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Comparison of the effects of the Feldenkrais method versus core stability exercise in the management of chronic low back pain: a randomised control trial

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Abstract

Objective: To investigate the effect of the Feldenkrais method versus core stability exercises on pain, disability, quality of life and interoceptive awareness in patients with chronic non-specific low back pain.
Design: A single-blinded, randomised, controlled trial.
Setting: Outpatient, sports medicine clinic of Mazandaran medical university.
Participants: Sixty patients with chronic non-specific low back pain randomised equally into the Feldenkrais method versus core stability exercises groups.
Intervention: Intervention group received Feldenkrais method consisting of training theoretical content and supervised exercise therapy two sessions per week for five weeks. Control group received educational programme and home-based core stability exercises for five weeks.
Outcome measures: All patients were examined by World Health Organization's Quality of life Questionnaire, McGill Pain Questionnaire, Oswestry Disability Questionnaire and Multidimensional Assessment of Interoceptive Awareness Questionnaire. All outcomes were measured at baseline and the end of the intervention
Results: There were statistically significant differences between groups for quality of life ($P=0.006$, from 45.51 to 60.49), interoceptive awareness ($P>0.001$, from 2.74 to 4.06) and disability ($P=0.021$, from 27.17 to 14.5) in favour of the Feldenkrais method. McGill pain score significantly decreased in both the Feldenkrais (from 15.33 to 3.63) and control groups (from 13.17 to 4.17), but there were no between-groups differences ($P=0.16$).

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Conclusion: Feldenkrais method intervention gave increased benefits in improving quality of life, improving interoceptive awareness and reducing disability index.

Keywords
Feldenkrais method, low back pain, core stability exercises, quality of life, interoceptive awareness

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Introduction

Psychological and social factors are significant determinants of occurrence and recurrence of low back pain.[1] According to the latest guidelines and current approaches to low back pain, traditional treatments including pharmacologic and surgical treatments are being less emphasised and psychological therapies are more considered.[2] Exercise therapy as a priority and complementary medicine including acupuncture, spinal manipulation, Tai Chi and yoga are recommended according to the current low back pain guidelines.[2–5]

The Feldenkrais method is one of the multidisciplinary treatment methods suggested in musculoskeletal complaints including neck pain,[6] low back pain,[7] shoulder pain,[6] balance,[8,9] mobility and gait.[9,10] The Feldenkrais method is a mind-body therapy and somatic education method.[11,12] Increasing awareness through habitual movements and activities of daily life is one of the principal methods applied in the Feldenkrais method. Feldenkrais method improves proprioceptive awareness via conducted treatment sessions with verbal guidance of the trainer.[13] The Feldenkrais method is a self-learning method to select the most suitable technique for moving the body. The Feldenkrais method is categorised as a pedagogical method.[13] Sensorimotor practices and experimental methods of movements lead to the self-learning process in which individuals will be aware of their most appropriate and painless method of body movement.[13,14] The purpose is to modify incorrect posture with the aim of reducing the pain.[13] Motor learning via external emphasis of attention (verbal instruction of the trainer) is achieved in the Feldenkrais method.[15] Improving functional integration is the second principal methods applied in the Feldenkrais method. The Feldenkrais method covers exercise therapy targets and simultaneously, improves psychological and social factors affecting low back pain via a mind-body approch.[14]

According to the high prevalence of low back pain and its disabling effects on quality of life and productivity of occupations, developing complementary treatment approaches is mandated.[16] Studies that have evaluated the effects of the Feldenkrais method in individuals with low back pain are limited[7,11–13] and there is limited evidence about the comparative effects of the Feldenkrais method versus other treatment methods in individuals with low back pain.[13] The challenging question is whether if there are any advantages in the Feldenkrais method over exercise therapy in individuals with low back pain in a comprehensive evaluation framework? The objective of this study was to evaluate the effects of the Feldenkrais method versus core stability exercises in patients with chronic non-specific low back pain on pain score, disability index, quality of life score, interoceptive awareness and activation of core stability muscles. The comprehensive evaluation method designed in the study, will develop us an effective guide in management of patients with chronic non-specific low back pain. The hypothesis is to demonstrate that the Feldenkrais method covers both exercise therapy targets and psychological and social factors.

