Signatory of DORA
https://doi.org/10.56183/iberojhr.v4i2.689
Ibero-American Journal of Health Science Research
OPEN ACCESS
BY-NC-ND
Received: 02/09/2024
Accepted: 05/11/2024
Published: 09/12/2024

Proprioceptive neuromuscular facilitation applied to dairy factory workers with low back pain

Facilitação Neuromuscular Proprioceptiva aplicada a trabalhadores de fábricas de laticínios com dor lombar

Cemira Michelle Pérez Castro
cperez4501@uta.edu.ec
https://orcid.org/0009-0003-6334-4409
Technical University of Ambato, Ecuador

Paola Gabriela Ortiz Villalba
https://orcid.org/0000-0001-6810-8841
Technical University of Ambato, Ecuador

Gerardo Fernando Fernández Soto
https://orcid.org/0000-0002-0246-0380
Technical University of Ambato, Ecuador

Diana Veronica Flores Farinango
https://orcid.org/0009-0006-7419-317
Technical University of Ambato, Ecuador

Verónica Lucía Molina Andrade
https://orcid.org/0009-0000-8480-736X
Technical University of Ambato, Ecuador

ABSTRACT

Background: Low back pain is considered a frequent musculoskeletal disorder, generating limitations to perform daily activities and states of disability. The objective is to establish the effectiveness of the Proprioceptive Neuromuscular Facilitation (PNF) technique in reducing lumbar pain of workers in dairy factories. Methods: a comparative study among longitudinal cohort groups was carried out. 25 participants were divided into two groups. PNF was applied to group A (n=13) and group B that was the control group (n=12). An initial evaluation was done and 12 weeks after the intervention a final evaluation was done. Pain intensity, the index of disability associated with back pain (BP) and quality of life were measured. Results: after 12 weeks of application of the protocol, the PNF technique significantly decreased pain intensity, improved functional disability associated with lumbar pain and quality of life with respect to health ($p<0.005$). For the control group there were no differences in the variables before and after the protocol was applied. Conclusions: The application of FNP in dairy factory workers is effective in reducing pain, disability associated with non-specific lumbar pain and improving the quality of life.

Keywords: muscle stretching exercises; back pain; exercise therapy; postural balance; occupational health.

RESUMO

Fundamento: A dor lombar é considerada um distúrbio osteomuscular frequente, gerando limitações para a realização de atividades diárias e estados de incapacidade. O objetivo é estabelecer a eficácia da técnica de Facilitação Neuromuscular Proprioceptiva (FNP) na redução da dor lombar de trabalhadores de fábricas de laticínios. Métodos: foi realizado estudo comparativo entre grupos de coortes longitudinais. 25 participantes foram divididos em dois grupos. A FNP foi aplicada ao grupo A (n=13) e ao grupo B que foi o grupo controle (n=12). Foi feita uma avaliação inicial e 12 semanas após a intervenção foi feita uma avaliação final. Foram mensurados a intensidade da dor, o índice de incapacidade associado à dor nas costas (PA) e a qualidade de vida. Resultados: após 12 semanas de aplicação do protocolo, a técnica FNP diminuiu significativamente a intensidade da dor, melhorou a incapacidade funcional associada à dor lombar e a qualidade de vida em relação à saúde ($p<0,005$). Para o grupo controle não houve diferenças nas variáveis antes e depois da aplicação do protocolo. Conclusões: A aplicação da FNP em trabalhadores de fábricas de laticínios é eficaz na redução da dor, da incapacidade associada à dor lombar inespecífica e na melhoria da qualidade de vida.

Palavras-chave: exercícios de alongamento muscular; dor nas costas; terapia por exercícios; equilíbrio postural; saúde ocupacional.

INTRODUCTION

One of the most common causes of musculoskeletal disorders (MSDs) is low back pain (LBP) (Caicedo et al, 2013). It affects 70% to 85% of the adult population at some point in life (Aguilera & Herrera, 2013). 90% of low back pain is of mechanical origin, most of them are non-specific and in some cases they can be chronic (GBD, 2018). It can even cause the disability of the individual who presents it (Asensio et al, 2021).

LBP can appear spontaneously. It can persist in 90% of cases for one month, in 10% of cases for 6 months and in 50% for up to 4 years (Dìas & Gérvas, 2002). This condition can generate a great socioeconomic impact (Zambrano et al, 2019). It is also considered an important public health problem (Bazan & Ventura, 2021). In Ecuador, according to data from the Ecuadorian Social Security Institute (IESS), low back pain is one of the main pathologies associated with occupational risks, more common in men than in women (IESS, 2018). When analyzing the working conditions to which workers in dairy factories are exposed, it is found that ergonomic risks are the main causal factor of BP due to manual handling of loads (Caicedo et al, 2013).

