Signatory of DORA
https://doi.org/10.56183/iberoeds.v4is.681
Ibero-American Journal of Education & Society Research
OPEN ACCESS
BY-NC-ND
**Received**: 21/05/2024
**Accepted**: 30/06/2024
**Published**: 20/07/2024

# Towards sustainable back health: the benefits of interval exercises

Hacia una salud de espalda sostenible: los beneficios de los ejercicios por intervalos

**Diana Verónica Flores Farinango**
dflores0105@uta.edu.ec
Universidad Técnica de Ambato- Ecuador
Facultad de Ciencias de la Salud
Maestría en Fisioterapia y Rehabilitación
https://orcid.org/0009-0006-7419-3177

**Gerardo Fernando Fernández Soto**
gfernandez@uta.edu.ec
Universidad Técnica de Ambato- Ecuador
Facultad de Ciencias de la Salud
Maestría en Fisioterapia y Rehabilitación
https://orcid.org/0000-0002-0246-0380

**Rafael Andrés Arcos Reina**
Ra.arcos@uta.edu.ec
Universidad Técnica de Ambato- Ecuador
Facultad de Ciencias de la Salud
Maestría en Fisioterapia y Rehabilitación
https://orcid.org/0009-0001-8686-9668

**Isaías Pastor Guamán Zúñiga**
isaias.guaman@hgl.mspz3.gob.ec
Operadora de Capacitación San José-Ecuador
Profesor y coordinador de área de Enfermería
Licenciatura en enfermería
https://orcid.org/0009-0002-6408-3768

**Vladimir Santiago Brito Sarabia**
vbrito0215@uta.edu.ec
Universidad Técnica de Ambato- Ecuador
Facultad de Ciencias de la Salud
Maestría en Fisioterapia y Rehabilitación
https://orcid.org/0009-0008-0168-7357

## ABSTRACT

**Background**: Low back pain is a health problem that affects the quality of life of the person and their economy, about 1710 million people have musculoskeletal disorders in the world. This is an injury caused by the activities of daily life, work, academics, professionals and leisure time, subjecting the back to excessive stress associated with making sudden movements and lack of physical conditioning of the muscles of the back, abdomen and of the thigh, however, 90% of the cases of low back pain do not determine the cause, calling it mechanical low back pain. The objective of this study is to implement a program of interval exercises in low back pain of mechanical origin in auxiliary nursing students. **Methods**: The rehabilitation plan was based on three stages. In the first stage, information was collected using the Oswestry low back pain disability scale, VAS analytical scale, calculation of maximum heart rate, personal history questionnaire, and taking vital signs (heart rate, blood pressure, temperature). partial oxygen saturation, breaths per minute), as well as height and weight. The second stage focused on muscle recruitment and conditioning through interval exercises with a 7-week program. In the third stage, strengthening was carried out with progressions in a 4-week program. **Results**: The greatest benefits experienced by the participants were pain intensity, personal care such as washing, dressing, etc. While certain activities of daily life such as walking, sitting, standing, sleeping, sexual activity, traveling, slight favorable changes were observed. **Conclusion**: the results suggest a predominance in the decrease in the intensity of pain and its repercussion in the activities of daily life.

**Keywords**: back health sustainability; low back pain; kinesiology; exercise;

## RESUMEN

**Antecedentes:** El dolor lumbar constituye un problema de salud que afectan la calidad de vida de la persona y su economía, cerca de 1710 millones de personas presentan trastornos musculoesqueléticos en el mundo. Esta es una lesión causada por las actividades de la vida diaria, laborales, académicas, profesionales y del tiempo libre, sometiendo a la espalda a esfuerzos excesivos asociados al realizar movimientos bruscos y al déficit de acondicionamiento físico de los músculos de la espalda, abdomen y del muslo, sin embargo 90% de los casos de lumbalgia no se determina la causa, denominándola lumbalgia mecánica. El objetivo del presente estudio es implementar un programa de ejercicios interválicos en el dolor lumbar de origen mecánico en estudiantes auxiliares de enfermería. **Métodos**: Proyecto de desarrollo, observacional, descriptiva de corte transversal de enfoque cuantitativo. El plan de rehabilitación se basó en tres etapas. En la primera etapa se realizó la recolección de información mediante la escala de incapacidad por dolor lumbar de Oswestry, escala analítica de EVA, cálculo de la frecuencia cardiaca máxima, cuestionario de antecedentes personales y toma de signos vitales (frecuencia cardiaca, presión arterial, temperatura, saturación parcial de oxígeno, respiraciones por minuto), además de talla y peso. La segunda etapa se centró en el reclutamiento y acondicionamiento muscular mediante ejercicios interválicos con un programa de 7 semanas. En la tercera etapa se realizó fortalecimiento con progresiones en un programa de 4 semanas. **Resultados:** Los mayores beneficios que experimentaron los participantes fueron la intensidad del dolor, cuidados personales como lavarse, vestirse, etc. Mientras que ciertas actividades de la vida cotidiana como caminar, estar sentado, estar de pie, dormir, actividad sexual el viajar se observaron ligeros cambios favorables. **Conclusión:** los resultados sugieren predominio en la disminución en la intensidad del dolor y su repercusión en las actividades de la vida cotidiana.

**Palabras clave:** sostenibilidad de la salud de la espalda; dolor lumbar; kinesiología; ejercicio.

## INTRODUCTION

Low back pain constitutes an important health problem that causes psychological alterations such as depression and anxiety, increasing absenteeism, decreasing work capacity and quality, affecting the performance of companies, as well as the well-being of workers. (Gissell & Oseguera, 2020). Acute mechanical low back pain must be treated to prevent its progression to chronic pain. Chronic low back pain is more complicated for daily living activities and increases health service costs. (Dada, Michelle;Zarnowski, 2021).

