

The Role of Physical Activity in Fatigue and Pain Self-Efficacy among Patients with Musculoskeletal Problems: A Comparative Study in Greece



Paraskevi Theofilou^{1,2,*}  and Efterpi Paraskevaidou¹

¹School of Social Sciences, Hellenic Open University, Patra, Greece

²Attica Region, General Directorate of Public Health and Social Welfare, Athens, Greece

Abstract:

Background: Recent studies have shown the important role of physical activity in reducing fatigue and improving self-efficacy in pain among patients with musculoskeletal problems.

Objective: The aim of this study was to investigate the relationship between physical activity, fatigue, and self-efficacy in pain among patients with musculoskeletal problems.

Methodology: For this purpose, a quantitative study was conducted on 138 patients (70 who exercised and 68 who did not exercise) with musculoskeletal problems, aged 18 years and older, in the areas of Attica. The assessment of fatigue and self-efficacy in pain was based on the Pain Self-Efficacy Questionnaire and Fatigue Assessment Scale.

Results: The results showed that patients with musculoskeletal problems reported moderate to high levels of self-efficacy in pain, without significant differences between patients who exercised and those who did not. On the contrary, patients who exercise reported significantly lower levels of overall and mental fatigue. Furthermore, increased self-efficacy was associated with reduced physical fatigue in the general patient sample, but no significant association was observed in the two patient subgroups.

Conclusion: The findings provide evidence that the role of physical activity is of great importance.

Keywords: Physical activity, Fatigue, Self-efficacy in pain, Musculoskeletal problems, Causes of disability, Sedentary lifestyle.

© 2025 The Author(s). Published by Bentham Open.

This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International Public License (CC-BY 4.0), a copy of which is available at: <https://creativecommons.org/licenses/by/4.0/legalcode>. This license permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

*Address correspondence to this author at the Hellenic Open University, School of Social Sciences, Patra, Greece and Attica Region, General Directorate of Public Health and Social Welfare, Athens, Greece; E-mail: pardrothe@gmail.com

Cite as: Theofilou P, Paraskevaidou E. The Role of Physical Activity in Fatigue and Pain Self-Efficacy among Patients with Musculoskeletal Problems: A Comparative Study in Greece. Open Public Health J, 2025; 18: e18749445426317. <http://dx.doi.org/10.2174/0118749445426317251007045309>



Received: June 30, 2025

Revised: August 26, 2025

Accepted: September 10, 2025

Published: October 14, 2025



Send Orders for Reprints to
reprints@benthamscience.net

1. INTRODUCTION

Musculoskeletal problems are considered one of the main causes of disability worldwide, affecting the ability of people with these conditions to participate in daily activities, work, or have a normal social life [1]. The World Health Organization reports that approximately 1.7 billion people worldwide suffer from musculoskeletal diseases, and they are the leading cause of health problems in 160 countries [2]. Due to population growth and aging, the percentage of people living with musculoskeletal diseases

has been increasing rapidly in recent years, prompting the scientific community to seek ways to improve the quality of life for these individuals [2, 3].

Patients with musculoskeletal problems often experience chronic pain, decreased activity, and persistent fatigue, which together create a vicious cycle. Chronic pain limits patients' physical activity, and physical inactivity (sedentary lifestyle) worsens their recovery, increasing fatigue. Furthermore, increased fatigue further reduces motivation for physical activity [4]. Assessing the

situation and how these factors interact is essential because each of these factors (pain, physical activity, and fatigue) is related to the level of functioning, psychological state, and overall quality of life of patients with musculoskeletal problems [5-7].

Physical activity is an important factor in both the prevention (in some cases) and rehabilitation of musculoskeletal problems [8]. Regular and appropriate intensity physical activity has been shown to improve muscle strength and endurance in patients with musculoskeletal problems, enhance joint flexibility, and stimulate endogenous pain control mechanisms [5, 9]. However, for many patients, participating in any form of physical activity and maintaining an exercise routine is challenging due to the nature of their illness, the levels of pain they experience, and possible other symptoms [10].

Physical activity plays an important role in the management and rehabilitation of patients with musculoskeletal problems, offering a range of physical, psychological and social benefits that overall improve the level of functioning of these patients and their quality of life [11, 12].

First, regular participation in any form of physical activity can help maintain and improve joint mobility, muscle strength, and endurance in patients with musculoskeletal problems [5]. Strengthening exercises (especially those that target the muscles surrounding the joints causing the musculoskeletal problem) can relieve pain and slow the deterioration of problems [13]. Low-intensity aerobic activities (such as walking, swimming, or cycling) enhance bone density and cardiovascular health without aggravating or straining joints. Over time, these activities help improve muscle strength and reduce the risk of secondary complications, such as osteoporosis or cardiovascular comorbidities [14, 15].

Second, physical activity activates the body's endogenous pain-regulating systems. Movement achieved through physical activity stimulates the release of endorphins that can reduce the sensation of pain, providing both immediate analgesic effects and long-term self-efficacy in pain management [16]. Regular physical activity also counteracts central sensitization (a phenomenon strongly observed in chronic musculoskeletal conditions, where the nervous system becomes hypersensitive to pain stimuli), thereby reducing overall pain intensity and the frequency of pain flare-ups [17].

