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Pain intensity, fear of movement, and fear of falling in earthquake survivors in Turkiye: a cross-sectional observational study

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ABSTRACT

Aims: On February 6, 2023, devastating earthquakes struck 11 provinces in Turkiye, leading to significant physical and psychological consequences for survivors. This study aimed to determine the frequency of pain intensity, fear of movement, and fear of falling among earthquake survivors and to examine their relationships with each other, as well as with psychological resilience and physical activity level.

Methods: This observational, cross-sectional study included 184 survivors (93 males-91 females; mean age: 34.02±10.76 years) with no pre-earthquake pain or physical trauma. Pain intensity, fear of movement, fear of falling, physical activity level, and psychological resilience were assessed using the 'Numerical Pain Scale', 'Causes of Fear of Movement Scale', 'Modified Falls Efficacy Scale', 'Short Form of the International Physical Activity Questionnaire', and 'Connor-Davidson Resilience Scale', respectively between May 02/2023 and July 30/2023. Pearson correlation analysis was performed to examine associations between these parameters.

Results: 46.7% of participants had fear of movement, 33.2% had fear of falling, and 37.7-50.5% experienced moderate to severe pain. Fear of movement was significantly associated with pain intensity, including headache (r=0.275, p<0.001), neck pain (r=0.294, p<0.001), upper back pain (r=0.262, p<0.001), and low back pain (r=0.284, p<0.001). Similarly, fear of falling (higher scores indicate lower fear) was positively associated with pain intensity, including headache (r=0.202, p=0.006), neck pain (r=0.179, p=0.015), upper back pain (r=0.191, p=0.010), and low back pain (r=0.282, p<0.001). Both fear of movement (r=-0.243, p=0.001) and fear of falling (r=0.220, p=0.003) were significantly associated with psychological resilience, while neither was correlated with physical activity level (p>0.05).

Conclusion: Fear of movement, fear of falling, and pain intensity are prevalent among survivors who had no prior pain and did not sustain physical trauma during the disaster. These factors are closely interrelated, independent of physical activity level. Psychological resilience plays a critical role in fear-related responses. These findings highlight the need for post-disaster rehabilitation strategies that address pain intensity, fear-related responses while considering psychological resilience.

Keywords: Earthquakes, pain, kinesiophobia, falling, psychological resilience

INTRODUCTION

On February 6th, 2023, earthquakes measuring 7.7 and 7.6 Mw. on the Richter Scale struck Kahramanmaraş in Turkiye at 04:17 A.M. and 13:24 P.M., respectively. The earthquakes resulted in considerable damage and fatalities affecting 11 provinces, including Kahramanmaraş, Hatay, Gaziantep, Osmaniye, Malatya, Adana, Diyarbakır, Elazığ, Şanlıurfa, Adıyaman and Kilis.[1] Beyond the immediate destruction, these types of major earthquakes also may increase the risk of mental and emotional disorders, including anxiety disorders,[2,3] sleep disorders[4,5] and post-traumatic stress disorder[2,6-8] as well as physical and biological complaints such as sensory and neurological disturbances.[9-16]

In a previous study analyzing pain severity, pain type, and treatment efficacy after an earthquake, hit the Abruzzi region of central Italy, one-third of the patients reported pain, and 58.8% of those reporting pain described it as severe.[17] In a study conducted in 2020, the relationship between newly-onset low back pain and preexisting musculoskeletal pain in other body regions was examined in 1,782 survivors of the Great East Japan Earthquake. During the post-disaster recovery period, the incidence of newly-onset low back pain was found to be 14.1%, and preexisting musculoskeletal pain in other body regions was identified as a related factor.[18] In 2024, post-earthquake low back and neck disability were examined

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in 291 individuals affected by the Kahramanmaraş-centered earthquakes. It was determined that 30% of the individuals had mild to moderate low back disability, while 60% had mild to moderate neck disability.[19] Although increased pain severity following earthquakes is frequently encountered, the number of studies on this topic remains limited, highlighting the need for further research.