Mobilization reduces the duration and intensity of low back pain, as well as recurrences and reduces the time absent from work, improving quality of life. (Ripoll Ocete, 2020) Although the benefits of movement on low back pain are known in studies carried out (Mora et al., 2015), it has not yet been established what the effects of interval exercises are on low back pain of mechanical origin. (Movasat Hajkhan et al., 2017) The present research aimed to implement an interval exercise program in low back pain of mechanical origin in the study population. (Lladó Trobat, 2019) (Inga et al., 2021)

**Epidemiology**

It is estimated that around 1.71 billion people suffer from musculoskeletal disorders in the world, with low back pain being the most common with a prevalence of 568 million people. It is the second cause of consultation in health homes. (Alfonso-mora et al., 2017) ) It is the most frequent cause of disability in 160 countries (ONU. 2021). In Latin America, low back pain is directly linked to work activities, affecting a third of workers. (Inga et al., 2021) According to the most relevant statistical information from the General Occupational Risk Insurance as of December 31, 2018, it indicates that the diagnosis that predominates in occupational diseases for the year 2015 was low back pain, corresponding to 31.1% of occupational diseases. (Social Instituto Ecuatoriano de Seguridad, 2018).(María & León, 2015)

**History and characteristics of interval exercise**

This technique is based on short, intense series of exercise alternating with short active or passive pauses. The American College of Sports Medicine recommends doing at least 150 minutes a week of moderate aerobic physical activity, or 75 minutes a week of vigorous aerobic activity, or a combination of these two modalities. It is recommended to use the continuous method (50-70% maximum heart rate) of moderate intensity as a preparation mechanism for resistance exercises. Historically, the use of aerobic exercise programs followed by strength exercise programs has had beneficial results for health (Verbrugghe et al., 2019)

Performing regular exercise is associated with positive changes in body health and reduces chronic inflammation due to cholinergic discharge, suppressing the synthesis and release of pro-inflammatory cytokines. (Zafra-santos & Espinoza-salinas, 2016)(Peña et al., 2013)

**Types of Interval exercises**

The German School defines three training methods: Continuous method, interval method, repetition method. Within the interval or interval method there is the intermittent modality in which the periods of effort and pause last less than a minute. (Zafra-santos & Espinoza-salinas, 2016)

**HIIT and the impact of health**

Exercise has proven to be effective in managing and reducing pain in different pathologies. (Pinzón Ríos, 2018) ) In recent years high-performance athletes have opted for high-intensity exercise (HIIT) as training. However, it has reemerged as a successful therapeutic program when improving the physical condition and health of the adult population (Zafra-santos & Espinoza-salinas, 2016)

In the 90s, studies were carried out on training with interval exercises in the non-athletic population (sedentary, carriers of some disease). Tabata, et al. I implemented a high-intensity interval training in a non-athletic population, involving fourteen subjects who were divided into two groups of seven people. Both groups performed bicycle ergometry: other exercises within the program were high- intensity sprint: seven to eight series, each series of 20 seconds, with training intensity of 170% of VO2 max. With a 10-second interval between sets, performed five days a week, for six weeks. Continuous submaximal training protocol: 70% of VO2 max, for 60 minutes, five days per week, for seven weeks. In conclusion: HIIT health training supports the idea that it is a method that has several benefits, with a main advantage, the short period of time needed to complete the training, with a minimum of equipment and physical adaptations. (Zafra-santos & Espinoza-salinas, 2016) (Del et al., n.d.).

## METHODS

**Design**

A cross-sectional descriptive development project with a quantitative approach was carried out, which took place at the San José Training Operator located in the canton of Latacunga-Ecuador. The degree of pain and its impact on activities of daily living were established using the Visual Analogue Pain Scale (VAS) and the disability scale for Oswestry low back pain, the maximum heart rate was quantified using a formula to work individually with each participant, vital signs were taken, personal history was questioned and the written consent was signed before the implementation of the study, it was evaluated with the scales and vital signs at the beginning and at the end of the intervention. The exercise guide was based on the studies of Cofré-Bolados et al. and Salom Moreno, J. et al. and adapted to the participants.

**Instrument**

A questionnaire was applied to the participants which had 4 parts, the first contained the informed consent for free and voluntary participation in the research study, the second part the participant filled out a data collection form on lifestyle, characteristics of activities, personal history and taking vital signs, the sheet was examined and validated by experts, in the third part the Oswestry disability scale for low back pain was applied and in the fourth part the pain was assessed with the Visual Analogue Pain Scale (VAS). (Salom Moreno et al., 2020)

**1.** Visual Analogue Pains Scale (VAS)

Measures the intensity of pain reported by the patient. It is based on a 10-centimeter horizontal line. On the far left is the expression of absence or lower intensity of pain and on the far right is the expression of the greatest intensity of pain. The patient must mark on the line the point that indicates the intensity of pain they are experiencing at the moment, measured with a millimeter ruler. The intensity of pain is expressed in centimeters or millimeters. (Vicente Herrero et al., 2018)

The assessment will be interpreted as follows:

Mild pain if the patient's rating is less than 3

Moderate pain if the patient's rating is between 4 and 7

Severe pain if the rating is equal to or greater than 8

The reliability of this test measured by Test-retest is good (r= 0.94 to 0.71) and this scale is sensitive to changes associated with treatment. (Vicente Herrero et al. 2018) (Ubillos-Landa, García-Otero, and Puente-Martínez 2019) (Vélez and Álvarez 2010).

**2.** Oswestry Low Back Pain Disability Scale

The Oswestry Pain Disability Scale is considered a specific complementary test for low back pain, which provides information on the impact of pain on activities of daily living. This scale is a self-administered questionnaire that measures limitations in daily activities. Consisting of 10 questions with 6 response options each. The questions refer to the intensity of the pain and how much activities of daily living (lifting weight, washing, dressing, sleeping, standing or sitting, sexual activity, social life and traveling) are affected by the presence of pain at the moment. to carry them out. (Alcántara Bumbiedro et al., 2006)(Universidad de Antioquia. Facultad de Medicina. et al., 1988)

It is a questionnaire whose time required to complete is 5 minutes, which the patient can complete by himself without the presence of an interviewer.

