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Postural and body awareness as correlates of musculoskeletal pain among community-dwelling housewives

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Abstract

Housewives are exposed to sustained physical and psychosocial demands during daily household activities, contributing to musculoskeletal pain as a public health concern. However, the associations between postural and body awareness and musculoskeletal pain remain insufficiently understood. The aim of this study was to explore the associations of postural and body awareness with musculoskeletal pain prevalence and pain intensity in community-dwelling housewives. This cross-sectional study included 228 housewives. Musculoskeletal pain was assessed using the Nordic Musculoskeletal Questionnaire and a numeric rating scale. Postural and body awareness were evaluated using the Postural Awareness Scale and the Body Awareness Questionnaire. Higher postural awareness was significantly associated with 12-month pain prevalence in the lower back (aOR = 1.054), neck (aOR = 1.080), and shoulders (aOR = 1.042). In contrast, higher postural awareness was associated with lower pain intensity in the lower back (B = −0.055), neck (B = −0.055), and upper back (B = −0.057). Higher body awareness was associated with increased pain intensity in the lower back (B = 0.024) and upper back (B = 0.026). Additionally, higher body mass index was associated with greater lower back pain intensity, while a higher number of children was associated with greater neck (B = 0.369) and upper back pain intensity (B = 0.322). Postural and body awareness demonstrate distinct associations with musculoskeletal pain among community-dwelling housewives. Higher postural awareness was associated with a higher likelihood of pain reporting but lower pain intensity, whereas greater body awareness was associated with higher pain intensity in the lower and upper back.

Introduction

Housewives are frequently exposed to substantial physical and psychosocial demands during domestic activities that occupy a large portion of their daily lives; however, the health impact of these demands is often underrecognized (Kaplan et al., 2020). Household work, shaped by cultural and social norms, involves physical, cognitive, and emotional labor (Aviv et al., 2025; Daminger, 2019). Routine tasks such as cooking, cleaning, laundry, and ironing require repetitive movements, awkward postures, and occasional heavy lifting, which cumulatively increase musculoskeletal load and may contribute to the development of pain (Norouzi et al., 2021; Norouzi et al., 2023; Norouzi et al., 2025).

The prevalence of musculoskeletal pain and discomfort among housewives is considerably high, with studies reporting rates ranging from 60.6% to 89% (Habib & Rahman, 2015; Mondal & Ghosh, 2021; Saat et al., 2022). From a biomechanical perspective, housework has been associated with widespread pain complaints, particularly concentrated in the lower back (48%) and knees (31%), while also affecting the shoulders and upper back (Habib & Rahman, 2015; Mondal & Ghosh, 2021; Saat et al., 2022). In addition to physical risk factors, the commonly observed low levels of physical activity and increased Body Mass Index

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among housewives may be associated with increased load on the musculoskeletal system and greater pain severity. More importantly, these pains are not merely physical discomforts; they restrict daily activities, diminish quality of life, and are associated with mental workload, adversely affecting psychological well-being (Saat et al., 2022).

Postural awareness, which plays a critical role in maintaining musculoskeletal health, is defined as an individual's capacity to perceive the position of body segments during daily activities and to appropriately manage this alignment (Cramer et al., 2018). Routine household tasks performed by housewives throughout the day, such as sweeping, dishwashing, and ironing, often involve demanding and awkward postures that increase biomechanical load on the trunk and neck regions (Norouzi et al., 2025). Insufficient postural awareness is particularly associated with increased pain intensity and reduced functional capacity (Cramer et al., 2018). Therefore, postural awareness may be relevant to understanding musculoskeletal problems among housewives.

Body awareness is a multidimensional construct that extends beyond postural awareness, encompassing the conscious perception of bodily sensations, physiological signals, and emotional states (Gyllensten et al., 2010). This awareness is not merely a physical perception; rather, it is a process shaped by the dynamic interplay of psychological factors, such as perceived stress, loneliness, and burnout (Kaplan, 2023), and physical components, including pain and levels of physical activity (Kalkışım et al., 2023). Physiologically, high body awareness has been shown to regulate the autonomic nervous system by enhancing parasympathetic activity, thereby reducing hemodynamic stress responses such as heart rate and blood pressure (Liem et al., 2024; Lustyk et al., 2012). Conversely, interoceptive deficits have been linked to body image disturbances and poorer chronic pain management (Kalkışım et al., 2023; Zhang & Yang, 2024), underscoring body awareness in housewives as a dynamic construct shaped by psychological, physical, and sociocultural factors.

Although existing literature has addressed the physical demands of domestic work, studies examining musculoskeletal pain in housewives together with postural and body awareness remain limited (Mondal & Ghosh, 2021; Saat et al., 2022). Therefore, this study aimed to examine the associations between these perceptual factors and musculoskeletal pain outcomes among community-dwelling housewives.

Methods

Participants and Study Design

This descriptive cross-sectional study was conducted among community-dwelling housewives in Erzurum, Türkiye. Participants were recruited using purposive sampling from their neighborhoods, homes, and social environments between November 2025 and March 2026. Ethical approval was obtained from the Atatürk University Faculty of Health Sciences Ethics Committee (Approval Number: 2025/11/07), and all procedures were performed in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection.

The study included housewives aged 18–75 years who were actively engaged in routine household activities. Inclusion criteria were adequate cognitive and communicative ability to complete the questionnaires. Exclusion criteria included recent orthopedic surgery, acute musculoskeletal trauma, diagnosed neurological or rheumatological conditions, and professional training or structured education related to posture or body awareness. An a priori power analysis was performed using G*Power 3.1 software (Heinrich Heine University, Düsseldorf, Germany) to estimate the required sample size for multiple linear regression analyses. Based on a small-to-moderate effect size (f^2 = 0.11, corresponding to an anticipated R^2 of 0.10), an alpha level of 0.05, statistical power (1–B) of 0.95, and six predictors, the analysis indicated that a minimum sample size of 197 participants was required. Accordingly, a total of 228 participants were included in the final analysis, exceeding the minimum sample size requirement.

Data Collection Tools

A structured form developed by the researchers was used to collect participants' demographic and household characteristics, including age, height, weight, marital status, education level, number of children, caregiving responsibilities within the household, the presence of employed individuals in the home, and area of residence (urban or rural).

Nordic Musculoskeletal Questionnaire

Musculoskeletal symptoms were assessed using the Nordic Musculoskeletal Questionnaire (NMQ), which evaluates the presence and distribution of musculoskeletal pain across nine anatomical regions. Participants reported pain experienced during the past 12 months and the past 7 days using dichotomous (yes/no) responses. Maximum pain intensity

experienced during the past 12 months was rated using a 0–10 numeric rating scale (NRS), where higher scores indicated greater pain intensity (Dickinson et al., 1992; Kahraman et al., 2016).

Postural Awareness Scale

Postural awareness was assessed using the Turkish version of the Postural Awareness Scale (PAS), originally developed by Cramer et al. and cross-culturally adapted into Turkish by Dursun and Önen (Cramer et al., 2018; Dursun & Önen, 2024). The PAS consists of 11 items rated on a 7-point Likert scale and comprises two subdimensions: Postural Awareness Familiarity and Attention Regulation for Postural Awareness. Total scores range from 11 to 77, with higher scores indicating greater postural awareness. The Turkish version has demonstrated good reliability, with a Cronbach's α of 0.85 (Dursun & Önen, 2024). In the present sample, the PAS demonstrated acceptable internal consistency (Cronbach's α = 0.777).

