quality, anxiety, depression, wind-up mechanism, conditioned pain modulation, cutaneous sensory threshold, musculoskeletal performance, walking ability, and perception of improvement.

Importantly, the commonly cited minimum clinically important difference of 27 points for the Revised Fibromyalgia Impact Questionnaire is based on absolute rather than relative change, creating substantial interpretive limitations. Since this threshold does not account for baseline severity, patients with low or moderate initial Revised Fibromyalgia Impact Questionnaire scores cannot achieve a clinically significant improvement, even when they experience a meaningful reduction in symptoms. Furthermore, the requirement of a reduction of approximately one-third in total symptom burden is unusually high compared to minimum clinically important difference criteria used for other clinical measures. Consequently, applying this fixed cutoff may underestimate true clinical improvement and minimize the substantial effect sizes observed in our sample. Therefore, interpretations based solely on these 27 points thresholds should be approached with caution. Complementary approaches, such as percentage change or standardized effect sizes, may provide a more accurate representation of meaningful clinical benefit.

Finally, these findings support the hypothesis that different types of exercise produce similar biological adaptations. Some researchers in the exercise science field argue that health outcomes resulting from exercise, such as musculoskeletal rehabilitation, are not related to the type of physical exercise performed, but rather to the amount of effort applied (i.e., total work). This means that in order to compare different types of exercise, it is crucial that the parameters of the proposed exercises are the same between-groups, namely intensity, total physical effort, and actual duration of the exercise session. However, each type of exercise has a specific way of adapting, such as heart rate, time under tension or maximum strength, which highlights another limitation for studies comparing different exercises.

CONCLUSION

Twenty-four sessions of progressive intensity strength training do not provide a greater reduction in the fibromyalgia impact than constant intensity or walking exercises. Walking or strength training improves sleep quality, anxiety, depression, wind-up mechanism, conditioned pain

modulation, cutaneous sensory threshold, musculoskeletal performance, walking ability, and perceived improvement in people with fibromyalgia. However, the benefits are not sufficient to achieve a minimal clinically important difference, and patients do not adhere to treatment after three months without exercise.

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4.3 Artigo 3 (publicado, A3 [acesso aberto]) – Os instrumentos utilizados para avaliar os sintomas da fibromialgia segundo os critérios do Colégio Americano de Reumatologia geram pontuações semelhantes às obtidas em outras dores musculoesqueléticas crônicas?

RESUMO – Objetivo: comparar os sintomas entre indivíduos com fibromialgia e aqueles com outras condições de dor musculoesquelética crônica. Adicionalmente, foram comparados os desfechos mais frequentemente investigados em estudos sobre fibromialgia, incluindo dor em repouso e após o movimento, fadiga, gravidade e impacto da dor, funcionalidade, impacto global e sintomas específicos da doença. **Métodos:** trata-se de um estudo transversal. Foram incluídos participantes com 18 anos ou mais que relataram dor musculoesquelética crônica (por pelo menos 3 meses). Em seguida, os participantes foram alocados em dois grupos: fibromialgia e dor musculoesquelética crônica. Os participantes responderam aos seguintes instrumentos: Fibromyalgia Impact Questionnaire–Revised (FIQ-R), Brief Pain Inventory (BPI), Escala Numérica de Dor (NPRS) para avaliação da dor e da fadiga, Widespread Pain Index (WPI) e Symptom Severity Scale (SSS). **Resultados:** um total de 166 participantes foi incluído no estudo e distribuído em dois grupos independentes: dor crônica (n = 83) e fibromialgia (n = 83). Foram observadas diferenças estatisticamente significativas ($p < 0,05$) e tamanhos de efeito elevados (d de Cohen $\geq 0,7$) nas comparações dos desfechos clínicos entre os grupos, incluindo dor difusa, gravidade dos sintomas, dor em repouso e após o movimento, fadiga, impacto e gravidade da dor, funcionalidade, impacto global e sintomas de fibromialgia. **Conclusão:** indivíduos com fibromialgia, classificados de acordo com os critérios do ACR de 2016, apresentam níveis mais elevados de dor (em repouso e após o movimento) e de fadiga, maior comprometimento funcional e impacto global, além de sintomas mais graves, quando comparados a indivíduos com outras condições de dor musculoesquelética crônica. Dessa maneira, os instrumentos WPI e SSS devem ser utilizados exclusivamente para avaliar sintomas específicos da fibromialgia.

Palavras-Chave: Dor Crônica. Serviços de Diagnóstico. Atenção Primária à Saúde. Reumatologia.

Referência bibliográfica: Pontes-Silva A., et al. Do the instruments used to assess fibromyalgia symptoms according to American College of Rheumatology criteria generate similar scores in other chronic musculoskeletal pain? *BMC Musculoskeletal Disorders*, 2023.

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Versão completa no idioma original da publicação (inglês) – Do the instruments used to assess fibromyalgia symptoms according to American College of Rheumatology criteria generate similar scores in other chronic musculoskeletal pain?

ABSTRACT – Objective: To compare the symptoms among fibromyalgia and other chronic musculoskeletal pain. Additionally, we also compared the most researched outcomes in fibromyalgia (i.e., present pain at rest and after movement; fatigue; pain severity and impact; function, global impact, and fibromyalgia symptom). **Methods:** A cross-sectional study. Participants over 18 years old were included if they presented report of chronic musculoskeletal pain (≥ 3 months) and after that, they were divided into two groups (fibromyalgia and chronic pain). They answered the Fibromyalgia Impact Questionnaire-Revised (FIQ-R), Brief Pain Inventory (BPI), Numerical Pain Rating Scale (NPRS) for pain and fatigue, WPI, and SSS. **Results:** A total of 166 participants were included in this study into two independent groups (chronic pain, n=83; fibromyalgia, n=83). We observed significant differences ($p < 0.05$) and large effect sizes (Cohen's d, ≥ 0.7) in clinical outcomes comparisons between groups (i.e., widespread pain; symptom severity; present pain at rest and after movement; fatigue; pain severity and impact; function, global impact, and fibromyalgia symptoms). **Conclusion:** Fibromyalgia patients (2016 ACR criteria) compared to other chronic musculoskeletal pain patients have higher levels of pain (at rest or after movement) and fatigue, greater impairment in both functionality and global impact, and worse symptoms. Therefore, the WPI and SSS instruments should be used exclusively to assess fibromyalgia symptoms.

Keywords: Chronic Pain. Diagnostic Services. Rheumatology. Primary Health Care.

INTRODUCTION

Fibromyalgia (or fibromyalgia syndrome) is a chronic condition characterized by widespread pain and complex symptomatology (MACFARLANE et al., 2017), such as fatigue (SARZI-PUTTINI et al., 2020b), sleep disturbances (UGHREJA et al., 2021), mood disorders (VALENCIA et al., 2022), and symptoms not explained by structural changes (KUDLOW et al., 2015). Its prevalence varies from 2 to 6% in the world population and is more identified in women aged between 20 and 55 years (SARZI-PUTTINI et al., 2020a). The literature recommends that the diagnosis of fibromyalgia should be based on the guidelines of the American College of Rheumatology (ACR) (WOLFE et al., 2016). However, taking into account that it is a disease characterized (in part) by chronic musculoskeletal pain, nothing prevents us from using the same ACR criteria to evaluate other musculoskeletal diseases, as the fibromyalgia assessment/diagnosis (2016 ACR criteria) uses generic instruments such as the Widespread Pain Index (WPI) and the Symptom Severity Scale (SSS) (WOLFE et al., 2016).

However, although WPI and SSS instruments perform generic assessments of chronic musculoskeletal pain (on axial region and/or upper and lower limbs) (WOLFE et al., 2016), it is necessary to verify whether there is a difference among the clinical outcomes' specificities (e.g., function, global impact, symptoms, pain severity/impact, and fatigue) when comparing patients with fibromyalgia to patients with other chronic musculoskeletal pain. Therefore, the hypothesis of this study was that patients with fibromyalgia have a worse clinical outcome compared to other chronic musculoskeletal pain.

Thus, the objective of this study was to compare (via WPI and the SSS) the symptoms among fibromyalgia and other chronic musculoskeletal pain. Additionally, we also compared the most researched outcomes in fibromyalgia (i.e., present pain at rest and after movement (FARRAR et al., 2001; FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011); fatigue (FARRAR et al., 2001; FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011); pain severity and impact (FERREIRA et al., 2011a); function, global impact, and fibromyalgia symptom (LUPI et al., 2017)).

METHODS

Study Design and Ethical Considerations

A cross-sectional study performed according to the STROBE Guidelines (MALTA et al., 2010). The protocol has been approved by the ethics committee of Universidade Federal de São Carlos, in Brazil (report number 4.193.940). This study was disclosed in social media from November 2020 to August 2021.

We disclosed in social media (Instagram® and Facebook®) and through messaging applications (WhatsApp®). All people who manifested interest in taking part in the study were contacted and checked for eligibility criteria. All those who were included in the study received an online form (via GoogleForms®) and agreed to take part in the study by clicking on the "I agree to take part in the present study" after reading the informed online consent form. All participants received an online booklet with information regarding fibromyalgia / chronic pain after the end of their participation.

Participants and Study Size

Considering the primary outcome of our study (comparisons between groups), we performed the sample calculation *a priori* using the t-test two tails (independent groups) through G*Power (version 3.1.9.7). We used the effect size of 0.44 (KUNDAKCI et al., 2022; SERRAT et al., 2021), alpha of 0.05, power of 0.80, and critical f of 1.97. As such, the total sample size was estimated at 166 participants divided into 2 independent groups (KANG, 2021) (fibromyalgia, n=83; chronic pain, n=83).

Participants over 18 years old that could read and write in Brazilian Portuguese were included if they presented report of chronic musculoskeletal pain (≥ 3 months) and after that, they were divided into two groups (fibromyalgia and chronic pain). For the fibromyalgia group, people should have the fibromyalgia diagnosis (participants were considered as with fibromyalgia if they fulfilled the ACR 2016 fibromyalgia diagnostic criteria (WOLFE et al., 2016), including the WPI ≥ 7 and the SSS ≥ 5 or WPI = 4-6 and SSS ≥ 9). For the chronic pain group, participants should have a history of chronic pain (≥ 3 months) but no fibromyalgia (i.e., arthritis, osteoarthritis, low back pain, neck pain, and so on). Namely, participants with chronic pain whose symptoms do not meet the ACR 2016 fibromyalgia diagnostic criteria.