In addition to musculoskeletal pain, earthquakes can also trigger post-earthquake dizziness syndrome,[20] and postural disorders. In a previous review study conducted in 2021, the results showed that the prevalence of balance disorders increased significantly after the major earthquakes when compared to before the earthquakes.[14] Exposure to major earthquakes and aftershocks has been shown to cause post-earthquake balance disorders by causing sensory conflicts mediated by vestibular dysfunction and/or psychological factors. In addition, that study[14] stated that this increase in the prevalence of balance disorders may also be caused by psychological factors, which is consistent with previous studies in the literature.[15,16]

The mechanisms of equilibrium dysfunction are likely to be explained by the sensory conflict theory/postural instability theory.[21,22] The basic pathology of equilibrium dysfunction is attributed to disruption of interplay between vestibular, neurological, visual and proprioceptive functions of the human body.[15] Psychological stress and maladaptive visual/somatosensory inputs caused by the earthquake may cause changes in the sense of movement, which is an important component of proprioception sense. Moreover, disruptions in the vestibular system may trigger the fear of falling, leading to decreases in physical activity capacity.

Although some previous studies reported the presence of dizziness or equilibrium disorders,[9-11,14] in survivors after the earthquake, only one study investigated the fear of movement and fear of falling.[23] In this study published in 2025, individuals affected by the Kahramanmaraş earthquake were evaluated in terms of fear of falling, balance, and fear of movement; increased age and post-traumatic stress were found to be significantly associated with fear of falling. However, this study did not address participants' physical activity levels and pain intensity.

Considering Turkiye's geographical location in a high-risk seismic zone, assessing the prevalence of increased pain severity, fear of movement, and fear of falling in earthquake-exposed individuals-along with their physical activity levels and psychological resilience-would provide valuable insights into post-earthquake disaster management by examining their interrelationships.

The present study aimed to investigate the relationships between pain intensity, fear of movement, and fear of falling in earthquake survivors without physical trauma. Additionally, we aimed to examine how these variables are associated with psychological resilience and physical activity levels. Our findings contribute to the literature by examining the interaction between pain intensity, fear of movement, and fear of falling in earthquake survivors without physical trauma, a topic that remains insufficiently explored. By adopting a multidimensional perspective that incorporates both physical and psychological aspects, this study provides new insights into post-earthquake functional impairments and supports the development of interventions aimed at facilitating the recovery process for affected individuals.

Furthermore, identifying the interaction between physical and psychological factors will enable the development of effective rehabilitation strategies for earthquake survivors without physical trauma and help shape evidence-based interventions aimed at improving long-term quality of life.

METHODS

Design of the Study

This observational and cross-sectional study received ethical approval from the Atılım University Rectorate Human Researches Ethics Committee (Date: 02.05.2023, Decision No: 604.01.02-60355), and was registered with ClinicalTrials.gov [NCT05881499]. The study was conducted per the principles stated in the Declaration of Helsinki. The participants who voluntarily agree to participate were included after obtaining written consent.

Participants

The study included 184 individuals between the ages of 18-63 who experienced the Kahramanmaraş-centered earthquakes (Adana, Adıyaman, Diyarbakır, Elazığ, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Osmaniye, and Şanlıurfa) and continued to live in the above-mentioned 11 provinces.

The inclusion criteria were determined as being between the ages of 18 and 65 and having experienced the Kahramanmaraş-centered earthquakes. Exclusion criteria were as follows: the presence of pain before earthquake; the presence of physical trauma during or after earthquake, the presence of any disease that may cause falls and balance impairment or fear of movement (e.g., hemiplegia, major organ dysfunction); using any medication that may cause balance disorder (e.g., psychotropic drugs); history of severe psychiatric disorder diagnosed before the earthquake; and history of balance disorder diagnosed before the earthquake (e.g., benign paroxysmal positional vertigo) having missing responses in questionnaires, inability to cooperate and illiteracy.

Finally, a total of 184 earthquake survivors (93 males, 91 females; median age: 34.09±10.62 years; range, 18 to 63 years) were included in the study.

The flow chart was shown in **Figure**.