In this sense, there is an interest in developing and integrating strategies that mitigate the vicious circle of erroneous beliefs (pain produced by exercises and physiotherapy) to reduce the chances of developing disability and chronic pain related to physical deterioration caused by BP (Aguilera & Herrera, 2013). The evidence shows that the most effective interventions are based on clinical guides for directed therapeutic exercise that consist of techniques (Álvarez & Guadalupe, 2016; García et al, 2015; Vilchez & Hernán, 2020). One of the most recommended techniques is FNP (Hill et al, 2017; Smedes et al 2016). This technique improves lumbar mobility, achieving greater stability of the trunk, and contributing positively to the reduction of lumbar pain and the strengthening of the core muscles, which are essential for stability. They include the abdominal, lumbar, pelvic, gluteal and deep spinal muscles. These allow work activities where weight loads are carried out (Blenda & Medeguer, 2020; Kim & Lee, 2017; George et al, 2013).

When the spine is subjected to a weight greater than it can support during long work hours and vicious postures, mechanical irritation of the pain sensitivity receptors occurs. It also limits the person's functionality.(Dada et al, 2021). Within the treatment to relieve these symptoms are some approaches that are used in physiotherapy such as dry needling. It is an invasive technique applied in myofascial pain syndrome, which is caused by myofascial trigger points (LLanos, 2020). Muscle energy technique relieves pain and increases joint range. Therefore, it improves the patient's functionality (Vilchez & Hernán, 2020) Most conservative interventions, systematic and planned therapeutic exercise continue to stand out, with the purpose of correcting or preventing health-related risk factors (Jakosen et al, 2015; Michishita et al, 2017; Van Vilsteren et al, 2015).

In a systematic review, "what are the exercises indicated in chronic low back pain and herniated disc?" Different types of exercises are mentioned that can increase flexibility, resistance and reduce chronic low back pain. Among the main aspects that are evident is that the effect of exercise is effective for the treatment of chronic low back pain but not acute low back pain. For this reason, the objective of the current research of the study carried out was to establish the effectiveness of the Proprioceptive Neuromuscular Facilitation technique in reducing low back pain in dairy factory workers, which is produced by weight loads and poor posture. These are factors of ergonomic risk in lumbar problems because they are exposed to the manipulation of weight loads (American Spine Society, 2020). Sánchez-Pinilla et al, (2020).

METHODOLOGY

The research developed was of an observational type, which reached a descriptive level, under a quantitative and longitudinal cohort approach. The research was carried out in two dairy factories, located in the Píllaro Parish, province of Tungurahua, Zone 3 of the Economic and Social Development of Ecuador. The sample was 25 participants who met the inclusion criteria: presence of low back pain in the last 12 weeks, individuals who work with heavy loads and adults aged 20 to 64 years. The exclusion criteria were: presence of acute low back pain, verifiable diagnosis of herniated discs, surgeries during the last year and course of physiotherapy or pharmacological treatment. The sample was divided into two groups.

An initial evaluation was carried out prior to the intervention. After 12 weeks, an evaluation was applied at the end. The level of disability, pain intensity and quality of life were measured using the following questionnaires:

- Roland-Morris Questionnaire is a reliable self-administered instrument to determine the degree of physical disability derived from nonspecific low back pain. Construct validity was tested by determining the correlation between the The Spanish RMQ and the Spanish adaptation of the Oswestry Questionnaire. The outcome was r = 0.197 (P = 0.0061) on day 1 and r = 0.341 (P = 0.0000) on day 15. The participant must answer Yes, or No, according to the situation in which they are related to their low back pain and the performance of activities of daily living. Each question marked as positive receives a

score of 1, and negative questions receive a score of 0; which must be added to generate a total to be interpreted. Thus, if the rating is 0, corresponds to no disability caused by low back pain. 24 represents the maximum possible disability; having intermediate values from 0 to 8 as mild disability, from 9 to 16 as moderate disability, and from 17 to 24 as severe disability (Kovacs et al, 2002).

- Numerical Pain Scale (NRS) allows the intensity of pain to be measured subjectively, since it describes what the patient perceives at the time of application. A good to excellent correlation was found between VAS and NRS scores (r = 0.941), VAS and VRS (r = 0.878). This scale is made up of a 10 centimeter horizontal line without numbering, at the ends of which are the extreme expressions of a symptom (on the left is the absence or lower intensity and on the right is the highest intensity). The patient must mark an x on the line in the place that he considers reflects the intensity of his pain. The intensity is expressed in centimeters or millimeters and is interpreted according to whether the score is less than or equal to 3, the pain is mild. If the score is between 4 and 7, the pain is moderate; and if the score is equal to or greater than 8, the pain is severe (Kersten et al, 2014).