Participants were excluded from the analysis if they had a history of tumors, traumas, acute infections, self-report of severe psychiatric illnesses (including severe depression, bipolarity, and schizophrenia), presence of severe comorbidities in the heart, liver, and/or kidney, presence of neoplasia, systemic autoimmune or inflammatory concomitant diseases, hypothyroidism, pregnancy and/or breastfeeding, and presence of therapeutic intervention in the last six months.

Assessment tools

Participants answered Fibromyalgia Impact Questionnaire-Revised (FIQ-R) (LUPI et al., 2017), Brief Pain Inventory (BPI) (FERREIRA et al., 2011a), and Numerical Pain Rating Scale (NPRS) (FARRAR et al., 2001; FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011) for pain and fatigue. All participants rated their pain (in two different situations: at rest, and after body movement) and fatigue from 0 (if they did not present pain/fatigue) to 10 (if they presented the worst imaginable pain or fatigue).

FIQ-R assesses the impact of fibromyalgia on life in relation to functional capacity, professional status, psychological disorders, and physical symptoms (BENNETT et al., 2009). Its Brazilian version has excellent test-retest reliability (ICC = 0.75) and comprises 21 items that investigate three domains: function (9 items, 30 points), global impact (2 items, 20 points), and symptoms (10 items, 50 points) (BENNETT et al., 2009; LUPI et al., 2017). Scores range from 0 to 100, with the latter being meaningful of a worst condition. The minimal important clinical difference for the FIQ-R is 27 points (SURENDRAN; MITHUN, 2018).

We also use BPI, a self-report instrument validated for the Brazilian population (FERREIRA et al., 2011b). BPI assesses pain severity and impact on a person's life with 15 items that assess presence, severity, location, functional impact, used therapeutic strategies, and treatment efficacy on an 11-point scale ranging from zero (no pain/no interference) to 10 (as bad as it can be). High scores indicate worse pain severity and impact. Its Brazilian version presented a two-dimensional structure (pain severity and interference) and excellent internal consistency ($\alpha = 0.87 - 0.91$) (FERREIRA et al., 2011a).

We assess pain intensity using the NPRS, a self-report instrument validated for the Brazilian population (FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011). NPRS is a single-item instrument that was used for pain and fatigue intensity. We evaluated pain in two different situations: at rest – "Currently and at the moment when you are sitting/lying on the couch watching your favorite TV show, do you feel pain?"; after body movement – "Currently and when you walked from the supermarket parking lot to the grocery store or crossed the street to work, do you feel pain?" (AVILA et al., 2014). For fatigue, we asked "During the answer to this questionnaire, which number best corresponds to your state of fatigue/body tiredness?". In all questions about pain/fatigue, zero means no pain/fatigue and 10 was the worst pain/fatigue imaginable. In chronic pain conditions, NPRS had a moderate to high test-retest reliability (0.67 to 0.96) (KAHL; CLELAND, 2005).

Statistical analysis

The distribution of variables was verified using Kolmogorov-Smirnov test. We set the significance level at 5% for all statistical tests, which in turn were processed using the Statistical Package for the Social Sciences software, version 17.0 (Chicago, IL, USA). The comparisons between variables were performed via independent T-test and presented as: mean, standard deviation (SD), mean difference (MD) with confidence interval (95% CI), and effect size (PONTES-SILVA, 2022), calculated using Cohen's d according to classification values: 0.2 = small, 0.5 = moderate, and ≥ 0.7 large (COHEN, 1977).

RESULTS

Three hundred and ninety-six women volunteered. After the screening, according to the eligibility criteria mentioned in the methods, a total of 166 participants were included in this study into two independent groups (Chronic Pain [CP], n=83; Fibromyalgia [FM], n=83). We observed significant differences ($p < 0.05$) and large effect sizes (Cohen's d, ≥ 0.7) in clinical outcomes comparisons shown in **Tables 1–2** (i.e., widespread pain [WPI]; symptom severity [SSS]; present pain at rest, after movement, and fatigue [NPRS]; pain severity and impact [BPI]; function, global impact, and fibromyalgia symptoms [FIQ-R]). Prevalence of WPI is similar in both groups. However, the number of regions affected by pain is significantly different between them (**Tables 1**–**2**).

Our study shows large effect sizes, indicating the clinical relevance of the comparisons of the present study. Clinical relevance (also known as clinical significance) indicates that the results of a study are meaningful or not for several stakeholders (ARMIJO-OLIVO, 2018). The clinical relevance facilitates the understanding and interpretation of results for professionals. Currently, the assessment of this approach has become a popular method to assist the transfer of knowledge into clinical practice.

Table 1. Participants' characteristics – values presented in mean (SD).

Variables	Chronic pain group (n=83)	Fibromyalgia group (n=83)	p
Age (years)	43.1 (13.0)	38.7 (10.1)	0.011*
Body mass (kg)	71.7 (13.5)	73.5 (15.5)	0.085
Stature (m)	1.62 (0.0)	1.64 (0.0)	0.766
Body mass index (Kg/m^2)	27.3 (5.2)	27.2 (5.3)	0.795
Widespread Pain Index (score)	4.8 (2.7)	13.3 (3.6)	<0.001*
Symptom Severity Scale (score)	5.9 (2.9)	9.2 (1.9)	<0.001*
Numerical Pain Rating Scale (score)			
Present pain at rest	5.0 (2.5)	6.6 (1.8)	0.007*
pain after movement	5.4 (2.7)	7.5 (2.2)	0.017*
Present fatigue	5.2 (3.3)	7.9 (1.8)	<0.001*
Brief Pain Inventory (score)			
Pain severity	5.2 (2.2)	6.8 (1.6)	<0.001*
Pain impact	5.5 (2.7)	7.4 (2.0)	0.001*
FIQ-R (score)			
Function (0-30)	11.9 (8.6)	21.5 (5.9)	<0.001*
Global impact (0-20)	9.5 (6.3)	16.3 (3.8)	<0.001*
Symptoms (0-50)	25.8 (12.3)	37.6 (6.9)	<0.001*
Total score (0-100)	47.4 (25.5)	75.5 (14.6)	<0.001*

BPI: Brief Pain Inventory; FIQ-R: Fibromyalgia Impact Questionnaire-Revised. * Significant difference (independent t-test, $p < 0.05$).

Table 2. Comparison of Pain and FIQ-R between groups.

Variables	Group (n=166/2)	Mean (SD)	Mean Difference	CI 95%	d
NPRS[a]	Chronic Pain	5.0 (2.5)	-1.62	-2.30, -0.95	0.7[#]
	Fibromyalgia	6.6 (1.8)			
NPRS[b]	Chronic Pain	5.4 (2.7)	-2.12	-2.87, -1.36	0.8[#]
	Fibromyalgia	7.5 (2.2)			
NPRS[c]	Chronic Pain	5.2 (3.3)	-2.66	-3.49, -1.82	1.0[#]
	Fibromyalgia	7.9 (1.8)			
Brief Pain Inventory					
Pain severity	Chronic Pain	5.2 (2.2)	-1.50*	-2.18, -0.99	0.8[#]
	Fibromyalgia	6.8 (1.6)			
Pain impact	Chronic Pain	5.5 (2.7)	-1.95*	-2.68, -1.22	0.8[#]
	Fibromyalgia	7.4 (2.0)			
FIQ-R					
Function	Chronic Pain	11.9 (8.6)	-9.57*	-11.86, 7.29	1.3[#]
	Fibromyalgia	21.5 (5.9)			
Global impact	Chronic Pain	9.5 (6.3)	-6.77*	-8.38, -5.15	1.3[#]
	Fibromyalgia	16.3 (3.8)			
Symptoms	Chronic Pain	25.8 (12.3)	-11.80*	-14.87, -8.73	1.1[#]
	Fibromyalgia	37.6 (6.9)			
Total score	Chronic Pain	47.4 (25.5)	-28.15*	-34.53, 21.77	1.3[#]
	Fibromyalgia	75.5 (14.6)			

CI: Confidence Interval; d: effect size (Cohen's d); FIQ-R: Fibromyalgia Impact Questionnaire-Revised; NPRS: Numerical Pain Rating Scale ([a] present pain at rest, [b] pain after movement, [c] present fatigue); SD: Standard Deviation. * Significant difference (independent t-test, $p < 0.05$). [#] Significant effect size (Cohen's d, large effect, ≥ 0.8).

DISCUSSION

Main results synthesis

The objective of this study was to compare (via WPI and the SSS) the symptoms among fibromyalgia and other chronic musculoskeletal pain. Additionally, we also compared the most researched outcomes in fibromyalgia (i.e., present pain at rest and after movement (FARRAR et al., 2001; FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011); fatigue (FARRAR et al., 2001; FERREIRA-VALENTE; PAIS-RIBEIRO; JENSEN, 2011); pain severity and impact (FERREIRA et al., 2011a); function, global impact, and fibromyalgia symptom (LUPI et al., 2017)). Our results showed that patients with fibromyalgia have higher levels of widespread pain and symptom severity than patients with other chronic musculoskeletal pain. Namely, the instruments used to assess fibromyalgia symptoms according to ACR criteria (WPI+SSS) generate significantly different scores in other chronic musculoskeletal pain (the same happens with the other outcomes analyzed). Therefore, reinforcements that these instruments (WPI+SSS) should be used only in patients with fibromyalgia.

Fibromyalgia diagnosis: challenges and perspectives

Since the last century, studies on fibromyalgia have evaluated patients using biomedical models (SMYTHE; MOLDOFSKY, 1977; YUNUS et al., 1981). This evaluation model was strengthened 1990's year when the ACR established classification criteria for fibromyalgia (WOLFE et al., 1990). Then, other updates appeared (2010 and 2011) whose combined review resulted in the 2016 criteria (WOLFE; HÄUSER, 2011): A) Widespread pain, defined as pain in at least 4 of 5 body's regions; B) Symptoms have been present at a similar level for at least three months; C) Widespread pain index ≥ 7 and symptom severity scale score ≥ 5 (or Widespread pain index of 4–6 and symptom severity scale score ≥ 9); D) A diagnosis of fibromyalgia is valid irrespective of other diagnoses (WOLFE et al., 2016).