Data Collection

The data was gathered through local authorities at aid points in earthquake-affected cities and collected via an online survey between May and July 2023. Researchers distributed the questionnaire through social media platforms (WhatsApp, Instagram, Facebook), encouraging respondents to share it with others who had experienced the earthquake. At the beginning of the online questionnaire sent to the individuals, they expressed whether they wanted to participate in the study or not. Thus, their consent was obtained. To assess whether

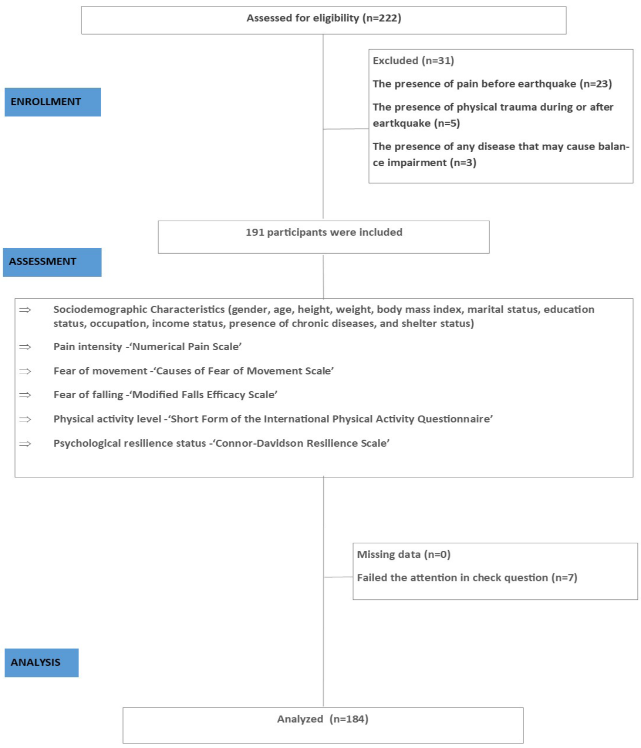

Figure. Flow chart

participants were answering the questions thoughtfully, the statement 'This question has been included to evaluate your level of attention; please select option C.' was inserted among the questions. Participants who did not select option C for this question were excluded from the study.

Sociodemographic characteristics: The sociodemographic characteristics of the participants, including gender, age, height, weight, body-mass index (BMI), marital status, education status, occupation, income status (income-expenditure relationship), presence of chronic diseases, and shelter status were recorded in a descriptive manner.

Assessment of the intensity of pain: Pain intensity was assessed using a 10 cm Numerical Pain Scale (NPS), where 0 indicated "no pain" and 10 represented "the worst pain imaginable."[24] Participants were asked to mark the level of pain they experienced on this scale, which was used to quantify their perceived pain severity. Prior to completing the questionnaire, participants were provided with a written explanation of the scale, ensuring they understood how to rate their pain. Additionally, a visual representation of the scale was included in the online form to maintain consistency in responses.

Assessment of the fear of movement: The fear of movement was assessed using the Turkish version of the Causes of Fear of Movement Scale.[25] This questionnaire, developed by Janusz Kocjan et al.[26] in 2014, consists of 20 questions and aims to diagnose and identify the causes of motor inactivity. The questionnaire is divided into two parts, biological and psychological, to determine the reasons for the fear of movement. This structure enables the identification of individual causes of fear of movement and the determination of biological and psychological causes separately. The total score obtained from the questionnaire is calculated as the average of the scores obtained from the biological and physiological sub-dimensions. In the updated version from 2018,[25] the total score ranges from 0 to 5. The scale uses a 5-point Likert scoring system (1: I totally disagree, 5: I totally agree). It has a minimum score of 0 and a maximum score of 200, with higher scores indicating greater fear of movement.

Assessment of the fear of falling: The Modified Falls Efficacy Scale (MFES) with 14 items (10 indoor and 4 outdoor activities) was used to assess fear of falling. It evaluates participants' confidence during different daily tasks and is a reliable and valid scale for estimating balance and mobility problems. The scale includes items scored between 0 (not confident) and 10 (completely confident) to assess participants' self-efficacy levels regarding falling.[27] The Turkish version developed by Çetişli-Korkmaz et al.[28] will be used in this study. Total the ratings (possible range=0-140) and divide by 14 to get each subject's MFES score. Scores of <8 indicate fear of falling. Higher scores reflect more confidence, less fear of falling. Lower scores reflect less confidence and more fear of falling.