The scale consists of 10 questions with 6 possible answers. Each item is valued from 0 to 5, if the first response option is marked it will be scored with 0, if the second option is marked it will be scored with 1 and so on respectively up to option 6 which will be scored with 5..(Oswestry, n.d.)

If more than one option is checked, the highest score is taken into account. If you do not respond to an item, it is excluded from the final calculation. The total score is expressed as a percentage (up to 100%), adding all the scores of the questions answered and then dividing by the maximum possible score (50) multiplied by 100.

$$\textbf{Total score} = \frac{50 - (5 \times \text{number of unanswered items})}{\text{Sum of the scores of the items answered x100}}$$

Interpretation of results 0-20%: minimal functional limitation

20%-40%: moderate

40%-60%: intense

60%-80%: disability

Greater than 80%: maximum functional limitation (Alcántara Bumbiedro et al., 2006). The reliability of this scale is 0.99. Therefore, it is of high sensitivity and high specificity. (Alcántara Bumbiedro et al. 2006)

**3.** Calculation of maximum heart rate

To determine the maximum heart rate, the age must be subtracted from 220. The resulting figure represents the number of times the heart should beat per minute at a maximum rate.

**Sample**

The participants were recruited from the groups of nursing assistant students of the San José Training Operator located in the canton of Latacunga- Ecuador. The total population is 45 students who were enrolled to follow the course at the time of starting this study, who were examined according to the inclusion and exclusion criteria, these were: nursing assistant students from the San José Training Operator , patients between 18 and 40 years of age with low back pain of mechanical origin and those excluding people with: specific causes of spinal pain such as radiculopathy, spinal pathology or post-surgery, who at the time of the intervention were undergoing physiotherapeutic or pharmacological treatment, use permanently use walking aids or have an amputation of a limb, it was then possible to determine the eligibility of the participants for the study, being 25 students

A search of bibliographic information was carried out in the databases: PubMed, Medigraphic, ScienceDirec, Ebrary, Pedro, Scielo, Google Scholar, collecting information regarding the application of interval exercises in low back pain of mechanical origin under the PRISMA standards (1 ,2), with advice from Lcda. Ft. María Alexandra Vaca Sánchez, Mg. In this way, academic documents related to the object of this study were used, the following terms or descriptors were included in the search: physiotherapy, interval exercises, low back pain, mechanical origin, musculoskeletal pain, under a global context (English - Spanish) and temporal context from 2018 to 2022. The information was managed through the application of a flowchart (Annex 7), granting 20 eligible articles as support for the foundation of the research.

**Intervention**

In the present investigation, a 12-week interval exercise protocol was implemented through 3 phases.

**Phase 1.** Patient education about the importance of interval exercise and its benefits in low back pain of mechanical origin and information collection. The Oswestry tests, VAS analytical scale, calculation of maximum heart rate, personal history questionnaire, taking vital signs (heart rate, blood pressure, temperature, partial oxygen saturation, breaths per minute) were applied to the participants. in addition to size and weight.

**Fase 2.** Muscle recruitment and muscle conditioning. Weeks 2-6, the exercises were performed: 1 squat with support, 2 trunk extension with shoulder flexion in a supine position, 3 side plank, 4 front plank supported on forearms and knees progressing to support on hands and toes, 5 twists Russians in which the participant is seated on the ground and must turn the trunk, bringing the hands from one side to the other with the heels resting on the ground, the abdomen must remain contracted and without support to stabilize the body (Zafra-santos & Espinoza-salinas, 2016)

5-minute warm-up on a stationary bike (SPINNING BIKE STINGRAY SFSPIN-2 brand)

1-minute repetitions on a stationary bike at 70% of maximum heart rate (max. HR) with 1-minute intervals at 50% of maximum heart rate. Each exercise period was monitored with a pulse oximeter. In the 5th and 6th week, HR was increased to 80%. max. While the interval period was maintained at 50% of HR. max

To facilitate recovery and reduce fatigue, upper and lower body exercises were alternated throughout the sessions.

Interval training was applied, in each week 1 exercise for the upper body and 1 for the lower body will be performed and one of central strength, 10 repetitions at 50% in the first session increasing 5% progressively per week until reaching 100% with retention of 10 seconds for each exercise

All sessions will end with stretching that will include upper and lower limbs and central muscles, each stretch will consist of 1 series with 3 repetitions of 30 seconds each stretch.

**Phase 3** strengthening with progressions. Exercises were performed for four weeks with: 1 front plank supported by hands and tiptoes, raising the legs alternately, 2 Russian twists in which the participant is seated on the floor and must rotate the trunk, taking the hands from one side to the other. with the legs raised, the abdomen must remain contracted and without support, 3 sit-ups with shoulder flexion, 4 sit-ups touching the contralateral elbow and knee, 5 side plank abducting the shoulder and extension of the upper leg. (Zafra-santos & Espinoza-salinas, 2016)(Salom Moreno et al., 2020).

5-minute warm-up on a stationary bike (SPINNING BIKE STINGRAY SFSPIN-2 brand)

1-minute repetitions on a stationary bike at 80% of maximum heart rate (max. HR), with 1-minute intervals at 50% of heart rate maximum. Each exercise period was monitored with a pulse oximeter. From the 7th to the 10th week, HR increased to 90%. max. and in the 11th to the 12th week it was increased to 100%, while the interval period was maintained at 50% of the HR. max. Each exercise period was monitored with a pulse oximeter.

