Exercise, vitality and health EVIS

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ABSTRACT

Low back pain is the main cause of disability in Spain, exercise has shown certain benefits in this ailment and could be a safe and effective alternative as an adjuvant in the treatment. The aim is to design a training programme focused on strength and flexibility work to improve the recovery process. Sixty patients (30 women), aged 57.1 ± 9.9 years, were divided into a control group (CG; n = 30; 56.4 ± 9.5 years) and an intervention group (IG; n = 30; 58.3 ± 10.4 years and 71.1 ± 11.3 kg) to which a 4-week training programme was applied. Quality of life, pain, pharmacological treatment and aspects of physical fitness were assessed before and after training. Inter- and intra-group differences were analysed using ANOVA, Mann-Whitney U test and Willcoxon ranks). All patients improved their quality of life, pathology severity index, perceived health and decreased medication (all $p < .05$). However, only the group of patients who train (GI) improve their strength and flexibility levels (both $p < .05$); they improve their pathology severity index more, achieving higher strength and flexibility values, higher quality of life, lower pain and lower medication intake than the control group (all $p < .05$).
Keywords: Exercise, Prescription, Quality of life, Health, Strength, Flexibility.

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INTRODUCTION

This document seeks to design and test an exercise program, called: Exercise, Vitality and Health "*EVIS*", which serves as a guide to give scientific validity to the prescription of physical exercise against chronic diseases and pain, with the purpose of its introduction into the National Health System.

Low back pain is the main cause of disability in Spain(National Health System Task Force, 2020). This seems to be associated with evolution and other multiple and different causes, such as some types of work, where a clear increase in these diseases can be observed in society. Hence we want to address this context, justified by two main questions:

Firstly, the use of physical exercise to counteract this chronic pain, in the lumbosacral area (L5-S1) with the clear objective of increasing people's quality of life.

On the other hand, evaluate the effectiveness of the program, with the purpose of establish joint lines of work, that is, use the professional symbioses of the sports physical educator (EFD) and doctors, with the common objective of increasing people's health or, in the case of pain, helping to live better with this pathology.

Rationale for the research

After the latest events that have occurred in the world population, it can be seen how health professionals do extraordinary work, caring for all the people who need it. However, the EFD will be a good complement that helps increase the quality of the service offered, carrying out a specific exercise program, in this case, those related to the lumbo-sacral area (L5-S1), with the purpose of increasing their quality of life.

Theoretical framework

The benefits of physical activity produce an increase in the quality of life, therefore, it is of vital interest that the population complies with the WHO recommendations (Paw et al., 2020).In countries of the European Union, such as France, they have developed a physical activity prescription program adapted to the French Health System.(Chenuel, 2022).

If you delve into the benefits of physical activity, a list is revealed that not only has enormous physical benefits, but also cognitive, psychological and an excellent tool to prevent diseases.(Zarr et al., 2022). However, scientific advances in this area inform us that physical activity has a mostly preventive effect, but that sometimes, if we adjust the prescription and for specific pathologies, they can be treated with adjuvant effects with physical exercise.(Pedersen & Saltin, 2015).

Exercise is a type of physical activity that is characterized by its dosage seeking a specific effect on health.(Casajús & Vivente-Rodríguez, 2011).

Low back pain is the main cause of disability in Spain(National Health System Task Force, 2020). It affects 80% of the population during their lifetime and entails public spending of 721,611.8 thousand euros on analgesics and 227,682.4 thousand euros on anti-inflammatory and antirheumatic drugs.(National Health System Task Force, 2020)and has no effective treatment. Therefore, exercise could be a safe and effective alternative as an adjuvant in the treatment of low back pain (Shirado et al. (2010). In fact, Fernández performed a meta-analysis, establishing a program of at least one to two 60-minute sessions per week of strength and flexibility for at least 3-9 weeks, which improved the recovery process and reduced the stiffness of the area. lumbar, more specifically, the improvement in strength helps to better support the spine and flexibility, gave a greater range of motion and favoured the reduction of low back pain.

Along these lines, muscular strength exercise prevents loss of muscle mass, called sarcopenia, being key in stabilizing the back. Therefore, the prescription of strength and resistance exercise to prevent the loss of muscle mass seems to be an effective treatment to reverse this situation: in fact, Hurst, established an effective protocol of strength exercises for the treatment of sarcopenia, providing a practical guide for doctors and health professionals.

In second place, Shirado et al. (2010)They concluded that physical exercise reduced low back pain and improved people's quality of life; in addition, an optimal and individualized dose was more effective than anti-inflammatories.

Thirdly, the vertebrae are separated from each other by vertebral discs, these wear out over the years, however, physical activity maintains its structure, especially moderate-vigorous intensity benefits the intervertebral disc.(Bowden et al., 2018).

Pain is increasingly present in society, therefore, any strategy that allows its elimination or control would be an option to consider, although exercise is a basic treatment, each individual must be evaluated individually to establish the dose of exercise. what you need, it seems that a good strategy is to strengthen the antagonists of the lower back (Hall et al., 2022)However, the prescription must be adjusted to the patient and readjusted during their intervention, that is, the person responsible for the exercise program must work in harmony with the doctor and the patient, in order to exponentially increase the chances of success.

Fourthly, once it has been established that physical exercise improves low back pain and prevents it. The general guidelines that establish Shiri et al., (2018), advocate a combination of stretching and strengthening exercises, performed 2-3 days per week.

It seems, therefore, that the design of a tool must address the needs and pathologies of each person, allowing exercises to be established that induce a reduction in pain and consequently an improvement in their quality of life. The optimal dose must be individualized to produce health benefits.(Codella & Della Guardia, 2022). This tool must be versatile and useful, where the patient can access it whenever they want and perform the stretches and exercises when the guidelines and recommendations for their implementation are guaranteed.

Therefore, multidisciplinary work is of vital interest, where doctors establish, based on the pathologies or chronic pain, which activities are appropriate for each patient, based on these indications the sports physical educator design exercises and guidelines tailored to each person, thus increasing the chances of success(Bouma et al., 2022).

In short, the prescription of physical activity for the treatment of diseases and chronic pain in the lumbar area induces benefits that society must take advantage of, such as: mitigating pain, maintaining the strength of the muscles that operate the joints involved in pathology, reduces joint stiffness and prevents skeletal muscle decline, therefore, it is vitally important that public bodies, establish physical activity as a way to cure and prevent diseases, enriching the service offered and therefore the quality of life that the company owns.

Hypotheses and research objectives

Main hypothesis

The prescription of physical exercise, based on improving flexibility and strength, is effective in reducing chronic pain in the lumbar area (L5-S1) and improving the perceived quality of life.

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General objectives

- Design a training program (EVIS), focused on strength and flexibility work, that improves the recovery process of patients with low back pain.