Third, physical activity has significant psychological benefits. Patients with musculoskeletal problems who participate in regular physical activity programs often report reduced symptoms of anxiety and depression, improved mood, and better sleep quality [18, 19]. Furthermore, physical activity provides a sense of progress (*e.g.*, increased muscle strength or flexibility) and may enhance the self-efficacy of patients with musculoskeletal problems, motivating them to continue adopting health-promoting behaviors [20]. This is particularly important because higher self-efficacy is associated with greater adherence to rehabilitation

protocols and more successful long-term outcomes in patients with musculoskeletal problems [21].

Finally, participation in group physical activities may enhance the sense of social support and social relationships of patients with musculoskeletal problems. Interaction with patients experiencing similar problems may alleviate feelings of isolation and improve patients' well-being [22]. In summary, physical activity has significant benefits for patients with musculoskeletal problems, both on a physical level (improvement of symptoms of the disease) and on a psychological level. In short, physical activity can be an effective intervention method that alleviates pain, improves mobility, and reduces fatigue, while simultaneously enabling patients with musculoskeletal problems to regain their functionality and quality of life.

The aim of this study is to investigate the benefits of physical activity in shaping fatigue levels and pain self-efficacy in patients suffering from a musculoskeletal problem. For this purpose, a comparison was made between patients with musculoskeletal problems who participate in physical activity and patients with musculoskeletal problems who do not participate in physical activity.

Based on the literature, the following research hypotheses were defined:

- [1] HA1: Patients with musculoskeletal problems who participate in physical activity are expected to have a significantly lower level of fatigue compared to patients with musculoskeletal problems who do not participate in physical activity.
- [2] HA2: Patients with musculoskeletal problems who participate in physical activity are expected to have a significantly higher level of self-efficacy in pain compared to patients with musculoskeletal problems who do not participate in physical activity.

2. METHODS

2.1. Research Design

To investigate the role of physical activity on fatigue and self-efficacy in patients with musculoskeletal problems, a quantitative study was conducted using a sample of patients with musculoskeletal problems who exercise and those who do not. The study is based on a between-subjects research design, which allows for the investigation of the existence of differences between independent groups.

2.2. Sample

The research sample consists of 138 individuals aged 18 years and older, including both men and women, of any educational level, experiencing musculoskeletal problems. The criterion for participation in the study was that patients had experienced any musculoskeletal problem for at least one year. Exclusion criteria were defined as individuals who have been diagnosed with a mental and/or psychological illness. Individuals under 18 years of age,

individuals with serious vision problems, and individuals suffering from postoperative pain were also excluded. The sample selection was carried out through the application of the convenience sampling method. Particularly, the participants were selected in collaboration with a private orthopedic clinic in the Ilisia area of Attica and with a private physiotherapy clinic in the Ilion area of Attica. Of the 138 participants, 70 (50.7%) exercised and 68 (49.3%) did not exercise.

2.3. Psychometric Tools

Data collection was performed using a questionnaire consisting of (1) a demographic and clinical characteristics form, (2) the Pain self-efficacy questionnaire (PSEQ) [23], and (3) the Fatigue assessment scale (FAS) [24]. The demographic and clinical characteristics form aimed to record patient characteristics, such as gender, age, height, weight, BMI, marital status, level of education, general health status, years of experiencing musculoskeletal problems, receiving treatment for musculoskeletal problems, existence of surgery for musculoskeletal problems, postoperative pain, postoperative complications and existence of another health problem that affects the pain they feel or causes fatigue. The Pain Self-Efficacy Questionnaire (PSEQ) [23] is a 10-item questionnaire developed to assess the self-efficacy of patients experiencing pain or chronic pain in performing activities (while in pain). Patients are asked to rate each statement on a seven-point scale ranging from 0 ("not at all confident") to 6 ("completely confident"), producing a total score ranging from 0 to 60. Higher scores indicate greater self-efficacy in managing pain.

The PSEQ has high internal consistency (Cronbach's $\alpha = 0.92$) and high test-retest reliability over a 3-month period [23]. In addition, the total score for each participant can be categorized as: low level of self-efficacy in pain (values 0 to 11), moderate level of self-efficacy in pain (values 12 to 32), and high level of self-efficacy in pain (values 33 to 60) [25]. The present tool has been validated by Theofilou *et al.* [26].

The Fatigue Assessment Scale (FAS) [24] is a self-report scale containing 10 statements that assess symptoms of chronic fatigue. The FAS scale treats fatigue as a two-dimensional concept, assessing both physical and mental aspects of fatigue. When completing the questionnaire, patients are asked to report how often they have experienced various symptoms in the last week, using a Likert scale ranging from 1 ("never") to 5 ("always"). The total fatigue score is derived from the sum of responses to the 10 statements and ranges from 10 to 50, with higher values indicating greater levels of fatigue. It is also possible to calculate scores for two subdimensions of fatigue. Mental fatigue (sum of responses to statements 3, 6, 7, 8, and 9) is a measure of the cognitive effects of fatigue on a patient (*e.g.*, lack of motivation, problems initiating tasks, problems thinking). Physical fatigue (sum of responses to statements 1, 2, 4, 5, and 10) is a measure of the physical effects of fatigue on a patient (*e.g.*, physical exhaustion, lack of energy). Questions 4 and 10 should be reverse-coded as they are negatively worded. The FAS scale has an internal consistency of $\alpha = 0.90$ (24). Furthermore, the total score for each participant can be categorized as: low fatigue level (values 10 to 22), moderate fatigue level (values 23 to 34), and high

fatigue level (values 35 to 50). The FAS has been used within the Greek population [27].