- Descriptive system of the EuroQol-5D questionnaire is a self-administered generic instrument for measuring health-related quality of life (HRQoL). It is applicable to analyze the efficacy and effectiveness of health interventions. The Spanish and Catalan versions of the EQ-5D have proven to be viable and valid for use in health interview surveys. Multivariate analyzes using VAS and tariff values as dependent variables and all sociodemographic and health variables as independent variables reached R2 values of 0.45 and 0.81, respectively. In the Spanish version, it consists of five dimensions of health (mobility, personal care, daily activities, pain/discomfort and anxiety/depression), with three levels of severity each (no problems, some problems/moderate problems and more serious problems). The patient must mark the level of severity that he considers corresponds to her health status in each dimension (Herdman et al, 2002; Brooks, 1996). The final interpretation of the descriptive part will be made based on the sum of the scores and their variation.

The intervention was carried out for 12 weeks, with a frequency of 2 times per week and duration of 40 min per session. The PNF technique was applied with rhythmic stabilization exercises, which consist of isometric contractions at the level of the shoulder girdle to strengthen the trunk (table 1).

Table 1. Intervention protocol

Week	*Exercise*	*Dosage*	*Frequency*
1 to 3	Stretch 1 Stretch 2	1 set of 8 repetitions each stretch 30 seconds between each stretch	2 visits with a 72-hour break between each one
	Rhythmic stabilization 1	3 sets 15 repetitions of the rhythmic stabilization exercise 60 seconds rest between each series	
4 to 6	Stretch 1 Stretch 2	1 set of 8 repetitions each stretch 30 seconds between each stretch	2 visits with a 72-hour break between each one
	Rhythmic stabilization 2	3 sets 15 repetitions of the rhythmic stabilization exercise 60 seconds rest between each series	
7 to 9	Stretch 3 Stretch 4	1 set of 8 repetitions each stretch 30 seconds between each stretch	2 visits with a 72-hour break between each one
	Rhythmic stabilization 3	3 sets 15 repetitions of the rhythmic stabilization exercise 60 seconds rest between each series	
11 to 12	Stretch 3 Stretch 4	1 set of 8 repetitions each stretch 30 seconds between each stretch	2 visits with a 72-hour break between each one
	Rhythmic stabilization 3 (with maximum resistance)	3 sets 15 repetitions of the rhythmic stabilization exercise 60 seconds rest between each series	

Source: the authors.

The data obtained from the questionnaire and scales applied, both before and after the intervention, were analyzed descriptively and statistically, to show possible variations in measurements and between groups.

The figures collected from the evaluations were processed using the SPSS V22 statistical system, after creating a database to tabulate and analyze them. Contingency tables on the clinical changes in disability, pain intensity and quality of life associated with the lower back pain were used.

To verify the hypothesis of measurements between groups, the Wilcoxon rank statistical test was applied; considering

that the variable to be measured is categorical and two measures were applied (before and after the intervention) to the same group of participants. For the comparison between groups the Mann-Whitney U test was applied, given that categorical variables are being compared in two study groups. The level of significance for the development of the tests was 95%, and a risk level of 5% (0.05).

Ethical and gender considerations

It should be mentioned that before any assessment or intervention, authorization was requested from the two dairy factories to be able to begin the research process. It is necessary to apply the physiotherapy evaluation sheet. The participants were informed about the aspects of their participation in the study. In this way, the objectives, the form of evaluation, the type of intervention, the benefits and possible effects were socialized. It aimed to voluntarily obtain their consent to participate in the study. A research protocol was applied that was submitted to the Human Research Ethics Committee of the Faculty of Health Sciences – UTA, on 10-28-2023. The code 022-CEISH-UTA-2023 was assigned, which indicates that it is APPROVED. Furthermore, in the revised document, all the ethical, methodological and legal requirements established by the regulations of this Committee are met.

RESULTS

Table 2. Level of disability resulting from low back pain: Roland Morris Questionnaire

Scores	Disability Level	FNP GROUP				CONTROL GROUP			
		Pretest		Posttest		Pretest		Posttest	
		Fr	%	Fr	%	Fr	%	Fr	%
0 to 8	Mild	7	54	13	100	10	83	10	83
9 to 16	Moderate	6	46	0	0	2	17	2	17
17 to 24	Severe	0	0	0	0	0	0	0	0
	TOTAL	13	100	13	100	12	100	12	100

Source: the authors.