Specific objectives

- To evaluate the effect of the program on the physical fitness components of strength and flexibility.
- Analyse whether the use of exercise helps reduce pharmacological treatment.
- Study the effect of the program on the patient's quality of life.
- To evaluate the effect of the program on low back pain and its association with possible improvements in strength or flexibility.

MATERIAL AND METHODS

Ethics committee

The intervention proposal has been approved by the Research Ethics Committee of the Autonomous Community of Aragon (CEICA), complying with the ethical guidelines of the 1961 Helsinki Declaration, revised in Fortaleza (2013), Spanish legislation and the legal regulations for clinical research in humans (Law 14/2007 on biomedical research). The subjects received written information, which explained the purpose of the intervention, the risks, benefits and possible discomfort that it could cause. All those who decided to participate signed an informed consent voluntarily.

Study population

The selection of the participants has been carried out through an observational sampling of an intentional or convenience nature, where the person in charge of the Beceite health centre (Teruel) selected the participants, patients with chronic or habitual low back pain who had no contraindications to perform exercise.

The sample is made up of 60 patients (30 women and 30 men), with an age between 39-72 years. This group was divided into two, a subgroup of 30 participants where the intervention proposal was carried out and another that served as a control group (n = 30).

Regarding the inclusion criteria, it was established in patients with pain, without medical contraindication that could aggravate the condition, confirmed by their doctor.

Program design

This is a quasi-experimental study without randomization.. The design of the program was based on scientific evidence, after a review of the literature, where a series of exercises was selected to work on strength and flexibility of the areas and muscles involved in low back pain.

The study begins with a familiarization and evaluation session in which the program exercises and those of the evaluation are taught. Once assimilated, a pre-intervention baseline evaluation was carried out. After the initial session, a 4-week exercise program (3 sessions of 75 min duration per week with direct supervision in the room) was applied to the intervention group. At the end of this period, the battery of evaluation tests was repeated for the entire sample.

Assessment

Pain and quality of life

The validated quality of life and pain questionnaire EuroQol Group Eq-5D was used.(EuroQol Group, 2009), which includes a visual analogy scale (VAS) for pain. From the responses, the 3-level quality of life index (EQ-5D-3L) and the severity index (SI) are calculated on the one hand:

- EQ-5D-3L: is a value that ranges between 0 and 1, with 1 considered as the absence of health problems. It is calculated by assigning a value (1-5) to the health status in each dimension, with 11111 being no problem in any dimension. If the status is different in any dimension, the coefficient table is used to calculate the social rate of values for Spain. of the EQ-5D following the instructions described in(Herdman et al., 2001).
- Severity index: we must add the digits marked in each of the 5 levels (health status) of each dimension. For a person who refers a state 12345, the sum is 15. To transform it into the IS, 5 is subtracted from the sum, which gives a range of values between 0 and 20 (states 11111 and 55555, respectively) and multiplied by 5, which produces, for each health state, an SI between 0 and 100, with 0 being the total absence of a health problem and 100 being the highest degree of severity.(Ministry of Health, Social Services and Equality, 2014).

Medication

The doctor who is in contact with the patients collected the pharmacological treatment indicating the medication they took before and after the 4 weeks of intervention.

Physical condition

Force

The isometric force exerted by the abdominal, dorsal and hip flexor muscles was evaluated using the hand-held dynamometer (Lafayette, model 01165, USA), before and after the intervention. The peak force (Kg), time to peak force (s) and average force exerted in the area (Kg) were recorded.

The proposed exercises are intended to strengthen the lower back and rectus abdominis and 4 exercises have been standardized for evaluation.

Regarding the study protocol, on the first day of intervention, a familiarization phase was carried out, where the sports physical educator taught the correct performance of the exercises. Once the correct performance of the exercises was established, abdominal strength was measured. and the muscles of the lower back.

Exercises for evaluating strength:

- *Abdominal recto:* the person is placed in a supine position, with the hips and knees at 90º, with both hands perpendicular to the trunk, they must exert maximum force by contracting the rectus abdominis. The sports physical educator must ensure that only one contraction of the rectus abdominis is performed. When the person becomes familiar with the exercise, the educator will measure the force exerted with the Lafayette placed at the lower end of the sternum.
- *Oblique abdominals*: the person is placed in a supine position, with the hips and knees at 45º, with both hands perpendicular to the trunk, they should try to touch the ankles with their hands. The sports physical educator must ensure that only one contraction of the obliques is performed. When the person becomes familiar with the exercise, the educator will measure the force exerted with the Lafayette placed on the shoulder. The same operation must be carried out on both sides.
- *Lumbar square*: the person is placed in a prone position with the body aligned, with both hands perpendicular to the trunk, they must try to raise the back and separate the lower trunk without the

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help of the arms. The sports physical educator must ensure that only one contraction of the quadratus lumborum is performed. When the person becomes familiar with the exercise, the educator will measure the force exerted with the Lafayette placed on the L1 vertebra.

- *Iliopsoas*: the person sits in a chair, with the hips and knees at 90º and with the hands resting on the sides of the chair, they must try to raise the thigh. The sports physical educator must ensure that only one contraction of the hip flexors is performed. When the person becomes familiar with the exercise, the educator will measure the force exerted with the Lafayette placed on the distal part of the thigh. The same operation must be performed on both legs.

Flexibility

Flexibility was evaluated using a goniometer to estimate the range of motion, where the degrees of hip extension and hip flexion were recorded in the proposed stretches. The sports physical educator in a familiarization phase, taught the correct performance of the stretches, once the appropriate guidelines for their performance were established, the measurements were taken.

Exercises to evaluate flexibility:

- *Hip flexors*: The person is placed in a supine position with their arms close to their trunk. Once their body is aligned in this position, the sports physical educator will tell them to flex their hips with their knees extended. The educator will measure flexibility by placing the goniometer over the joint. The same operation must be performed on both legs.
- *Hip extensors*: The person is placed in a prone position with their arms close to their trunk. Once their body is aligned in this position, the sports physical educator will tell them to extend their hips with their knees at 45º. The educator will measure flexibility by placing the goniometer over the joint. The same operation must be performed on both legs.

Statistical analysis

JAMOVI 2.3.26 was used to analyse the data. The normality of the sampling distribution was evaluated using Shapiro-Wilk tests. Descriptive data are reported as mean and standard deviation (SD), number of participants (n) or percentage (%).

A repeated measures ANOVA was carried out to study whether there were significant changes after 4 weeks of training between the groups (group time interaction) and within each group for the normally distributed variables (today's health).

In addition, using parametric tests (the rest of the variables, which did not show a normal distribution), the differences between groups in the pre-intervention and post-intervention (Mann-Whitney U) and intragroup were studied with an analysis of differences in means for samples. related pre-post (Willcoxon ranks). The level of statistical significance for all analyses was set at $p < .05$.