Although this initiative is relevant to health sciences, it is possible to note that patients continue to be assessed via the biomedical model (PONTES-SILVA, 2023). Perhaps, that happening because The prevalence of fibromyalgia appears to differ according to the diagnostic criteria used (GALVEZ-SÁNCHEZ; REYES DEL PASO, 2020). The 1990 criteria have been considered stricter than the 2010 criteria, such that only more severely affected patients are identified (WOLFE et al., 2010). Studies recruiting fibromyalgia patients according to the 1990 ACR criteria reported higher mean WPI and SSS scores than studies in which patients were recruited using the 2010 ACR criteria (GALVEZ-SÁNCHEZ et al., 2020; WOLFE et al., 2010). However, most recent studies as well as international recommendations guide the use of the 2016 ACR criteria (WOLFE et al., 2016).

Our and the literature's results

Chronic musculoskeletal pain is one of the main reasons for referrals to health professionals (LUQUE-SUAREZ; MARTINEZ-CALDERON; FALLA, 2019). It can be caused by a wide variety of inflammatory (LIN et al., 2020) and noninflammatory conditions (BRIGGS et al., 2022), including arthritis (DZAKPASU et al., 2021), hypermobility (HUGUET et al., 2016), low back pain (LIN et al., 2020), neck pain (VALENTIJN et al., 2022), growing pains (HUGUET et al., 2016), and complex regional pain syndrome (COLES; WEISSMANN; UZIEL, 2021). Some patients with fibromyalgia have these symptoms associated with the disease, thus, hindering the diagnostic accuracy of fibromyalgia (GALVEZ-SÁNCHEZ; REYES DEL PASO, 2020). As such, some authors have used the WPI in the evaluation of other disorders, e.g., temporomandibular disorders (GALVEZ-SÁNCHEZ; REYES DEL PASO, 2020), psoriatic arthritis (LUBRANO et al., 2021), musculoskeletal surgery (DUDENEY et al., 2019), and headache (DUDENEY et al., 2019).

Our results indicate that the WPI, as well as the SSS, should be used exclusively on fibromyalgia evaluation. In addition, the scores of the instruments most used in studies on fibromyalgia (FIQ-R, BPI, and NPRS), observed in our study, reinforced that the severity of symptoms is greater in fibromyalgia patients. However, although our results support the use of SSS in patients with fibromyalgia, we highlighted that Elkana et al. (ELKANA et al., 2019) found that the SSS has an insignificant relationship between the subjective appraisal of cognitive impairment and the objective cognitive scores on computerized subtests. Therefore, we suggest novel studies in this area.

Strengths and clinical applicability

Although patients with fibromyalgia have chronic musculoskeletal pain in different parts of the body (spine, knee, and so on (MACFARLANE et al., 2017)), it does not mean that patients who have other chronic musculoskeletal pain, but no fibromyalgia, may be evaluated using the same instruments proposed by the ACR to assess fibromyalgia symptoms (WPI and SSS) (WOLFE et al., 2016).

As clinical applicability to evidence-based practice, we suggest to the health professionals, first of all, screen fibromyalgia using specific instruments (e.g., the fibromyalgia rapid screening tool (DE SOUSA et al., 2022)). In the same way, other chronic musculoskeletal pain must be evaluated by specific instruments (respecting the cross-cultural adaptation (MOKKINK; PRINSEN; PATRICK, 2019)), because there are questionnaires, scales, and specific tests for low back pain (PAULI; STARKWEATHER; ROBINS, 2019), knee pain (AKIN-AKINYOSOYE et al., 2021), neck pain (NOORI et al., 2020), temporomandibular disorders (BOTROS et al., 2022), and other musculoskeletal diseases. Therefore, the WPI and SSS apply to the individuals which ACR has suggested: fibromyalgia patients (MACFARLANE et al., 2017; WOLFE et al., 2016, 2018).

Limitations and prospects for novel studies

Although this was the first study to compare fibromyalgia symptoms, according to ACR criteria (WPI+SSS), to scores in other chronic musculoskeletal pain, our study has limitations that must be addressed. Although participants reported pain and global symptoms lasting > 3 months, we do not know the pain duration total values in the groups, the prevalence of headache, cramps in the lower abdomen, and depression during the previous six months. We also do not know if the investigated instruments (WPI+SSS) are sufficient to

assess fibromyalgia symptoms or whether they should be associated with computerized tests. Besides, medication use was not controlled in that study, and we did not use a polysymptomatic distress scale— we suggest novel studies to investigate these limitations.

CONCLUSION

Fibromyalgia patients (2016 ACR criteria) compared to other chronic musculoskeletal pain patients have higher levels of pain (at rest or after movement) and fatigue, greater impairment in functionality and global impact, and worse symptoms. Therefore, WPI and SSS instruments should be used exclusively to assess fibromyalgia symptoms.

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4.4 Artigo 4 (publicado, A2 [acesso fechado]) – Variáveis sociais para replicação de estudos relacionados ao apoio social, autocuidado e conhecimento sobre fibromialgia: um estudo transversal.

RESUMO – Objetivo: investigar variáveis biopsicossociais que contribuem para a explicação do apoio social, do autocuidado e do conhecimento sobre fibromialgia em pessoas com fibromialgia. **Métodos:** trata-se de um estudo transversal. Foram elaborados dez modelos de variáveis preditoras (escolaridade, etnia, doenças associadas, regiões corporais afetadas pela dor, situação ocupacional, renda mensal, estado civil, nível de saúde, uso de medicação, prática de atividades esportivas, relações interpessoais, nível de nutrição, dor difusa, gravidade dos sintomas, coabitação, pessoas dependentes, número de filhos, apoio social, autocuidado e conhecimento sobre fibromialgia), cuja capacidade explicativa foi testada individualmente com o objetivo de prever os escores médios do Fibromyalgia Knowledge Questionnaire (FKQ), do Medical Outcomes Study's Social Support Scale (MOS-SSS) e do Appraisal of Self-Care Agency Scale–Revised (ASAS-R). A análise de variância foi utilizada para verificar a associação entre todas as variáveis dos modelos matematicamente ajustados (valor de $F \geq 2,20$), sendo reportados apenas os modelos com correção estatística ($p < 0,05$) e coeficiente de determinação $R^2 > 0,20$. **Resultados:** participaram do estudo 190 pessoas com fibromialgia, com idade média de 42,3 ± 9,7 anos. Os resultados indicaram que as variáveis escolaridade, etnia, regiões corporais afetadas pela dor, frequência de prática de atividades esportivas, presença de pessoas dependentes, número de filhos, dor difusa, apoio social e autocuidado explicam 27% dos escores médios do FKQ. As variáveis estado civil, autocuidado e conhecimento sobre fibromialgia explicam 22% dos escores médios do MOS-SSS. Já as variáveis escolaridade, etnia, situação ocupacional, frequência de prática de atividades esportivas, nível de nutrição, coabitação, número de filhos, apoio social e conhecimento sobre fibromialgia explicam 30% dos escores médios do ASAS-R. **Conclusão:** estudos que utilizam escores médios de apoio social, autocuidado e conhecimento sobre fibromialgia devem considerar a coleta e a análise das variáveis sociais descritas neste estudo.

Palavras-Chave: Dor crônica. Modelos biopsicossociais. Saúde pública. Apoio social. Populações vulneráveis.

Referência bibliográfica: Pontes-Silva A., et al. Social variables for replication of studies using mean scores of social support, self-care, and fibromyalgia knowledge: a cross-sectional study. *Rheumatology International*, 2023.

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Social variables for replication of studies using mean scores of social support, self-care, and fibromyalgia knowledge: a cross-sectional study.

ABSTRACT – Objective: To investigate biopsychosocial variables that contribute to explaining social support, self-care, and fibromyalgia knowledge in patients with fibromyalgia. **Methods:** A cross-sectional study. We built ten models of predictive variables (schooling, ethnicity, associated diseases, body regions affected by pain, employment status, monthly income, marital status, health level, medication, sports activities, interpersonal relationships, nutrition level, widespread pain, symptom severity, cohabitation, dependent people, number of children, social support, self-care, and fibromyalgia knowledge) and individually tested their explanatory performance to predict mean scores on the Fibromyalgia Knowledge Questionnaire (FKQ), Medical Outcomes Study's Social Support Scale (MOS-SSS), and Appraisal of Self-Care Agency Scale-Revised (ASAS-R). We used analysis of variance to verify the association among all variables of mathematically adjusted models (F-value ≥ 2.20) and we reported only models corrected with $p < 0.05$ and $R^2 > 0.20$. One hundred and ninety people with fibromyalgia (aged 42.3 ± 9.7 years) participated in the study. **Results:** Our results show that the variables schooling, ethnicity, body regions affected by pain, frequency of sports activities, dependent people, number of children, widespread pain, social support, and self-care determine 27% of the mean FKQ scores. Marital status, self-care, and fibromyalgia knowledge determine 22% of mean MOS-SSS scores. Schooling, ethnicity, employment status, frequency of sports activities, nutrition level, cohabitation, number of children, social support, and fibromyalgia knowledge determine 30% of the mean ASAS-R scores. **Conclusion:** Studies using mean scores of social support, self-care, and fibromyalgia knowledge should collect and analyze the social variables described in the present study.

Keywords: Chronic Pain. Models Biopsychosocial. Public Health. Social Support. Vulnerable Populations.

4.5 Artigo 5 (publicado, B1 [acesso fechado]) – Examinando variáveis clínicas e sociodemográficas e apoio social na adesão ao exercício em mulheres com fibromialgia: um estudo de coorte.