Material and methods

The study was conducted as a single-blinded, single-centre parallel-group randomised control trial. Study was registered at the Iranian Registry of Clinical Trials (IRCT20200117046160N1). This study was approved by the Mazandaran University of medical sciences ethical committee (ethics code: IR.MAZUMS.IMAMHOSPITAL.REC1397.108). All participants received comprehensive information about the

objective of the study and intervention details. All individuals signed informed consent with the responsibility of Mazandaran University of Medical Sciences for the integrity and conduct of the study. The study was conducted between April 2018 and November 2019 in the sports medicine clinic of Mazandaran University of Medical sciences.

All Patients diagnosed with chronic nonspecific low back pain by an orthopedist or sports medicine specialist were referred to the sports medicine clinic of Mazandaran University of Medical Sciences. Participants were enrolled in the study if they were meeting the inclusion criteria. Inclusion criteria were as follows: individuals diagnosed with chronic nonspecific low back pain with a history of at least a three-month duration, individuals between 18 and 65 years of age, pain score detected according to the 10 scored Visual Analogue Scale (VAS)[17] for the pain score between 3 and 6. The exclusion criteria were as follows: the history of cancer, spine infection, rheumatologic diseases, history of spine fracture, history of trauma, red flag signs including unwanted weight loss (exceeding 10 percent of the total body weight) in the past six months and fever, history of psychological disease and history of spine surgery, radiculopathy, anatomical and congenital disturbance. Finally, sixty female individuals with chronic nonspecific low back pain meeting the inclusion criteria were recruited in the study.

The eligible participants were randomly assigned to two groups including intervention and control by a computerised randomisation programme with 1:1 allocation. The research assistant enrolling and determining allocation was unaware of the allocation sequence. Sequentially numbered envelopes were applied. A sports medicine physician assigned participants to interventions. Participants and sports medicine physician were not blinded due to the nature of the interventions. An independent supervisor accomplished a systematic, blinded assessment at baseline and the end of the five weeks of intervention. Epidemiologist specialist performing statistical analysis was blinded.

The intervention group received the Feldenkrais method which consisted of training theoretical content and supervised exercise therapy in the sports medicine clinic. A supervised exercise therapy session with verbal guidance of trainer was performed two sessions per week with a maximum of five participants for five weeks. The duration of each session was between 30 and 45 minutes. Improving awareness through movement and functional integration are the leading principals of the Feldenkrais method. Each session is based on the investigation of specific movements with concentrating on increasing awareness and improving pain-free effective function. To improve self-image, habitual patterns of movement are explored in each session with verbal guidance of the trainer. Participants are guided to the body parts which are less considered during movements (Movements are illustrated as Appendix A).

The control group received educational programme and home-based core stability exercises. Transverse abdominus muscle contraction was the main principle of the programmes in static and dynamic positions according to the progression stage of the participants. The exercises were progressed weekly under the supervision of sports medicine physicians. By the end of each week, if each individual accomplished the exercises and completed the logbook, they would have access to next week's exercises. The exercise movements were assessed and corrected by the supervisor physician, weekly (Movements are illustrated as Appendix A).

Demographic information and baseline assessments were obtained at the beginning of the study. All the assessments were repeated after five weeks following the interventions.

Assessments included of the following domains:

- World Health Organization's quality of life instrument short form (WHOQOL-BREF questionnaire)[18] which evaluates the quality of life in four major health related domains including physical health domain, psychological domain, social relationship domain and environmental domain. It also provides a total quality of life and general health evaluation, simultaneously.
- McGill Pain questionnaire[19,20] which evaluates the perception of pain in sensory, affective and evaluative domains and miscellaneous pains.
- Oswestry low back pain disability questionnaire[20–22] consists of scales for the intensity of

pain, lifting abilities, personal care, ability to walk, ability to sit, sexual performance, ability to stand, social life, sleep quality and ability to travel. Each item consists of six different conditions in a range from no disability (zero score) to complete disability (five score) statements.