Intervention proposal

The intervention proposal is based on designing an exercise program, applicable to specific patients, based on the approval of the person in charge of the health centre. Once this notification of vital interest is obtained, the exercise program will come into operation. This program will be supervised by the sports physical educator, where he will teach the correct performance of the exercises and stretches. In addition, all participants will have contact with the educator to Get in touch if you need it.

Objective 1, improvement of flexibility, a catalogue of illustrated exercises is presented that will address a multitude of stretches that can be performed, with the aim of giving mobility to that joint or the muscles that cause pain.

Objective 2, strength improvement, a series of illustrated exercises for muscle strengthening are presented. You can work on agonists, antagonists or both at the same time, both eccentric and concentric, their determination will be based on the indications of the medical report.

Work algorithm

First, a person with lower back pain who is temporarily inactive should take the following steps (Figure 1):

- The medical report states that he can perform physical activity and that the patient has a strong muscle contracture in the lumbar area, without involvement of the intervertebral discs.
- Staging of the exercise program.
- First part stretching the hip flexors and knee flexors.
- Second part, work on strengthening the muscles of the agonists in the lower back area, for example, performing the deadlift exercise with rubber bands.

Figure 1. Work algorithm in patients with low back pain.

Secondly, the lines of work will be established according to the American College of Sports Medicine (Liguori & American College of Sports Medicine, 2021):

- Stretches
  - Stretches of no more than 30 seconds
  - It should be the minimum stimulus that produces tension
  - It should not cause pain
  - Avoid maximum elongations or rebounds
- Force
  - Work with own weight
  - Maintain body alignment
  - Respect concentric-eccentric work

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Regarding the intervention guidelines, it is intended that they follow a progression, where participants perform 15 repetitions, in three series, with a 1-minute rest between series.

Thirdly, the line of healthy stretching proposed by Mares, where the following key questions are established:

- The back should be straight and without load.
- The muscle that is intended to be stretched must be at rest, that is, without load, not acting as a support for the part that is intended to be worked.
- The stretch should begin with minimal tension, and there should be no bouncing.
- Breathing must be controlled.

Fourthly, the muscles that participate in the movements of the back, and therefore, will be subject to stretching and strengthening are those established by Miralles. These muscles are listed below:

- Extenders
  - Iliocostalis, long dorsi and spinalis.
- Flexors:
  - Rectus femoris, obliques (internal and external), psoas and iliacus.
- Lateral flexors:
  - Oblique abdominals, quadratus lumborum and intertransverse abdominals.
- Rotators:
  - Flexor and extensor muscles

Fifthly, it will be divided by levels of illness as established by the person responsible for the health centre, based on the contraindications they have for physical exercise, that is, the following levels will be established (Table 1):

- Level 1: patients with serious affections (alterations of the lumbar spine, hernias).
- Level 2: patients with medium impairments (loss of the natural curvatures of the back).
- Level 3: patients with mild impairments (wear of the intervertebral discs, without alteration of the vertebrae).

Table 1. Qualification. Quadrant of exercises and performance guidelines.

Job/level	**1 Level**	**2 Level**	**3 Level**
Flexibility exercises	< 30 seconds M. relaxed	< 30 seconds M. relaxed	< 30 seconds M. relaxed
Heating	3 and 4	1 and 4	2 and 4
Back	1 and 2	3 and 4	2 and 3
Buttocks	2 and 5	1 and 3	4 and 6
Abductors	3	1 and 3	2 and 3
Hamstrings	2	2 and 3	1 and 2
Quadriceps	3	1 and 3	2 and 3
Psoas/iliac	1 and 3	1 and 2	1 and 3
ABS	1	1	1 and 2
Strength exercises	15 repetitions 3 series 1 min rest between sets	15 repetitions 3 series 1 min rest between sets	15 repetitions 3 series 1 min rest between sets
Exercises	1 and 3	2 and 4	5 and 6

Note. The numbers correspond to the type of exercise designed for each level. Source: self-made.

RESULTS

Finally, the sample was made up of 60 participants, 30 men and 30 women, aged (57.1 ± 9.9 years) and weight (57.1 ± 9.9 years), divided into CG (n = 30; 15 women; 56.4 ± 9.5 years and 74.2 ± 11.2 kg) and GI (n = 30; 15 women; 58.3 ± 10.4 years and 71.1 ± 11.3 kg) without significant differences for age or weight. A previous exploratory analysis has been carried out for men and women separately, but given that the trends appear similar, it has been decided to show the results for men and women together to increase the sample size and thus the statistical power. Below are the results obtained at the beginning and end of the four weeks of intervention.

Pain and quality of life

Quality of life

Table 2 shows the quality of life values and the IS of disease. It can be seen that both groups show similar levels of deterioration in quality of life with low levels of severity.

After a period of one month, both groups improved their quality of life (increase of 6.7% vs 4.7% in controls and trained respectively) also significantly decreasing the severity index (increase of 12% vs 30% in controls and trained respectively), the intervention group showing significantly better EQ-5D-3L and IS than the control group at the end of the training period (both $p < .05$). Changes are especially observed in the dimension of pain and discomfort, and in that of anxiety and depression (annexed supplementary material (15.3)).

Table 2. Qualification. Quality of life results.

	Control group		Intervention group	
	Pre	post	Pre	post
Quality of life index 3 levels (EQ-5D-3L)	0.74 (0.23)	0.79 (0.20)#	0.81 (0.18)	0.85 (0.18)* #
Severity index (SI)	17.7 (13.2)	15.5 (12.9) #	12.4 (11.8)	8.6 (10.7)* #

*Note. Average grade (± Standard deviation) * p < .05 comparison between groups Mann-Whitney U. # p < .05 intergroup comparison pre-post Wilcoxon ranges. Source: self-made.*

Today's health

Table 3 shows the values of current health perception. It is observed that the intervention group had higher values both before and after the intervention. Both groups improved their health perception 1 month later, increasing by 7.8% in controls compared to 19.6% in the intervention group ($p < .05$ and time group $p < .01$).

Table 3. Qualification. Today's health results.

Today's health	Control group		Intervention group	
	Pre	post	Pre	post
Today's average health (0-100)	54.8 (11.5)	59.1 (12.9) #	61.2 (12.0)*	73.2 (13.9)* #

*Note. Average grade (± Standard deviation) * p < .05 comparison between groups and # p < .05 comparison between groups pre-post repeated measures ANOVA. Source: self-made.*

Table 4. Qualification. Medication results.

Medication	Control group		Intervention group	
	Pre	post	Pre	post
Average number of drugs for low back pain per week	3.1 (2.8)	2.9 (2.7)	1.7 (2.7)*	0.7 (1.3)* #

*Note. Average grade (± Standard deviation) * p < .05 comparison between groups Mann-Whitney U. # p < .05 intergroup comparison pre-post Wilcoxon ranges. Source: self-made.*

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Medication

Table 4 shows that the intervention group used a lower number of drugs both before and after the intervention ($p < .05$), however only those who trained significantly decreased the use of drugs compared to the control group ($p < .05$).