RESUMO – Objetivo: examinar as variáveis clínicas e sociodemográficas que influenciam a adesão à prática de exercícios físicos em pacientes com fibromialgia. **Métodos:** foram incluídas mulheres com fibromialgia e idades entre 18 e 55 anos. Elas foram convidadas a participar de um programa de exercícios físicos (treinamento resistido ou aeróbico) com duração de três meses. Após a primeira semana de intervenção, todas as participantes responderam a um formulário, a partir do qual foram geradas 31 variáveis. Após os três meses de tratamento, o pesquisador responsável registrou o número de mulheres que interromperam a participação em seus respectivos programas de exercício. Três modelos foram construídos e testados individualmente quanto ao seu poder explicativo para prever a descontinuidade da participação no exercício (taxa de abandono). Em cada modelo, a associação entre as variáveis preditoras e a variável desfecho foi avaliada por meio de modelos matematicamente ajustados (qui-quadrado ≥ 40; $p \leq 0,05$). Somente os modelos corrigidos com nível de significância inferior a 0,05 e coeficiente de determinação ajustado para as variáveis independentes (R^2 superior a 0,50) foram aceitos e apresentados. Foi realizada uma regressão logística binária em cada um dos modelos. O modelo univariado foi utilizado para construir um termo representativo dos efeitos principais das variáveis independentes sobre a taxa de abandono. **Resultados:** após o ajuste do modelo e a exclusão de 15 variáveis, o modelo final da taxa de abandono incluiu 12 variáveis e suas respectivas subcategorias. O modelo apresentou poder explicativo significativo, conforme indicado pelo valor de qui-quadrado de 48,114 ($R^2 = 0,73$; $p < 0,05$). Em termos práticos, 73% do abandono da prática de exercícios físicos pode ser atribuído às variáveis independentes incluídas no modelo. O apoio social foi a única variável com capacidade preditiva estatisticamente significativa ($p < 0,05$), com coeficiente beta negativo ($\beta = -0,091$) e efeito protetor contra o abandono da atividade física (OR = 0,913; IC 95% = 0,835–0,998). Esses resultados indicam que mulheres com fibromialgia que dispõem de apoio social têm menor probabilidade de interromper a participação em programas de

exercícios físicos. **Conclusão**: o apoio social constitui um fator protetor para a adesão à prática de exercícios físicos em mulheres com fibromialgia.

Palavras-Chave: Dor. Sistema musculoesquelético. Qualidade de vida. Exercício. Saúde pública.

Referência bibliográfica: Pontes-Silva A., et al. Examining clinical and sociodemographic variables and social support on exercise adherence in women with fibromyalgia: a cohort study. *Sport Sciences for Health*, 2025.

Disponível em: https://dx.doi.org/10.1007/s11332-025-01386-x.

Examining clinical and sociodemographic variables and social support on exercise adherence in women with fibromyalgia: a cohort study.

ABSTRACT – Objective: To examine the clinical and sociodemographic variables that influence exercise adherence in patients with fibromyalgia. **Methods:** We included women with fibromyalgia aged 18–55 years. They were invited to participate in an exercise program (resistance or aerobic) for 3 months. After the first week of the intervention, all patients were invited to answer a form and their answers generated 31 variables. After 3 months of treatment, the supervising researcher reported the number of women who dropped out of their respective exercises. Three models were constructed and individually tested for their explanatory power in predicting discontinuation of exercise participation (dropout rate). In each of the models, the association between the predictor variables and the outcome variable was evaluated using mathematically adjusted models (Chi-square ≥ 40, $p \leq .05$). Only the corrected models with a significance level of $< .05$ and a coefficient of determination adjusted for the independent variables (R^2) $> .50$ were accepted and reported. Binary logistic regression was performed on each of them. The univariate model was used to construct a term representing the main effects of the independent variables on the dropout rate. **Results:** After adjusting the model and excluding variables (i.e., 15), the total number of variables included in the final dropout rate model ($n = 12$ + their subcategories) showed a significant level of power, as indicated by a Chi-squared value of 48.114 ($R^2 = .73$, $p < .05$). Namely, 73% of the dropout from exercise may be attributed to the independent variables. Social support was the only variable with a significant ($p < .05$) predictive capacity (beta $= -.091$) and protective effect (OR $= .913$; 95% CI $= .835, .998$). This indicates that women with fibromyalgia who have social support are less likely to discontinue exercise participation. **Conclusion:** Social support is a protective factor for exercise adherence in women with fibromyalgia.

Keywords: Pain. Musculoskeletal system. Quality of life. Exercise. Public health.

5 CONSIDERAÇÕES FINAIS

Os estudos que compõem esta tese demonstram que é viável, seguro e metodologicamente consistente avaliar e tratar pessoas com dor musculoesquelética crônica – especialmente aquelas com fibromialgia – por meio de intervenções não-farmacológicas baseadas em exercícios físicos. Independentemente do tipo de exercício ou da estratégia de progressão da intensidade, as intervenções propostas proporcionaram benefícios clínicos e fisiológicos significativos, reafirmando a importância do exercício como componente fundamental no manejo da fibromialgia e de outras condições de dor crônica.

Quanto aos parâmetros de prescrição, os achados indicam que diferentes modalidades de exercício – incluindo treinamento de força com intensidade progressiva, treinamento de força com intensidade constante e caminhada – resultam em adaptações biológicas semelhantes. Embora o treinamento de força com intensidade progressiva tenha promovido maiores ganhos no desempenho musculoesquelético, especialmente na extensão do joelho, tais diferenças não resultaram em reduções superiores no impacto da fibromialgia em comparação com as demais intervenções. Esses resultados sugerem que a escolha da modalidade e da progressão do exercício deve considerar preferências individuais, tolerância, contexto clínico e viabilidade de implementação, mais do que buscar um modelo único de prescrição.

Do ponto de vista diagnóstico e avaliativo, os resultados reforçam a especificidade dos instrumentos propostos pelo Colégio Americano de Reumatologia para a fibromialgia, evidenciando que medidas como o *Widespread Pain Index* e a *Symptom Severity Scale* discriminam adequadamente essa condição em relação a outras dores musculoesqueléticas crônicas, não devendo ser utilizadas de forma indiscriminada fora desse contexto. Além disso, a integração de desfechos autorrelatados, de medidas objetivas de desempenho musculoesquelético e de avaliações de mecanismos de dor mostrou-se fundamental para uma compreensão mais ampla e multifatorial dos efeitos das intervenções.

Um dos principais achados desta tese refere-se à baixa adesão à prática de exercícios físicos após o período de intervenção supervisionada. A análise dos fatores associados à adesão evidenciou que variáveis sociais, especialmente o apoio social, exercem papel determinante na continuidade da prática de atividade física. Adicionalmente, variáveis biopsicossociais explicaram proporções relevantes da variabilidade nos escores de apoio social, autocuidado e conhecimento sobre fibromialgia, reforçando que o sucesso do tratamento não-farmacológico transcende aspectos puramente fisiológicos, dependendo também de determinantes sociais, comportamentais e contextuais.

Nesse sentido, os achados desta tese corroboram a necessidade de uma abordagem biopsicossocial integrada no cuidado de pessoas com fibromialgia que considere não apenas o exercício físico como estímulo terapêutico, mas também estratégias educativas, de fortalecimento do autocuidado e de ampliação das redes de apoio social. Intervenções que negligenciam esses fatores tendem a apresentar efeitos limitados e baixa sustentabilidade ao longo do tempo.

Do ponto de vista científico-metodológico, esta tese contribui ao reunir diferentes delineamentos de estudo, empregar análises estatísticas robustas e integrar múltiplas dimensões de avaliação, oferecendo evidências consistentes sobre os efeitos do exercício físico, seus mecanismos e seus limites clínicos na fibromialgia. Esses resultados ampliam o corpo de conhecimento sobre intervenções não-farmacológicas e fornecem subsídios para pesquisadores, profissionais da área clínica e formuladores de políticas públicas.

Por fim, os achados aqui apresentados reforçam que o tratamento não-farmacológico da fibromialgia deve ser compreendido como um processo contínuo, individualizado e contextualizado, no qual o exercício físico é uma ferramenta essencial, mas não a única. É fundamental incorporar estratégias que promovam adesão, engajamento e suporte social para potencializar os benefícios clínicos e promover mudanças sustentáveis na saúde e na qualidade de vida dessa população.

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APÊNDICES

APÊNDICE A – Parecer do Comitê de Ética em Pesquisa

UFSCAR - UNIVERSIDADE FEDERAL DE SÃO CARLOS

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Musculação com intensidade progressiva versus intensidade constante em indivíduos com fibromialgia: ensaio clínico controlado randomizado cego

Pesquisador: André Pontes Silva

Área Temática:

Versão: 1

CAAE: 58819722.0.0000.5504

Instituição Proponente: Centro de Ciências Biológicas e da Saúde

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 5.499.078

Apresentação do Projeto:

As informações elencadas na apresentação do projeto foram retiradas do arquivo Informações Básicas da Pesquisa (PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1946902, de 17/05/2022) e/ou do Projeto Detalhado (APS_Projeto_Tese, de 17/05/2022):

RESUMO: Contexto: A fibromialgia é uma condição crônica caracterizada por dor generalizada e sintomatologia complexa, incluindo fadiga, distúrbios sono, disfunção autonômica, funcional e transtornos de humor. Embora o exercício de resistência seja uma das principais recomendações de intervenção, sabemos que a contração muscular pode provocar dor e interferir na adesão ao tratamento. Uma tentativa de evitar isso é progredir a intensidade do exercício, como na musculação, cujas cargas são adicionadas conforme as adaptações biológicas. Porém, até o momento, não sabemos se um programa de musculação com intensidade progressiva, comparado à intensidade constante, promove benefícios adicionais sobre sintomas de fibromialgia. Este estudo comparará os efeitos de 24 sessões de musculação com intensidade progressiva, aos efeitos do mesmo programa de musculação com intensidade constante, no impacto da fibromialgia. Além disso, avaliará as mudanças de sensibilização central, modulação autonômica, força muscular e funcionalidade após 24 sessões de musculação em indivíduos com fibromialgia. Métodos: Ensaio clínico controlado randomizado cego. Incluiremos indivíduos com fibromialgia (segundo o ACR) e idade 18 anos. A amostra será randomizada para três grupos e avaliada com

Fibromyalgia Impact Questionnaire-Revised, Escala Numérica de Dor, Limiar Sensitivo Cutâneo, Somação Temporal da Dor, Modulação Condicionada da Dor, Variabilidade da Frequência Cardíaca, Teste de caminhada de 6 minutos, força muscular e percepção de melhora. O Grupo 1 (intensidade progressiva – experimental) iniciará o programa de musculação com 50% da força máxima; reavaliaremos a força muscular a cada 4 semanas (teste de 1-RM) e adicionaremos 20% do valor observado, em kg, à intensidade do exercício (1° mês 50%; 2° mês 70%; 3° mês 90% da força máxima). O grupo 2 (intensidade constante – controle A) fará exatamente as mesmas avaliações e programa de musculação, entretanto, a intensidade (50% da força máxima) será mantida até o final do tratamento. O grupo 3 (caminhada – controle B) realizará uma caminhada na esteira, com duração de 40 minutos e intensidade leve, estabelecida pela velocidade de caminhada correspondente à 50% da frequência cardíaca máxima, cuja monitorização será realizada por meio de um cardiofrequencímetro.