- The Multidimensional Assessment of Interoceptive Awareness questionnaire (MAIA)[23,24] which is a multidimensional self-reporting questionnaire that assesses major domains of mind–body interactions. Noticing, not distracting, not worrying, attention regulation, emotional awareness, self-regulation, body Listening and trusting are scales in MAIA questionnaire determining different modes of responsiveness toward bodily perceptions.

All the questioners applied in the study were assessed for validity and reliability in the Iranian population.[18–24] The thickness of transverse abdominis muscle at rest and in contraction was determined via ultrasound imaging before the intervention and at the end of five weeks of the intervention by a single sports medicine physician.[25] (Appendix B)

In order to calculate the minimum sample size required in this study, the study conducted by Teresa Paolucci[12] was used. In Paolucci study, the effectiveness of Feldenkrais sports therapy showed a change in the Median (Inter-quartile range = IQR) of pain score from 2.5 (2–3) to 1 (0–2). After converting the IQR to standard deviation (SD) and using the following formula, the minimum sample size per each group has been estimated to be 27 people. Taking into account of 10% attrition rate, 30 patients have been allocated to each group.

$N = 2k^* SD^2 / d^2$ (Confidence level of 95%, Power of study of 90%, SD = 1.3, $d = 1$) = 30 in each group.

Statistical analysis

Initially, the distribution of variables was examined by performing non-parametric Kolmogorov-Smirnov test and also drawing histogram. Quantitative variables in baseline characteristics including age, body mass index (BMI), McGill Total-score, Oswestry low back pain disability questionnaire score, Transverse Abdominis diameter at rest and in contraction were described by Mean (SD) and their differences between two groups were assessed by independent *t*-test. Also to test repeated measures of each questionnaire score (between two groups and in two stages of before and after intervention) we used GLM (General Linear Model) mixed between-within subject analysis of variance. It should be noted that the effectiveness of the intervention has been analysed using the Intention-to-treat (ITT) method. The interpretation of the Partial Eta Squared value based on Cohen's guideline is as follows: small effect = 0.01, moderate effect = 0.06, large effect = 0.14. The level of significance was defined as two-sided $P \leqslant 0.05$ and all analyses were performed using IBM SPSS version 24.

Results

Sixty participants were recruited and allocated to the intervention and control group, randomly ($n = 30$ for the Feldenkrais group, $n = 30$ for the core stability exercises group) (Figure 1). Baseline characteristics and clinical data of the participants are described in Table 1.

A mixed between-within subjects' analysis of variance was conducted to assess the impact of two different interventions on participants' scores of quality of life scale and its sub-scales, across two time periods (pre-intervention and after five-week post-intervention) (Table 2).

Also multiple mixed between-within subjects' analysis of variance were conducted to assess the impact of two different interventions on participants' scores of McGill pain questionnaire, Oswestry low back pain disability questionnaire, Multidimensional Assessment of Interoceptive Awareness questionnaire scales (MAIA score) and Transverse Abdominis muscle diameter across two time periods (pre-intervention and after five-week post-intervention). The results of analyses of these scores are shown in Table 3.

Discussion

Our study results demonstrated that the Feldenkrais method was significantly more effective in improving quality of life (WHOQOL-BREF score),