In the comparison between measures after the application of the protocol, the level of disability in the FNP group decreased from a moderate level in 46% and a mild level in 54% to a level of mild disability in 100% of the population sample. While in the control group, no difference was seen between the measures, maintaining a moderate level of disability in 17% of the sample and 83% in the mild level of disability. The results establish that the application of the protocol based on proprioceptive neuromuscular facilitation administered to dairy factory workers considerably reduced the level of disability associated with nonspecific low back pain (table 2).

Table 3. Pain intensity: NRS Numerical Pain Scale

Scores	Pain intensity	FNP GROUP				CONTROL GROUP			
		Pretest		Posttest		Pretest		Posttest	
		Fr	%	Fr	%	Fr	%	Fr	%
≤ 3	Mild	0	0	10	77	0	0	0	0
4 to 7	Moderate	8	62	3	13	9	75	9	75
≥ 8	Severe	5	38	0	0	3	25	3	25
	TOTAL	13	100	13	100	12	100	12	100

NRS: Numerical Pain Scale PNF: Proprioceptive Neuromuscular Facilitation.
Source: the authors.

In the comparison between measurements after the application of the protocol, the intensity of pain in the FNP group decreased from a severe level in 38% and a moderate level in 62% of the sample to a moderate level in 13% and a mild level in the remaining 77%. While in the control group, no difference was seen between the measures, maintaining moderate

pain intensity in 75% and severe pain in 25% of the sample. The results establish that the application of the protocol based on proprioceptive neuromuscular facilitation administered to dairy factory workers significantly decreased the intensity of pain that the workers presented before the application of the protocol (table 3).

Table 4. Health-related quality of life (HRQoL): EuroQol-5D Questionnaire

Levels	PNF GROUP												CONTROL GROUP											
	Pretest						Posttest						Pretest						Posttest					
Dimension	N1		N2		N3		N1		N2		N3		N1		N2		N3		N1		N2		N3	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
Mobility	6	46	7	54	0	0	12	92	1	8	0	0	9	75	3	25	0	0	9	75	3	25	0	0
Personal care	12	92	1	8	0	0	13	100	0	0	0	0	9	75	3	25	0	0	10	83	2	17	0	0
Daily activities	6	46	7	54	0	0	13	100	0	0	0	0	4	33	8	67	0	0	5	42	7	58	0	0
Pain/Discomfort	0	0	13	100	0	0	8	62	5	38	0	0	0	0	12	100	0	0	0	0	12	100	0	0
Anxiety Depression	7	54	5	38	1	8	12	92	1	8	0	0	10	83	2	17	0	0	10	83	2	17	0	0

PNF: Proprioceptive neuromuscular facilitation.
N1: level 1 better quality of life; N2: level 2 moderate quality of life; N3: level 3 worst quality of life.
Source: the authors.

In the comparison between measures after the application of the protocol, the quality of life related to health HRQOL, in the PNF group of a level 2 in all dimensions and a level 3 in anxiety/depression; it went to level two in pain/discomfort with 38% and level 1 in all dimensions. On the other hand, in the control group, there have been very small variations in quality of life behavior, maintaining levels 1 and 2 in all dimensions. Thus, in the PNF group that received proprioceptive neuromuscular facilitation for low back pain, a considerable improvement was seen, indicating no problems in quality of life for the majority of workers (Table 4).

Table 5.Disability Level: Roland Morris Questionnaire

Disability level	PNF Group Pretest PNF Group Posttest	Control Group Pretest Control group Posttest
Z	-2,449b	,000c
asymptotic sig. (bilateral)	.014	1,000

Source: the authors.

After applying the protocol based on PNF in dairy factory workers with low back pain, the differences between means of the level of disability in both the FNP group and the control group were measured, applying the Wilcoxon Rank test for related samples. The results reflect a significant difference in the measurements of the PNF group, $p<0.05$. While in the control group no significant differences were found, given that $p<1.000$ was obtained. Given that the probability in the PNF group is less than alpha (0.05), the research hypothesis can be accepted and the null hypothesis rejected. It can be stated that there are significant differences between measurements after the application of the FNP protocol, related to the level of disability in the FNP group. While in the control group there are no significant differences between measures related to the level of disability (table 5).

Table 6.Pain intensity: NRS Numerical Pain Scale

Pain intensity	PNF Group Pretest PNF Group Posttest	Control group Pretest Control Group Posttest
Z	-3,207b	,000c
asymptotic sig. (bilateral)	.001	1,000

Source: the authors.