Body Awareness Questionnaire

Body awareness was assessed using the Body Awareness Questionnaire (BAQ), developed by Shields et al. and adapted into Turkish by Karaca et al. (Karaca & Bayar, 2021; Shields et al., 1989). The BAQ consists of 18 items rated on a 7-point Likert scale, with higher total scores indicating greater body awareness (Shields et al., 1989). The Turkish version has demonstrated a factor structure consistent with the original scale and good internal consistency (Cronbach's α > 0.80), supporting its reliability in Turkish-speaking adult populations (Karaca & Bayar, 2021). In the present sample, the BAQ demonstrated excellent internal consistency (Cronbach's α = 0.900).

Statistical Analysis

Data were analyzed using SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). The normality of continuous variables was assessed using both visual methods (histograms, probability plots) and analytical methods (Kolmogorov-Smirnov and/or Shapiro-Wilk tests). Descriptive statistics for normally distributed continuous variables were expressed as mean ± standard deviation (SD), while non-normally distributed variables were presented as median values. Categorical variables were reported as frequencies and percentages. Comparisons of data among housewives were conducted using the independent samples *t*-test for two-group comparisons and one-way analysis of variance (ANOVA) for comparisons involving more than two groups. Effect sizes for ANOVA were reported as eta squared (η^2). Participants reporting no pain in the respective body region were assigned an NRS score of 0 and were included in the pain intensity analyses. Caregiving status was coded as 0 = non-caregiver and 1 = caregiver. Hierarchical multiple linear regression analyses were performed to examine factors associated with musculoskeletal pain intensity. Prior to model fitting, regression assumptions were evaluated, including linearity, normality and homoscedasticity of residuals, and independence of errors. Multicollinearity was assessed using variance inflation factors (VIF), and all predictors remained below the acceptable threshold (VIF <5). To aid clinical interpretation, regression coefficients for PAS and BAQ, originally expressed per 1-point increment, were additionally rescaled to reflect a change of one standard deviation (SD = 12.3 points for PAS; SD = 20.5 points for BAQ) for statistically significant associations. SD-based regression coefficients for pain intensity were further compared against the commonly cited 2-point minimal clinically important difference (MCID) threshold for NRS (Salaffi, Stancati, Silvestri, Ciapetti, & Grassi, 2004). For hierarchical linear regression analyses, body regions with a mean maximum pain intensity score of ≥5.0 (low back, upper back, and neck) were included. For binary logistic regression analyses, body regions with a 12-month pain prevalence greater than 50% (low back, upper back, neck, shoulder, and knee) were included. For dichotomous musculoskeletal pain outcomes (presence vs. absence), binary logistic regression analyses were performed to examine factors associated with pain presence in specific body regions. A p-value of <0.05 was considered statistically significant.

Results

Participant Characteristics

The final sample consisted of 228 participants. The mean age of the participants was 40.0 years (SD = 9.5, range: 19–74). The mean BMI was 26.3 kg/m² (SD = 4.9). The mean Postural Awareness Scale (PAS) was 43.0 (SD = 12.3), and the mean Body Awareness Questionnaire (BAQ) score was 92.4 (SD = 20.5). Participants reported having an average of 2.3 children (SD = 1.4, range: 0–7). Detailed demographic and clinical characteristics are presented in Table 1.

Pain Prevalence, Persistence, and Intensity by Body Region

Pain prevalence by body region over the last 12 months and the last 7 days is shown in Figure 1. Over the past 12 months, the highest prevalence was observed in the

low back (79.4%, n=181), followed by the upper back (78.5%, n=179), neck (70.6%, n=161), shoulder (69.3%, n=158) and knee (60.1%, n=137). During the last 7 days, pain was most frequently reported in the upper back (66.2%, n=151) and low back (62.3%, n=142), with comparable prevalence in the neck (57.5%, n=131) and shoulder (55.3%, n=126).

Maximum pain intensity scores (0–10 NRS) across body regions are presented in Figure 2. The highest mean maximum pain intensity was reported for the low back (5.4), upper back (5.2), and neck (5.0), while lower values were observed for the shoulder (4.4), knee (4.2), hip (3.6), ankle/foot (3.2), wrist (3.1), and elbow (2.3).

Table 1
Demographic and clinical characteristics of the participants.

	Mean ± SD	Median (min – max)
Age (years)	40.0 ± 9.5	40 (19 – 74)
Height (cm)	162.8 ± 6.5	163 (150 – 183)
Weight (kg)	69.7 ± 13.7	70 (47 – 120)
BMI (kg/m^2)	26.3 ± 4.9	26.3 (18 – 41.5)
PAS	43.0 ± 12.3	42.5 (13 – 77)
BAQ	92.4 ± 20.5	95 (18 – 126)
Number of Children (n)	2.3 ± 1.4	2 (0 – 7)

SD: Standard deviation; n: Number; min: Minimum; max: Maximum; cm: Centimeter; kg: Kilogram; BMI: Body mass index; PAS: Postural Awareness Scale; BAQ: Body Awareness Questionnaire.

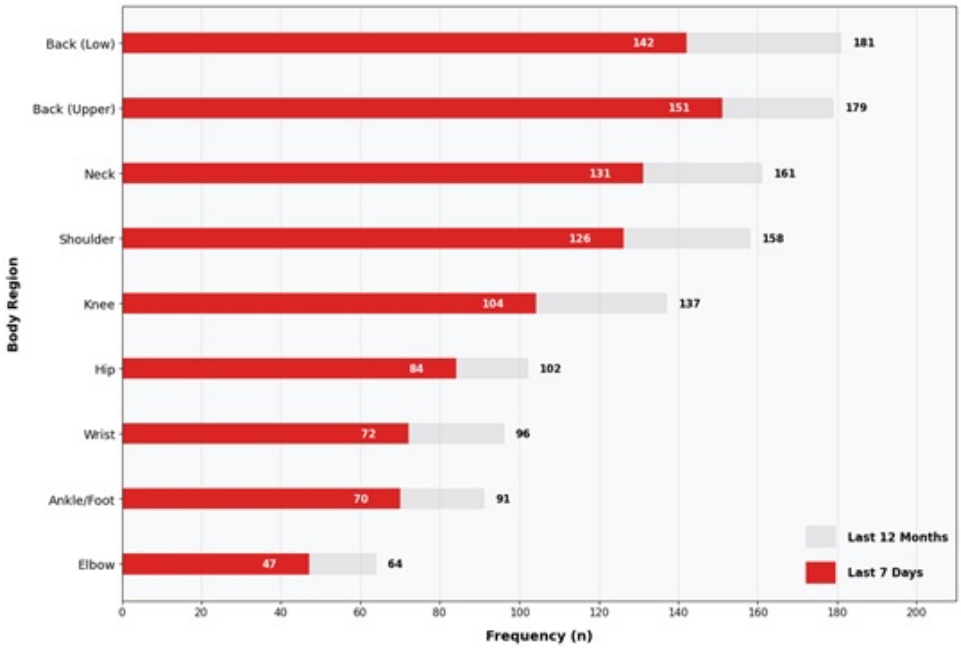

Figure 1. Distribution of musculoskeletal complaints by body region.