2.4. Procedure

The questionnaires were completed by patients in collaboration with the orthopedic clinic in the Ilisia area of Attica and with the physiotherapy clinic in the Ilion area of Attica. In the first stage, the research questionnaire was posted on the Google Forms platform. Then, communication with the patients took place. The patients were approached online (*via email*) by distributing the questionnaire to their emails. In the next stage, the patients were informed about the purpose of the research with an appropriate introductory note in the electronic questionnaire. The introductory note also referred to the inclusion criteria and exclusion criteria from the study. Patients who wished to participate in the study declared their consent and then completed the electronic questionnaire. Completion of the questionnaire was anonymous and voluntary. The data collected from the process were used only for the completion of this thesis, and no one except the researchers has access to them. Permission for the data collection was taken by the directors of the clinics (the documents from 17.3.2025).

2.5. Statistical Analysis

The statistical analysis of the data was carried out in the SPSS version 25 software. In the first stage, a descriptive analysis of the socio-demographic data of the participants was carried out in order to have an image of the sample profile. Subsequently, a descriptive analysis was carried out for the total score of the questionnaires in order to capture the level of fatigue and the level of self-efficacy in pain for patients with musculoskeletal problems in the research sample. The next analysis aimed to investigate the normality of the research variables. For this purpose, the Kolmogorov-Smirnov statistical test was used. According to the Kolmogorov-Smirnov statistical test, a significant deviation of the variables from the normal distribution was recorded ($p < 0.05$). Therefore, non-parametric statistical tests were applied to the data. For the comparison between patients with musculoskeletal problems who exercise and patients with musculoskeletal problems who do not exercise, the non-parametric Mann-

Whitney test and the χ^2 independence test were applied to the data. In addition, to investigate the existence of a correlation between fatigue and self-efficacy in pain, the non-parametric Spearman correlation coefficient was calculated. The investigation of the correlation between fatigue and self-efficacy in pain was carried out in the entire sample and separately in the two groups of patients. All analyses were performed at a statistical significance level of 5%.

3. RESULTS

Table 1 presents the aggregated demographic characteristics of the sample of 138 patients with musculoskeletal problems who participated in the study. A total of 96 (69.6%) women and 42 (30.4%) men participated in the study. The data show that 61.6% ($n = 85$) of the patients were married, 26.8% ($n = 37$) were

single, and 8% (n = 11) were divorced. The results of the analysis show that 44.9% (n = 62) of the patients had a normal BMI, 37% (n = 51) were overweight, and 17.4% (n = 24) were obese. The majority of the patients were university/technical institute graduates (n = 56, 40.6%) and postgraduates (n = 38, 27.5%). A smaller percentage of patients comprised primary and secondary school graduates (n = 33, 23.9%) or PhD holders (n = 11, 8%). The results regarding the subjective health status of the patients show that 4.4% (n = 6) reported a poor or very poor level of health, 21.7% (n = 30) reported a moderate level of health, and 73.9% (n = 102) of the patients reported a good or very good level of health. Finally, the data show that 32.6% (n = 45) of the patients received treatment for musculoskeletal problems, while 50.7% (n = 70) reported exercising systematically every week.

Table 2 shows that 1.4% (n = 2) of patients had undergone surgery for musculoskeletal problems, while 30.4% (n = 42) of patients reported having another health

problem that affects the pain they feel or causes them fatigue.

Finally, Table 3 provides demographic data between patients who exercise systematically every week and patients who do not exercise systematically every week.

Table 4 presents the results of the descriptive analysis for the research variables and the results of the normality test based on the Kolmogorov-Smirnov statistical test. The results show that the mean of the scale regarding self-efficacy in pain is equal to 37.4 (SD = 17.1) and deviates significantly from the normal distribution ($p < 0.05$). The mean indicates a moderate to high level of self-efficacy in pain for patients with musculoskeletal problems. In addition, the analysis showed a moderate to low level of fatigue for patients with musculoskeletal problems (SD = 23.6, SD = 7.0), with physical fatigue (SD = 12.9, SD = 3.7) prevailing over mental fatigue (SD = 10.6, SD = 4.0). All variables related to fatigue deviate significantly from the normal distribution ($p < 0.05$).

Table 1. Sample demographics.