To facilitate recovery and reduce fatigue, upper and lower body exercises were alternated throughout the sessions. Interval training was applied, in each week 1 exercise for the upper body and 1 for the lower body will be performed and one of central strength, 10 repetitions at 50% in the first session increasing 5% progressively per week until reaching 100% with

retention of 10 seconds for each exercise All sessions will end with stretching that will include upper and lower limbs and central muscles, each stretch will consist of 1 series with 3 repetitions of 30 seconds each stretch.

At the end of the intervention, a final evaluation was carried out using the Oswestry low back pain disability scale and VAS. Of the 25 participants in the study, 17 reported improvements in low back pain and performance of activities of daily living, demonstrating the positive impact on the management of low back pain of mechanical origin with interval exercises.

**Statistical analysis**

The results were tabulated with the SPSS version 29.0 operating system, expressed in tables. After the application of the exercise guide, it was verified by the Wilcoxon rank test for related samples, there is a significant difference in both the Oswestry Low Back Pain Disability Scale and Pre-test Evaluation, Visual Analogue Pain Scale (VAS), obtaining a probability of p<000 for both tests. These statistical values being less than alpha (0.05). The research hypothesis can be accepted and the null hypothesis rejected; stating that there are benefits in the application of interval exercises in low back pain of mechanical origin.

**Bioethical considerations**

In the present study, an interval exercise program was applied after signing the informed consent for the free and voluntary participation of the collaborators. This document complies with approved ethical requirements by bioethics committee for research in human beings CBISH-FCS-UTA with resolution 023-CEISH-UTA-2023

## RESULTS

**Sociodemographic information**

The data of the participants was analyzed by tabulating gender, age, weight, height, body mass index. Regarding gender, 18 women participated, corresponding to 72%, and 7 men, corresponding to 28% of the population. According to age was counted as follows: 18 years corresponding to 6 participants with 24%; 19 years corresponding to 2 participants, with 8%; 21 years corresponding to 6 participants with 24%; 23 years corresponding to 2 participants, with 8%; 24 years corresponding to 3 participants with 12%; 25 years corresponding to 2 participants with 8%; 31 years corresponding to 1 participant with 4%; 34 years corresponding 1 participant with 4%; 40 years corresponding to 2 participants with 8%.

Regarding BMI. 8% (2 participants) of the population are underweight; 56% (14 participants) normal weight; 32% (8 participants) are overweight and 8% (2 participants) are obese as observed in Table 1.

**TABLE 1. Sociodemographic characteristics of nursing students at the San José Training Operator**

| | | Frequency | Percentage % |
|---|---|---|---|
| **AGE** | Young | 21 | 84 |
| | Adult | 4 | 16 |
| | Total | 25 | 100 |
| **GENDER** | Female | 18 | 72 |
| | Male | 7 | 28 |
| | Total | 25 | 100 |
| **SIZE** | 1.40-1.49 m | 4 | 16 |
| | 1.50-1.59 m | 14 | 56 |
| | 1.60-1.69 m | 7 | 28 |
| | Total | 25 | 100 |
| **WEIGHT** | 44-49 Kg | 5 | 20 |
| | 50-59 Kg | 8 | 32 |
| | 60- 69 Kg | 6 | 24 |
| | 70-79 Kg | 4 | 16 |
| | 80 kg | 2 | 8 |
| | Total | 25 | 100 |
| **BMI** | Under weight | 2 | 8 |
| | Normal weight | 11 | 44 |
| | Overweight | 9 | 36 |
| | Grade 1 obesity | 3 | 12 |
| | Total | 25 | 100 |

**Visual Analogue Pain Scale (VAS)**

VAS is used to measure the intensity of pain reported by the patient. It is based on a 10-centimeter 0 millimeters horizontal line. At the far left is the expression of absence or lesser intensity of pain and at the far right is the expression of the greatest intensity of pain. Each participant marked on the line the point they indicate the intensity of pain that I present at the moment, it is measured with a millimeter ruler. The intensity of the pain is expressed in centimeters or millimeters. The reliability of this test measured by Test-retest is good (r= 0.94 to 0.71) and this scale is sensitive to changes associated with treatment. (Vicente Herrero et al., 2018) (Ubillos-Landa et al., 2019)(Vélez & Álvarez, 2010)

The assessment will be interpreted as follows:

Mild pain if the patient's rating is less than 3

Moderate pain if the patient's score is between 4-7

Severe pain if the rating is equal to or greater than 8

Results. The results of the pre-test of the VAS evaluation are observed, in which 24% of the population (6 participants) presented mild pain (1-3); 76% (19 participants) reported moderate pain (4-7). In the post test it is observed a difference in which 68% (17 participants) have mild pain and 32% (8 participants) have pain moderate (table 2).

**TABLE 2**. Pain intensity, pre- and post-test evaluation in nursing assistant students.

| | **Pre-test evaluation, Visual scale Pain Analog (EVA)** | | **Post-test evaluation, Visual Analogue Pain Scale (EVA)** | |
|---|---|---|---|---|
| **Pain Intensity** | Frequency | Percentage % | Frequency | Percentage % |
| **Mild pain 1-3 mm** | 6 | 24 | 17 | 68 |
| **Moderate pain 1-7 mm** | 19 | 76 | 8 | 32 |
| **Severe pain > 8 mm** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

The results at the beginning of the intervention showed that 76% of the population reported moderate pain, while 24% presented mild pain, at the end of the intervention 32% indicated moderate pain while 68% described pain mild, which reflects that moderate pain decreased by 57.8%, who reported that their symptoms went from moderate to mild after the intervention period. Demonstrating that there was a decrease in intensity in the low back pain, indicating the positive impact on the management of low back pain of mechanical origin with exercises intervals

**Oswestry low back pain disability scale**

The Oswestry Pain Disability Scale is considered a specific complementary test for lumbar pain, which provides information on the impact of pain on activities of daily living. This scale is a self-administered questionnaire, which measures limitations in daily activities. Consisting of 10 questions with 6 options of response each. The questions refer to the intensity of the pain and how much activities are affected of daily life (lifting, washing, dressing, sleeping, standing or sitting, sexual activity, social life, and travel) the presence of pain at the time of performing them (Alcántara Bumbiedro et al., 2006).