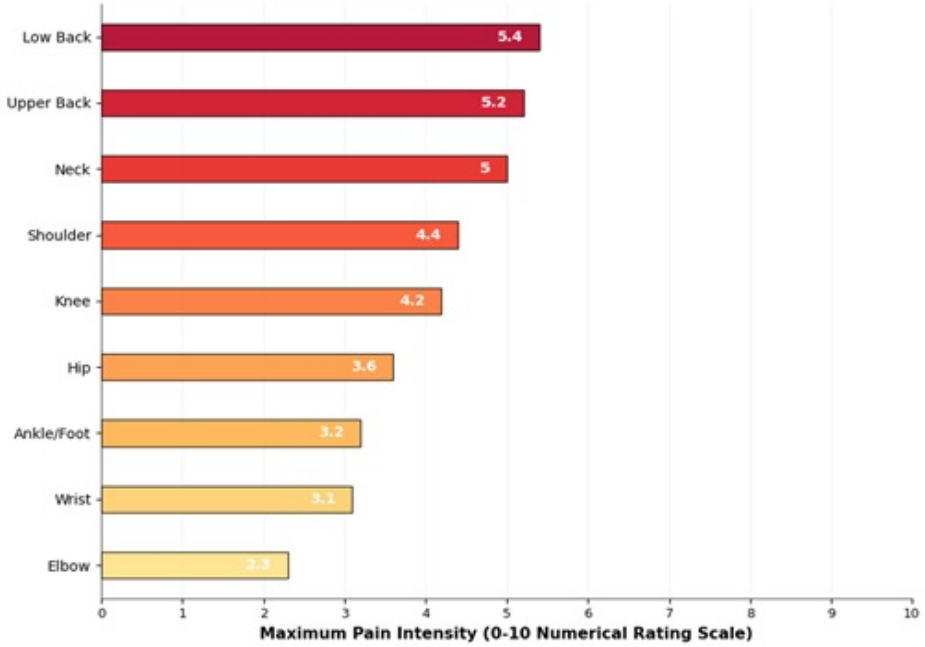

Figure 2. Distribution of maximum pain intensity by body region.

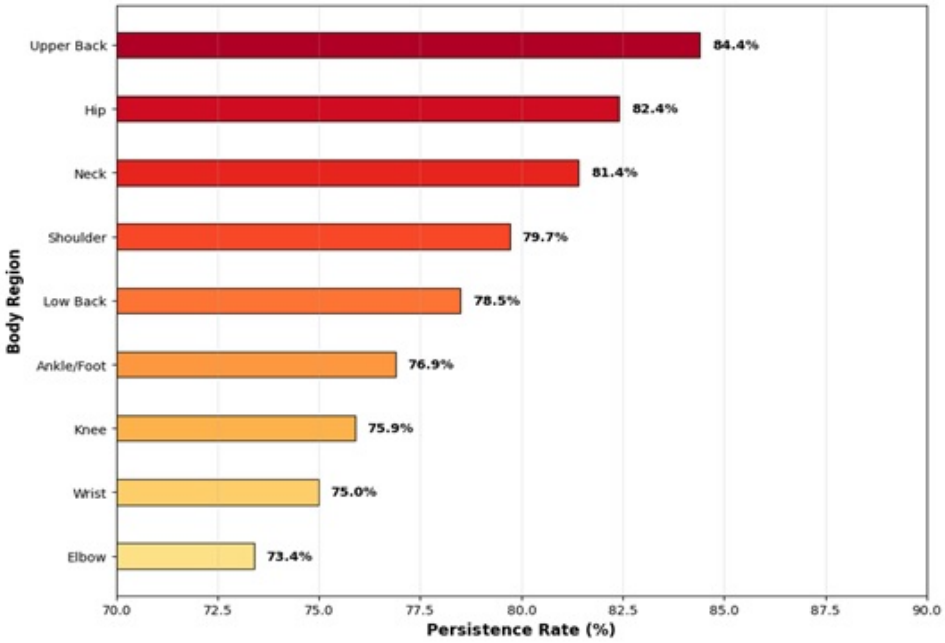

Figure 3. Pain persistence rates by body region color scale: yellow (low) to red (high).

Pain persistence rates by body region are illustrated in Figure 3. The highest persistence was observed in the upper back (84.4%), hip (82.4%), and neck (81.4%), followed by the shoulder (79.7%) and low back (78.5%).

Subgroup Analyses for PAS and BAQ

No statistically significant differences were observed in PAS or BAQ scores across demographic or clinical subgroups, including age, BMI category, number of children, education level, marital status, residential area, or caregiving status (all $p > 0.05$). Effect sizes were uniformly small ($\eta^2 < 0.03$), indicating negligible practical differences (Table 2).

Factors Associated with Pain Prevalence by Body Region

Multivariable logistic regression models were constructed to examine factors associated with 12-month and last 7-day pain prevalence for specific body regions (Table 3).

Low Back Pain

The model for 12-month low back pain prevalence was significant (Nagelkerke $R^2 = 0.122$). PAS was significantly associated with 12-month low back pain prevalence (adjusted odds ratio [aOR] = 1.054, 95% CI: 1.023–1.086, $p = 0.001$). Age, BMI, and BAQ were not significantly associated with 12-month low back pain prevalence. For last 7-day low back pain prevalence (Nagelkerke $R^2 = 0.079$), higher PAS scores were also significantly associated with pain prevalence (aOR = 1.039, 95% CI: 1.014–1.065, $p = 0.002$). Expressed per SD increase in PAS, the odds of 12-month low back pain were 1.91-fold higher (95% CI: 1.32–2.76), and 1.60-fold higher for 7-day prevalence (95% CI: 1.19–2.17).

Neck Pain

For 12-month neck pain prevalence (Nagelkerke $R^2 = 0.190$), higher PAS scores were significantly associated with pain prevalence (aOR = 1.080, 95% CI: 1.048–1.113, $p < 0.001$). In the model for 7-day neck pain prevalence (Nagelkerke $R^2 = 0.137$), higher PAS scores (aOR = 1.046, 95% CI: 1.020–1.072, $p < 0.001$) were significantly associated with pain prevalence, whereas BAQ scores were not significantly associated with pain prevalence (aOR = 1.015, 95%CI: 1.000–1.030, $p = 0.052$). Per SD increase in PAS, the odds were 2.58-fold higher for 12-month neck pain (95% CI: 1.78–3.73) and 1.74-fold higher for 7-day neck pain (95% CI: 1.28–2.35).

Upper Back Pain

In the model for 7-day upper back pain prevalence (Nagelkerke $R^2 = 0.116$), higher PAS scores were significantly associated with pain prevalence (aOR = 1.051, 95% CI: 1.024–1.079, $p < 0.001$). The model for 12-month upper back pain prevalence (Nagelkerke $R^2 = 0.064$) showed a non-significant association between PAS and pain prevalence (aOR = 1.024, 95% CI: 0.997–1.052, $p = 0.087$). Per SD increase in PAS, the odds of 7-day upper back pain were 1.84-fold higher (95% CI: 1.34–2.55); the corresponding 12-month estimate (1.34, 95% CI: 0.96–1.87) remained non-significant.