Force

Table 5 shows the analysed strength values, where you can see how some strength variables improve slightly, tipping the balance generally towards the intervention group. However, there are variables that improve significantly, such as:

- Strength in the rectus abdominis, the average force exerted in the area and the peak force, reveals significantly higher values both in the pre- and post-evaluation, with the latter being more pronounced where the intervention group presented a 46. 4% more force than the control group ($p < .05$). The average time to peak strength increased significantly between the first and second evaluation of the intervention group ($p < .05$).
- Strength of the quadratus lumborum, in this case the intervention group has a time to peak strength that is 27% lower than the control before training, showing after training more peak strength, average strength and a shorter time to reach peak strength. than the control group (all $p < .05$).
- Left oblique strength showed a difference in the meantime to peak strength between both groups in the first and second evaluations. In addition, the intervention group obtained a 50% increase pre/post compared to the first evaluation ($p < .05$).
- Right oblique strength, the average time to peak strength, was the only variable that increased in comparison between the pre/post evaluation of both groups ($p < .05$).
- Left iliac psoas, the intervention group shows lower values of time to peak force and higher average force before the intervention (both $p < .05$). After training, the intervention group not only presents higher values in peak force, average force and lower time to peak force, but it is the only group that significantly changes these values, increasing the force and decreasing the time to reach it (all $p < .05$).
- Right iliac psoas, the intervention group shows higher values of peak force before the intervention ($p < .05$). After training, the intervention group not only presents higher values in peak strength and average strength but is the only group that significantly changes these values, increasing the strength and the time to achieve it (all $p < .05$).

Table 5. Qualification. Strength results.

Force	**Control group**		**Intervention group**	
Rectus abdominis strength (4 sec)	Pre	post	Pre	post
Average peak force (Kg)	10.3 (3.1)	9.9 (3.5)	18.4 (4.6)*	18.5 (4.7)*
Average time to peak force (seconds)	1.8 (0.7)	1.7 (0.8)	1.9 (0.5)	2 (0.4)#
Average force exerted in the area (Kg)	7.4 (2.4)	7.3 (2.7)	11.4 (3.8)*	11.6 (3.8)*
Lumbar square strength (4 sec)				
Average peak force (Kg)	9.9 (3.5)	10.1 (3.5)	12.3 (4.3)	12.3 (4.5)*
Average time to peak force (seconds)	2.2 (0.5)	2.2 (0.7)	1.6 (0.4)*	1.5 (0.4)*
Average force exerted in the area (Kg)	7.8 (3.6)	7.7 (3.3)	8.3 (4.0)	8.4 (4.2)*
Left oblique strength (4 sec)				
Average peak force (Kg)	10.3 (4.2)	10.2 (4.3)	10.4 (4.3)	10.5 (4.0)
Average time to peak force (seconds)	0.5 (0.3)	0.6 (0.4)	1 (0.6)*	1.5 (0.5)*#
Average force exerted in the area (Kg)	7.7 (3.9)	7.6 (4.3)	7.9 (3.3)	7.8 (3.1)

Right oblique strength (4 sec)				
Average peak force (Kg)	11.2 (4.4)	11.3 (4.3)	11.2(3.8)	11.4 (3.6)
Average time to peak force (seconds)	1 (0.4)	1.3 (0.5) #	1 (0.6)	1.5 (0.4)#
Average force exerted in the area (Kg)	7.9 (3.2)	8 (2.9)	8.7 (3.3)	9.2 (2.8)
Left iliac psoas strength (4 sec)				
Average peak force (Kg)	18.7 (7.1)	18.6 (6.8)	21.1 (5.3)	22 (5.4)*#
Average time to peak force (seconds)	2 (0.6)	1.9 (0.7)	1.5 (0.6)*	1.3 (0.6)*#
Average force exerted in the area (Kg)	10.3 (3.1)	9.8 (4.3)	13.2 (3.3)*	13.9 (3.6)*
Right iliac psoas strength (4 sec)				
Average peak force (Kg)	18.8 (7.1)	18.5 (6.5)	23.6 (6.5)*	23.8 (6.2)*
Average time to peak force (seconds)	1.4 (0.9)	1.4 (0.8)	1.2 (0.6)	1.5 (0.5)#
Average force exerted in the area (Kg)	12.2 (5.5)	11.8 (5.4)	14.2 (3.9)	14.7 (3.7)*#

*Note. Average grade (± Standard deviation) * p < .05 comparison between groups Mann-Whitney U. # p < .05 intergroup comparison pre-post Wilcoxon ranges. Source: self-made.*

Flexibility

Table 6 describes the results obtained from flexibility, where significant results can be observed, this being the case, first of all, of the average of the left hip flexors, where the intervention group ($p < .05$) presented higher values in both the first and second evaluations compared to the control group, with the second being where there is a more pronounced difference of 6.3% ($p < .05$). Furthermore, the intervention group presented pre/post evaluation improvements of 1.5% ($p < .05$).

Secondly, the mean of left hip extensors, the intervention group showed significant differences compared to the control group ($p < .05$).

Also, it showed favourable increases of 5.2% between pre/post evaluation of the intervention group ($p < .05$). After training, the right hip extensors revealed higher values in the intervention group, which improved by 16.6% after training (both $p < .05$).

Table 6. Qualification. Flexibility results.

Hip flexibility (in º)	**Control group**		**Intervention group**	
	Pre	post	Pre	post
Left hip flexors average	129 (4.6)	126 (4.1)#	132 (3.2) *	134 (2.4) *#
Left hip extensor stocking	17 (1.0)	17 (0.9)	19 (1.4) *	20 (0.9) *#
Right hip flexors average	129 (3.3)	129 (4.0)	132 (3.0) *	135 (1.4) *#
Right hip extensor stocking	18 (1.19	17 (1,1)	18 (1,2)	21 (1,2) *#

*Note. Average grade (± Standard deviation) * p < .05 comparison between groups Mann-Whitney U. # p < .05 intergroup comparison pre-post Wilcoxon ranges. Source: self-made.*

DISCUSSION

The main findings of this study are that all patients improve their quality of life, their pathology severity index, their perceived health, and reduce medication; this is undoubtedly because they all follow medical treatment for that purpose. However, the group of patients who train improves their levels of strength and flexibility; Their pathology severity index improves more, achieving a higher quality of life, less pain and less medication intake than the control group.

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Low back pain is one of the main causes of disability in Spain(National Health System Task Force, 2020), because it affects 80% of the population during their lifetime, leading, for example, to absenteeism and disability, and in turn having an impact on the increase in public spending, which according to the latest survey ranges over 108 million euros (documentation complemented in annexes (15.7)). The pain and quality of life questionnaire showed that after a month of pharmacological treatment all people improved their quality of life, but it seems that those patients who combined it with strength and flexibility training obtained extra benefits in the variables analysed, the differences The most relevant were in the dimensions of pain, anxiety and depression. In the first, 28 patients in the intervention group had pain and after the training the number increased to 17, a relevant fact that allows us to think that exercise can be a good help method for the treatment of low back pain, as other studies agree (Shirado et al. 2010).