The scale consists of 10 questions with 6 possible answers. Each item is valued from 0 to 5, if the first option is marked the response will be scored with 0, if the second is marked it will be scored with 1 and so on respectively until option 6 which will be scored with 5

If more than one option is checked, the highest score is taken into account. If you do not respond to an item, it will be excluded from the final calculation. The total score is expressed as a percentage (up to 100%), adding all scores of the questions answered later is divided by the maximum possible score (50) multiplied by 100. The reliability of this scale is 0.99. Therefore, it is of high sensitivity and high specificity. (Alcántara Bumbiedro et al., 2006)

Results analysis

0-20%: minimum functional limitation 20%-40%: moderate

40%-60%: intense

60%-80%: disability

Greater than 80%: maximum functional limitation. (Alcántara Bumbiedro et al., 2006)

Results. The results of the Oswestry low back pain disability scale are observed, the pre-test in which it was found

that at the beginning 32% (8 participants) of the population had moderate functional limitation, while that 68% (17) of the population manifested intense functional limitation, in the post-test it was observed that 24% (6) presented minimal functional limitation, 52% (13) had moderate functional limitation and 24% (6) of the participants maintained severe functional limitation(Universidad de Antioquia. Facultad de Medicina. et al., 1988)

**TABLE 3.** Pre- and post-test evaluation of pain intensity and its impact on activities of daily living (Oswestry low back pain disability scale) in nursing assistant students.

| Oswestry low back pain disability scale. | Pre test | | Post test | |
|---|---|---|---|---|
| | Frequency | Percentage % | Frequency | Percentage % |
| **Minimum Functional Limitation 0-20%** | 0 | 0 | 6 | 24 |
| **Moderate Functional Limitation 20%-40%** | 8 | 32 | 12 | 48 |
| **Intense Functional Limitation 40%-60%** | 17 | 68 | 7 | 28 |
| **Disability 60%-80%** | 0 | 0 | 0 | 0 |
| **maximum functional limitation > 80%** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

At the beginning of the intervention, 68% of the population with severe functional limitation and 32% of the participants with moderate functional limitation, at the end of the intervention it was observed that the intense functional limitation decreased 64.7%, the vast majority of these participants manifest a moderate functional limitation and others a limitation mild functional. Which indicates that there was an improvement in the performance of activities of daily living, demonstrating the positive impact on the management of low back pain of mechanical origin with interval exercises. The results of activities of daily living measured by the Low Back Pain Disability Scale of Oswestry are seen from table 4 to table 13.

**Table 4**. Question 1 of the Oswestry Low Back Pain Disability Scale.

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **PAIN INTENSITY** | Frequency | Percentage | Frequency | Percentage |
| **I can handle the pain without taking painkillers.** | 3 | 12 | 5 | 20 |
| **The pain is strong, but I manage without taking painkillers** | 8 | 32 | 10 | 40 |
| **The pain relievers completely relieve my pain.** | 6 | 24 | 5 | 20 |
| **Painkillers relieve my pain a little** | 8 | 32 | 5 | 20 |
| **Painkillers barely relieve my pain** | 0 | 0 | 0 | 0 |
| **Painkillers don't take away my pain and I don't take them.** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 4 details the results on the Oswestry Low Back Pain Disability Scale test from the comparison of the test before and after the intervention, in which a decrease in pain intensity is recorded.

**Table 5**. Question 2 of the Oswestry Low Back Pain Disability Scale.

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **PERSONAL CARE (WASHING, DRESSING, ETC.)** | Frequency | Percentage | Frequency | Percentage |
| **I can manage on my own without the pain increasing.** | 2 | 8 | 3 | 12 |
| **I can handle it on my own, but this increases my pain.** | 5 | 20 | 6 | 24 |
| **Washing, dressing, etc., causes pain and I have to do it slowly and carefully.** | 3 | 12 | 13 | 52 |
| **I need some help, but I can do most things on my own.** | 15 | 60 | 3 | 12 |
| **I need help doing most of the things.** | 0 | 0 | 0 | 0 |
| **I can't get dressed, it's hard for me to wash, and I usually stay in bed** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 5 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which personal care is recorded (washing, dressing, etc.). and an improvement in functionality is observed

**Table 6**. Question 3 of the Oswestry Low Back Pain Disability Scale.

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **LIFT WEIGHT** | Frequency | Percentage | Frequency | Percentage |
| **I can lift heavy objects without increasing pain** | 0 | 0 | 2 | 8 |
| **I can lift heavy objects, but my pain increases** | 5 | 20 | 11 | 44 |
| **The pain prevents me from lifting heavy objects off the floor, but I can do so if they are in a comfortable place (e.g. on a table).** | 11 | 44 | 6 | 24 |
| **The pain prevents me from lifting heavy objects, but I can lift light or medium objects if they are in a comfortable place.** | 5 | 20 | 4 | 16 |
| **I can only lift very light objects** | 4 | 16 | 2 | 8 |
| **I can't lift or lift anything** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 6 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which the function of lifting weight is recorded and an improvement is observed in the functionality.

**Table 7**. Question 4 of the Oswestry Low Back Pain Disability Scale

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **WALK** | Frequency | Percentage | Frequency | Percentage |
| **The pain doesn't stop me from walking** | 0 | 0 | 0 | 0 |
| **The pain prevents me from walking more than a kilometer** | 6 | 24 | 10 | 40 |
| **The pain prevents me from walking more than 500 meters** | 15 | 60 | 13 | 52 |
| **The pain prevents me from walking more than 250 meters** | 4 | 16 | 2 | 8 |
| **I can only walk with a cane or crutches** | 0 | 0 | 0 | 0 |
| **I stay in bed most of the time and I have to crawl to the bathroom** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 7 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which walking function is recorded and a slight improvement is observed in the functionality.