Table 2
Comparison of BAQ and PAS scores across demographic subgroups.

	PAS		BAQ	
	Mean ± SD	Statistics	Mean ± SD	Statistics
Age (years)				
18-24 (n=12)	41.91 ± 12.23	F = 0.33	93.16 ± 17.81	F = 0.26
25-44 (n=143)	43.42 ± 11.34	*p* = 0.804	91.50 ± 21.11	*p* = 0.854
45-59 (n=66)	42.66 ± 14.46	η^2 =0.004	94.18 ± 20.37	η^2 = 0.008
60-74 (n=7)	39.99 ± 11.89		92.42 ± 15.05	
BMI (kg/m^2)				
18-24.9 (n=84)	44.39 ± 12.40	F = 0.90	92.50 ± 19.27	F=0.49
25-29.9 (n=102)	42.37 ± 12.18	*p* = 0.410	93.42 ± 21.70	*p* = 0.612
30-41.5 (n=42)	41.71 ± 12.62	η^2 = 0.008	89.69 ± 20.17	η^2 = 0.004
Number of Children				
No child (n=29)	44.72 ± 12.24	F = 1.87	90.86 ± 18.03	F = 1.01
1 Child (n=28)	43.39 ± 14.10	*p* = 0.136	95.54 ± 18.38	*p* = 0.390
2 Children (n=75)	44.97 ± 11.44	η^2 = 0.024	89.52 ± 23.56	η^2 = 0.013
3+ Children (n=96)	40.81 ± 12.34		94.19 ± 19.16	
Educational Level				
Illiterate (n=4)	27.50 ± 7.55	F = 2.28	90.75 ± 12.09	F=0.36
Primary School (n=65)	42.62 ± 10.63	*p* = 0.081	90.35 ± 23.20	*p*=0.779
High School (n=57)	43.32 ± 13.02	η^2 = 0.030	92.46 ± 23.35	η2=0.005
University (n=102)	43.67 ± 12.83		93.73 ± 17.11	
Marital status				
Married (n=207)	42.51 ± 12.19	t = -1.87	92.27 ± 20.76	t=-0.30
Divorced (n=21)	47.76 ± 13.09	*p* = 0.063	93.67 ± 18.20	*p*=0.766
		η^2 = 0.015		η2=0.000
Area of Residence				
Rural (n=22)	41.14 ± 15.99	t = -0.74	95.09 ± 19.41	t=0.65
Urban (n=206)	43.19 ± 11.91	*p* = 0.458	92.11 ± 20.64	*p*=0.518
		η^2 = 0.002		η2=0.002
Caregiver				
Yes (n=54)	42.11 ± 14.25	t = -0.60	91.24 ± 20.15	t=-0.47
No (n=174)	43.27 ± 11.71	*p* = 0.548	92.75 ± 20.66	*p*=0.637
		η^2 = 0.002		η2=0.001

SD: Standard deviation; n: Number; BMI: Body mass index; PAS: Postural Awareness Scale; BAQ: Body Awareness Questionnaire. F: One-way ANOVA; t: Independent samples t-test; η^2: Eta square (effect size); p<0.05 indicates statistical significance;

Shoulder Pain

For 12-month shoulder pain prevalence (Nagelkerke R^2 = 0.109), higher PAS scores were significantly associated with pain prevalence (aOR = 1.042, 95% CI: 1.015–1.069, p = 0.002). The model for 7-day shoulder pain prevalence (Nagelkerke R^2 = 0.099) showed similar findings, with higher PAS scores being significantly associated with pain prevalence (aOR = 1.037, 95% CI: 1.012–1.062, p = 0.003). Additionally, higher BMI was significantly associated with a lower likelihood of 7-day shoulder pain prevalence (aOR = 0.925, 95% CI: 0.860–0.994, p = 0.034). Per SD increase in PAS, the odds were 1.66-fold higher for 12-month shoulder pain (95% CI: 1.20–2.27) and 1.56-fold higher for 7-day shoulder pain (95% CI: 1.16–2.10).

Knee Pain (12-Month)

The model for 12-month knee pain prevalence (Nagelkerke R^2 = 0.091) showed that higher age was significantly associated with a lower likelihood of pain prevalence (adjusted odds ratio [aOR] = 0.954, 95% CI: 0.923–0.987, p = 0.006). PAS, BMI, and BAQ were not significantly associated with 12-month knee pain prevalence.

Factors Associated with Pain Intensity by Body Region

Hierarchical linear regression analyses were performed to examine factors associated with pain intensity in the low back, upper back, and neck regions, which had the highest mean pain intensity scores (≥5.0) (Table 4).

Table 3
Multivariable logistic regression comparing 12-month and 7-day pain presence.

12-Month Prevalence							Last 7-Day Prevalence						
Body Region	Nagelkerke R2	Predictor	B	SE	p	aOR (95% CI)	Body Region	Nagelkerke R2	Predictor	B	SE	p	aOR (95% CI)
Lower Back	0.122	Age	0.025	0.020	0.222	1.025 (0.985–1.066)	Lower Back	0.079	Age	0.016	0.016	0.323	1.016 (0.984–1.049)
		BMI	-0.089	0.048	0.063	0.915 (0.833–1.005)			BMI	-0.056	0.037	0.134	0.946 (0.879–1.017)
		PAS	0.052	0.015	0.001	1.054 (1.023–1.086)			PAS	0.039	0.012	**0.002**	1.039 (1.014–1.065)
		BAQ	-0.013	0.008	0.125	0.987 (0.971–1.004)			BAQ	-0.008	0.007	0.269	0.992 (0.978–1.006)
		Constant	-1.175	1.458	0.420	0.309			Constant	-0.633	1.202	0.599	0.531
Upper back	0.064	Age	0.027	0.019	0.155	1.027 (0.990–1.065)	Upper Back	0.116	Age	0.010	0.017	0.558	1.010 (0.977–1.044)
		BMI	0.012	0.042	0.767	1.012 (0.933–1.099)			BMI	0.043	0.038	0.250	1.044 (0.970–1.124)
		PAS	0.024	0.014	0.087	1.024 (0.997–1.052)			PAS	0.050	0.013	**<0.001**	1.051 (1.024–1.079)
		BAQ	0.013	0.009	0.161	1.013 (0.995–1.031)			BAQ	0.003	0.008	0.666	1.003 (0.988–1.018)
		Constant	-4.957	1.505	0.001	0.007			Constant	-4.737	1.323	0.001	0.009
Neck	0.190	Age	-0.010	0.019	0.587	0.990 (0.954–1.027)	Neck	0.137	Age	-0.022	0.017	0.187	0.978 (0.947–1.011)
		BMI	0.002	0.041	0.955	1.002 (0.925–1.086)			BMI	0.045	0.037	0.220	1.046 (0.973–1.124)
		PAS	0.077	0.015	<0.001	1.080 (1.048–1.113)			PAS	0.045	0.013	**<0.001**	1.046 (1.020–1.072)
		BAQ	-0.005	0.008	0.513	0.995 (0.979–1.011)			BAQ	0.015	0.008	0.052	1.015 (1.000–1.030)
		Constant	-3.497	1.350	0.010	0.030			Constant	-3.925	1.263	0.002	0.020
Shoulder	0.109	Age	-0.019	0.018	0.295	0.982 (0.948–1.016)	Shoulder	0.099	Age	-0.002	0.016	0.904	0.998 (0.967–1.030)
		BMI	-0.071	0.041	0.080	0.931 (0.860–1.009)			BMI	-0.078	0.037	0.034	0.925 (0.860–0.994)
		PAS	0.041	0.013	**0.002**	1.042 (1.015–1.069)			PAS	0.036	0.012	**0.003**	1.037 (1.012–1.062)
		BAQ	-0.004	0.008	0.626	0.996 (0.982–1.011)			BAQ	0.001	0.007	0.913	1.001 (0.987–1.015)
		Constant	0.329	1.270	0.795	1.390			Constant	0.291	1.180	0.806	1.337
Knee	0.091	Age	-0.047	0.017	**0.006**	0.954 (0.923–0.987)							
		BMI	-0.045	0.037	0.214	0.956 (0.889–1.027)							
		PAS	0.008	0.012	0.500	1.008 (0.985–1.032)							
		BAQ	-0.005	0.007	0.503	0.995 (0.982–1.009)							
		Constant	2.721	1.221	0.026	15.195							