Assessment of the physical activity level: It was assessed with the short form of the International Physical Activity Questionnaire.[29] The Turkish version of this questionnaire, was conducted by Öztürk et al.[31] The criterion in the questionnaire is that physical activities are performed for at least 10 minutes at a time. In the last 7 days with the survey; duration of vigorous physical activity, duration of moderate physical activity, walking and sitting for one day are questioned. The total physical activity score (MET-min/week) is calculated by converting vigorous, moderate activity and walking times to MET (1 MET=3.5 ml/kg/min) corresponding to the basal metabolic rate with the following calculations.

Psychological resilience status: Psychological Resilience Status was assessed using the Connor-Davidson Resilience Scale (CD-RISC-25).[31,32] It consists of 25 questions and three sub-dimensions, namely perseverance and personal competence, tolerance for negative events and spiritual tendency. The first sub-dimension, 'perseverance and personal competence,' has a maximum score of 60, the second sub-dimension, 'tolerance for negative events,' has a maximum score of 24, and the third sub-dimension, 'spiritual tendency,' has a maximum score of 16. The scale uses a 5-point Likert-type scoring system, ranging from 0-4 points, with "never true" (0 points) to "almost always true" (4 points) as response options. There is no cut-off point on the scale, and the highest possible score is 100 points, indicating a higher level of psychological resilience as the score increases.

Sample Size Calculation

The required sample size was calculated using G*Power software (Faul, Erdfelder, Lang, and Buchner, 2007) to determine the achieved statistical power for the correlation analysis of fear of movement with other variables. The correlation coefficient (r=0.242) obtained in the study was entered into the analysis with an α error probability of 0.05 and a total sample size of 184. In the post hoc power analysis, the two-tailed test revealed an achieved power (1-β) of 0.91, indicating that the study had sufficient power to detect a significant correlation. These results suggest that the sample size was adequate to examine the relationships between fear of movement and related factors with a high probability of correctly identifying true effects.

Statistical Analysis

The statistical analyses were conducted using IBM SPSS Statistics (Version 23.0, Armonk, NY: IBM Corp.). The unit of analysis was the group. As analyses were conducted at the group level, no further adjustments were needed. Descriptive statistics of categorical variables were presented as numbers and percentages, while numerical variables were reported as means, standard deviations, and confidence intervals.

The distribution of the data was assessed using skewness-kurtosis values, histograms, and Q-Q plots. Skewness and kurtosis coefficients were considered within the acceptable range of -1 to +1, indicating a normal distribution.[33] Since the data were normally distributed, Pearson correlation analysis was applied to examine relationships between parameters.

All statistical analyses were conducted at a significance level of 0.05, and two-tailed tests were used to assess differences between groups. There was no missing data in this study.

RESULTS

The socio-demographic characteristics of the participants are presented in Table 1. The study included 184 individuals (50.5% male, 49.5% female). Most participants were married (53.8%), had a university degree (59.2%), and were employed (75.5%). The majority lived in their own houses (59.8%), and income levels were distributed as 33.7% below, 40.8% equal to, and 25.5% above expenses.

Regarding health-related parameters, 12% had chronic diseases, and 50.5% reported headaches. The prevalence of neck, upper back, and low back pain was 37.5%, 46.2%, and 44%, respectively. Additionally, 46.7% had a fear of movement (>50 points), 33.2% had a fear of falling (>8 points), and 22.5% had high psychological resilience (>94 points).

In terms of physical activity levels, 13.6% engaged in low, 24.5% in moderate, and 62% in high-intensity physical activity (>3000 MET-min/week).

Table 2 presents the descriptive statistics of the participants, including mean, standard deviation, minimum-maximum values, and 95% confidence intervals. The mean age was 34.02±10.76 years, with a BMI of 24.44±3.97 kg/m^2. The mean Numerical Pain Scale (NPS) scores for headache, neck pain, upper back pain, and low back pain were 4.43±3.41, 3.57±3.45, 3.98±3.72, and 3.89±3.68, respectively.