		N	%
Gender	Male	42	30.4%
	Female	96	69.6%
Marital status	Single	37	26.8%
	Married	85	61.6%
	Divorced	11	8.0%
	Widower(s)	5	3.6%
Body mass index	Underweight	1	0.7%
	Normal	62	44.9%
	Overweight	51	37.0%
	Obesity	24	17.4%
Level of education	Primary education	8	5.8%
	Secondary education	25	18.1%
	University	56	40.6%
	Master	38	27.5%
	Phd	11	8.0%
General health status	Very bad	3	2.2%
	Bad	3	2.2%
	Moderate	30	21.7%
	Good	77	55.8%
	Very good	25	18.1%
Are you receiving treatment for musculoskeletal problems?	Yes	45	32.6%
	No	93	67.4%
Do you exercise systematically every week?	Yes	70	50.7%
	No	68	49.3%

Table 2. Data on the percentage of patients who had surgery and the percentage of patients who had another health problem that affects the pain they feel or causes fatigue.

	Yes		No	
	N	%	N	%
Have you had surgery for your musculoskeletal problems?	2	1.4%	136	98.6%
Are you facing another health problem that affects the pain you feel or causes fatigue?	42	30.4%	96	69.6%

Table 3. Demographics between the two groups.

		Systematic exercise			
		Yes		No	
		N	%	N	%
Gender	Male	22	31.4%	20	29.4%
	Female	48	68.6%	48	70.6%
Marital status	Single	20	28.6%	17	25.0%
	Married	43	61.4%	42	61.8%
	Divorced	6	8.6%	5	7.4%
	Widower(s)	1	1.4%	4	5.9%
Level of education	Primary	1	1.4%	7	10.3%
	Secondary	10	14.3%	15	22.1%
	University	27	38.6%	29	42.6%
	Master	25	35.7%	13	19.1%
	Phd	7	10.0%	4	5.9%
Body mass index	Underweight	0	0.0%	1	1.5%
	Normal	32	45.7%	30	44.1%
	Overweight	24	34.3%	27	39.7%
	Obesity	14	20.0%	10	14.7%
General health status	Very bad	3	4.3%	0	0.0%
	Bad	2	2.9%	1	1.5%
	Moderate	9	12.9%	21	30.9%
	Good	40	57.1%	37	54.4%
	Very good	16	22.9%	9	13.2%
Treatment for musculoskeletal problems	Yes	24	34.3%	21	30.9%
	No	46	65.7%	47	69.1%
Surgery for musculoskeletal problems	Yes	0	0.0%	2	2.9%
	No	70	100%	66	97.1%
Another health problem	Yes	21	30.0%	21	30.9%
	No	49	70.0%	47	69.1%

Table 4. Descriptive analysis results for research variables and regularity check.

	M	SD	Min	Max	p
Self-efficacy in pain	37.4	17.1	0.0	60.0	<0.05
Fatigue	23.6	7.0	10.0	42.0	<0.05
Mental fatigue	10.6	4.0	5.0	25.0	<0.05
Physical fatigue	12.9	3.7	5.0	22.0	<0.05

$p = p$ -value Kolmogorov Smirnov test.

Table 5 presents the results of the analysis for the categorization of the levels of fatigue and self-efficacy in pain in all patients. The analysis showed that 60.1% ($n = 83$) of the patients have a high level of self-efficacy in pain,

and 33.3% ($n = 46$) have a moderate level of self-efficacy in pain. In addition, it appears that 41.3% ($n = 57$) of the patients have a low level of fatigue, and 53.6% ($n = 74$) of the patients have a moderate level of fatigue.

Table 5. Levels of fatigue and self-efficacy in pain in all patients.

		N	%
Self-efficacy in pain	Low level	9	6.5%
	Medium level	46	33.3%
	High level	83	60.1%
Fatigue	Low level	57	41.3%
	Medium level	74	53.6%
	High level	7	5.1%

The results of the comparisons of fatigue and self-efficacy in pain in relation to systematic physical activity of patients with musculoskeletal problems are given below. The Mann-Whitney test revealed a statistically significant difference between patients with musculoskeletal problems who exercise and patients with musculoskeletal problems who do not exercise in total fatigue ($U = 1842.5$, $p = 0.022$) and mental fatigue ($U = 1861.0$, $p = 0.026$). On the contrary, no statistically significant difference was recorded between patients with musculoskeletal problems who exercise and patients with musculoskeletal problems who do not exercise in the level of self-efficacy in pain ($U = 2137.0$, $p = 0.300$). Table 6 shows that patients with musculoskeletal problems who exercise ($M = 22.2$, $SD = 6.4$) report significantly lower levels of fatigue compared to patients with musculoskeletal problems who do not exercise ($M = 25.0$, $SD = 7.3$). Similarly, patients with musculoskeletal problems who exercise ($M = 9.8$, $SD = 3.4$) report significantly lower levels of mental fatigue compared to patients with musculoskeletal problems who do not exercise ($M = 11.5$, $SD = 4.4$).

Table 7 presents the findings of the analysis based on the χ^2 independence test for the level of fatigue and self-efficacy regarding exercise. The analysis showed a significant dependence between the level of fatigue and

exercise ($\chi^2 = 5.883$, $p = 0.043$) while no significant dependence was recorded between the level of self-efficacy in pain and exercise ($\chi^2 = 1.455$, $p = 0.483$). The analysis shows that of all patients with musculoskeletal problems who exercise, 48.6% report a low level of fatigue, 50% report a moderate level of fatigue, and 1.4% report a high level of fatigue. Accordingly, of all patients with musculoskeletal problems who do not exercise, 33.8% report a low level of fatigue, 57.4% report a moderate level of fatigue, and 8.8% report a high level of fatigue.