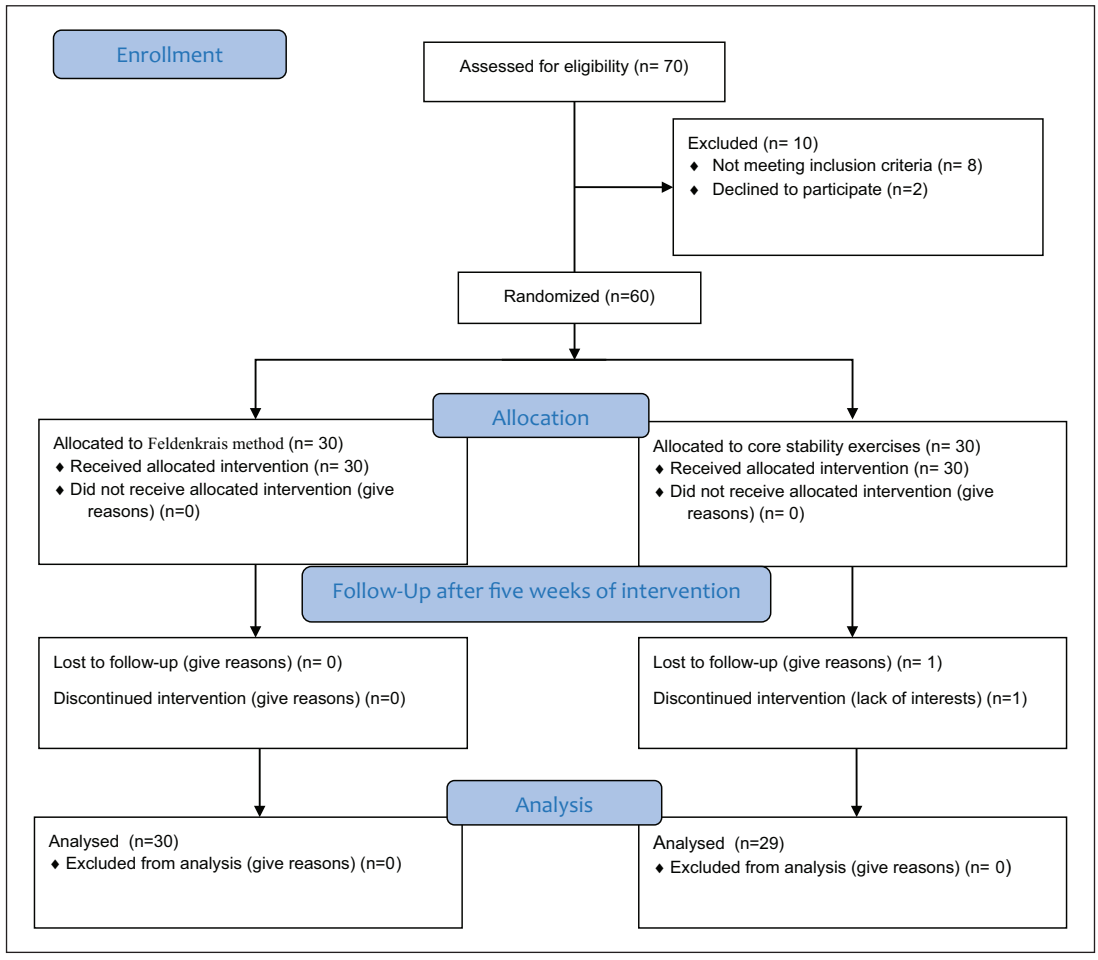

Figure 1. Flow diagram of the study.

Table 1. Demographical and clinical data of participants at baseline.

	Intervention group (mean ± SD)	Control group (mean ± SD)	*P*-values
Number of participants	30	29	–
Age (years)	42.6 ± 11.6	38.89 ± 12.52	0.24
Body Mass Index (kg/m2)	26.9 ± 3.71	26.1 ± 2.7	0.35
McGill Total-score	15.3 ± 7.2	13.1 ± 6.6	0.23
Oswestry score	27.2 ± 6.5	27 ± 8.5	0.91
Transverse Abdominis diameter at rest (mm)	3.1 ± 0.53	3 ± 0.44	0.472
Transverse Abdominis diameter in contraction (mm)	3.6 ± 0.62	3.9 ± 0.84	0.14
WHOQOL-BREF score	45.5 ± 9.4	47.6 ± 10.3	0.41
MAIA score	2.7 ± 0.59	2.7 ± 0.85	0.89

SD: Standard Deviation; WHOQOL-BREF: World Health Organization's quality of life instrument short form.