The total fear of movement score was 50.86±18.02, with psychological and biological sub-dimensions averaging 2.32±0.89 and 2.41±0.96, respectively. The mean fear of falling score was 6.23±2.73, and the psychological resilience status score was 94.21±19.46. The physical activity level (MET-min/week) was 6262.43±5967.37, indicating a wide range of activity levels among participants.

Table 1. Socio-demographic characteristics of the participants

		n	%
The provinces where participants experienced the earthquake	Kahramanmaraş	56	30.4
	Malatya	30	16.3
	Hatay	26	14.1
	Elazığ	20	10.8
	Kilis	17	9.2
	Adana	16	8.7
	Diyarbakır	5	2.7
	Şanlıurfa	4	2.2
	Mersin	4	2.2
	Adıyaman	3	1.6
	Gaziantep	3	1.6
Gender	Male/female	93/91	50.5/49.5
Marital status	Single/married/other	79/99/6	42.9/53.8/3.3
Education level	Elementary/secondary/ high school	3/9/25	1.6/4.9/13.6
	University/ postgraduate	109/38	59.2/20.7
Occupation	Employee/student/ unemployed	139/32/13	75.5/17.4/7.1
Income status	Income is less than/equal to/greater than expenses	62/75/47	33.7/40.8/25.5
Type of housing	Tent/container/relative's house/own house	11/12/51/110	6/6.5/27.7/59.8
Body-mass index	Underweight/normal/ overweight/obese	9/101/55/19	4.9/54.9/29.9/10.3
Presence of chronic disease	Positive	22	12
Presence of headache (NPS)	>5	93	50.5
Presence of neck pain (NPS)	>5	69	37.5
Presence of upper back pain (NPS)	>5	85	46.2
Presence of low back pain (NPS)	>5	81	44
Fear of movement	>50 points	86	46.7
Fear of falling	>8 points	61	33.2
Psychological resilience status	>94 points	25	22.5
Physical activity level	<600 MET-min/week; 600-3000 MET-min/week; >3000 MET-min/week	25/45/114	13.6/24.5/62

NPS: Numerical Pain Scale; MET: Metabolic equivalent of task

Table 3 presents the correlation analysis results, demonstrating significant associations between fear of movement, fear of falling, and pain intensity.

Fear of movement (total score) was significantly correlated with headache intensity (r=0.275, p<0.001), neck pain intensity (r=0.294, p<0.001), upper back pain intensity (r=0.262, p<0.001), and low back pain intensity (r=0.284, p<0.001), all indicating low correlations.

Table 2. Descriptive statistics

	x±SD	Min-max	95% confidence interval	
			Lower bound	Upper bound
Age (year)	34.02±10.76	13-63	32.08	35.63
BMI (kg/m²)	24.44±3.97	16.80-39.92	23.86	25.02
Height (cm)	170.25±8.92	154-189	168.95	171.54
Weight (kg)	71.22±14.55	43-110	69.10	73.33
Headache (NPS)	4.43±3.41	0-10	3.93	4.93
Neck pain (NPS)	3.57±3.45	0-10	3.07	4.07
Upper back pain (NPS)	3.98±3.72	0-10	3.44	4.52
Low back pain (NPS)	3.89±3.68	0-10	3.36	4.43
Fear of movement-total	50.86±18.02	20-100	48.23	53.47
Fear of movement-psychological	2.32±0.89	1-5	2.18	2.44
Fear of movement-biological	2.41±0.96	1-5.25	2.27	2.55
Fear of falling	6.23±2.73	1-10	5.83	6.63
Psychological resilience status	94.21±19.46	25-125	91.38	97.04
Physical activity level	6262.43±5967.37	0-27600	5393.46	7130.40

BMI: Body-mass index, cm: Centimetre, kg: Kilogramme, kg/m²: kilogramme/metre², NPS: Numerical Pain Scale