HIPÓTESE: A hipótese é que a progressão da intensidade de um programa de musculação, em indivíduos com fibromialgia, gera maiores benefícios clínicos (redução do impacto da fibromialgia) do que o mesmo programa de exercícios com intensidade constante.

METODOLOGIA: Aspectos éticos A pesquisa ocorrerá no Departamento de Fisioterapia da Universidade Federal de São Carlos (DFisio/UFSCar), e o projeto será submetido ao Comitê de Ética em Pesquisa em Seres Humanos da referida instituição. Após a aprovação o cadastraremos, para consultas públicas, no Registro Brasileiro de Ensaios Clínicos (ReBEC). Divulgaremos a pesquisa por meio de mídias sociais (WhatsApp, Facebook, Instagram, Twitter) e nos meios de divulgação da UFSCar, além de panfletos e cartazes nos serviços de saúde pública da cidade de São Carlos. Delineamento da pesquisa: Tratar-se-á de um ensaio clínico controlado randomizado cego, reportado de acordo com o CONSORT.34 Randomizaremos a amostra (por meio do site randomization.com) para distribuição dos indivíduos em três grupos: grupo 1 (intensidade progressiva – experimental), grupo 2 (intensidade constante – controle A) e grupo 3 (caminhada – controle B). Os detalhes sobre os exercícios estão descritos no tópico 3.5. O pesquisador responsável pelo recrutamento, elegibilidade e avaliações, bem como o estatístico, desconhecerão a qual grupo o indivíduo pertencerá (cegamentos do avaliador e do estatístico); haverá um colaborador independente para a randomização e alocação oculta, por meio de envelopes foscos, selados e sequencialmente numerados; e o pesquisador responsável pela condução dos exercícios abrirá os envelopes apenas no momento da intervenção, para identificar o indivíduo e o respectivo

programa de exercício. Amostra Realizamos o processamento do cálculo amostral por meio do software Ene, versão 3.0 (Universidade Autônoma de Barcelona, Barcelona, Espanha). Para isso, elegemos como variável de desfecho primário o impacto da fibromialgia, mensurado por meio do Revised Fibromyalgia Impact Questionnaire (FIQ-R). Baseamos o cálculo na detecção da diferença mínima clinicamente importante de 27 pontos entre os grupos,35 desvio padrão de 16,3 pontos,36 poder estatístico de 80%, significância de 5% e perda amostral de 15%, assim, a amostra deverá conter 26 indivíduos por grupo (n = 78). Após a aprovação do comitê de ética, recrutaremos indivíduos de ambos os sexos, com idades entre 20 e 55 anos, para participar da pesquisa mediante o Termo de Consentimento Livre e Esclarecido (apêndice 1). Anamnese, exame físico e caracterização da amostra: Inicialmente, coletaremos aspectos pessoais, sociodemográficos e clínicos, tais como: queixa principal, história da dor atual, pregressa e familiar, doenças associadas, uso de medicamentos, escolaridade e aspectos profissionais/laborais. Após isso, aplicaremos os instrumentos do estudo.

CRITÉRIOS DE INCLUSÃO: I) diagnóstico de fibromialgia pautado nas recomendações do Colégio Americano de Reumatologia (ACR) de 2016.
CRITÉRIOS DE EXCLUSÃO: I) condições neurológicas que interfiram nas avaliações, como paralisias, alterações sensitivas importantes e de nível de consciência/compreensão; II) doenças articulares em níveis avançados; III) suspeita de trombose, cardiopatias e pós-operatórios imediatos; IV) gravidez; V) abuso de álcool e substância ilícitas; VI) câncer ativo.

Objetivo da Pesquisa:

Objetivo Primário: Comparar os efeitos de 24 sessões de musculação com intensidade progressiva, aos efeitos do mesmo programa de musculação com intensidade constante, no impacto da fibromialgia.

Objetivo Secundário: Avaliar as mudanças de sensibilização central, modulação autonômica, força muscular e funcionalidade após 24 sessões de musculação em indivíduos com fibromialgia.

Avaliação dos Riscos e Benefícios:

Riscos: Esta pesquisa contém alguns riscos, por exemplo, faremos perguntas sobre a dor e o impacto dessa dor na vida dos pacientes, nesse momento talvez o voluntário se sinta constrangimento para responder; além disso, é possível que alguns participantes sintam dor muscular após o exercício, pois, uma sessão de exercício físico, normalmente, causa um pouco de dor muscular no dia seguinte. Para minimizar os riscos, o participante responderá às perguntas,

em formulários, sozinho(a) (os dados pessoais não serão divulgados). Em relação à dor muscular, estudos mostram que ela ocorrerá apenas nas primeiras semanas, e podem ser reduzidas com as orientações no TCLE: descansar um pouco mais do que de costume e tomar mais água.

Benefícios: Benefícios imediatos aos voluntários: diagnóstico (caso não esteja estabelecido), avaliação dos sintomas (e se for de interesse dos participantes, encaminharemos uma cartilha com orientações para auto manejo da dor) e a redução das dores (considerando os efeitos analgésicos do exercício). Retorno social: ao considerar os benefícios globais do exercício físico em indivíduos com fibromialgia, estúdios de musculação poderão se tornar uma opção de tratamento para esses pacientes, pois são acessíveis em termos financeiros e de localização. Por isso, é fundamental entender como a intensidade do programa de musculação deve ser progredida para reduzir o impacto da fibromialgia. Os resultados do presente estudo darão este subsídio e clareza aos profissionais de saúde, que por sua vez, planejarão um programa de musculação para esta população, considerando a individualidade biológica de cada um(a), ao ajustar a intensidade do exercício.

Comentários e Considerações sobre a Pesquisa:

Trata-se de uma pesquisa que deve seguir os preceitos éticos estabelecidos pela Resolução CNS nº 466/2012 suas complementares.

Considerações sobre os Termos de apresentação obrigatória:

Vide campo "Conclusões ou Pendências e Lista de Inadequações"

Recomendações:

Vide campo "Conclusões ou Pendências e Lista de Inadequações"

Conclusões ou Pendências e Lista de Inadequações:

Considerando a situação sócio sanitária, bem como os planos de contingenciamento da pandemia da COVID-19 municipais e Estaduais; Considerando que as Portarias/Resoluções de Instituições Proponentes de pesquisa são constantemente atualizadas; Considerando o papel do sistema CEP/CONEP em garantir a segurança e proteção do participante da pesquisa por meio dos Protocolos submetidos na Plataforma Brasil; Considerando a corresponsabilidade do pesquisador pela integridade e bem-estar dos participantes da pesquisa;

Este CEP orienta aos pesquisadores o acompanhamento da situação sócio sanitária da região em que ocorrerá a pesquisa, bem como as determinações legais dos planos de contingenciamento do COVID-19 para determinação do início, suspensão ou continuidade de atividades de pesquisas

presenciais, mesmo que o Protocolo já se encontre aprovado pelo CEP.

Não há pendências.

Considerações Finais a critério do CEP:

Diante do exposto, o Comitê de ética em pesquisa - CEP, de acordo com as atribuições definidas na Resolução CNS nº 466 de 2012 e 510 de 2016, manifesta-se por considerar "Aprovado" o projeto. A responsabilidade do pesquisador é indelegável e indeclinável e compreende os aspectos éticos e legais, cabendo-lhe, após aprovação deste Comitê de Ética em Pesquisa: II - conduzir o processo de Consentimento e de Assentimento Livre e Esclarecido; III - apresentar dados solicitados pelo CEP ou pela CONEP a qualquer momento; IV - manter os dados da pesquisa em arquivo, físico ou digital, sob sua guarda e responsabilidade, por um período mínimo de 5 (cinco) anos após o término da pesquisa; V - apresentar no relatório final que o projeto foi desenvolvido conforme delineado, justificando, quando ocorridas, a sua mudança ou interrupção. Este relatório final deverá ser protocolado via notificação na Plataforma Brasil. OBSERVAÇÃO: Nos documentos encaminhados por Notificação NÃO DEVE constar alteração no conteúdo do projeto. Caso o projeto tenha sofrido alterações, o pesquisador deverá submeter uma "EMENDA".

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1946902.pdf	17/06/2022 10:14:28		Aceito
Projeto Detalhado / Brochura Investigador	APS_Projeto_Tese.pdf	17/06/2022 10:13:09	André Pontes Silva	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE.pdf	17/06/2022 10:12:56	André Pontes Silva	Aceito
Folha de Rosto	Folha_de_rosto.pdf	17/06/2022 10:12:26	André Pontes Silva	Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

UFSCAR - UNIVERSIDADE FEDERAL DE SÃO CARLOS

Continuação do Parecer: 5.468.078

SAO CARLOS, 29 de Junho de 2022

Assinado por:
Adriana Sanches Garcia de Araújo
(Coordenador(a))

Endereço: WASHINGTON LUIZ KM 235
Bairro: JARDIM GUANABARA **CEP:** 13.565-905
UF: SP **Município:** SAO CARLOS
Telefone: (16)3351-9685 **E-mail:** cephumanos@ufscar.br

APÊNDICE B – Parecer do Registro Brasileiro de Ensaios Clínicos (ReBEC)

Gmail ANDRÉ PONTES-SILVA <contato.andrepsilva@gmail.com>

Ensaio clínico RBR-9pbq9fg aprovado

1 mensagem

ReBEC <sistema.rebec@gmail.com> 6 de outubro de 2022 às 11:21
Para: "contato.andrepsilva@gmail.com" <contato.andrepsilva@gmail.com>, ReBEC <rebec@icict.fiocruz.br>

Esta é uma mensagem automática. Por favor não responda.