Table 2. Comparison of changes in subscales of World Health Organization's quality of life instrument short form (WHOQOL-BREF) within and between intervention (Feldenkrais method) and control (core stability exercise) groups after five weeks of intervention.

Score (Mean (SD))		Feldenkrais ($n=30$)	Core stability ($n=29$)	partial eta squared	*P*-value
Total scale	Before	45.51 ± 9.42	47.64 ± 10.32	0.125	0.006
	After	60.49 ± 7.20	55.44 ± 6.30		
	P-value	<0.001	<0.001		
Physical health	Before	55.59 ± 15.88	54.56 ± 16.52	0.000	0.884
	After	79.64 ± 13.69	79.31 ± 16.78		
	P-value	<0.001	<0.001		
Psychological heath	Before	54.86 ± 14.51	53.01 ± 13.85	0.127	0.006
	After	80.83 ± 14.49	66.52 ± 10.76		
	P-value	<0.001	<0.001		
Social relationship	Before	61.11 ± 19.61	65.51 ± 13.67	0.241	<0.001
	After	80.83 ± 14.86	63.79 ± 13.95		
	P-value	<0.001	0.607		
Environmental health	Before	57.71 ± 10.94	68.32 ± 26.53	0.097	0.016
	After	65.94 ± 12.69	62.61 ± 9.57		
	P-value	0.009	0.249		
General health	Before	57.92 ± 16.57	52.59 ± 18.10	0.029	0.197
	After	76.67 ± 15.65	77.59 ± 15.08		
	P-value	<0.001	<0.001		

SD: Standard Deviation.

Table 3. Comparison of changes in McGill pain score, Oswestry disability score, Multidimensional Assessment of Interoceptive Awareness score and changes in Transverse Abdominis muscle diameter at rest and in contraction within and between intervention (Feldenkrais method) and control (core stability exercise) groups after five weeks of intervention.

Score (Mean (SD))		Feldenkrais ($n=30$)	Core stability ($n=29$)	partial eta squared	*P*-value
McGill (Pain)	Before	15.33 ± 7.29	13.17 ± 6.60	0.033	0.166
	After	3.63 ± 3.71	4.17 ± 4.56		
	P-value	<0.001	<0.001		
Oswestry (Disability)	Before	27.17 ± 6.51	26.96 ± 8.49	0.089	0.021
	After	14.50 ± 3.38	19.31 ± 5.79		
	P-value	<0.001	<0.001		
Multidimensional Assessment of Interoceptive Awareness	Before	2.74 ± 0.59	2.77 ± 0.85	0.496	<0.001
	After	4.06 ± 0.45	2.84 ± 0.89		
	P-value	<0.001	0.316		
Transverse Abdominis muscle diameter at rest	Before	3.10 ± 0.53	3.01 ± 0.44	0.076	0.034
	After	3.24 ± 0.53	3.25 ± 0.51		
	P-value	<0.001	<0.001		
Transverse Abdominis muscle diameter in contraction	Before	3.64 ± 0.62	3.93 ± 0.84	0.422	<0.001
	After	3.95 ± 0.76	5.01 ± 1.22		
	P-value	<0.001	<0.001		

SD: Standard Deviation.

improving interoceptive awareness (MAIA score) and reducing disability index (Oswestry score) compared to core stability exercises. Transverse abdominis muscle diameter at rest and in contraction significantly increased within the Feldenkrais method group and core stability exercises group but more improvement in the core stability exercises compared to the Feldenkrais method was detected. Within groups, McGill pain scores in both core stability exercises and Feldenkrais method improved but there were no significant differences between groups.