The next analysis was performed to examine the association between self-efficacy in pain and fatigue in the entire sample of patients as well as in the two subgroups of patients. The analysis was based on the non-parametric Spearman's rho correlation coefficient. The results of Table 8 shows that self-efficacy in pain is not significantly related to the overall level of fatigue ($\rho = -0.135$, $p = 0.114$) and the level of mental fatigue ($r = -0.073$, $p = 0.349$) in the entire sample of patients. On the contrary, a statistically significant negative correlation is recorded between self-efficacy in pain and physical fatigue ($\rho = -0.192$, $p = 0.024$). These findings indicate that in the entire sample of patients with musculoskeletal problems, an increase in self-efficacy in pain is associated with a decrease in physical fatigue.

Table 6. Comparison of fatigue and self-efficacy in pain in terms of physical activity of patients with musculoskeletal disorders: Mann-Whitney criterion findings.

-	Exercise				U	p
	Yes		No			
	M	SD	M	SD		
Self-efficacy in pain	39.0	17.2	35.7	16.9	2137.0	0.300
Fatigue	22.2	6.4	25.0	7.3	1842.5	0.022
Mental fatigue	9.8	3.4	11.5	4.4	1861.0	0.026
Physical fatigue	12.4	3.5	13.5	3.8	1921.5	0.050

Table 7. Level of fatigue and self-efficacy in relation to exercise: Independence control findings χ^2 .

-		Exercise				x ²	p
		Yes		No			
		N	%	N	%		
Self-efficacy in pain	Low level	5	7.1%	4	5.9%	1.455	0.483
	Medium level	20	28.6%	26	38.2%		
	High level	45	64.3%	38	55.9%		
Fatigue	Low level	34	48.6%	23	33.8%	5.883	0.043
	Medium level	35	50.0%	39	57.4%		
	High level	1	1.4%	6	8.8%		

Table 8. Association of self-efficacy in pain and fatigue in the whole patient sample: Spearman Rho coefficient findings.

-	-	Self-efficacy in pain	Fatigue	Mental fatigue	Physical fatigue
Self-efficacy in pain	Rho	1.000	-0.135	-0.073	-0.192*
	p	-	0.114	0.394	0.024
	N	138	138	138	138
Fatigue	Rho	-0.135	1.000	0.924**	0.911**
	p	0.114	-	0.000	0.000
	N	138	138	138	138
Mental fatigue	Rho	-0.073	0.924**	1.000	0.700**
	p	0.394	0.000	-	0.000
	N	138	138	138	138
Physical fatigue	Rho	-0.192*	0.911**	0.700**	1.000
	p	0.024	0.000	0.000	-
	N	138	138	138	138

Table 9 presents the results for the correlation between self-efficacy in pain and fatigue in all patients who exercise. The analysis showed that for patients who exercise, there is no statistically significant correlation with the total level of fatigue ($\rho = -0.124$, $p = 0.306$), with the level of mental fatigue ($r = -0.031$, $p = 0.799$), and with the level of physical fatigue ($r = -0.214$, $p = 0.075$).

Table 10 presents the results for the correlation between self-efficacy in pain and fatigue in all patients who do not exercise. The analysis showed that for patients who do not exercise, there is no statistically significant correlation with the total level of fatigue ($\rho = -0.116$, $p = 0.346$), with the level of mental fatigue ($r = -0.068$, $p = 0.582$), and with the level of physical fatigue ($r = -0.131$, $p = 0.286$).

Table 9. Association of self-efficacy in pain and fatigue in all patients who exercise: Findings of the Spearman Rho coefficient.

-	-	Self-efficacy in pain	Fatigue	Mental fatigue	Physical fatigue
Self-efficacy in pain	Rho	1.000	-0.124	-0.031	-0.214
	p	-	0.305	0.799	0.075
	N	70	70	70	70
Fatigue	Rho	-0.124	1.000	0.922**	0.932**
	p	0.305	-	0.000	0.000
	N	70	70	70	70
Mental fatigue	Rho	-0.031	0.922**	1.000	0.733**
	p	0.799	0.000	-	0.000
	N	70	70	70	70
Physical fatigue	Rho	-0.214	0.932**	0.733**	1.000
	p	0.075	0.000	0.000	-
	N	70	70	70	70

Table 10. Association of self-efficacy in pain and fatigue in all patients who do not exercise: Findings of the Spearman Rho coefficient.

-	-	Self-efficacy in pain	Fatigue	Mental fatigue	Physical fatigue
Self-efficacy in pain	Rho	1.000	-0.116	-0.068	-0.131
	p	-	0.346	0.582	0.286
	N	68	68	68	68
Fatigue	Rho	-0.116	1.000	0.919**	0.880**
	p	0.346	-	0.000	0.000
	N	68	68	68	68
Mental fatigue	Rho	-0.068	0.919**	1.000	0.648**
	p	0.582	0.000	-	0.000
	N	68	68	68	68

(Table 10) contd.....