On the other hand, anxiety and depression, in line with low back pain, is among the top five diseases in Spain, with a high social cost and the economic repercussion that this entails (complementary documentation in annex (15.9)). After the intervention, those trained also benefited from the effects of the training, increasing the number of patients without psychological conditions, results in line with other research.(Zarr et al., 2022).

On the other hand, regarding medication is where a more striking difference is obtained, because after the intervention an average of 0.7 is obtained, this implies that there are patients who no longer take medication. Therefore, if in Spain there is public spending of approximately 1 million euros on analgesics, anti-inflammatories and antirheumatics (National Health System Task Force, 2020), (complementary documentation in annexes (15.8)), exercise can help improve pharmacological treatment and be a safe and effective line of work as an adjuvant in the treatment of lumbar pain, as other researchers such as Shirado et al. (2010). Fact of vital interest, because patients who did not follow the intervention program maintain high levels of prescription and intake of medications.

Focusing on the components of physical condition, after carrying out a preliminary analysis of correlations (complementary documentation in annexes (15.4)), it can be seen that higher levels of strength correlate with better quality of life, lower severity of pathologies, lower medication and lower pain, so the hypothesis arises as to whether the increase in strength results in these effects. Therefore, it seems logical to be able to perform the exercises for longer and vary them, with the aim of being able to progress from 4 to 9 weeks as suggested in other studies (Fernández-Rodríguez et al. 2022).

However, another aspect detected is that the time to reach peak force is not stable, that is, for example, while it decreases in the left iliac psoas, it increases in the right, being an optimal time to generate the maximum force. Our study shows adaptations in the times used to reach peak strength in different muscles, but in general they result in greater strength, this could be indicating that the proposed training is effective in optimizing muscle function in these patients.

In relation to flexibility, after the exploratory analysis, correlations are obtained similar to those observed in the strength variables with respect to quality of life, pain and severity, because it provides greater mobility to the affected area. This could explain that our program that combines strength and flexibility exercises increases the benefits exclusively due to pharmacological treatment and therefore improves their quality of life, with less severity of pathologies, less medication and less pain.

This study is not free of limitations, which refer, among others, to the sample size, the intervention time, replacing the indirect recording with direct methods, analysing the adaptations of the patients to each exercise, and not doing a specific analysis by sex. Randomization of participants was also not feasible.

In any case, this pilot study will allow us to analyse the real possibilities of implementing the program and the necessary resources. On the other hand, regarding the strengths of the study, they are the design of specific exercises for patients, the intervention supervised by a sports physical educator, establishing interdisciplinary work guidelines or establishing scientifically supported lines of work.

Ethical aspects

The intervention proposal has been approved by the Research Ethics Committee of the Autonomous Community of Aragon (Ceica), complying with the ethical guidelines of the 1961 Helsinki Declaration, revised in Fortaleza (2013), Spanish legislation and the legal regulations for clinical research in humans (Law 14/2007 on biomedical research). Respecting the integrity and anonymity of all participants.

CONCLUSIONS

Exercise improves strength and flexibility in patients with low back pain and seems to be a safe tool to reduce pain, medication and the severity of pathologies, being a means of self-care to increase quality of life. In relation to the silver objectives, it is concluded:

- Objective of evaluating the effect of the program on the physical condition components of strength and flexibility, it is concluded that through the measurements carried out, the positive evolution of both components before and after the study intervention has been evaluated.
- Objective of analysing whether the use of exercise helps to reduce pharmacological treatment, it is concluded that physical exercise could be associated with a decrease in pharmacological prescription and intake since after the intervention there is a large decrease in the group that trains with patients who They don't take medication.
- Objective to determine the effect of the program on quality of life, it is concluded that safe and supervised exercise improves quality of life by reducing the severity index of people with low back pain.
- Objective of evaluating the effect of the program on low back pain and its association with possible improvements in strength or flexibility, it is concluded that despite there being improvements, the program must continue to be implemented and specific analyses must be carried out to consolidate with certainty whether the increase in Strength and flexibility reduces pain.

Future perspectives of research

Regarding future perspectives, a wide range of possibilities opens up to reduce chronic pain and diseases that cause discomfort, through the prescription of physical activity.

Finally, it is an avenue of research that will help public coffers save billions of euros in anti-inflammatories, because those responsible for health will be able to prescribe physical exercises instead of medication.

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DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author.

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REFERENCES

Bouma, A., van Nassau, F., Nauta, J., Krops, L., van der Ploeg, H., Verhagen, E., van der Woude, L., van Keeken, H., Dekker, R. , van Mechelen, W., de Groot, V., van der Leeden, M., Zwerver, J., Fluit, M., van den Akker-Scheek, I., Stevens, M., Diercks, R., Bossers , W., Buffart, L., … van Twillert, S. (2022). Implementing Exercise = Medicine in routine clinical care; needs for an online tool and key decisions for implementation of Exercise = Medicine within two Dutch academic hospitals. BMC Medical Informatics and Decision Making, 22(1), 1-15. https://doi.org/10.1186/s12911-022-01993-5

Bowden, JA, Bowden, AE, Wang, H., Hager, R.L., LeCheminant, JD, & Mitchell, UH (2018). In vivo correlates between daily physical activity and intervertebral disc health. Journal of Orthopedic Research, 36(5), 1313-1323. https://doi.org/10.1002/jor.23765

Casajús, JA, & Vivente-Rodríguez, G. (2011). Physical Exercise and Health in Special Populations. In the Higher Sports Council. Exernet.

Chenuel, B. (2022). P07-03 The characteristics of the medical prescription for adapted physical activity among the French Health System, experience of the Grand Est region. European Journal of Public Health, 32(Supplement_2). https://doi.org/10.1093/eurpub/ckac095.103

Codella, R., & Della Guardia, L. (2022). The conundrum of exercise dose: when the unknown becomes known. In Journal of Men's Health (Vol. 18, Issue 3, p. 79). IMR Press Limited. https://doi.org/10.31083/j.jomh1803079

National Health System work team. (2020). Annual Report of the National Health System 2020-2021. In Department of Health.

EuroQol Group. (2009). Health QuestionnaireSpanish version for Spain EQ-5D-5L. 1-3.