B: regression coefficient; SE: standard error; aOR: adjusted odds ratio; CI: confidence interval; BMI: body mass index; PAS: Postural Awareness Scale; BAQ: Body Awareness Questionnaire; Nagelkerke R^2 indicates model fit.

Table 4
Hierarchical regression analysis according to pain intensity.

Predictors		Low Back (n:228)				Neck (n:228)				Upper Back (n:228)			
		B	**SE**	**p**	**95% CI**	**B**	**SE**	**p**	**95% CI**	**B**	**SE**	**p**	**95% CI**
Step 1	**Age**	-0.012	0.026	0.630	-0.06 – 0.04	-0.027	0.023	0.239	-0.07 – 0.02	-0.044	0.024	0.066	-0.09 – 0.00
	BMI	0.119	0.049	**0.016***	0.02 – 0.22	0.031	0.044	0.482	-0.06 – 0.12	0.002	0.046	0.959	-0.09 – 0.09
	Number of Children	0.106	0.164	0.519	-0.22 – 0.43	0.455	0.147	**0.002***	0.17 – 0.75	0.403	0.154	**0.009***	0.10 – 0.71
	Caregiving (Ref: No)	0.762	0.460	0.099	-0.15– 1.67	0.677	0.413	0.103	-0.14– 1.49	1.278	0.433	**0.003***	0.43 – 2.13
		B	**SE**	**p**	**95% CI**	**B**	**SE**	**p**	**95% CI**	**B**	**SE**	**p**	**95% CI**
Step 2	**Age**	-0.009	0.025	0.710	-0.06 – 0.04	-0.021	0.022	0.346	-0.07 – 0.02	-0.041	0.023	0.077	-0.09 – 0.00
	BMI	0.109	0.048	**0.024***	0.01 – 0.20	0.017	0.043	0.688	-0.07 – 0.10	-0.008	0.045	0.865	-0.10 – 0.08
	Number of Children	0.027	0.162	0.868	-0.29 – 0.35	0.369	0.145	**0.011***	0.08 – 0.65	0.322	0.151	**0.033***	0.03 – 0.62
	Caregiving (Ref: No)	0.721	0.449	0.110	-0.16 – 1.61	0.614	0.402	0.128	-0.18– 1.41	1.237	0.418	**0.003***	0.41– 2.06
	PAS	-0.055	0.016	**0.001***	-0.09 – -0.02	-0.055	0.015	**<0.001***	-0.08 – -0.03	-0.057	0.015	**<0.001***	-0.09 – -0.03
	BAQ	0.024	0.010	**0.014***	0.01 – 0.04	0.005	0.009	0.529	-0.01 – 0.02	0.026	0.008	**0.004***	0.01 – 0.04
Statistics		R^2 (Step 1)=0.042 Total R^2 (Step 2)=0.099 ΔR^2 (Step 2)=0.057; p=0.001 Durbin-Watson=2.193				R^2 (Step 1)=0.060 Total R^2 (Step 2)=0.119 ΔR^2 (Step 2)=0.059; p=0.001 Durbin-Watson=2.029				R^2 (Step 1)=0.072 Total R^2 (Step 2)=0.141 ΔR^2 (Step 2)=0.069; p<0.001 Durbin-Watson=2.106			

B: regression coefficient; SE: standard error; CI: confidence interval; BMI: body mass index; PAS: Postural Awareness Scale; BAQ: Body Awareness Questionnaire. R^2 indicates the proportion of variance in the dependent variable explained by the model.

Low Back Pain Intensity

The final model (Step 2) explained 9.9% of the variance in low back pain intensity (Total R^2 = 0.099). The addition of PAS and BAQ in Step 2 resulted in a statistically significant increase in explained variance (ΔR^2 = 0.057, p = 0.001). In the final model, higher PAS was associated with lower pain intensity (B = −0.055, p = 0.001), while higher BAQ was associated with higher pain intensity (B = 0.024, p = 0.014). Higher BMI was also associated with greater low back pain intensity (B = 0.109, p = 0.024). Per SD increase in PAS, low back pain intensity decreased by 0.68 points on the NRS. Similarly, per SD increase in BAQ, low back pain intensity increased by approximately 0.49 points on the NRS.

Neck Pain Intensity

The final model accounted for 11.9% of the variance in neck pain intensity (Total R^2 = 0.119, ΔR^2 for Step 2 = 0.059, p = 0.001). Higher PAS was significantly associated with lower neck pain intensity (B = −0.055, p < 0.001). A higher number of children was significantly associated with greater neck pain intensity (B = 0.369, p = 0.011). BAQ was not significantly associated with neck pain intensity in the final model. Per SD increase in PAS, neck pain intensity decreased by 0.68 points on the NRS.

Upper Back Pain Intensity

This model explained 14.1% of the variance in upper back pain intensity (Total R^2 = 0.141, ΔR^2 for Step 2 = 0.069, p < 0.001). Higher PAS was significantly associated with lower upper back pain intensity (B = −0.057, p < 0.001), whereas higher BAQ was significantly associated with greater upper back pain intensity (B = 0.026, p = 0.004). Additionally, a higher number of children (B = 0.322, p = 0.033) was significantly associated with greater upper back pain intensity, whereas being a caregiver was significantly associated with higher upper back pain intensity (B = 1.237, p = 0.003). Per SD increase in PAS, upper back pain intensity decreased by 0.70 points on the NRS. Similarly, per SD increase in BAQ, upper back pain intensity increased by approximately 0.53 points on the NRS.