Statistically, after applying the protocol based on PNF in dairy factory workers with low back pain, the differences between means of pain intensity in both the FNP group and the control group were measured. The Rank test and Wilcoxon were applied for related samples. The results reflect a significant difference in the measurements of the PNF group, by one ($p<0.001$) in the p value. While in the control group no significant differences were found, given that a ($p=1,000$) was obtained. It is greater than the alpha (0.05). Since the probability in the PNF group is ($p<0.05$), the research hypothesis can be accepted and the null hypothesis rejected; stating that there are significant differences between measurements after the application of the PNF protocol (related to pain intensity in the PNF group). In the control group there are no significant differences between measures related to the level of disability (table 6).

Table 7.Quality of life – Euro QoI5D Questionnaire

EQ5D	Mobility PNF Group Last initial	PNF person care Last initial	PNF daily activity Last initial	PNF Pain/Discomfort Last initial	PNF Anxiety/Depression Last initial	Mobility Control Last initial	Care person Control Last initial	Daily activity Control Last initial	Pain/Discomfort Control Last initial	Anxiety/Depression Control Last initial
Z	-2,449b	-1,000b	-2,646b	-2,828b	-2,449b	,000c	-1,000b	-1,000b	-1,890d	,000c
Asymptotic sig. (bilateral)	.014	,317	.008	.005	.014	1,000	,317	,317	.059	1,000

Source: the authors.

After applying the protocol to dairy factory workers, the differences between measures related to the quality of both the PNF and control groups were measured. The Wilcoxon Rank test for related samples was applied. The results reflect a significant difference in the measurements of the PNF group ($p<0.05$) in the dimensions of mobility (0.014), daily activities (0.008), pain/discomfort (0.05) and anxiety/depression (0.14).); except in personal care (0.317). While in the control group no significant differences were found, since ($p>0.05$) was obtained in mobility (1.000), personal care (0.317), daily activities (0.317), pain/discomfort (0.059) and anxiety/depression (1,000). Therefore, the PNF group obtained ($p<0.05$), so the research hypothesis can be accepted and the null hypothesis rejected; stating that there are significant differences between measures after the application of the FNP protocol (related to quality of life in the PNF group). While in the control group there are no significant differences between measures related to quality of life (table 7).

DISCUSSION

Low back pain is one of the most common musculoskeletal disorders worldwide. In some cases, the pain is persistent and as it progresses, functional limitation occurs and may lead to a reduction in the ability to work, affecting your quality of life. It affects especially workers who carry out manual lifting of loads, as they do in dairy factories. The evidence shows that the most effective interventions to reduce the clinical picture of LBP are based on the application of therapeutic exercise guides (Álvarez & Guadalupe, 2016; García et al, 2015; Vilchez & Hernán, 2020). The Proprioceptive Neuromuscular Facilitation PNF is most recommended (Hill et al, 2017; Smedes et al, 2016), due to its positive effect on lumbar mobility and trunk stability,

In the initial assessment of the population, disability derived from nonspecific low back pain was found to be mild in 54% and moderate in 46% in the PNF group; while in the control 83% mild and 17% moderate disability according to the Roland Morris scale. They correspond to the findings of Bazan, C., & Ventura, A. (2021) where 82.35% of workers with chronic low back pain have moderate to severe physical disability (Santiago & Castro, 2018). Furthermore, Del Pozo et al, demonstrated that individuals with low back pain had greater functional disability in relation to workers without low back pain (Del Pozo et al, 2013).

In terms of pain intensity, 62% of the PNF group showed moderate intensity and the remaining 38% showed severe pain while in the control group 75% had mild intensity and the remaining 25% had severe intensity according to the NRS

numerical pain scale. The results of the study are similar to those found by (Vicente et al, 2015), in Spanish workers, who presented a high incidence of intense pain (Vicente et al, 2015), and (Oliveira et al, 2004)., where in female workers who remained in a single position all day had a high level of physical disability associated with lower back pain (Oliveira & Dal Berto, 2004). Thus, even in the measurement of quality of life related to health HRQOL collected with the EQ5D Questionnaire, it was found in the PNF group that 50% did not present problems in personal care, anxiety/depression and the other 50% presented some or moderate problems in the dimensions of mobility, daily activities and pain/discomfort. In the control group more than 70% did not present problems in mobility, personal care and anxiety/depression; but more than 60% presented some or moderate problems in the dimensions of daily activities and pain/discomfort. There are similar results showing that the quality of life decreases considerably since low back pain affects the physical, mental and social well-being of workers.(Covarrubias, 2010). Consequently, both the PNF group and the control group present a similar intensity of pain and alterations in quality of life, and although the level of disability associated with low back pain is not very similar. Both groups have considerable limitations associated with lower back pain.