Fernández-Rodríguez, R., Álvarez-Bueno, C., Cavero-Redondo, I., Torres-Costoso, A., Pozuelo-Carrascosa, DP, Reina-Gutiérrez, S., Pascual-Morena, C., & Martínez -Vizcaíno, V. (2022). Best Exercise Options for Reducing Pain and Disability in Adults With Chronic Low Back Pain: Pilates, Strength, Core-Based, and Mind-Body. A Network Meta-analysis. In Journal of Orthopedic and Sports Physical Therapy (Vol. 52, Issue 8, pp. 505-521). JOSPT, Inc. JOSPT, 1033 North Fairfax Street, Suite 304, Alexandria, VA 22134-1540. https://doi.org/10.2519/jospt.2022.10671

Hall, M., Allison, K., Hinman, R.S., Bennell, K.L., Spiers, L., Knox, G., Plinsinga, M., Klyne, D.M., McManus, F., Lamb, K.E., Da Costa, R. ., Murphy, NJ, & Dobson, FL (2022). Effects of adding aerobic physical activity to strengthening exercise on hip osteoarthritis symptoms: protocol for the PHOENIX randomized controlled trial. BMC Musculoskeletal Disorders, 23(1), 1-17. https://doi.org/10.1186/s12891-022-05282-0

Herdman, M., Badia, X., & Berra, S. (2001). EuroQol-5D: a simple alternative for measuring health-related quality of life in primary care. Primary care / Spanish Society of Family and Community Medicine, 28(6), 425-430. https://doi.org/10.1016/S0212-6567(01)70406-4

Hurst, C., Robinson, SM, Witham, MD, Dodds, RM, Granic, A., Buckland, C., De Biase, S., Finnegan, S., Rochester, L., Skelton, D.A., & Sayer, AA (2022). Resistance exercise as a treatment for sarcopenia: Prescription and delivery. In Age and Aging (Vol. 51, Issue 2, pp. 1-10). https://doi.org/10.1093/ageing/afac003

Liguori, G., & American College of Sports Medicine. (2021). ACSM Manual for Exercise Assessment and Prescription (4th ed.). Wolters Kluwer.

Marés, E. (2017). Correct, harmful and contradictory stretches. In European Hispanic (1st ed., Vol. 1). European Hispanic. Retrieved from [Accessed 2024, 23 september]: https://es.pdfdrive.com/estiramientos-e191473843.html

Ministry of Health, Social Services and Equality. (2014). National Health Survey. Spain 2011/12. Health-related quality of life in adults: EQ-5D-5L. Monographic Reports Series No. 3.

Miralles Marrero, RC (1998). Clinical biomechanics of the musculoskeletal system. In clinical biomechanics of the musculoskeletal system. Masson.
Paw, M.C.A., Singh, A., Velde, S., Verloigne, M., Van Mechelen, W., & Brug, J. (2020). Who guidelines on physical activity and sedentary behavior. Routledge Handbook of Youth Sport. https://doi.org/10.4324/9780203795002
Pedersen, B.K., & Saltin, B. (2015). Exercise as medicine - Evidence for prescribing exercise as therapy in 26 different chronic diseases. Scandinavian Journal of Medicine and Science in Sports, 25, 1-72. https://doi.org/10.1111/sms.12581
Shirado, O., Doi, T., Akai, M., Hoshino, Y., Fujino, K., Hayashi, K., Marui, E., & Iwaya, T. (2010). Multicenter randomized controlled trial to evaluate the effect of home-based exercise on patients with chronic low back pain: The Japan low back pain exercise therapy study. Spine, 35(17). https://doi.org/10.1097/BRS.0b013e3181d7a4d2
Shiri, R., Coggon, D., & Falah-Hassani, K. (2018). Exercise for the Prevention of Low Back Pain: Systematic Review and Meta-Analysis of Controlled Trials. In American Journal of Epidemiology (Vol. 187, Issue 5, pp. 1093-1101). Oxford Academic. https://doi.org/10.1093/aje/kwx337
Zarr, R., Han, B., Estrada, E., & Cohen, D.A. (2022). The Park Rx trial to increase physical activity among low-income youth. Contemporary Clinical Trials, 122, 106930. https://doi.org/10.1016/j.cct.2022.106930

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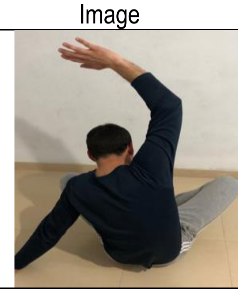
ANNEX. SUPPLEMENTARY TABLES AND FIGURES.

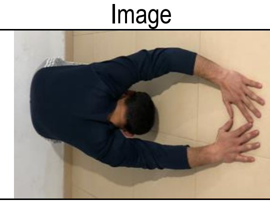
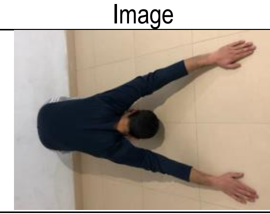
Table 1. Qualification. Warming massage.

No.	Buttocks	Muscles	Image
1	Sit on the foam roller with your hands on the floor. Place the bent leg on the thigh of the supporting leg. Perform a knee flexion-extension movement.	Gluteus maximus, medius and minimus.	
No.	**Hamstrings**	**Muscles**	**Image**
2	Place the foam roller over your hamstrings Place both hands on the floor and raise your hips. Perform a forward and backward movement on the hamstrings.	Femoral biceps. Semimembranosus. Semitendinosus.	
No.	**Plantar self-massage**	**Muscles**	**Image**
3	Standing leaning on the wall. Place a tennis ball on the sole of one foot Perform a back and forth movement on the plantar fascia.	Abductor of the fifth finger. Adductor hallucis. Foot square. flexor digitorum brevis. flexor hallucis brevis. flexor digitorum brevis.	
No.	**Trigger point self-massage**	**Muscles**	**Image**
4	lie down on the ground With your thumb, massage the rectus abdominis, always following the direction of the muscles	External and internal oblique Rectus major	

Note: the numbers correspond to the type of exercise designed for each level. Source: self-made.

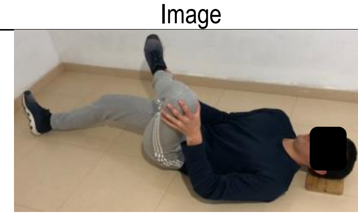
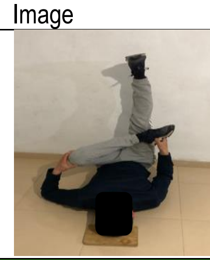
Table 2. Back stretches.