Discussion

This study provides novel evidence addressing a significant gap in the literature by examining the associations of postural and body awareness with musculoskeletal pain among housewives. Our findings indicate that higher postural awareness (PAS) was associated with lower pain intensity, whereas higher body awareness (BAQ) was associated with greater pain

intensity. Regression analyses further showed that higher postural awareness was associated with a higher likelihood of reporting pain (pain prevalence), while also being associated with lower pain intensity. Additionally, the most frequently reported pain sites among housewives during the past 12 months and the past 7 days were the lower back, neck, shoulders, upper back, and knees.

Musculoskeletal pain among housewives is considered a critical public health issue due to its high prevalence and its detrimental impact on daily activities. A review of the literature indicates that this problem transcends geographical boundaries. In a study conducted among low-income housewives in Kuala Lumpur, the most frequently affected region was reported to be the lower back (35%) (Saat et al., 2022) whereas in rural areas of Bangladesh, this rate was found to increase up to 80.46% (Habib & Rahman, 2015). The high prevalence rates observed in these studies have been significantly associated with risk factors such as heavy lifting, performing household chores for more than eight hours a day, and the adoption of improper postures (Nawrin & Hasan, 2020). Evidence from Türkiye also supports these findings. A recent study conducted among women aged 15–49 reported that the prevalence of lower back pain reached 94%, particularly among inactive women, and that engagement in household chores was directly associated with pain (Baybaşin & Saka, 2021). Our study determined that over the past 12 months, 79.4% of housewives reported lower back pain, 78.5% reported upper back pain, 70.6% reported neck pain, and 69.3% reported shoulder pain. This high and multi-regional pain prevalence may reflect the chronic physical demands associated with continuous and repetitive household work. Accordingly, our findings suggest that the high prevalence of pain across multiple body regions is consistent with the cumulative physical demands of household work and aligns with similar findings reported in the literature.

In our study, higher postural awareness scores were associated with lower pain intensity, a finding consistent with previous literature suggesting a potential regulatory role of postural awareness in the pain experience (Colgan et al., 2021; Cramer et al., 2018). High postural awareness has been described as a "self-regulatory capacity" that may enable individuals to detect and correct faulty postures and the associated biomechanical stress at an early stage. Potential mechanisms proposed in previous studies include improved sensorimotor integration, cortical reorganization, and modulation of descending pain inhibitory pathways (Botelho et al., 2016; Stroman, Powers, Ioachim, Warren, & McNeil, 2021). Conversely, the positive association between Postural Awareness Scale (PAS) scores and 12-month and 7-day pain prevalence highlights two key aspects of this capacity. PAS has been proposed to function like an "early detection system," enabling the earliest signals of musculoskeletal discomfort to be more readily perceived (Cramer et al., 2018). Therefore, individuals with high PAS scores may perceive and report pain or discomfort more frequently, which can statistically result in higher reported prevalence. The critical point, however, is that this early awareness may facilitate corrective behaviors, such as postural adjustments or movement modifications (Bravo et al., 2019; Gözgen & Belgen Kaygısız, 2025). Such awareness may be associated with behavioral responses, including postural adjustments or movement modifications that could partly explain its association with lower pain intensity. Accordingly, our findings indicate that postural awareness appears to have two distinct associations with the pain experience. Although the associations between PAS and pain intensity were statistically significant, their magnitude, corresponding to approximately 0.68–0.70 points on the NRS per one SD increase in PAS, remained below the commonly cited 2-point MCID threshold. This suggests that the observed associations may be limited in terms of clinical relevance at the individual level. On one hand, high PAS scores may facilitate earlier recognition and reporting of discomfort signals, and consequently, higher reported pain prevalence. On the other hand, when this awareness capacity is translated into an effective self-regulatory mechanism through early corrective behaviors, it may be associated with lower pain intensity. Therefore, our findings suggest that postural awareness may represent more than a simple indicator of pain presence and may also be associated with differences in pain intensity. Although high awareness may be associated with more frequent pain reporting, it may reflect an adaptive characteristic associated with lower pain intensity and potentially more effective pain self-management. However, because of the cross-sectional design, the direction of these associations cannot be determined. An alternative explanation is that women with longstanding or recurrent musculoskeletal pain may become more attentive to their posture as a consequence of living with pain, resulting in higher postural awareness scores. Longitudinal studies are

needed to clarify the temporal direction and potential causal nature of these associations.

Body awareness showed a relationship more consistent with pain intensity rather than pain prevalence. Higher BAQ scores were associated with greater pain intensity in the lower back and upper back, whereas BAQ was not significantly associated with pain prevalence. When expressed per one SD increase in BAQ, these significant associations corresponded to increases of approximately 0.49 points in low back pain intensity and 0.53 points in upper back pain intensity. Both magnitudes were below the commonly cited 2-point MCID threshold, suggesting that these associations, although statistically significant, may have limited clinical relevance at the individual level. This pattern suggests that increased body awareness may be associated with the subjective experience of pain. The positive association between BAQ scores and pain intensity suggests that greater body awareness may not necessarily correspond to a more favorable pain experience. Although the BAQ was developed to measure attention to bodily processes (Shields et al., 1989), heightened body awareness has been shown in some individuals to be linked with somatosensory amplification, which may contribute to greater pain perceptions (Köteles & Doering, 2016). Somatosensory amplification is characterized by heightened selective attention to bodily sensations and the tendency to interpret these sensations as threatening, and it has been associated with pain intensity and functional limitations in chronic pain populations (Ciaramella et al., 2021; Cramer et al., 2018). Furthermore, neuroimaging studies have shown that cortical networks associated with body awareness, such as the insula and anterior cingulate cortex, play a role in attentional and emotional appraisal processes, and that activation of these networks can modulate pain perceptions (Kenntner-Mabiala et al., 2008; Luo et al., 2022). In this context, the positive association observed in our study suggests that pain perception may be influenced not only by the level of body awareness but also by how body awareness is experienced in conjunction with emotional load and attentional focus. However, because of the cross-sectional design, this interpretation should be made with caution, and longitudinal studies are needed to clarify the direction of these associations.

The positive association between the number of children and pain intensity in the neck and upper back, together with the association between caregiving status and higher upper back pain intensity, may reflect greater physical demands associated with caregiving responsibilities. Previous research has shown that increased caregiving demands are associated with poorer physical health, higher musculoskeletal load, psychological distress, and reduced quality of life among women (Gokcin Eminel et al., 2021; Kim et al., 2023; Villarejo Aguilar et al., 2012). Evidence further suggests that the combined effects of childcare and domestic labor may be associated with greater pain frequency and severity among women (Krantz et al., 2005). Accordingly, a higher number of children may be considered a proxy for cumulative caregiving demands, which may be associated with greater pain intensity, potentially through biomechanical and stress-related mechanisms proposed in previous studies (Ovdii et al., 2024). Additionally, the absence of significant differences in postural and body awareness across demographic and clinical subgroups may reflect the relatively homogeneous nature of the study population and the shared physical demands of domestic work, as limited variability within subgroups may have reduced the likelihood of detecting between-group differences.