In the comparison between measures after the application of the protocol, the level of disability in the PNF group decreased from a moderate level in 46% and a mild level in 54% to a level of mild disability in 100%, achieving a significance of 0.014; while in the control group no difference was seen between the measures, maintaining a moderate level of disability in 17% of the sample and 83% in the mild level of disability (1,000). On the other hand, the pain intensity of the control group decreased from a severe level in 38% and moderate in 62% of the sample to a moderate level in 13% and mild in 77%, being statistically significant with a p value of 0. 001. In the control group no difference was seen between the measurements, maintaining moderate pain intensity in 75% and severe pain in 25% of the sample with a significance of p equal to 1.000. Thus, even in health-related quality of life (HRQoL), an improvement was seen in the PNF group. They went from presenting some or moderate problems to presenting no problems in all dimensions, except pain and discomfort. 38% of the population continued to have some problems despite statistically significant differences in mobility (0.014), daily activities (0.008), pain/discomfort (0.000) and anxiety/depression (0.014); except in personal care (0.317); while in the control group many problems remained in all dimensions,

In the differences between groups, the level of disability showed significant differences before and after the protocol was applied (0.000). In the same way, similar data were seen for pain intensity before the application of the protocol p=0.380 and after p=0.000. On the other hand, in quality of life, no significant difference was reflected in the initial evaluation in mobility (0.150), personal care (0.248), daily activities (0.281) and anxiety/depression (0.109); except for pain/discomfort (0.000) In the final evaluation, mobility (0.248), personal care (0.113), pain/discomfort (0.330) and anxiety/depression (0.499); except in the dimension of daily activities (0.001) were found. These findings are related to several research works, such as in a comparative study carried out for 4 weeks. They were able to see that lumbar stabilization exercises such as proprioceptive neuromuscular facilitation exercises are effective in reducing low back pain and associated disability; although the PNF group demonstrated greater significance(Koutarapu & Ghumare, 2022). Similarly, the application of PNF was compared to general trunk exercises for three weeks. PNF significantly decreased the intensity of pain and improved the associated functional disability compared to the control group.(Areeudomwong & Buttagat, 2019). Regarding the comparison of PNF with conventional therapy, Bleda, A. & Meseguer H. indicate that PNF more effectively reduces pain in low back pain and the associated disability compared to conventional therapy. (Bleda & Meseguer, 2020); Likewise, they found the same result when comparing it with kinesiotherapy and manual therapy(Zaworski & Latosiewicz, 2021)and also by applying hot compress therapy and ultrasound for 6 weeks(Kim & Lee, 2017).

In this way, the results demonstrate that the application of a PNF protocol in dairy factory workers is effective in reducing pain, disability associated with nonspecific low back pain, and improving quality of life.

CONCLUSION

Initially, the dairy factory workers, both the PNF group and the control group, presented considerable pain intensity and alterations in quality of life that are similar in presentation. Although the level of disability associated with low back pain does not have similar values between the groups, there are limitations associated with lower back pain. After the 12-week application of the first assessment, the PNF group showed changes in pain intensity, decreasing the intensity of pain from severe-moderate to moderate-mild and the disability from a moderate level to mild. In the same way, as for quality of life, they went from presenting some or moderate problems to presenting no problems in all dimensions, except pain and discomfort. While, in the control group after 12 weeks without intervention, no changes were observed in the initial values of pain intensity, associated disability and quality of life. Statistically significant differences between the measurements in the two groups could be seen in all variables. Thus, it can be concluded that the application of a PNF protocol in dairy factory workers is effective in reducing pain, disability associated with nonspecific low back pain, and improving quality of life.

REFERENCES

Aguilera, A., & Herrera, A. (2013). Low back pain: a very popular and at the same time unknown ailment. Community and Health. Community and Health, 11(2), 80-89. Available in: http://ve.scielo.org/scielo.php?script=sci_arttext&pid=S1690-32932013000200010

Álvarez, G., & Guadalupe, M. (2016). Sedentary lifestyle and physical activity in administrative workers in the public sector. Unemi Science Magazine, 9(21), 116-124. Available in: https://www.redalyc.org/journal/5826/582661267010/582661267010.pdf

Areeudomwong, P., & Buttagat, V. (2019). Proprioceptive neuromuscular facilitation training improves pain-related and balance outcomes in working-age patients with chronic low back pain: a randomized controlled trial. Braz J Phys Ther, 23(5), 428-436. doi:10.1016/j.bjpt.2018.10.005

Asensio, J., Quesada, M., Fabregat, G., López, M., & De Andrés, J. (2021). Practical recommendations for the management of the patient with chronic pain during the pandemic of COVID-19. Rev Esp Anestesiol Reanim, 68(9), 495-503. doi:10.1016/j.redare.2020.08.013