-	-	Self-efficacy in pain	Fatigue	Mental fatigue	Physical fatigue
Physical fatigue	Rho	-0.131	0.880**	0.648**	1.000
	p	0.286	0.000	0.000	-
	N	68	68	68	68

4. DISCUSSION

The results of the present study indicate that patients with musculoskeletal problems generally exhibit moderate to high levels of self-efficacy in pain. This observation is consistent with the theoretical framework of Bandura [28], and other studies that have used it, according to which individuals who face chronic problems (such as chronic pain) develop those limitations that are necessary to manage adverse situations for them [29, 30]. However, despite the relatively high level of self-efficacy in pain, no statistically significant difference in self-efficacy was found between patients who exercise systematically and those who do not exercise systematically, which may indicate that physical activity alone is not sufficient to further enhance patients' self-efficacy in the face of pain, if it is not accompanied by comprehensive education and psychosocial support programs [20, 31].

Regarding fatigue, the results showed that in general, patients with musculoskeletal problems experience moderate to low levels of fatigue overall, with physical fatigue prevailing over mental fatigue. These findings are consistent with studies that report musculoskeletal problems are primarily associated with physical symptoms of fatigue, as these problems lead to muscle dysfunction, which in turn causes long-term physical symptoms [32, 33]. An important finding of the study was that patients who exercise systematically show significantly lower levels of overall and mental fatigue compared to those who do not exercise systematically. This relationship is supported by the literature, as studies have reported that regular exercise, even of low or moderate intensity, contributes to reducing fatigue by improving the cardiorespiratory system and reducing inflammation [5, 34]. Furthermore, physical activity appears to have a beneficial effect on individuals' mental health, reducing symptoms of anxiety and depression, which contribute to mental fatigue [13].

The lack of association between pain self-efficacy and fatigue levels in both the exercising and non-exercising patient groups suggests that pain self-efficacy and fatigue interact differently with physical activity. While exercise clearly improves fatigue, self-efficacy appears to be more influenced by psychosocial factors, such as education, information on pain management, and social support [31].

Health professionals and physiotherapists can design individualized physical activity programs that emphasize aerobic and strengthening exercises, focusing on endurance and a gradual increase in physical functionality, to help patients with fatigue problems and improve their daily lives. At the same time, it would be useful for health professionals to be able to improve the self-efficacy in pain of patients with musculoskeletal problems through appropriate information or interventions. Improving self-efficacy in pain could be

improved through pain management seminars, relaxation techniques, and self-care instructions, especially in patients with low educational levels or burdened health status. Similarly, seeking support in self-help groups or using digital tools to monitor patient progress (*e.g.*, telemedicine) can enhance a patient's sense of control over pain.

5. STUDY LIMITATIONS

The research conducted has some important limitations that should be considered. First, the design was cross-sectional; therefore, it does not allow conclusions about causal relationships between physical activity, self-efficacy in pain, and fatigue. Second, the sampling choice, made through collaboration with specific medical practices and physical therapy centers, limits the generalizability of the results, as patients from different regions (*e.g.*, rural areas) or treatment centers were not included. Third, the assessment of physical activity was based solely on a question without the use of a scale to measure the intensity or type of physical activity. In addition, more specific forms of physical activity (*e.g.*, aerobic versus strength training) or other demographic factors were not investigated, which limits the depth of investigation into the relationship between exercise, fatigue, and self-efficacy in pain.

CONCLUSION

The findings underscore the importance of incorporating physical activity programs into intervention strategies to alleviate fatigue in patients with musculoskeletal diseases or those experiencing musculoskeletal pain.

To strengthen the findings of this thesis, future research should adopt other types of designs (*e.g.*, longitudinal or experimental designs), with the aim of investigating causal relationships between physical activity, fatigue, and self-efficacy in pain. In addition, it is necessary to use objective measurements of physical activity (*e.g.*, using portable accelerometers) in order to limit the biases resulting from the use of self-report tools. Furthermore, it would be useful to study how different types of physical activity and different intensities of physical activity, or demographic factors, affect fatigue and self-efficacy in pain. Similarly, future research should investigate the effect of psychosocial factors, such as social support and mental health, to evaluate the set of parameters and factors that shape patients' fatigue and their self-efficacy in managing pain. Finally, it would be useful to develop and evaluate structured interventions that combine patient education in pain management with exercise programs, evaluating their effectiveness in terms of improving self-efficacy and reducing fatigue.

AUTHORS' CONTRIBUTIONS

The authors confirm their contributions to the paper as follows: Investigation: EP; writing - original draft preparation: PT. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

PSEQ = Pain Self-efficacy Questionnaire

FAS = Fatigue Assessment Scale

ETHICAL STATEMENT

Permission for the data collection was taken by the directors of the clinics (the documents from 17.3.2025). All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all subjects involved in the study.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The authors confirm that the data supporting the findings of this research are available within the article.

FUNDING

None.