**Table 8**. Question 5 of the Oswestry Low Back Pain Disability Scale

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **SIT** | Frequency | Percentage | Frequency | Percentage |
| **I can sit in any type of chair as long as I want.** | 0 | 0 | 1 | 4 |
| **I can be sitting in my favorite chair as long as you want** | 1 | 4 | 2 | 8 |
| **The pain prevents me from sitting for more than an hour** | 7 | 28 | 11 | 44 |
| **The pain prevents me from sitting for more than half an hour** | 16 | 64 | 10 | 40 |
| **The pain prevents me from sitting for more than ten minutes.** | 1 | 4 | 1 | 4 |
| **Total** | 25 | 100 | 25 | 100 |

Table 8 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which the sitting function is recorded and a slight improvement is observed. in functionality.

**Table 9**. Question 6 of the Oswestry Low Back Pain Disability Scale

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **STAND** | Frequency | Percentage | Frequency | Percentage |
| **I can stand as long as I want without increasing pain.** | 0 | 0 | 0 | 0 |
| **I can stand as long as I want, but the pain increases** | 7 | 28 | 12 | 48 |
| **The pain prevents me from standing for more than an hour** | 9 | 36 | 6 | 24 |
| **The pain prevents me from standing for more than half an hour** | 9 | 36 | 7 | 28 |
| **The pain prevents me from standing for more than ten minutes** | 0 | 0 | 0 | 0 |
| **The pain prevents me from standing** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 9 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which the function of standing is recorded and a slight improvement is observed. improvement in functionality.

**Table 10.** Question 7 of the Oswestry Low Back Pain Disability Scale

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **SLEEP** | Frequency | Percentage | Frequency | Percentage |
| **The pain does not prevent me from sleeping well** | 7 | 28 | 11 | 44 |
| **I can only sleep if I take pills** | 16 | 64 | 14 | 56 |
| **Even taking pills I sleep less than six hours** | 2 | 8 | 0 | 0 |
| **Even taking pills I sleep less than four hours** | 0 | 0 | 0 | 0 |
| **Even taking pills I sleep less than two hours** | 0 | 0 | 0 | 0 |
| **The pain completely prevents me from sleeping** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 10 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which the sleeping function is recorded and a slight improvement is observed in the functionality.

**Table 11**. Question 8 of the Oswestry Low Back Pain Disability Scale

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **SEXUAL ACTIVITY** | Frequency | Percentage | Frequency | Percentage |
| **My sexual activity is normal and my pain does not increase.** | 1 | 4 | 1 | 4 |
| **My sexual activity is normal, but my pain increases** | 7 | 28 | 8 | 32 |
| **My sexual activity is almost normal, but my pain increases a lot** | 14 | 56 | 13 | 52 |
| **My sexual activity has been very limited due to pain** | 3 | 12 | 3 | 12 |
| **The pain prevents me from all types of sexual activity** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 11 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which sexual activity is recorded and a slight improvement in performance is observed. functionality.

**Table 12.** Question 9 of the Oswestry Low Back Pain Disability Scale

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **SOCIAL LIFE** | Frequency | Percentage | Frequency | Percentage |
| **My social life is normal and my pain does not increase** | 0 | 0 | 0 | 0 |
| **My social life is normal, but my pain increases** | 0 | 0 | 0 | 0 |
| **The pain does not have a major effect on my social life but it does prevent my more energetic activities, such as dancing, etc.** | 10 | 40 | 13 | 52 |
| **The pain has limited my social life and I don't go out as often.** | 12 | 48 | 12 | 48 |
| **Pain has limited my social life to home** | 3 | 12 | 0 | 0 |
| **I have no social life because of the pain.** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 12 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which social life is recorded and a slight improvement in performance is observed. functionality.

**Table 13.** Question 10 of the Oswestry Low Back Pain Disability Scale

| | PRE-TEST | | POST TEST | |
|---|---|---|---|---|
| **TRAVEL** | Frequency | Percentage | Frequency | Percentage |
| **I can travel anywhere without increasing pain** | 0 | 0 | 0 | 0 |
| **I can travel anywhere, but the pain increases** | 4 | 16 | 4 | 16 |
| **The pain is strong, but I can endure trips of more than two hours** | 6 | 24 | 6 | 24 |
| **Pain limits me to trips of less than an hour** | 11 | 44 | 12 | 48 |
| **Pain limits me to short, necessary trips of less than half an hour.** | 4 | 16 | 3 | 12 |
| **The pain prevents me from traveling except to go to the doctor or hospital.** | 0 | 0 | 0 | 0 |
| **Total** | 25 | 100 | 25 | 100 |

Table 13 details the results of the Oswestry Low Back Pain Disability Scale test and the comparison of the test before and after the intervention, in which travel is recorded and a slight improvement in functionality is observed.

**Table 14**. Wilcoxon rank test to verify the hypothesis

| | **Oswestry Low Back Pain Disability Scale** | **Pre-test evaluation, scale Visual Analog of Pain (EVE)** |
|---|---|---|
| | Initial-final | Initial-final |
| **Z** | -4,389[b] | -4,483[b] |
| **Asymptotic sig. (bilateral)** | 00 | 00 |

After applying the interval exercise guide to the nursing assistant students, it was possible to verify Using the Wilcoxon rank test for related samples, there is a significant difference in both Scale of disability due to Oswestry low back pain and pre-test evaluation, Visual Analogue Pain Scale (VAS) obtained a probability of p<0,000 for both tests. These statistical values being less than alpha (0.05). The research hypothesis can be accepted and the null hypothesis rejected; stating that there are significant differences between means, related to the Oswestry Low Back Pain Disability Scale and pre-test Evaluation, Visual Analogue Pain Scale (VAS) after the application of the interval exercise guide (Table 14).