Bazan, C., & Ventura, A. (2021). Lumbar pain related to anxiety and depression in police officers at a police station in Lima. Rev. Fac. Med. Hum., 21(2), 75 - 81. doi:http://dx.doi.org/10.25176/rfmh.v21i1.3229

Bleda, A., & Meseguer, A. (2020). Proprioceptive neuromuscular facilitation in people with chronic low back pain: systematic review. Physiotherapy, 42(2), 85-97. doi:10.1016/j.ft.2019.11.002

Brooks, R. (1996). EuroQol: the current state of play. Health Policy, 37(1) 53 - 72. doi:10.1016/0168-8510(96)00822-6

Caicedo, I., Barbosa, M., Cruz, W., & Sanabria, J. (2013). Muscular strength, flexibility and posture in the prevalence of low back pain in helicopter crew members of the Colombian National Army. Rev. Fac. Med., 6(4), 357-363. Available in: http://www.scielo.org.co/pdf/rfmun/v61n4/v61n4a4.pdf

Covarrubias, A. (2010). Low back pain: A public health problem. Pain Clinic, 33(Suppl 1), 106-109. Available in: https://www.medigraphic.com/pdfs/rma/cma-2010/cmas101y.pdf

Dada, M., Zarnowski, A., & Salazar, A. (2021). Update on low back pain in primary care. Rev.méd.sinerg, 6(8), 696. Available in: https://revistamedicasinergia.com/index.php/rms/article/view/696

Del Pozo, B., Gusi, N., Adsuar, J., Del Pozo, J., Parraca, J., & Hernandez, M. (2013). Musculoskeletal fitness and health-related quality of life characteristics among sedentary office workers affected by sub-acute, non-specific low back pain: a cross-sectional study. Physiotherapy, 99(3), 194-200. doi:10.1016/j.physio.2012.06.006

Dìas, M., & Gérvas, J. (2002). Low back pain. Family Medicine. SEMERGEN, 28(1), 21-41. Available in: https://www.sciencedirect.com/science/article/abs/pii/S1138359302744018

García, A., Martínez, N., Saturno, P., & López, F. (2015). Clinical approach to chronic low back pain: synthesis of recommendations based on evidence from existing clinical practice guidelines. An. Syst. Sanit. Navar., 38(1).117-130. https://dx.doi.org/10.4321/S1137-66272015000100012.

GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. (2018). Global, regional, and national, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet, 392(10159), 1789 –1858. doi:10.1016/S0140-6736(18)32279-7

George, A., Kumar, D., & Nikhil, N. (2013). Effectiveness of trunk proprioceptive neuromuscular facilitation training in mechanical low back pain. International Journal of Current Research, 5(7), 1965-1968. Available in: http://journalcra.com/sites/default/files/issue-pdf/Download%203707.pdf

Herdman, M., Badia, X., & Berra, S. (2002). The EuroQol-5D: a simple alternative for measuring health-related quality of life in primary care. Aten Primary, 28(6), 425-429. Available in: https://core.ac.uk/download/pdf/82225711.pdf

Hernando, J., Pérez, D., Sánchez, M., & Beltrán, H. (2021). Therapeutic exercise as a treatment for chronic spinal pain: systematic review of randomized clinical trials. Rehabilitation, 55(1), 49 - 66. doi:10.1016/j.rh.2020.06.005

Hill, K., Robinson, K., Cuchna, J., & Hoch, M. (2017). Immediate Effects of Proprioceptive Neuromuscular Facilitation Stretching Programs Compared With Passive Stretching Programs for Hamstring Flexibility: A Critically Appraised Topic. J Sport Rehabil, 26(6), 567–572. doi:10.1123/jsr.2016-0003

IESS. (2018). Statistical bulletin, General occupational risk insurance. Ecuadorian Institute of Social Security. Available in: https://www.iess.gob.ec/documents/10162/51889/Boletin_estadistico_2018_nov_dic.pdf

Jakosen, M., Sundstrup, E., Brandt, M., Jay, K., Aagaard, P., & Andersen, L. (2015). Physical exercise in the workplace prevents deterioration in work ability among healthcare workers: a cluster randomized controlled trial. BMC Public Health volume, 15(1174), e15. doi: https://doi.org/10.1186/s12889-015-2448-0

Kersten, P., White, P., & Tennant, A. (2014). Is the pain visual analogue scale linear and responsive to change? An exploration using Rasch analysis. PLoS One, 9(6), e99485. doi:10.1371/journal.pone.0099485