Prezado Registrante,

Temos o prazer de informar que seu estudo foi publicado no Registro Brasileiro de Ensaios Clínicos (ReBEC) com o número RBR-9pbq9fg . Agradecemos por seu registro e colaboração e, desde já, nos colocamos à disposição para esclarecer quaisquer dúvidas que possam surgir, seja em caso de atualização do registro ou, até mesmo, uma nova submissão. Por favor, não hesite em contactar-nos. Cordialmente, ReBEC Staff - ReBEC/ICICT/LIS Av. Brasil 4036 - Maré - sala 807 Rio de Janeiro RJ CEP: 21040-360 Tel: +55(21)3882-9227

Acesso: https://ensaiosclinicos.gov.br/rg/RBR-9pbq9fg

Esta é uma mensagem automática. Por favor não responda.

APÊNDICE C – Avaliações realizadas e arquivos utilizados na coleta de dados do ensaio

ANAMNESE

Nome: **Nascimento (data):** **Diagnóstico (meses):**

Profissional (ACR?): **Massa corporal (kg):** **Estatura (m):**

Cintura (cm): **Abdômen (cm):** **Quadril (cm):**

<table>
<tr><td colspan="4">Paciente satisfaz os critérios diagnósticos para fibromialgia (ACR-2016) se as 3 condições a seguir forem atendidas:
1) Widespread pain index (WPI ≥ 7) e Symptom Severity Scale (SSS ≥ 5). Ou WPI ≥ 3 e SSS ≥ 9;
2) Presença dos sintomas com severidade semelhante há pelo menos 3 meses;
3) Ausência de condições crônicas e/ou doenças que justificam os sintomas.</td></tr>
<tr><td colspan="4">Avaliação</td></tr>
<tr><td colspan="4">1. WPI (escore de 0 a 19): observe as áreas afetadas pela dor na última semana. Quantas áreas o paciente teve dor?</td></tr>
<tr><td>Lado direito</td><td>Lado esquerdo</td><td>Região axial anterior</td><td>Região axial posterior</td></tr>
<tr><td>Ombro
Braço
Antebraço
Quadril
Coxa
Perna</td><td>Ombro
Braço
Antebraço
Quadril
Coxa
Perna</td><td>Mandíbula (esquerda)
Mandíbula (direita)
Tórax
Abdômen</td><td>Pescoço
Coluna torácica
Coluna lombar</td></tr>
<tr><td colspan="4">2. SSS (escore de 0 a 12): obtenção do escore via soma dos 3 sintomas + extensão dos sintomas somáticos em geral.</td></tr>
<tr><td colspan="2">Fadiga
(0) (1) (2) (3)
Indisposição ao acordar
(0) (1) (2) (3)
Problemas cognitivos
(0) (1) (2) (3)</td><td colspan="2">Para cada um dos 3 sintomas, indique o nível de severidade na última semana:
0 nenhum(a)
1 leve
2 moderado(a) – frequentemente presente
3 grave – persistente</td></tr>
<tr><td colspan="4">*A respeito de sintomas somáticos em geral, indique se o paciente possui:</td></tr>
<tr><td colspan="4">0 nenhum
1 poucos sintomas
2 um número moderado de sintomas
3 muitos sintomas</td></tr>
<tr><td colspan="4">3. Após exames, identificou-se condições crônicas e/ou doenças que justifiquem os sintomas? (Não); (Sim):</td></tr>
</table>

* Sintomas somáticos que podem ser considerados: dor muscular, síndrome do intestino irritável, fadiga/cansaço, problema de memória, fraqueza muscular, dor de cabeça, dor/cãibras no abdômen, dormência/formigamento, tontura, insônia, depressão, constipação intestinal, náuseas ou vômitos, nervosismo, dor no peito, visão turva, febre, diarreia, boca seca, coceira, chiado no peito, síndrome de Raynaud, urticária/vergões, zumbido nos ouvidos, azia, úlceras orais, perda/alteração do paladar, convulsões, olhos secos, falta de ar, perda de apetite, erupção cutânea, sensibilidade ao sol, dificuldades auditivas, hematomas fáceis, perda de cabelo, micção frequente, micção dolorosa e espasmos da bexiga.

Instrumento de Rastreio Rápido da Fibromialgia (FiRST)

Você sofre de dores nas articulações (juntas), músculos ou tendões há 3 meses pelo menos. Por favor, responda a este questionário para ajudar o seu médico a avaliar mais efetivamente suas dores e seus sintomas.

Por favor preencha o questionário respondendo sim ou não (somente uma resposta: SIM ou NÃO) para cada uma das seguintes afirmações. Assinale a caixa que corresponde à sua resposta.

	Sim	Não
Sinto dor em todo o meu corpo.		
Minha dor é acompanhada de uma fadiga geral contínua e muito desagradável.		
Minha dor se parece com queimaduras, choques elétricos ou câimbras.		
Minha dor é acompanhada de outras sensações incomuns por todo o meu corpo, como pontadas, formigamentos ou dormências.		
Minha dor é acompanhada por outros problemas de saúde, tais como problemas digestivos, urinários, dores de cabeça ou pernas inquietas.		
Minha dor tem impacto significativo na minha vida, principalmente no meu sono e na minha capacidade de concentração, fazendo eu me sentir geralmente mais lento.		

De Sousa AP, de Arruda GT, Pontes-Silva A, de Souza MC, Driusso P, Avila MA. Measurement properties of the Brazilian online version of the Fibromyalgia Rapid Screening Tool (FiRST). Adv Rheumatol. 2022 Oct 31;62(1):39. doi: 10.1186/s42358-022-00271-2. PMID: 36316763; PMCID: PMC9628418.

Questionário de Impacto da Fibromialgia (FIQ-R)

Instruções: Para cada questão, marque um "X" no quadrado que melhor indica o quanto a fibromialgia dificultou a realização das seguintes atividades nos últimos 7 dias.

Escovar ou pentear seus cabelos	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Caminhar continuamente por 20 minutos	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Preparar uma refeição em casa	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Passar o aspirador, esfregar com a mão ou varrer o chão	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Erguer e carregar uma sacola cheia de compras	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Subir um lance de escadas	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Trocar a roupa de cama	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Ficar sentado por 45 minutos	Sem dificuldade □□□□□□□□□□ Muita dificuldade
Fazer compras no supermecado	Sem dificuldade □□□□□□□□□□ Muita dificuldade

Sub-total do domínio função (somente para uso interno) ☐

A fibromialgia me impediu de realizar as atividades da semana	Nunca □□□□□□□□□□ Sempre
Eu fiquei completamente esgotado pelos meus sintomas de fibromialgia	Nunca □□□□□□□□□□ Sempre

Sub-total do domínio impacto global
(somente para uso interno) ☐

Por favor, indique o seu nível de dor	Sem dor □□□□□□□□□□ Dor insuportável
Por favor,indique o seu nível de energia	Muita energia □□□□□□□□□□ Sem energia
Por favor,indique o seu nível de rigidez	Sem rigidez □□□□□□□□□□ Muitarigidez
Por favor,indique a qualidade do seu sono	Acordo bem descansado □□□□□□□□□□ Acordo muito cansado
Por favor,indique o seu nível de depressão	Sem depressão □□□□□□□□□□ Muito deprimido
Por favor, indique a qualidade de sua memória	Boa memória □□□□□□□□□□ Memória muito ruim
Por favor,indique o seu nível de ansiedade	Sem ansiedade □□□□□□□□□□ Muito ansioso
Por favor,indique o seu nível de sensibilidade ao toque	Sem sensibilidade □□□□□□□□□□ Muita sensibilidade
Por favor, indique o nível de equilíbrio do seu corpo	Sem desequilíbrio □□□□□□□□□□ Muito desequilíbrio
Por favor, indique o seu nível de sensibilidade a barulhos altos, luzes fortes, odores e frio	Sem sensibilidade □□□□□□□□□□ Muita sensibilidade

Sub-total do domínio sintomas
(somente para uso interno) ☐

PONTUAÇÃO TOTAL – FIQR
(somente para uso interno) ☐

Escala de Pittsburgh para qualidade do sono

As questões seguintes referem-se aos seus hábitos de sono durante o mês passado. Suas respostas devem demonstrar, de forma mais precisa possível, o que aconteceu na maioria dos dias e noites apenas desse mês. Por favor, responda a todas as questões.

1) Durante o mês passado, a que horas você foi habitualmente dormir?

Horário habitual de dormir: _____

2) Durante o mês passado, quanto tempo (em minutos) habitualmente você levou para adormecer a cada noite:

Número de minutos: _____

3) Durante o mês passado, a que horas você habitualmente despertou?

Horário habitual de despertar: _____

4) Durante o mês passado, quantas horas de sono realmente você teve à noite? (isto pode ser diferente do número de horas que você permaneceu na cama)

Horas de sono por noite: _____

5) Durante o mês passado, com que frequência você teve problemas de sono porque você...

a) Não conseguia dormir em 30 minutos

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

b) Despertou no meio da noite ou de madrugada

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

c) Teve que levantar à noite para ir ao banheiro

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

d) Não conseguia respirar de forma satisfatória

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

e) Tossia ou roncava alto

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

f) Sentia muito frio

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

g) Sentia muito calor

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

h) Tinha sonhos ruins

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

i) Tinha dor

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

j) Outra razão (por favor, descreva):

_____

_____

Durante o mês passado, com que freqüência você teve problemas com o sono por essa causa acima?

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

6) Durante o mês passado, como você avaliaria a qualidade geral do seu sono?

( ) muito bom

( ) bom

( ) ruim

( ) muito ruim

7) Durante o mês passado, com que frequência você tomou medicamento (prescrito ou por conta própria) para ajudar no sono?

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

8) Durante o mês passado, com que freqüência você teve dificuldades em permanecer acordado enquanto estava dirigindo, fazendo refeições, ou envolvido em atividades sociais?

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

9) Durante o mês passado, quanto foi problemático para você manter-se suficientemente entusiasmado ao realizar suas atividades?

( ) nunca no mês passado

( ) menos de uma vez por semana

( ) uma ou duas vezes por semana

( ) três ou mais vezes por semana

Escala Hospitalar de Ansiedade e Depressão

Este questionário ajudará o seu médico a saber como você está se sentindo. Leia todas as frases. Marque com um "X" a resposta que melhor corresponder a como você tem se sentido na ÚLTIMA SEMANA. Não é preciso ficar pensando muito em cada questão. Neste questionário as respostas espontâneas têm mais valor do que aquelas em que se pensa muito. Marque apenas uma resposta para cada pergunta.