Table 3. Correlations between parameters

		Fear of movement/ total score	Fear of movement/ psychological	Fear of movement/ biological	Fear of falling	Headache	Neck pain	Upper back pain	Low back pain	Psychological resilience status	Physical activity level
Fear of movement-total score	r	1.000	.253	.162	-.080	.275	.294	.262	.284	-.243	.057
	p	.	.001*	.028*	.281	<.001*	<.001*	<.001*	<.001*	.001*	.441
Fear of movement-psychological	r	.253	1.000	.718	-.154	.038	.028	-.020	.016	-.104	.054
	p	.001*	.	<.001*	.037*	.609	.705	.793	.825	.161	.470
Fear of movement-biological	r	.162	.718	1.000	-.019	.067	.027	-.007	-.033	-.112	-.054
	p	.028	.000	.	.796	.364	.713	.926	.661	.132	.467
Decreased fear of falling	r	-.080	-.154	-.019	1.000	-.202	-.179	-.191	-.282	.220	-.020
	p	.281	.037	.796	.	.006*	.015*	.010*	<.001*	.003*	.788
Headache (NPS)	r	.275	.038	.067	-.202	1.000	.716	.676	.638	-.129	.096
	p	.000	.609	.364	.006*	.	<.001*	<.001*	<.001*	.081	.195
Neck pain (NPS)	r	.294	.028	.027	-.179	.716	1.000	.824	.782	-.131	.036
	p	.000	.705	.713	.015	<.001*	.	<.001*	<.001*	.076	.625
Upper back pain (NPS)	r	.262	-.020	-.007	-.191	.676	.824	1.000	.842	-.137	.071
	p	.000	.793	.926	.010*	<.001*	<.001*	.	<.001*	.063	.338
Low back pain (NPS)	r	.284	.016	-.033	-.282	.638	.782	.842	1.000	-.078	.058
	p	.000	.825	.661	<.001*	<.001*	<.001*	<.001*	.	.291	.435
Psychological resilience status	r	-.243	-.104	-.112	.220	-.129	-.131	-.137	-.078	1.000	.068
	p	.001	.161	.132	.003*	.081	.076	.063	.291	.	.357
Physical activity level	r	.057	.054	-.054	-.020	.096	.036	.071	.058	.068	1.000
	p	.441	.470	.467	.788	.195	.625	.338	.435	.357	.

NPS: Numerical Pain Scale

Fear of falling scale score was significantly associated with headache intensity (r=-0.202, p=0.006), neck pain intensity (r=-0.179, p=0.015), upper back pain intensity (r=-0.191, p=0.010), and low back pain intensity (r=-0.282, p<0.001), all indicating low correlations.

Pain intensity in different body regions was significantly correlated with each other. Additionally, psychological resilience status was negatively correlated with fear of movement (r=-0.243, p=0.001) and positively correlated with decreased fear of falling (r=0.220, p=0.003), both indicating low correlations.

DISCUSSION

This study is the first to comprehensively examine the relationships between pain intensity, fear of movement, and fear of falling among earthquake survivors who had no pre-existing pain and did not sustain physical trauma during the disaster. Our findings reveal that pain is a prevalent issue among survivors, despite the absence of direct physical injury, and that fear of movement and fear of falling are significantly associated with pain intensity across different body regions albeit with low correlations. Moreover, psychological resilience emerged as a key factor influencing these fear-related responses, whereas physical activity levels did not show a significant relationship with fear of movement (kinesiophobia) or fear of falling. These results highlight the unique impact of earthquakes on survivors' pain perception and fear-related behaviors, filling a critical gap in the existing literature.

A total of 184 earthquake survivors, from 11 affected provinces, participated in this study, with an almost equal distribution of males (50.5%) and females (49.5%). Notably, 46.7% of the participants reported fear of movement, while 33.2% exhibited increased fear of falling. Despite having no history of pain before the earthquake, 50.5% of the survivors experienced headaches, 37.5% reported neck pain, 46.2% suffered from upper back pain, and 44% had low back pain. These findings underscored the considerable impact of the earthquake on musculoskeletal health, even in individuals without direct physical trauma.