Kim, B., & Lee, H. (2017). Effects of proprioceptive neuromuscular facilitation-based abdominal muscle strengthening training on pulmonary function, pain, and functional disability index in chronic low back pain patients. J Exerc Rehabil, 13(3), 486–490.doi:10.12965/jer.1735030.515

Koutarapu, S., & Ghumare, D. (2022). Proprioceptive neuromuscular facilitation exercises versus lumbar stabilization exercises for chronic low back pain patients: A randomized interventional study. Indian J Occup Ther, 54(1), (23-28). doi:10.4103/ijoth.ijoth_18_21

Kovacs, F. (2005). The use of the Roland-Morris questionnaire in patients with low back pain treated in Primary Care. Family Medicine, SEMERGEN, 31(7), 333-335. doi:10.1016/S1138-3593(05)72944-0

Kovacs, F., Llobera, J., Gil Del Real, M., Abraira, V., Gestoso, M., Fernández, C., & Primaria Group, K. (2002). Validation of the Spanish version of the Roland-Morris questionnaire. Spine (Phila Pa 1976), 27(5), 538–542. doi:10.1097/00007632-200203010-00016

Llanos, C. (2020). Treatment for chronic low back pain through invasive physiotherapy in myofascial pain syndrome after high intensity exercise. Case report / Treatment for chronic low back pain through invasive physiotherapy in myofascial pain syndrome. Physiotherapy, 42(3), 157-160. Available in: https://pesquisa.bvsalud.org/portal/resource/pt/ibc-191005

Michishita, R., Jiang, Y., Ariyoshi, D., Yoshida, M., Moriyama, H., & Yamato, H. (2017). The practice of active rest by work units improves personal relationships, mental health and physical activity of workers. Journal of Occupational Health, 59(2), 122-130. doi:10.1539/joh.16-0182-OA

National Guideline Center (UK). (2016). Low Back Pain and Sciatica in Over 16s: Assessment and Management. London: National Institute for Health and Care Excellence (NICE). Available in: https://pubmed.ncbi.nlm.nih.gov/27929617/

Oliveira, M., & Dal Berto, V. &. (2004). Revalence of low back pain in seamstresses and correlation with quality of life and disability. Archives of Health Sciences of UNIPAR, 8(2), 111-119. Available in: https://ojs.revistasunipar.com.br/index.php/saude/article/view/225/198

Sánchez-Pinilla, RO (2020). What are the exercises indicated for chronic low back pain and herniated discs? FMC - Continuing Medical Education in Primary Care, 27(1), 34–46. https://doi.org/10.1016/J.FMC.2019.06.007

Santiago, C., K., P., & Castro, N. (2018). Low back pain and its relationship with the disability index in a rehabilitation hospital. Rev Cient Cienc Méd, 21(2), 13-20. Available in: http://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S1817-74332018000200003#:~:text=El%20dolor%20lumbar%20es%20uno,prevalencia%20de%20incapacity1%2C2.

Smedes, F., Heidmann, M., Schäfer, C., Fischer, N., & Stępień, A. (2016). The proprioceptive neuromuscular facilitation concept; the state of the evidence, a narrative. Physical Therapy Reviews 21, 17-31. doi:10.1080/10833196.2016.1216764

Van Vilsteren, M., Van Oostrom, S., De Vet, H., Franche, R., Boot, C., & Anema, J. (2015). Workplace interventions to prevent work disability in workers on sick leave. Cochrane Database Syst Rev, 2015(10), 10(CD006955). doi:10.1002/14651858.CD006955.pub3

Vicente, T., López, A., Ramírez, V., Capdevila, L., Terradillos, M., & Aguilar, E. (2015). Pain in workers: prevalence and intensity. Impact of sociodemographic and labor variables. Rev Asoc Esp Espec Med Trab, 24(4), 158-168. Available in: https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1132-62552015000400003

Vilchez, M., & Hernán, G. (2020). Efficacy of muscle energy techniques in musculoskeletal pain syndromes: a systematic review. Physiotherapy, 42(3), 145-156. Available in: https://pesquisa.bvsalud.org/portal/resource/pt/ibc-191004

Zambrano, C., Samaniego, G., Pesantez, M., & Granda, M. (2019). Low back pain (Lumbalgia), a disease that does not discriminate: Classification, Diagnosis and treatment. Scientific Journal World of Research and Knowledge, 3(2), 610-627. doi:10.26820/recimundo/3.(2).abril.2019.610-627

Zaworski, K., & Latosiewicz, R. (April 2021). The effectiveness of manual therapy and proprioceptive neuromuscular facilitation compared to kinesiotherapy: a four-arm randomized controlled trial. Eur J Phys Rehabil Med, 57(2), 280-287. doi:10.23736/S1973-9087.21.06344-9