Our multiple linear regression analyses showed a statistically significant and positive association between increased BMI and the severity of lower back pain. This finding is consistent with the view that higher body weight may increase the biomechanical load on the lumbar spine, which may be associated with greater pain intensity (Heuch et al., 2010; Liu et al., 2024). Interestingly, the lack of a significant association between BMI and neck and upper back pain severity suggests that pain in different body regions may be associated with distinct underlying factors. In our analyses, pain severity in these regions was more strongly associated with direct indicators of caregiving load, such as the number of children, rather than general factors such as BMI. This finding may indicate that neck and upper back pain is more closely associated with caregiving-related demands, potentially including repetitive activities such as lifting, bending, and prolonged static postures. Consequently, while our results suggest that higher BMI is associated with greater lower back pain intensity**,** they also underscore the importance of considering caregiving-related biomechanical and behavioral factors when interpreting neck and upper back pain. Although the regression models explained a modest proportion of the variance in pain outcomes, these findings should be interpreted in the context of the multifactorial nature of musculoskeletal pain. The R^2 values indicate that the factors included in the models explain only part of the

broader biomechanical, psychological, and contextual influences on pain.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design precludes any conclusions regarding the temporal direction or causality of the observed associations. Second, participants were recruited using purposive sampling from community settings, which may limit the generalizability of the findings to other populations. Third, both the exposure variables (postural and body awareness) and the outcome measures (musculoskeletal pain prevalence and intensity) were based on self-reported questionnaires, introducing the possibility of reporting bias and common method bias. In addition, the assessment of musculoskeletal pain over the previous 12 months may have been affected by recall bias. Another limitation is that household workload was not quantified. Variables such as the duration and intensity of domestic work, frequency of specific household tasks, and caregiving hours may influence musculoskeletal pain and should be considered in future studies. Furthermore, although our discussion considers the potential roles of emotional load and somatosensory amplification in explaining the association between body awareness and pain intensity, psychological factors such as depression, anxiety, and pain catastrophizing were not assessed. Future research incorporating these variables would provide a more comprehensive understanding of the mechanisms underlying the observed associations. Finally, because multiple statistical tests were performed, the possibility of an increased risk of Type I error should be considered when interpreting the findings.

Conclusion

This study examined the associations between postural awareness, body awareness, and musculoskeletal pain outcomes among housewives, highlighting that awareness-related constructs are not unidimensional within the pain experience. Postural awareness was associated with lower pain intensity, whereas greater body awareness was associated with higher perceived pain severity. In addition, body mass index and caregiving-related factors, such as the number of children, were differentially associated with pain intensity across anatomical regions. Together, these findings underscore the importance of adopting a biopsychosocial perspective when examining musculoskeletal pain in housewives. Future longitudinal studies are needed to clarify the temporal direction of these associations, while intervention studies are required to determine whether modifying postural or body awareness can influence musculoskeletal pain outcomes.

Ethical Approval

The study was approved by the Atatürk University Faculty of Health Sciences Ethics Committee (Approval Number: 2025/11/07) and was conducted in accordance with the principles of the Declaration of Helsinki.

Author Contributions

Conceptualization: BO, SU, FT. Data curation: BO, SU. Formal analysis: BO, SU. Investigation: FT, BO, SU. Methodology: FT, BO. Project administration: BO. Resources: FT. Supervision: BO. Visualization: BO, SU. Writing – original draft: BO, SU, FT. Writing – review & editing: BO, SU, FT.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Conflict of Interest

The authors hereby declare that there was no conflict of interest in conducting this research.

References

Aviv, E., Waizman, Y., Kim, E., Liu, J., Rodsky, E., & Saxbe, D. (2025). Cognitive household labor: gender disparities and consequences for maternal mental health and wellbeing. *Arch Womens Ment Health, 28*(1), 5-14. doi: 10.1007/s00737-024-01490-w

Baybaşin, C., & Saka, G. (2021). Determination of the frequency of low back pain, affecting factors and the relationship between low back pain and physical activity level in women aged 15-49. *Online Turkish Journal of Health Sciences, 6*(3), 340-346. doi:10.26453/otjhs.822620

Botelho, L. M., Morales-Quezada, L., Rozisky, J. R., Brietzke, A. P., Torres, I. L., Deitos, A., . . . Caumo, W. (2016). A Framework for Understanding the Relationship between Descending Pain Modulation, Motor Corticospinal, and Neuroplasticity Regulation Systems in Chronic Myofascial Pain. *Front Hum Neurosci, 10*, 308. doi: 10.3389/fnhum.2016.00308

Bravo, C., Skjaerven, L. H., Espart, A., Guitard Sein-Echaluce, L., & Catalan-Matamoros, D. (2019). Basic Body Awareness Therapy in patients suffering from fibromyalgia: A randomized clinical trial. *Physiother Theory Pract, 35*(10), 919-929. doi: 10.1080/09593985.2018.1467520

Ciaramella, A., Silvestri, S., Pozzolini, V., Federici, M., & Carli, G. (2021). A retrospective observational study

comparing somatosensory amplification in fibromyalgia, chronic pain, psychiatric disorders and healthy subjects. *Scand J Pain, 21*(2), 317-329. doi: 10.1515/sjpain-2020-0103

Colgan, D. D., Green, K., Eddy, A., Brems, C., Sherman, K. J., Cramer, H., . . . Christopher, M. (2021). Translation, cross-cultural adaptation, and psychometric validation of the English version of the Postural Awareness Scale. *Pain Med, 22*(11), 2686-2699. doi: 10.1093/pm/pnab200

Cramer, H., Mehling, W. E., Saha, F. J., Dobos, G., & Lauche, R. (2018). Postural awareness and its relation to pain: validation of an innovative instrument measuring awareness of body posture in patients with chronic pain. *BMC Musculoskeletal Disorders, 19*(1), 109.

Daminger, A. (2019). The cognitive dimension of household labor. *American Sociological Review, 84*(4), 609-633.

Dickinson, C., Campion, K., Foster, A., Newman, S., O'rourke, A., & Thomas, P. (1992). Questionnaire development: an examination of the Nordic Musculoskeletal questionnaire. *Applied Ergonomics, 23*(3), 197-201.

Dursun, Ö., & Önen, C. (2024). Turkish reliability and validity of postural awareness scale in office workers. *Türk Fizyoterapi ve Rehabilitasyon Dergisi, 35*(1), 114-122.

Gokcin Eminel, A., Kahraman, T., & Genc, A. (2021). Physical workload during caregiving activities and related factors among the caregivers of children with cerebral palsy. *Ir J Med Sci, 190*(2), 701-709. doi: 10.1007/s11845-020-02337-w

Gözgen, H., & Belgen Kaygısız, B. (2025). Effectiveness of body awareness therapy on pain and pain coping strategies in postmenopausal women: A randomized controlled study. *J Back Musculoskelet Rehabil, 38*(6), 1418-1428. doi: 10.1177/10538127251339819

Gyllensten, A. L., Skär, L., Miller, M., & Gard, G. (2010). Embodied identity—A deeper understanding of body awareness. *Physiotherapy Theory and Practice, 26*(7), 439-446. doi: 10.3109/09593980903422956

Habib, M. M., & Rahman, S. U. (2015). Musculoskeletal symptoms (MSS) and their associations with ergonomic physical risk factors of the women engaging in regular rural household activities: A picture from a rural village in Bangladesh. *Work, 50*(3), 347-356. doi: 10.3233/wor-151990

Heuch, I., Hagen, K., Heuch, I., Nygaard, Ø., & Zwart, J.-A. (2010). The impact of body mass index on the prevalence of low back pain: the HUNT study. *Spine, 35*(7), 764-768.