## DISCUSSION

In the pain reassessment, 17 participants reported improvements corresponding to 68% of the study population, decreasing the intensity of pain from moderate to mild on the visual analogue scale. The greatest benefits that participants experienced were the decrease in pain intensity and personal care such as washing, dressing, etc. While certain activities of daily living such as walking, sitting, standing, sleeping, sexual activity, and traveling, slight favorable changes were observed. The present study shares the assertion that exercise is the most indicated way to improve the symptoms of low back pain. progressively activating and strengthening the muscles, demonstrating the positive impact on the management of low back pain of mechanical origin with interval exercises.

In the study carried out by Verbrugghe et al. (2023) aims to: evaluate the effects of HIT on central sensitization symptoms and perceived stress in people with chronic nonspecific low back pain. The study population was 51 participants with an average age of 43.6 years. I performed a secondary analysis of a previously published trial, the methodology evaluated the Central Sensitization Inventory (CSI) and the Perceived Stress Scale (PSS) at baseline and six months after 12 weeks of HIT. Forming two groups based on the CSI scores (low CSI/high CSI). Models were carried out to observe the changes in the CSI/PSS scores and if these were related to the success of the therapy based on the modified Oswestry Disability Index, the study identified a decrease in favor of the high CSI, as a conclusion indicates that HIT improves central sensitization symptoms in people with chronic nonspecific low back pain. (Verbrugghe et al., 2023)

In 2020 Tagliaferri et al. published a randomized trial "Randomized trial of general strength and conditioning versus motor control and manual therapy for chronic low back pain on physical and self-report outcomes." Whose study objective was to evaluate the effectiveness of general strength and conditioning (GSC) compared to motor control exercise and manual therapy (MCMT) to treat chronic low back pain (CLBP) pain intensity. The participants were treated for six months. Each session began with 20 minutes of aerobic conditioning; high-intensity exercises began at 65% progressing to 85% of maximum heart rate (HRmax). Participants also exercised at home three times a week for 20 to 40 minutes of jogging or walking at 65-85% of max HR. Referred pain was measured every 15 days during the training program. The results showed that after 6 months both groups improved pain symptoms and increased muscle strength in both training modalities (Tagliaferri et al., 2020)

Therefore, the studies by Tagliaferri et al. indicate that the exercises are effective in reducing low back pain, increasing functional capacity, improving stability and muscle strength. (Tagliaferri et al., 2020) Verbrugghe in his study indicates that high intensity training (HIT) is considered effective in the rehabilitation of chronic nonspecific low back pain by reducing pain, improving the person's functional capacity and increasing physical performance. (Verbrugghe et al., 2020).

## CONCLUSIONS

This study evaluated the benefits of interval exercises in nursing assistant students, a guide to interval exercises was developed and applied based on the studies of Verbrugghe et al. Tagliaferri et al and Cofré-Bolados. Among the greatest benefits that participants experienced were a decrease in pain intensity, personal care such as washing, dressing, etc. While other activities of daily living such as walking, sitting, standing, sleeping, sexual activity and traveling slight favorable changes were observed. This study suggests that a combination of exercise exercises at 70% of HR Max progressing to 100% of HR Max. with intervals at 50% of HR Max. 2 or 3 times a week can be recommended for the management of low back pain of mechanical origin.

## REFERENCES


Alcántara Bumbiedro, S., Flórez Garcia, M. T., Echávarri Pérez, C., & García Pérez, F. (2006). Escala de incapacidad por dolor lumbar de Oswestry. *Rehabilitación (Madrid)*, *40*(3), 150–158.

Alfonso-mora, M. L., Romero-ardila, Y. P., & Montaño-gil, E. M. (2017). Effects of an exercise plan on low back pain in office workers. *Medicas UIS*, *30*(3).

Dada, Michelle;Zarnowski, A. (2021). Actualización de lumbalgia en atención primaria. *Sinergia*, *6*(8), 3–14.

Del, U., Físico, E., & Fines, C. O. N. (n.d.). *Utilización del ejercicio físico con fines terapéuticos en la lumbalgia*.

Gissell, S., & Oseguera, E. (2020). Factores de riesgo de lumbalgia en personal de enfermería, hospital Militar Central, Honduras. *Facultad de Ciencias Médicas*, *4*(1), 2–8. https://www.researchgate.net/profile/Eliab-Oseguera-Oyuela/publication/352523343_FACTORES_DE_RIESGO_DE_LUMBALGIA_EN_PERSONAL_DE_ENFERMERIA_HOSPITAL_MILITAR_CENTRAL_HONDURAS/links/60cceddb458515dc1791b24d/FACTORES-DE-RIESGO-DE-LUMBALGIA-EN-PERSONAL-DE-ENFE

Inga, S., Suasnabar, K. A. R., & Mejial, C. R. (2021). Factors associated with the development of lumbar pain in nine risk occupations in the peruvian mountains. *Revista de La Asociacion Espanola de Especialistas En Medicina Del Trabajo*, *30*(1), 48–56.

Iurkaev, E. (2020). *Influencia del masaje terapéutico en personas que presentan lumbalgia crónica : revisión bibliográfica*.

Lladó Trobat, J. M. (2019). *Beneficios del Yoga en el dolor lumbar crónico inespecífico*. *118*, 10671. http://dspace.uib.es/xmlui/handle/11201/150546

María, A., & León, S. (2015). Nurses Low Back Pain Prevalence and Its Relationship With Associated Biomechanical Risk Factors During. *MEDICINA (Bogotá)*, *37*(4111), 120–5498.