In a study by Paolucci et al. back school exercise and Feldenkrais method had the same efficacy on chronic pain reduction (McGill scores) and quality of life (Short Form (SF)-36 Health Survey) at the end of the intervention in patients with chronic low back pain.[12] Meanwhile, at the follow-up stage the Feldenkrais method had better efficacy in reducing pain compared to the back school exercises.[12] Our study consisted of a short follow up period which could be the reason of why there was no between groups difference in pain score reported in our study. However, permanent and consistent effects of Feldenkrais method in lifestyle requires a longer process. The results of our study in the interoceptive awareness domain are consistent with the results of the study by Paolucci et al. in which the Feldenkrais method had greater efficiency in interoceptive awareness (MAIA score) compared to back school exercises at the follow-up stage.[12]

Mind–body interactions are the key predictors of pain, disability and satisfaction of quality of life.[26] Principal determinant of Felendecaris method is increasing interoceptive awareness.[26]

Interoceptive awareness consists of perception of the physiological status of the body.[26] In a qualitative study by Pugh et al. improved self-efficacy through increasing awareness and somatic education was reported in the Feldenkrais method in patients with low back pain.[11] In a qualitative study by Öhman et al. improved sense of control and management over painful conditions were reported in the Feldenkrais method in patients with non-specific neck and shoulder pain.[27] Interoceptive awareness is a main predictor of perception of pain.[26] It has been proposed that neurological pathways and activated cortex areas related to pain and interoceptive awareness are integrated.[26] Self-management of pain consists of different methods including endurance, fear-avoidance and concentrating on pain via mindfulness.[26] In Felendecaris method mindful movements are conducted accompanied with external attention focus in performing motor skills.[15] The Feldenkrais method is based on two major principles including consciousness through movement and synchronised performance.[28] Via a mind–body approach, Feldenkrais method enables individuals to achieve a pain-free pattern of movements with a concentration on the consciousness of their own biomechanics.[28] Finally, Felendecaris method improves quality of life and decreases disability.

In a study by Brown et al. Feldenkrais method aiming trunk musculature, induced a significant change in the external oblique muscle electromyography activity.[29] Exercise therapy aiming at motor control and strengthening of the core stability muscles including the transverse abdominis and the lumbar multifidus is a leading strategy in treatment and prevention of low back pain.[30,31] Ultrasound imaging is a suitable method to evaluate muscle activation via measuring the alteration in muscle thickness. In our study following both Feldenkrais method and core stability exercises, within group improvement in transverse abdominis muscle activation were significant. Even though, more significant improvement of core stability exercises on core stability muscles activation was obtained, Feldenkrais method simultaneously induced improvement in core stability muscles and interoceptive awareness of the individuals. The aim of Feldenkrais method is to improve motor skills via mindfulness method. Considering the importance of transverse abdominis muscle in the treatment and prevention of low back pain, the Feldenkrais method could be an effective approach in planning for low back pain treatment programmes.

Several limitations existed in this study. All the participants recruited in the study were female individuals with mild to moderate nonspecific low back pain, which makes it challenging to make decisions about severe low back pain conditions. Comprehensive studies aiming for other target

groups including athletes, male individuals, radicular low back pain and individuals with severe low back pain conditions are suggested. In this study the control group received home based core stability exercises programme. Studies conducting supervised core stability exercises for control group could be another suggestion for future research. This study contained a short-term follow-up. However, Feldenkrais method is a mind body approach which requires a long process to practice focusing on the motor skills and studies conducting long term follow-ups are suggested to evaluate the outcomes.

In this study transverse abdominis muscle was assessed via ultrasound imaging which presents a reliable measure of the effects of Feldenkrais method on the core stability muscles. The Feldenkrais method led to better clinical improvement, but not to any better outcome in terms of abdominal musculature. Evaluation of all aspects including pain level, disability level, quality of life and interoceptive awareness presents a comprehensive judgement for future treatment planning. Considering the fact that interoceptive awareness has a significant role in patients with low back pain.[1] It is recommended that patients are educated to assume responsibility of their spinal health to enhance success rate of treatment via Feldenkrais method. Developing approaches aiming interoception is highly suggested. Effectiveness of Feldenkrais method in chronic pain control could be implications for clinical practice and future studies with larger study population is recommended.

Clinical messages

- The Feldenkrais method may be more effective than education and core stability exercises in improving quality of life, improving interoceptive awareness and reducing disability index in patients with non-specific chronic low back pain.

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Supplemental material

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