Kahraman, T., Genç, A., & Göz, E. (2016). The Nordic Musculoskeletal Questionnaire: cross-cultural adaptation into Turkish assessing its psychometric properties. *Disability and Rehabilitation, 38*(21), 2153-2160.

Kalkışım Ş, N., Erden, A., Kanber Uzun, Ö., Ertemoğlu Öksüz, C., Zihni, N. B., & Çan, M. A. (2023). Relationship between body awareness level and musculoskeletal pain complaints, physical activity level and emotional status in healthy people. *Acta Neurol Belg, 123*(5), 1789-1796. doi: 10.1007/s13760-022-02056-2

Kaplan, A., Sabbah-Karkabi, M., & Herzog, H. (2020). "When I iron my son's shirt, I feel my maternal role": Making women's invisible work visible. *Journal of Family Issues, 41*(9), 1525-1545. doi: 10.1177/0192513X19894351

Kaplan, V. (2023). Mental health states of housewives: an evaluation in terms of self-perception and codependency. *Int J Ment Health Addict, 21*(1), 666-683. doi: 10.1007/s11469-022-00910-1

Karaca, S., & Bayar, B. (2021). Turkish version of body awareness questionnaire: validity and reliability study. *Türk Fizyoterapi ve Rehabilitasyon Dergisi, 32*(1), 44-50. doi: 10.21653/tjpr.660186

Kenntner-Mabiala, R., Andreatta, M., Wieser, M. J., Mühlberger, A., & Pauli, P. (2008). Distinct effects of attention and affect on pain perception and somatosensory evoked potentials. *Biol Psychol, 78*(1), 114-122. doi: 10.1016/j.biopsycho.2008.01.007

Kim, H., Beach, S. R., Friedman, E. M., Donovan, H., & Schulz, R. (2023). Effects of childcare, work, and caregiving intensity on male and female family caregivers. *J Gerontol B Psychol Sci Soc Sci, 78*(6), 959-968. doi: 10.1093/geronb/gbad022

Köteles, F., & Doering, B. K. (2016). The many faces of somatosensory amplification: The relative contribution of body awareness, symptom labeling, and anxiety. *J Health Psychol, 21*(12), 2903-2911. doi: 10.1177/1359105315588216

Krantz, G., Berntsson, L., & Lundberg, U. (2005). Total workload, work stress and perceived symptoms in Swedish male and female white-collar employees. *Eur J Public Health, 15*(2), 209-214. doi: 10.1093/eurpub/cki079

Liem, T., Bohlen, L., Jung, A. M., Hitsch, S., & Schmidt, T. (2024). Does Osteopathic Heart-Focused Palpation Modify Heart Rate Variability in Stressed Participants with Musculoskeletal Pain? A Randomised Controlled Pilot Study. *Healthcare (Basel), 12*(2). doi: 10.3390/healthcare12020138

Liu, Y., Tang, G., & Li, J. (2024). Causations between obesity, diabetes, lifestyle factors and the risk of low back pain. *Eur Spine J, 33*(2), 525-532. doi: 10.1007/s00586-023-08069-6

Luo, L., Xiao, M., Luo, Y., Yi, H., Dong, D., Liu, Y., Chen, X., Li, W., & Chen, H. (2022). Knowing what you feel: Inferior frontal gyrus-based structural and functional neural patterns underpinning adaptive body awareness. *J Affect Disord, 315*, 224-233. doi: 10.1016/j.jad.2022.07.051

Lustyk, M. K., Douglas, H. A., Bentley, J. A., & Gerrish, W. G. (2012). Cardiovascular responses to a laboratory stressor in women: Assessing the role of body awareness. *Body Mov Dance Psychother, 7*(1), 55-70. doi: 10.1080/17432979.2011.617522

Mondal, J., & T. Ghosh. 2022. *Impact of work-related factors on musculoskeletal discomfort among the rural housewives in Central India.* In International Conference of the Indian Society of Ergonomics, 1495–1507. Cham: Springer.

Nawrin, S., & Hasan, M. M. (2020). Musculoskeletal Pain among Rural Homemakers and their Health Seeking Behaviors. *Clin & Med Sci, 2*(1).

Norouzi, S., Tavafian, S. S., Cousins, R., & Mokarami, H. (2021). Study protocol for a randomized controlled trial to improve the quality of life of housewives with musculoskeletal disorders: a health promotion intervention based on a participatory ergonomic

approach-the Housewives Ergonomic Intervention (HEI) trial. *Trials,* 22(1), 490. doi: 10.1186/s13063-021-05436-w

Norouzi, S., Tavafian, S. S., Cousins, R., & Mokarami, H. (2023). Understanding risk factors for musculoskeletal disorders in Iranian housewives: Development of a comprehensive health promotion behavior model. *BMC Public Health, 23*(1), 617. doi: 10.1186/s12889-023-15518-w

Norouzi, S., Tavafian, S. S., Cousins, R., & Mokarami, H. (2025). Evaluation of postural stress and risk factors for developing work-related musculoskeletal disorders among full-time women homemakers. *Sport Sciences for Health, 21*(1), 173-180.

Ovdii, M., Cherepenko, I., Tsyhanok, A., Dmytrenko, A., & Kravets, R. (2024). Relationship of chronic low back pain intensity with functional activity, stress and quality of life in working-age adults. *Pain, Joints, Spine, 14*(3), 155-161.

Saat, N. Z. M., Hanawi, S. A., Farah, N. M. F., Hanafiah, H., & Zuha, A. A. (2022). Relationship between physical activity and musculoskeletal disorders among low income housewives in Kuala Lumpur: A cross sectional study. *PLoS One, 17*(10), e0274305. doi:10.1371/journal.pone.0274305

Salaffi, F., Stancati, A., Silvestri, C. A., Ciapetti, A., & Grassi, W. (2004). Minimal clinically important changes in chronic musculoskeletal pain intensity measured on a numerical rating scale. *Eur J Pain, 8*(4), 283-291. doi: 10.1016/j.ejpain.2003.09.004

Shields, S. A., Mallory, M. E., & Simon, A. (1989). The body awareness questionnaire: reliability and validity. *Journal of Personality Assessment, 53*(4), 802-815.

Stroman, P. W., Powers, J. M., Ioachim, G., Warren, H. J. M., & McNeil, K. (2021). Investigation of the neural basis of expectation-based analgesia in the human brainstem and spinal cord by means of functional magnetic resonance imaging. *Neurobiol Pain, 10*, 100068. doi: 10.1016/j.ynpai.2021.100068

Villarejo Aguilar, L., Zamora Peña, M., & Casado Ponce, G. (2012). Overload and pain in perceived caregivers of dependent elder. *Enfermería Global, 11*(3), 159-165.

Zhang, N., & Yang, H. X. (2024). A network analysis of body image concern, interoceptive sensibility, self-consciousness, and self-objectification. *J Clin Psychol, 80*(11), 2247-2267. doi: 10.1002/jclp.23734