Mora, R. Z., Medina, E. C., Eva, D., & Medina, C. (2015). Ejercicio como intervención en el tratamiento del dolor lumbar crónico. *Artículo de Revisión*, *4*(March), 16–21. www.medigraphic.org.mxhttp://www.medigraphic.com/ridwww.medigraphic.org.mx

Movasat Hajkhan, A., Bohórquez Heras, C., Turrión Nieves, A., & Álvarez de Mon Soto, M. (2017). Protocolo diagnóstico del dolor lumbar mecánico. *Medicine (Spain)*, *12*(26), 1541–1545. https://doi.org/10.1016/j.med.2017.01.016

Oswestry, I. D. E. D. D. E. (n.d.). *O S W EST RY*. 4–6.

Peña, G., Heredia, J. R., Segarra, V., Mata, F., Isidro, F., Martín, F., & Silva, M. E. Da. (2013). Generalidades del "HIIT" Aplicado a esfuerzos cardiovasculares en los programas de salud y fitness. *Revista EFDeportesEFDeportes*, *Septiembre*, 9. http://www.efdeportes.com/efd183/hit-aplicado-a-esfuerzos-cardiovasculares.htm

Pinzón Ríos, I. D. (2018). Dolor y Ejercicio. *Archivos de Medicina (Manizales)*, *18*(1), 181–200. https://doi.org/10.30554/archmed.18.1.2035.2018

Ripoll Ocete, M. (2020). Eficacia del ejercicio terapéutico en fisioterapia para el manejo del dolor lumbar crónico no específico en adultos. *NPunto*, *3*, 93–144.

Salom Moreno, J., Sánchez Jorge, S., Vicente Campos, D., & Berlanga, L. (2020). Efectos analgésicos del ejercicio físico en pacientes con dolor crónico musculoesquelético durante el confinamiento por la pandemia COVID-19. *Archivos de Medicina Del Deporte*, *37*(6), 393–397.

Santos, C., Donoso, R., Ganga, M., Eugenin, O., Lira, F., & Santelices, J. P. (2020). Dolor Lumbar: Revisión Y Evidencia De Tratamiento. *Revista Médica Clínica Las Condes*, *31*(5–6), 387–395. https://doi.org/10.1016/j.rmclc.2020.03.008

Social Instituto Ecuatoriano de Seguridad. (2018). Seguro General de Riesgos del Trabajo Boletín Estadístico Bimensual. *Boletin Estadistico 2018*, 11–19.

Tagliaferri, S. D., Miller, C. T., Ford, J. J., Hahne, A. J., Main, L. C., Rantalainen, T., Connell, D. A., Simson, K. J., Owen, P. J., & Belavy, D. L. (2020). Randomized trial of general strength and conditioning versus motor control and manual therapy for chronic low back pain on physical and self-report outcomes. *Journal of Clinical Medicine*, *9*(6), 1–16. https://doi.org/10.3390/jcm9061726

Ubillos-Landa, S., García-Otero, R., & Puente-Martínez, A. (2019). Validation of an instrument for measuring chronic pain in nursing homes. *Anales Del Sistema Sanitario de Navarra*, *42*(1), 19–30. https://doi.org/10.23938/ASSN.0390

Universidad de Antioquia. Facultad de Medicina., K., Lugo Agudelo, L. H., Morales Vergara, M. V., & Londoño Mesa, A. (1988). Validacion ODI Colombia. *Iatreia*, *21*(4), s22–s22. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-07932008000600019&lng=en&nrm=iso&tlng=es

Vélez, P., & Álvarez, C. (2010). VALIDACIÓN DE UNA ESCALA PARA VALORAR EL DOLOR EN PACIENTES ODONTOLÓGICOS. (Validation of a Scale to assess pain in odontological patients). *VALIDACIÓN DE UNA ESCALA PARA VALORAR EL DOLOR EN PACIENTES ODONTOLÓGICOS. (Validation of a Scale to Assess Pain in Odontological Patients)*, *3*(1), 4–13.

Verbrugghe, J., Agten, A., Stevens, S., Hansen, D., Demoulin, C., Eijnde, B. O., Vandenabeele, F., & Timmermans, A. (2019). Exercise intensity matters in chronic nonspecific low back pain rehabilitation. *Medicine and Science in Sports and Exercise*, *51*(12), 2434–2442. https://doi.org/10.1249/MSS.0000000000002078

Verbrugghe, J., Agten, A., Stevens, S., Hansen, D., Demoulin, C., Eijnde, B. O., Vandenabeele, F., & Timmermans, A. (2020). High intensity training to treat chronic nonspecific low back pain: Effectiveness of various exercise modes. *Journal of Clinical Medicine*, *9*(8), 1–14. https://doi.org/10.3390/jcm9082401

Verbrugghe, J., Agten, A., Stevens, S., Vandenabeele, F., Roussel, N., Verbunt, J., Goossens, N., & Timmermans, A. (2023). High intensity training improves symptoms of central sensitization at six-month follow-up in persons with chronic nonspecific low back pain: Secondary analysis of a randomized controlled trial. *Brazilian Journal of Physical Therapy*, *27*(2), 100496. https://doi.org/10.1016/j.bjpt.2023.100496

Vicente Herrero, M. T., Delgado Bueno, S., Bandrés Moyá, F., Ramírez Iñiguez de la Torre, M. V., & Capdevila García, L. (2018). Valoración del dolor. Revisión Comparativa de Escalas y Cuestionarios. *Revista de La Sociedad Española Del Dolor*, *25*(4), 228–236. https://doi.org/10.20986/resed.2018.3632/2017

Zafra-santos, E., & Espinoza-salinas, A. (2016). High intensity aerobic interval training: history and clinical exercise physiology. *Revista de La Universidad Industrial de Santander*, *48*(3), 275–284. http://www.scielo.org.co/pdf/suis/v48n3/v48n3a02.pdf