[A] **1) Eu me sinto tenso ou contraído:**

3 ( ) A maior parte do tempo

2 ( ) Boa parte do tempo

1 ( ) De vez em quando

0 ( ) Nunca

[D] **2) Eu ainda sinto gosto pelas mesmas coisas de antes:**

0 ( ) Sim, do mesmo jeito que antes

1 ( ) Não tanto quanto antes

2 ( ) Só um pouco

3 ( ) Já não sinto mais prazer em nada

[A] **3) Eu sinto uma espécie de medo, como se algo ruim fosse acontecer:**

3 ( ) Sim, e de um jeito muito forte

2 ( ) Sim, mas não tão forte

1 ( ) Um pouco, mas isso não me preocupa

0 ( ) Não sinto nada disso

[D] **4) Dou risada e me divirto quando vejo coisas engraçadas:**

0 ( ) Do mesmo jeito que antes

1 ( ) Atualmente um pouco menos

2 ( ) Atualmente bem menos

3 ( ) Não consigo mais

[A] **5) Estou com a cabeça cheia de preocupações:**

3 ( ) A maior parte do tempo

2 ( ) Boa parte do tempo

1 ( ) De vez em quando

0 ( ) Raramente

[D] **6) Eu me sinto alegre:**

3 ( ) Nunca

2 ( ) Poucas vezes

1 ( ) Muitas vezes

0 ( ) A maior parte do tempo

[A] 7) Consigo ficar sentado à vontade e me sentir relaxado:

0 ( ) Sim, quase sempre

1 ( ) Muitas vezes

2 ( ) Poucas vezes

3 ( ) Nunca

[D] 8) Eu estou lento para pensar e fazer as coisas:

3 ( ) Quase sempre

2 ( ) Muitas vezes

1 ( ) De vez em quando

0 ( ) Nunca

[A] 9) Eu tenho uma sensação ruim de medo, como um frio na barriga ou um aperto no estômago:

0 ( ) Nunca

1 ( ) De vez em quando

2 ( ) Muitas vezes

3 ( ) Quase sempre

[D] 10) Eu perdi o interesse em cuidar da minha aparência:

3 ( ) Completamente

2 ( ) Não estou mais me cuidando como deveria

1 ( ) Talvez não tanto quanto antes

0 ( ) Me cuido do mesmo jeito que antes

[A] 11) Eu me sinto inquieto, como se eu não pudesse ficar parado em lugar nenhum:

3 ( ) Sim, demais

2 ( ) Bastante

1 ( ) Um pouco

0 ( ) Não me sinto assim

[D] 12) Fico esperando animado as coisas boas que estão por vir:

0 ( ) Do mesmo jeito que antes

1 ( ) Um pouco menos do que antes

2 ( ) Bem menos do que antes

3 ( ) Quase nunca

[A] 13) De repente, tenho a sensação de entrar em pânico:

3 ( ) A quase todo momento

2 ( ) Várias vezes

1 ( ) De vez em quando

0 ( ) Não sinto isso

[D] 14) Consigo sentir prazer quando assisto a um bom programa de televisão, de rádio ou quando leio alguma coisa:

0 ( ) Quase sempre

1 ( ) Várias vezes

2 ( ) Poucas vezes

3 ( ) Quase nunca

SOMAÇÃO TEMPORAL (ALGÔMETRO)

DATA DE NASCIMENTO: MASSA(KG): ESTATURA (M): CINTURA (CM):

REALIZAR O <u>ESTÍMULO DE PRESSÃO CONSTANTE</u> NO BRAÇO DIREITO (2,5kg).
Em posição anatômica, demarque o sítio na distância de 7,5 cm da prega distal do punho.

↓

SOLICITAR O AUTORRELATO DE DOR (ESCALA NUMÉRICA DE DOR [END]) A CADA 10s.

Pré-intervenção: 0s = _____; 10s = _____; 20s = _____; 30s = _____.

Pós-intervenção: 0s = _____; 10s = _____; 20s = _____; 30s = _____.

MODULAÇÃO CONDICIONADA (ALGÔMETRO + ESFIGMOMANÔMETRO)

REALIZAR O <u>ESTÍMULO DE PRESSÃO</u> NO BRAÇO DIREITO (END = 4) – ANOTE O VALOR (kg).
Em posição anatômica, demarque o sítio na distância de 7,5 cm da prega distal do punho.

↓

REALIZAR O <u>ESTÍMULO ISQUÊMICO</u> NO BRAÇO ESQUERDO (ESFIGMO, 250mmHg).
Objetivo: atingir END ≥ 5, sendo necessário, solicite flexão/extensão de cotovelo.

↓

REPETIR O <u>ESTÍMULO DE PRESSÃO</u> NO BRAÇO DIREITO (END = 4) – ANOTE O VALOR (kg).
Agora, o estímulo de pressão é simultâneo ao condicionado (depois, retire o esfigmo).

↓

REPETIR O <u>ESTÍMULO DE PRESSÃO</u> NO BRAÇO DIREITO (END = 4) – ANOTE O VALOR (kg).
Este estímulo de pressão deverá ocorrer após 30s da retirada do esfigmomanômetro.

↓

REPETIR O <u>ESTÍMULO DE PRESSÃO</u> NO BRAÇO DIREITO (END = 4) – ANOTE O VALOR (kg).
Este estímulo de pressão deverá ocorrer após 5min de intervalo.

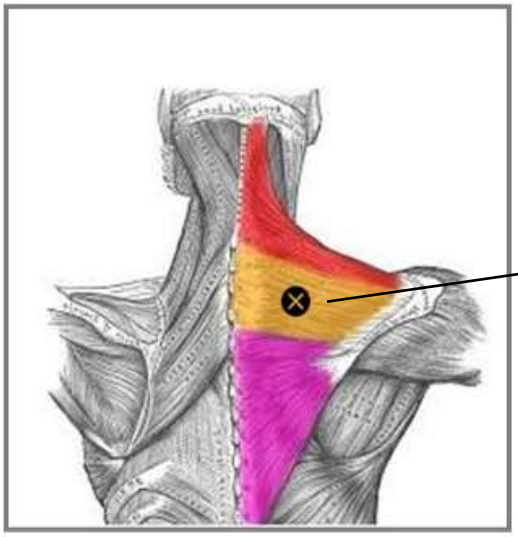
PRÉ-INTERVENÇÃO

Pré-estímulo = _____; Intra-estímulo = _____; Pós-estímulo 1 = _____; Pós-estímulo 2 = _____.

PÓS-INTERVENÇÃO

Pré-estímulo = _____; Intra-estímulo = _____; Pós-estímulo 1 = _____; Pós-estímulo 2 = _____.

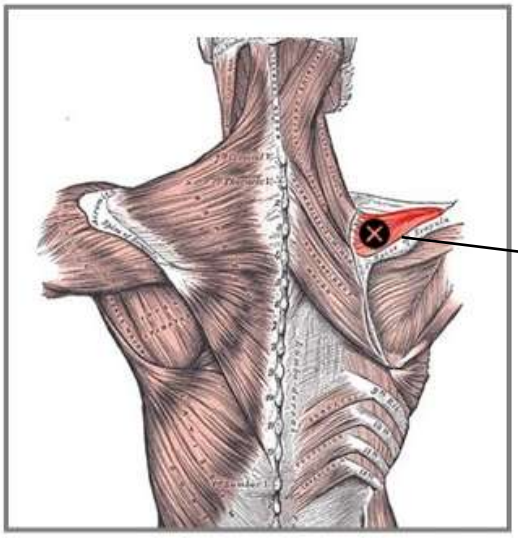
ESTESIOMETRIA



TRAPÉZIO

Pré-intervenção:

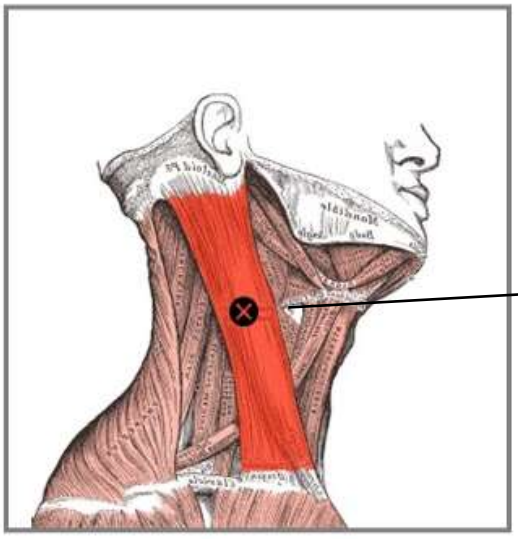
Pós-intervenção:



SUPRAESPINHAL

Pré-intervenção:

Pós-intervenção:



ESTERNOCLEIDOMASTOIDEO

Pré-intervenção:

Pós-intervenção:

TESTE DE CAMINHADA DE 6 MINUTOS (TC6)

NOME:				**AVALIADOR:**
IDADE:	**PESO:**	**ALTURA:**	**SEXO:** ☐ **F** ☐ **M**	**DATA:** / /
VALORES BASAIS:				

SEDESTAÇÃO	**ORTOSTATISMO**
Frequência Cardíaca:	Frequência Cardíaca:
Pressão Arterial Sistêmica:	Pressão Arterial Sistêmica:
Saturação de Oxigênio:	Saturação de Oxigênio:
BORG:	BORG:
FREQUÊNCIA CARDÍACA MÁXIMA:	**FREQUÊNCIA CARDÍACA SUBMÁXIMA (85%):**

TEMPO	**FC**	**PAS**	**BORG DISPNEIA**	**BORG MMII**	**SpO_2**
1'					
2'					
3'					
4'					
5'					
6'					
Rec 1'					
Rec 3'					
Rec 6'					
Distância Percorrida:		**Distância Predita:**		**Distância (%):**	

1° MINUTO	**2° MINUTO**	**3° MINUTO**	**4° MINUTO**	**5° MINUTO**	**15" ANTES DO FIM.**
Você está indo muito bem. Faltam 5'.	Continue assim. Faltam 4'.	Você está indo muito bem. Falta 3'.	Mantenha o ritmo. Faltam 2'.	Está indo muito bem. Falta 1'.	Você deverá parar quando eu pedir.