No.	Seated Lateral Bend	Muscles	Image
1	Sit cross-legged or V-shaped Raise and stretch your arm up and diagonally Tilt your trunk to one side Place your other hand on the floor Move your shoulder down The right glute should touch the floor	Angle of the scapula Lumbar square Broad back pectoralis major Teres major rhomboids Trapeze spinal erectors	
No.	**Standing Lateral Bend**	**Muscles**	**Image**
2	With legs open Raise your arm until it rests on the wall Tilt your trunk to one side Rest your other hand and forearm on the wall Drop shoulder support	scapula angle Lumbar square Broad back spinal erectors pectoralis major Teres major rhomboids Trapeze	

No.	Lateral tilt on the floor	Muscles	Image
3	Lie face down on the floor Extend your arm Tilt your body Keep your trunk and thighs close to the ground	scapula angle Lumbar square Broad back spinal erectors pectoralis major Teres major rhomboids Trapeze	
No.	Bring your head and knees together	Muscles	Image
4	lie on your side Flex your trunk and legs When you breathe in, expand your back	Lumbar square spinal erectors	
No.	Bend your trunk forward	Muscles	Image
5	Sit on your heels Flex your trunk forward Support your head and forearms When you breathe in, expand your back	Lumbar square spinal erectors	
No.	Bend your trunk backwards	Muscles	Image
6	On knees Lean your trunk forward Place your hands on the floor so that your arms form a V shape. Lower your hips	Broad back pectoralis major Teres major rhomboids	

Note: the numbers correspond to the type of exercise designed for each level. Source: adapted from (Marés, 2017).

Table 3. Qualification. Glute stretches.

No.	Trunk over leg flexion	Muscles	Image
1	Sit on one leg extended back and the other bent at a 90º angle. Bend your trunk over your front leg Support your hands and forearms	crural square Upper and lower geminus Gluteus maximus and medius Shutters Pyramidal	
No.	Bend your leg towards your trunk	Muscles	Image
2	Lie face up on the floor Bend one leg towards the trunk Hold the leg from behind	crural square Upper and lower geminus Gluteus maximus and medius Shutters Pyramidal	
No.	Cross the bent leg towards the trunk	Muscles	Image
3	Lie on the floor near a wall Stretch one leg, bend the other towards the chest, cross it over the stretched leg and touch your foot to the wall Grab the leg with the opposite hand and pull it Keep the sacral area in contact with the ground	crural square Upper and lower geminus Gluteus maximus and medius Shutters Pyramidal	

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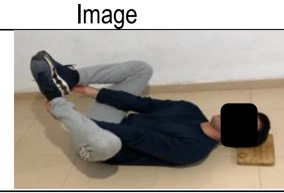
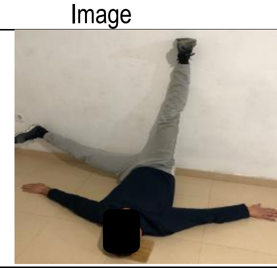
No.	Cross-legged push-up	Muscles	Image
4	Sit on the floor and cross your legs over each other Flex your trunk toward your legs Put your hands on the floor	crural square Upper and lower geminus Gluteus maximus and medius Shutters Pyramidal	
No.	Flexion of legs on the body	Muscles	Image
5	lay down on the ground Cross one leg over the other Flex your legs Take the uncrossed leg and bring it closer to the chest Keep the sacrum on the ground	crural square Upper and lower geminus Gluteus maximus and medius Shutters Pyramidal	

Note: the numbers correspond to the type of exercise designed for each level. Source: adapted from (Marés, 2017)

Table 4. Qualification. Abductor/adductor stretches.

No.	Leg extended inwards	Muscles	Image
1	Lie on the floor, face up Stretch your legs Move one leg inward Bend the other leg and cross it with the stretched one at the knee	Geminos Gluteus maximus, medius and minimus Pyramidal Shutters Tensor fascia lata	
No.	Bring the soles of the feet together	Muscles	Image
2	Lie on the floor near the wall Put your feet on the wall Bring the soles of your feet together and separate your knees	Adductor magnus, median and minor Gluteus medius and minimus Pectineus internal rotators Tight fascia lata	
No.	Open legs extended on the wall	Muscles	Image
3	lay down on the ground Rest your legs on the wall Move one leg toward the floor If your leg does not reach the ground, you should put an object to rest your leg on.	Adductor magnus, median and minor Hamstrings Pectineus Internal rectus	

Note: the numbers correspond to the type of exercise designed for each level. Source: adapted from (Marés, 2017)

Table 11. Qualification. Hamstring stretches.

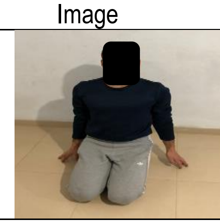
No.	Extended legs with support on the wall	Muscles	Image
1	lay down on the ground Support your legs on the wall extended Keep the sacrum in contact with the ground	Femoral biceps Semimembranosus Semitendinosus	

No.	Extended legs held by a rope	Muscles	Image
2	lay down on the ground Stretch your legs Use a rope that passes through the soles of your feet Keep the sacrum in contact with the ground	Femoral biceps Twins Semimembranosus Semitendinosus	

No.	Extended leg held by a rope	Muscles	Image
3	lay down on the ground Stretch one leg Use a rope that passes through the soles of your feet. The other leg should be flexed and the sole of the foot in contact with the ground Keep the sacrum in contact with the ground	Femoral biceps Twins Semimembranosus Semitendinosus	

Note: the numbers correspond to the type of exercise designed for each level. Source: adapted from (Marés, 2017).

Table 5. Qualification. Quadriceps stretches.

No.	Sitting on heels	Muscles	Image
1	Sit on your heels with your knees bent Put your hands on the floor Pelvis in retroversion	Extensor long and brevis of the fingers Ankle dorsiflexors anterior peroneus Femoral rectus Tibialis anterior Vastus lateralis, intermediate and internal	

No.	leg flexion	Muscles	Image
2	Standing, bend one leg and hold it by foot Bring your heel closer to your buttock Pelvis in retroversion	Extensor long and brevis of the fingers Ankle dorsiflexors anterior peroneus Femoral rectus Tibialis anterior Vastus lateralis, intermediate and internal	

No.	Bending the leg over the side	Muscles	Image
3	On your side, bend your top knee take your foot Bring your heel closer to your buttock Pelvis in retroversion	Extensor long and brevis of the fingers Ankle dorsiflexors anterior peroneus Femoral rectus Tibialis anterior Vastus lateralis, intermediate and internal	

Note: the numbers correspond to the type of patients. Source: adapted from (Marés, 2017).

Board6. Qualification. Psoas/iliac stretches

No.	Bending one leg over the body	Muscles	Image
1	Lie on the floor, place a wooden block on the sacrum Bend one leg and hold it by the hamstring Extend the other leg	Iliac Psoas Adductor longus, brevis and magnus Gluteus medius and minimus Pectineus Anterior rectus Sartorius Tensor fascia lata	

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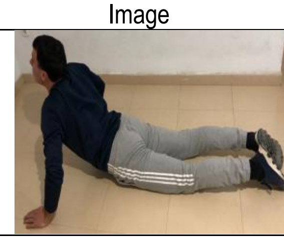
No.	Trunk flexion with hand support	Muscles	Image
2	Flex one leg Stretch the other leg Lean your trunk forward Touch your hands on the ground	Iliac Psoas Adductor longus, brevis and magnus Gluteus medius and minimus Pectineus Anterior rectus Sartorius Tensor fascia lata	

No.	One Leg Knee Stretch	Muscles	Image
3	Kneel on one leg with a 90º knee bend. The other leg should be flexed 90º at the knee and hip Arms akimbo	Iliac Psoas major and minor	

Note: the numbers correspond to the type of patients. Source: adapted from (Marés, 2017).