Previous studies have primarily focused on trauma-induced pain following earthquakes. A study conducted in 2012 examined the prevalence and trajectory of trauma-related pain in the weeks following the 2009 earthquake in the Abruzzi region of Italy.[17] That retrospective observational study analyzed pain severity, pain type, and treatment efficacy over the five weeks following the disaster.[17] Their findings indicated that 34.6% of the patients reported pain, and among them, 58.8% experienced severe pain.[17] Pain prevalence followed a biphasic pattern: in the first 15 days, pain was predominantly associated with physical trauma, then decreased before resurging around the fifth week due to rebuilding efforts.[17] Their results highlighted the significant burden of trauma-related pain in post-earthquake settings and suggested that pain intensity may fluctuate based on physical activity and environmental stressors during recovery.[17] Unlike that study, which focused on trauma-induced pain and its treatment, our research provided a novel perspective by evaluating pain intensity, fear of movement, and fear of falling in earthquake survivors who did not sustain physical injuries. This distinction is crucial, as it enables a better understanding of pain mechanisms that arise independently of direct trauma, potentially driven by psychological stress, altered postural control, or heightened central sensitization.

Another study conducted on survivors of the Kahramanmaraş-centered earthquakes examined the relationships between post-earthquake anxiety, sleep disturbances, and musculoskeletal pain.[19] That study, which included 291 participants, found that low back and neck pain were prevalent, with up to 37% of individuals exhibiting moderate to severe disability according to the Oswestry Disability Index and Neck Disability Index.[19] However, that study did not assess whether participants had sustained physical trauma, making it unclear whether pain was due to direct injury or secondary to psychological and environmental stressors.[19]

Another study investigated the development of new-onset low back pain (LBP) among survivors of the Great East Japan earthquake (GEJE), examining the role of preexisting musculoskeletal pain.[18] That longitudinal study followed 1,782 survivors who had no LBP at three years post-earthquake and reassessed them one year later.[18] The results revealed that 14.1% of participants developed new-onset LBP, and those with preexisting musculoskeletal pain were at significantly higher risk.[18] Our study complemented that research by focusing on an earlier post-disaster period (3-5 months after the earthquake) rather than years later, allowing for a more immediate evaluation of musculoskeletal pain responses in non-injured survivors.[18] Additionally, while that study examined anxiety and sleep disturbances, it did not evaluate movement-related fears such as fear of movement and fear of falling, which are critical in understanding functional limitations post-disaster.

These studies collectively demonstrated the significant impact of earthquakes on musculoskeletal health, yet they primarily focused on trauma-related pain, long-term pain trajectories, or psychological factors like anxiety and sleep disturbances. Our study provided a unique perspective by evaluating pain intensity, fear of movement, and fear of falling in non-injured survivors within the early post-disaster period, highlighted the need for early intervention strategies that addressed both physical and psychological aspects of recovery.

In our study, 46.7% of the participants reported high levels of fear of movement, indicating that nearly half of the non-injured earthquake survivors experienced significant movement-related fear despite the absence of direct physical trauma. This finding suggests that factors beyond physical injury, such as psychological distress, altered postural control, and central sensitization, may contribute to fear of movement in post-earthquake populations. Given that fear of movement is associated with activity avoidance and long-term functional impairment, its high prevalence in our sample underscores the need for early interventions targeting movement-related fears to prevent chronic disability.

A study published in 2025 was the first to evaluate post-earthquake fear of movement, fear of falling, and balance impairments in earthquake survivors.[23] Their findings highlighted the role of aging and post-traumatic stress disorder (PTSD) in fear of falling.[23] However, this study did not assess pain intensity, psychological resilience, or physical activity levels, leaving an important gap in understanding how these factors influence movement-related fears.

Unlike the previous study,[23] which focused on PTSD and aging, our study demonstrates a direct relationship between pain severity and fear of falling, highlighting the need for pain management strategies in post-disaster rehabilitation.

Furthermore, while physical activity is often considered a protective factor against falls, our findings indicated that it is not significantly associated with fear of falling in earthquake survivors. Instead, psychological resilience appears to play a critical role, suggesting that mental health interventions aimed at enhancing resilience may be as important as physical rehabilitation programs in post-earthquake recovery efforts.