CONFLICT OF INTEREST

Dr. Paraskevi Theofilou is the Co - editor in Chief of the Open Public Health Journal.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

- [1] Chang YF, Yeh CM, Huang SL, *et al.* Work ability and quality of life in patients with work-related musculoskeletal disorders. *Int J Environ Res Public Health* 2020; 17(9): 3310. <http://dx.doi.org/10.3390/ijerph17093310> PMID: 32397534
- [2] Musculoskeletal health. 2022. Available from: <https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions>
- [3] Vega-Fernández G, Olave E, Lizana PA. Musculoskeletal disorders and quality of life in Chilean teachers: A cross-sectional study. *Front Public Health* 2022; 10: 810036. <http://dx.doi.org/10.3389/fpubh.2022.810036> PMID: 35425737
- [4] Kalin AS, Aytur YK. Physical activity levels of individuals with chronic musculoskeletal disorders: Their relationship with barriers and facilitators. *Musculoskelet Care* 2023; 21(3): 797-805. <http://dx.doi.org/10.1002/msc.1754> PMID: 36876649
- [5] De la Corte-Rodriguez H, Roman-Belmonte JM, Resino-Luis C, Madrid-Gonzalez J, Rodriguez-Merchan EC. The role of physical exercise in chronic musculoskeletal pain: Best medicine—A narrative review. *Healthcare* 2024; 12(2): 242. <http://dx.doi.org/10.3390/healthcare12020242> PMID: 38255129
- [6] Diaz AJ, Rosety MA, Armario JC, *et al.* Regular exercise improved fatigue and musculoskeletal pain in young adult psoriatic patients without psoriatic arthritis. *Nutrients* 2023; 15(21): 4563. <http://dx.doi.org/10.3390/nu15214563> PMID: 37960216
- [7] Garnaes KK, Mørkved S, Salvessen Ø, *et al.* What factors are associated with health-related quality of life among patients with chronic musculoskeletal pain? A cross-sectional study in primary health care. *BMC Musculoskelet Disord* 2021; 22(1): 102. <http://dx.doi.org/10.1186/s12891-020-03914-x> PMID: 33482782
- [8] Cento AS, Leigheb M, Caretti G, Penna F. Exercise and exercise mimetics for the treatment of musculoskeletal disorders. *Curr Osteoporos Rep* 2022; 20(5): 249-59. <http://dx.doi.org/10.1007/s11914-022-00739-6> PMID: 35881303
- [9] Rhim HC, Tenforde A, Mohr L, *et al.* Association between physical activity and musculoskeletal pain: An analysis of international data from the ASAP survey. *BMJ Open* 2022; 12(9): 059525. <http://dx.doi.org/10.1136/bmjopen-2021-059525> PMID: 36123076
- [10] Lima LV, Abner TSS, Sluka KA. Does exercise increase or decrease pain? Central mechanisms underlying these two phenomena. *J Physiol* 2017; 595(13): 4141-50. <http://dx.doi.org/10.1113/jp273355> PMID: 28369946
- [11] Alseminy MAMM, Chandrasekaran B, Bairapareddy KC. Association of physical activity and quality of life with work-related musculoskeletal disorders in the UAE young adults. *Healthcare* 2022; 10(4): 625. <http://dx.doi.org/10.3390/healthcare10040625> PMID: 35455803
- [12] Molinero O, Salguero A, Márquez S. Perceived health, depression and psychological well-being in older adults: Physical activity and osteoarticular disease. *Sustainability* 2021; 13(15): 8157. <http://dx.doi.org/10.3390/su13158157>
- [13] Eisele A, Schagg D, Krämer LV, Bengel J, Göhner W. Behaviour change techniques applied in interventions to enhance physical activity adherence in patients with chronic musculoskeletal conditions: A systematic review and meta-analysis. *Patient Educ Couns* 2019; 102(1): 25-36. <http://dx.doi.org/10.1016/j.pec.2018.09.018> PMID: 30279029
- [14] Curtis GL, Chughtai M, Khlopas A, *et al.* Impact of physical activity in cardiovascular and musculoskeletal health: Can motion be medicine? *J Clin Med Res* 2017; 9(5): 375-81. <http://dx.doi.org/10.14740/jocmr3001w> PMID: 28392856
- [15] Moreira-Silva I, Teixeira PM, Santos R, Abreu S, Moreira C, Mota J. The effects of workplace physical activity programs on musculoskeletal pain. *Workplace Health Saf* 2016; 64(5): 210-22. <http://dx.doi.org/10.1177/2165079916629688> PMID: 27147634
- [16] Pangkahila EA, Adiputra N, Pangkahila W, Yasa IWPS. Balanced physical exercise increase physical fitness, optimize endorphin levels, and decrease malondialdehyde levels. *Bali Med J* 2016; 5(3): 145. <http://dx.doi.org/10.15562/bmj.v5i3.337>
- [17] Zheng X, Reneman MF, Preuper RHRS, Otten E, Lamothe CJC. Relationship between physical activity and central sensitization in chronic low back pain: Insights from machine learning. *Comput Methods Programs Biomed* 2023; 232: 107432. <http://dx.doi.org/10.1016/j.cmpb.2023.107432> PMID: 36868164
- [18] Rowley N, Mann S, Steele J, Horton E, Jimenez A. The effects of exercise referral schemes in the United Kingdom in those with cardiovascular, mental health, and musculoskeletal disorders: A preliminary systematic review. *BMC Public Health* 2018; 18(1): 949. <http://dx.doi.org/10.1186/s12889-018-5868-9> PMID: 30068338
- [19] Sivas F, Moran M, Yurdakul F, Ulucaköy Koçak R, Başkan B, Bodur H. Physical activity, musculoskeletal disorders, sleep, depression, and quality of life before and after bariatric surgery. *Turk J Phys Med Rehabil* 2020; 66(3): 281-90. <http://dx.doi.org/10.5606/tftrd.2020.3694> PMID: 33089084
- [20] Elbers S, Wittink H, Pool JJM, Smeets RJEM. The effectiveness of generic self-management interventions for patients with chronic musculoskeletal pain on physical function, self-efficacy, pain intensity and physical activity: A systematic review and meta-analysis. *Eur J Pain* 2018; 22(9): 1577-96. <http://dx.doi.org/10.1002/ejp.1253> PMID: 29845678