Table 7. Qualification. Abdominal stretches.

No.	Trunk lateral inclination	Muscles	Image
1	Lie face down Tilt your body as if you wanted to bring your hands and feet together. The outer arm should be stretched The inside elbow should be flexed 90º	External and internal oblique Lumbar square Broad back Spinal erectors	
No.	trunk elevation	Muscles	Image
2	Lie face down Raise the trunk with the help of your hands	External and internal oblique Rectus major	

Note: the numbers correspond to the type of patients Source: adapted from (Marés, 2017).

Table 15. Qualification. Back strengthening exercises.

No.	bicycle crunches	Muscles	Image
1	lie down on the ground Bend your legs towards your trunk Perform alternating leg movements	Abdominal rect	
No.	ABS Crossing of legs	Muscles	Image
2	Cross your knees Rectus abdominis contraction	Abdominal rect	

No.	Lateral decubitus leg raise		
3	Place yourself in a lateral decubitus position Arms resting on the floor Raise one leg	Abdominal rect abdominal oblique	
No.	**Alternative leg raises**	**Muscles**	**Image**
4	Get on all fours, supporting your knees and hands. Raise one leg up to the line of the body	Buttocks spinal erectors Lumbar square	
No.	**Deadlift in two phases**	**Muscles**	**Image**
5	1 phase: hip flexion 2 phase: knee flexion Undo the phases 1 phase: knee extension 2 phase: hip extension	Lower back Hamstrings Buttocks Quadriceps	
No.	**Deadlift with rubber bands (6)**	**Muscles**	**Image**
6	hip extension Knee extension	Lower back Hamstrings Buttocks Quadriceps	

Note: the numbers correspond to the type of patients. Source: self-made.

Table 8. Qualification. Mobility results.

Mobility	**Control group**		**Intervention group**	
	Pre	post	Pre	post
I have no problems walking	25	25	27	28
I have slight problems walking	4	4	3	2
I have moderate problems walking	1	1	0	0
I have serious problems walking	0	0	0	0
I cannot walk	0	0	0	0

Source: self-made.

Table 9.Qualification. Self-care results.

Self-care	**Control group**		**Intervention group**	
	Pre	post	Pre	post
I have no problems washing or dressing	22	27	28	28
I have slight problems washing or dressing	8	3	1	2
I have moderate problems washing or dressing myself	0	0	1	0
I have serious problems washing or dressing myself	0	0	0	0
I can't wash or dress	0	0	0	0

Source: self-made.

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Table 10. Qualification. Results of daily activities.

Daily activities	Control group		Intervention group	
	Pre	post	Pre	post
I have no problems carrying out my daily activities	26	25	27	28
I have mild problems carrying out my daily activities	4	4	1	2
I have moderate problems carrying out my daily activities	0	1	2	0
I have serious problems carrying out my daily activities	0	0	0	0
I can't do my daily activities	0	0	0	0

Source: self-made.

Table 11. Qualification. Results pain and discomfort.

Pain and discomfort	Control group		Intervention group	
	Pre	post	Pre	post
I have no pain or discomfort	0	1	2	13
I have mild pain or discomfort	14	16	19	6
I have moderate pain or discomfort	4	4	2	4
I have severe pain or discomfort	9	6	6	6
I have extreme pain or discomfort	3	3	1	1

Source: self-made.

Table 20. Qualification. Anxiety and depression results.

Anxiety and depression	Control group		Intervention group	
	Pre	post	Pre	post
I'm not anxious or depressed	9	10	16	25
I am mildly anxious or depressed	17	16	13	5
I am moderately anxious or depressed	2	4	0	0
I am very anxious or depressed	2	0	1	0
I am extremely anxious or depressed	0	0	0	0

Source: self-made

Table 21. Correlation matrix between quality of life, severity index, current health, medication and flexibility of the flexor and extensor muscles of the hip joint.

Variable		Post_EQ5D3L	IS_post	health_today_post	medic_post
1.Post_EQ5D3L	Pearson's r	—			
	p-value	—			
2. IS_post	Pearson's r	-0.904	—		
	p-value	< .001	—		
3. health_today_post	Pearson's r	0.455	-0.581	—	
	p-value	< .001	< .001	—	
4.medic_post	Pearson's r	-0.708	0.729	-0.483	—
	p-value	< .001	< .001	< .001	—
5. TYPICORAPRE	Pearson's r	-0.050	-0.009	-0.036	-0.075
	p-value	.705	.943	.785	.572
6. FLEXCADIZDPOST	Pearson's r	0.514	-0.551	0.509	-0.690
	p-value	< .001	< .001	< .001	< .001
7. EXTCADIZDPOST	Pearson's r	0.331	-0.428	0.519	-0.570
	p-value	.010	< .001	< .001	< .001
8. FLEXCADDERPOST	Pearson's r	0.574	-0.639	0.560	-0.768
	p-value	< .001	< .001	< .001	< .001
9. EXTCADDERPOST	Pearson's r	0.427	-0.481	0.550	-0.589
	p-value	< .001	< .001	< .001	< .001

Table 22. Correlation matrix between quality of life, severity index, current health, medication and muscle strength of the hip joint.

Variable		Post_EQ5D3L	IS_post	health_today_post	medic_post
1.Post_EQ5D3L	Pearson's r	—			
	p-value	—			
2. IS_post	Pearson's r	-0.904	—		
	p-value	< .001	—		
3. health_today_post	Pearson's r	0.455	-0.581	—	
	p-value	< .001	< .001	—	
4.medic_post	Pearson's r	-0.708	0.729	-0.483	—
	p-value	< .001	< .001	< .001	—
5. FMEDIARAPOST	Pearson's r	0.569	-0.556	0.510	-0.557
	p-value	< .001	< .001	< .001	< .001
6. FMEDIACLPOST	Pearson's r	0.321	-0.327	0.396	-0.291
	p-value	.012	.011	.002	.024
7. FMEDIAOBIPOST	Pearson's r	0.519	-0.468	0.338	-0.464
	p-value	< .001	< .001	.008	< .001
8. FMEDIAOBDPOST	Pearson's r	0.425	-0.362	0.332	-0.327
	p-value	< .001	.004	.010	.011
9. FMEDIAPIIPOST	Pearson's r	0.563	-0.603	0.451	-0.548
	p-value	< .001	< .001	< .001	< .001
10. FMEDIAPIDPOST	Pearson's r	0.624	-0.623	0.384	-0.533
	p-value	< .001	< .001	.002	< .001

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