Psychological resilience plays a crucial role in post-disaster recovery, particularly in mitigating fear-related movement restrictions. Our findings showed that individuals with higher resilience reported lower levels of fear of movement and fear of falling, despite experiencing musculoskeletal pain. This suggests that resilience acts as a protective mechanism, potentially buffering against the psychological distress that often exacerbates movement-related fears. These findings highlighted the need for incorporating psychological resilience-building interventions into rehabilitation programs, as strengthening mental coping strategies may enhance physical recovery and prevent long-term disability in earthquake survivors.

Physical activity is widely recognized as a key component of musculoskeletal health and overall well-being. However, our findings indicated that physical activity levels were not significantly associated with fear of movement or fear of falling in earthquake survivors. This suggests that, in post-disaster settings, psychological factors such as fear and stress may override the protective benefits of regular physical activity. Additionally, disruptions to daily routines and limited access to exercise facilities following a disaster may contribute to reduced physical activity engagement. Future research should explore how structured physical activity programs can be effectively implemented in post-disaster rehabilitation settings to support both physical and psychological recovery.

The sociodemographic characteristics of survivors also played a crucial role in shaping post-earthquake health outcomes. The majority (59.8%) were living in their own homes, while 27.7% resided with relatives, and 12.5% were in temporary shelters such as tents or containers. These living conditions may have influenced their overall health, as individuals in unstable housing situations often reported higher pain levels and increased movement-related fears. Financial constraints were another critical factor, with 33.7% of participants stating that their income was below their expenses, which could have contributed to heightened stress and limited access to healthcare resources. Many participants were displaced from their homes and had to live in temporary shelters such as tents or containers, leading to significant environmental and psychological stressors. The lack of stable housing and reduced access to healthcare services may have exacerbated musculoskeletal pain and increased movement-related fears.

Additionally, financial constraints and loss of social support networks could have further contributed to psychological distress, reinforcing the need for targeted interventions that consider the broader social determinants of health in disaster-affected populations. Future studies should examine how living conditions and socioeconomic status influence rehabilitation outcomes in earthquake survivors.

Another notable finding was the high level of education among participants, which can be attributed to the study being conducted five months after the earthquake when essential personnel, including government employees, teachers, and other public sector workers, were required to return to duty in affected regions. This may have influenced the sample composition and should be considered when interpreting the findings. Our data indicated that 75.5% of participants were employed, while 24.5% were unemployed or unable to work due to disaster-related disruptions. Those who returned to work may have experienced additional physical and psychological stress due to occupational demands, whereas unemployed individuals may have faced financial insecurity, further exacerbating post-disaster health challenges. Additionally, individuals who resumed their professional duties in disaster-affected areas may have encountered increased workloads, logistical difficulties, and heightened emotional stress, all of which could contribute to musculoskeletal complaints and movement-related fears. Future research should explore the interplay between employment status, psychological resilience, and musculoskeletal health in disaster recovery settings to better understand the long-term implications of work-related stress and financial instability on post-earthquake rehabilitation outcomes.

Limitations

The present study has some limitations. Fear of movement, pain, and fear of falling were assessed through self-reported questionnaires, which, while validated, may not fully capture the complexity of these constructs. Additionally, as a cross-sectional study, causal relationships between pain, psychological resilience, and movement-related fears cannot be definitively established. Future studies should employ longitudinal designs to explore how these relationships evolve over time and consider objective movement analyses to further examine postural adaptations and functional limitations in earthquake survivors.

CONCLUSION

Despite these limitations, this study has several strengths. It is among the first to investigate the interplay between pain intensity, fear of movement, and fear of falling in earthquake survivors who did not sustain physical injuries. By incorporating psychological resilience as a protective factor, our study provides novel insights into how psychological factors influence post-disaster musculoskeletal health. Additionally, our findings highlight the importance of addressing movement-related fears in early rehabilitation programs to prevent long-term functional limitations. These contributions underscore the need for comprehensive rehabilitation approaches that integrate both physical and psychological components to optimize recovery in earthquake-affected populations.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Atılım University Rectorate Human Researches Ethics Committee (Date: 02.05.2023, Decision No: 604.01.02-60355).

Informed Consent

Signed and informed consent forms were obtained from all earthquake victims.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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