- [21] Martinez-Calderon J, Zamora-Campos C, Navarro-Ledesma S, Luque-Suarez A. The role of self-efficacy on the prognosis of chronic musculoskeletal pain: A systematic review. *J Pain* 2018; 19(1): 10-34.
<http://dx.doi.org/10.1016/j.jpain.2017.08.008> PMID: 28939015
- [22] Nicolson PJA, Williamson E, Morris A, *et al.* Musculoskeletal pain and loneliness, social support and social engagement among older adults: Analysis of the Oxford Pain, Activity and Lifestyle cohort. *Musculoskelet Care* 2021; 19(3): 269-77.
<http://dx.doi.org/10.1002/msc.1526> PMID: 33201582
- [23] Nicholas MK. The pain self-efficacy questionnaire: Taking pain into account. *Eur J Pain* 2007; 11(2): 153-63.
<http://dx.doi.org/10.1016/j.ejpain.2005.12.008> PMID: 16446108
- [24] Michielsen HJ, De Vries J, Van Heck GL. Psychometric qualities of a brief self-rated fatigue measure. *J Psychosom Res* 2003; 54(4): 345-52.
[http://dx.doi.org/10.1016/S0022-3999\(02\)00392-6](http://dx.doi.org/10.1016/S0022-3999(02)00392-6) PMID: 12670612
- [25] Bishay F, Tippin GK, Fransson A, Hapidou eg. Establishing cut-offs for the Pain Self-Efficacy Questionnaire for people living with chronic pain. *J Mil Veteran Fam Health* 2023; 9(4): 50-62.
<http://dx.doi.org/10.3138/jmvfh-2022-0076>
- [26] Theofilou P, Aroni A, Tsironi M, *et al.* Reliability of the greek version of the pain self-efficacy questionnaire in patients with chronic kidney disease. *J Nurs* 2014; 53(2): 175-84.
- [27] Zyga S, Alikari V, Sachlas A, *et al.* Assessment of fatigue in end stage renal disease patients undergoing hemodialysis: Prevalence and associated factors. *Med Arh* 2015; 69(6): 376-80.
<http://dx.doi.org/10.5455/medarh.2015.69.376-380> PMID: 26843728
- [28] Bandura A, Freeman WH, Lightsey R. Self-Efficacy: The exercise of control. *J Cogn Psychother* 1999; 13(2): 158-66.
<http://dx.doi.org/10.1891/0889-8391.13.2.158>
- [29] Anger J, Lee U, Ackerman AL, *et al.* Recurrent Uncomplicated urinary tract infections in Women: AUA/CUA/SUFU guideline. *J Urol* 2019; 202(2): 282-9.
<http://dx.doi.org/10.1097/JU.0000000000000296> PMID: 31042112
- [30] Kardash L, Wall CL, Flack M, Searle A. The role of pain self-efficacy and pain catastrophising in the relationship between chronic pain and depression: A moderated mediation model. *PLoS One* 2024; 19(5): 0303775.
<http://dx.doi.org/10.1371/journal.pone.0303775> PMID: 38781197
- [31] Lorig KR, Sobel DS, Ritter PL, Laurent D, Hobbs M. Effect of a self-management program on patients with chronic disease. *Eff Clin Pract* 2001; 4(6): 256-62.
PMID: 11769298
- [32] Beckers E, Hermans K, Van Tubergen A, Boonen A. Fatigue in patients with rheumatic and musculoskeletal diseases: A scoping review on definitions, measurement instruments, determinants, consequences and interventions. *RMD Open* 2023; 9(3): 003056.
<http://dx.doi.org/10.1136/rmdopen-2023-003056> PMID: 37541741
- [33] Daneshmandi H, Choobineh AR, Ghaem H, Alhamd M, Fakherpour A. The effect of musculoskeletal problems on fatigue and productivity of office personnel: A cross-sectional study. *J Prev Med Hyg* 2017; 58(3): E252-8.
PMID: 29123372
- [34] Pinckard K, Baskin KK, Stanford KI. Effects of exercise to improve cardiovascular health. *Front Cardiovasc Med* 2019; 6: 69.
<http://dx.doi.org/10.3389/fcvm.2019.00069> PMID: 31214598