OBSERVAÇÕES:

CÁLCULOS	
Frequência Cardíaca Máxima e Submáxima.	**Distância Percorrida Predita.**
Homens: 220 – idade. Mulheres: 210 – idade. $FC_{Submáxima} = FC_{máx}$ X 0.85.	DP= 622,461 – (1,846 x idade) = (61,503 x gênero) Masculino: 1. Feminino: 0.

REFERÊNCIAS: Iwama AM, Andrade GN, Shima P, Tanni SE, Godoy I, Dourado VZ. The sixminute walk test and body weight-walk distance product in healthy Brazilian subjects. **Braz J Med Biol Res**. 2009; 42 (11): 1080-5.

TESTE DE UMA REPETIÇÃO MÁXIMA

REALIZAR 10 MOVIMENTOS SEM CARGA.
Objetivo: compreender a técnica e realizar um aquecimento específico.

▼

REALIZAR 5-10 MOVIMENTOS SUBMÁXIMOS (CARGA ESTIMADA) – ANOTE O VALOR (kg).
Este teste deverá ocorrer após 1min de intervalo. Solicite o autorrelato de dor e fadiga.

▼

REALIZAR 1-2 MOVIMENTOS MÁXIMOS (CARGA ESTIMADA) – ANOTE O VALOR (kg).
Este teste deverá ocorrer após 3min de intervalo. Solicite o autorrelato de dor/fadiga (END).

Semana 0

Exercício	10rep (kg = 0)	5-10rep (kg = ?)	1-2rep (kg = ?)
1. Extensora			
2. Leg press			
3. Gemeos sentada			
4. Supino inclinado			
5. Remada sentada			
6. Elevação lateral			

Semana 4

Exercício	10rep (kg = 0)	5-10rep (kg = ?)	1-2rep (kg = ?)
1. Extensora			
2. Leg press			
3. Gemeos sentada			
4. Supino inclinado			
5. Remada sentada			
6. Elevação lateral			

Semana 8

Exercício	10rep (kg = 0)	5-10rep (kg = ?)	1-2rep (kg = ?)
1. Extensora			
2. Leg press			
3. Gemeos sentada			
4. Supino inclinado			
5. Remada sentada			
6. Elevação lateral			

POSICIONAMENTO NO BIODEX

PESO DO MEMBRO: DATA: HORA: REPETIÇÕES:

DISTÂNCIA DO ENCOSTO:

ALTURA DA CADEIRA:

DISTÂNCIA DA CADEIRA:

DISTÂNCIA DO BIODEX:

DISTÂNCIA DA ALAVANCA:

FORÇA DE PREENSÃO (D): E:

VARIABILIDADE DA FREQUÊNCIA CARDÍACA

MINUTO	FREQUÊNCIA RESPIRATÓRIA	OBS:
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Treinamento de força 1º mês.

IDENTIFICAÇÃO DO EXERCÍCIO (CARGA)	**SÉRIES (REPETIÇÕES)**
— *Aquecimento global*	*5min*
1. EXTENSORA ( )	3x (10 rep)
2. LEG PRESS ( )	3x (10 rep)
3. GÊMEOS SENTADA ( )	3x (10 rep)
4. SUPINO INCLINADO ( )	3x (10 rep)
5. REMADA SENTADA ( )	3x (10 rep)
6. ELEVAÇÃO LATERAL ( )	3x (10 rep)

Nome: **Período:** **Cadência:** 1111. **Intervalo:** . **% de 1-RM:**

Treinamento de força 2º mês.

IDENTIFICAÇÃO DO EXERCÍCIO (CARGA)	**SÉRIES (REPETIÇÕES)**
— *Aquecimento global*	*5min*
1. EXTENSORA ( )	3x (10 rep)
2. LEG PRESS ( )	3x (10 rep)
3. GÊMEOS SENTADA ( )	3x (10 rep)
4. SUPINO INCLINADO ( )	3x (10 rep)
5. REMADA SENTADA ( )	3x (10 rep)
6. ELEVAÇÃO LATERAL ( )	3x (10 rep)

Nome: **Período:** **Cadência:** 1111. **Intervalo:** . **% de 1-RM:**

Treinamento de força 3º mês.

IDENTIFICAÇÃO DO EXERCÍCIO (CARGA)	**SÉRIES (REPETIÇÕES)**
— *Aquecimento global*	*5min*
1. EXTENSORA ( )	3x (10 rep)
2. LEG PRESS ( )	3x (10 rep)
3. GÊMEOS SENTADA ( )	3x (10 rep)
4. SUPINO INCLINADO ( )	3x (10 rep)
5. REMADA SENTADA ( )	3x (10 rep)
6. ELEVAÇÃO LATERAL ( )	3x (10 rep)

Nome: **Período:** **Cadência:** 1111. **Intervalo:** . **% de 1-RM:**

Treinamento aeróbico ( ).

IDADE	**FACMAX**	**% DETERMINADA**

Nome: **Período:**

Registros para o treinamento de força

Exercício	Frequência Cardíaca			Pressão Arterial			Nível de Dor			Nível de Esforço			Repetições			Tempo		
1																		
2																		
3																		
4																		
5																		
6																		
Número da sessão de exercício:																		

Exercício	Frequência Cardíaca			Pressão Arterial			Nível de Dor			Nível de Esforço			Repetições			Tempo		
1																		
2																		
3																		
4																		
5																		
6																		
Número da sessão de exercício:																		

Exercício	Frequência Cardíaca			Pressão Arterial			Nível de Dor			Nível de Esforço			Repetições			Tempo		
1																		
2																		
3																		
4																		
5																		
6																		
Número da sessão de exercício:																		

Exercício	Frequência Cardíaca			Pressão Arterial			Nível de Dor			Nível de Esforço			Repetições			Tempo		
1																		
2																		
3																		
4																		
5																		
6																		
Número da sessão de exercício:																		

Exercício	Frequência Cardíaca			Pressão Arterial			Nível de Dor			Nível de Esforço			Repetições			Tempo		
1																		
2																		
3																		
4																		
5																		
6																		
Número da sessão de exercício:																		

Exercício	Frequência Cardíaca			Pressão Arterial			Nível de Dor			Nível de Esforço			Repetições			Tempo		
1																		
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Exercício	Frequência Cardíaca			Pressão Arterial			Nível de Dor			Nível de Esforço			Repetições			Tempo		
1																		
2																		
3																		
4																		
5																		
6																		
Número da sessão de exercício:																		

Registros para o treinamento de caminhada

MINUTO	FC (ESTEIRA)	PA	END	PSE
0				
5				
10				
15				
20				
25				
30				
35				
40				

Distância: Velocidade: Caloria: Sessão de número?

MINUTO	FC (ESTEIRA)	PA	END	PSE
0				
5				
10				
15				
20				
25				
30				
35				
40				

Distância: Velocidade: Caloria: Sessão de número?

MINUTO	FC (ESTEIRA)	PA	END	PSE
0				
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10				
15				
20				
25				
30				
35				
40				

Distância: Velocidade: Caloria: Sessão de número?

MINUTO	FC (ESTEIRA)	PA	END	PSE
0				
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40				

Distância: Velocidade: Caloria: Sessão de número?

MINUTO	FC (ESTEIRA)	PA	END	PSE
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30				
35				
40				

Distância: Velocidade: Caloria: Sessão de número?

MINUTO	FC (ESTEIRA)	PA	END	PSE
0				
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15				
20				
25				
30				
35				
40				

Distância: Velocidade: Caloria: Sessão de número?

CRONOGRAMA DE ATENDIMENTO

PACIENTE:

DATA INICIAL (DATA FINAL):

Sessão de exercício	Data	Presente	Ausente
1ª *			
2ª			
3ª			
4ª			
5ª			
6ª			
7ª			
8ª *#			
9ª			
10ª			
11ª			
12ª			
13ª			
14ª			
15ª			
16ª #			
17ª			
18ª			
19ª			
20ª			
21ª			
22ª			
23ª			
24ª			

Reavaliar a força muscular (1RM).

* Avaliação para o TCC da Thayná (pré e pós exercício).

OBS: Faltas poderão ser repostas apenas na mesma semana —em dias separados.

Síntese de avaliações

Instrumento/Teste	Variável/desfecho	Bibliografia	Pontuação	Diferença mínima
Avaliação inicial*	Anamnese	Elaborada pelo autor	n/a	n/a
Fibromyalgia Rapid Screening Tool*	Triagem da fibromialgia	De Sousa et al. (2022)[1]	Ponto de corte ≥ 5	n/a
Fibromyalgia Impact Questionnaire-Revised*	Impacto da fibromialgia	Lupi et al. (2016)[2]	Total: 0-100 Função: 0-30 Impacto global: 0-20 Sintoma: 0-50	27 pontos[3]
Escala de Pittsburgh*	Qualidade do sono	Bertolazi et al. (2011)[4]	Total: 0-21 ponto de corte ≥ 5	n/a
Escala Hospitalar de Ansiedade e Depressão*	Ansiedade e depressão	Marcolino et al. (2007)[5]	Total: 0-21 ansiedade ≥ 8 depressão ≥ 9	n/a
Escala Numérica de Dor*	Intensidade de dor	Ferreira-Valente et al. (2011)[6]	Total: 0-10 ponto de corte ≥ 3	2 pontos[7,8]
Variabilidade da Frequência Cardíaca	Modulação autonômica	Pontes-Silva et al. (2022)[9]	n/a	n/a
Estesiometria*	Limiar sensitivo cutâneo	Sanchez et al. (2019)[10]	n/a	n/a
Somação temporal da dor (algômetro)*	Wind-up	Herrero et al. (2000)[11]	n/a	n/a
Modulação condicionada da dor*	Controle inibitório nociceptivo difuso	Van-Wijk et al. (2010)[12]	n/a	n/a
Teste de caminhada de 6min*	Capacidade de caminhar	Kaleth et al. (2016)	n/a	156 a 167 metros[13]
Dinamometria do membro inferior dominante*	Força muscular	Avila et al. (2008)[14]	n/a	n/a
Dinamometria de membros superiores*	Força muscular	n/a	n/a	n/a
Teste de 1-RM†	Força muscular para carga dinâmica	Busch et al. (2013)[15]	n/a	n/a

*Primeiro dia de avaliação. †Segundo dia de avaliação.

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