

MUSCULOSKELETAL, REHABILITATION & REGENERATIVE MEDICINE SECTION

More than Ownership: The Importance of Relationships with Companion Dogs for the Psychological Adjustment of Fibromyalgia Patients

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Abstract

Objective. This study explored the role of companion dogs for psychological adjustment to pain in patients with fibromyalgia with different levels of social support. It also considered the potential moderating effects of the quality of the owner-dog relationship and the use of interactions with dogs as a coping strategy. **Setting.** A cross-sectional approach was followed using an online questionnaire. **Subjects and Methods.** Linear regression analyses were performed on data obtained from 106 participants (dog owners and non-owners). Sub-analyses were performed on 64 dog owners. **Results.** Complex associations were observed between human social support, dog ownership and anxiety/depression levels. For participants with low levels of social support, owning a dog was associated with higher levels of anxiety and depression. In contrast, for moderate and high levels of social support, owning a dog was associated with lower levels of anxiety and depression. Sub-analyses showed that participants in this study actively used interactions with companion dogs to manage their pain more frequently than other pain coping strategies. Among those interactions, patting and stroking the dog to cope with pain was associated with lower anxiety levels, even after adjusting for social support. Emotional closeness with the dog was associated with lower depression levels. **Conclusions.** Obtained results highlight the importance to go beyond mere ownership when addressing the effects of companion dogs and suggest that the development of emotional ties with companion dogs and the active use of interactions with these animals to cope with pain may contribute to better psychological adjustment in patients with fibromyalgia, regardless of human social support.

Key Words: Fibromyalgia; Anxiety; Depression; Companion Dogs; Social Support

Introduction

It is widely recognized that chronic pain leads to negative emotions and psychological distress [1]. In fact, over half of the patients who suffer from chronic pain develop mood disorders, such as anxiety and depression [2–4]. This reduces quality of life and complicates medical care

while increasing healthcare costs due to medication and physician office visits [5, 6]. Interestingly, several studies have shown that the psychological outcomes as well as the associated healthcare costs for patients with chronic pain may dramatically change because of differences in social relationships like perceived social support [7, 8]. In

fact, social networks have long been recognized as holding significant relevance for the design of long-term condition self-management intervention. It has been found that satisfaction with social support buffered the association between pain intensity and depressive symptomatology in arthritis patients [9]. In addition, it has been suggested that interventions focusing on social resources may beneficially influence long-term outcomes in patients with chronic pain [10].

Recently, the role of companion animals as family members has been increasingly recognized [11], and the suggestion has emerged that a biopsychosocial model of care should also consider the companion animals in a patient's life [12, 13]. Indeed, studies show that companion animals, and especially dogs, tend to occupy a place within the family circle being frequently described as capable of providing comfort and companionship [14]. Evidence has also been reported showing a beneficial link to human health derived from companion animal ownership (for reviews and discussions on the topic see [15–17]). Nevertheless, other studies have reported none or even negative outcomes from animal ownership [18, 19]. Hence, several propositions emerged calling for attention on variables that may affect the type and/or strength of such link [20, 21]. For example, it was suggested that owning a companion animal may matter most (or only) for people with poorer levels of social support [22, 23].

It has been proposed that it is not the ownership status per se that is related to beneficial (or detrimental) effects on human health but rather the quality of the human-companion animal relationship [24]. Therefore, the research approaches that integrate both positive (e.g., emotional bond) and negative aspects (e.g., costs and responsibility for caring) of the human-companion animal relationship have become extremely relevant. In fact, the failure to identify health implications associated to the human-animal relationship may be due to the employment of inadequate measures of that relationship, including “attachment” measures [25]. While this term (“attachment”) is the most commonly used concept to describe and measure the human-animal companion relationship, several authors have questioned whether it can actually be used in the context of human-companion animal relationships. Van Houtert et al. [26], for example, argued that using attachment for measuring the human-companion animal relationship is contrary to the social exchange theory of relationships (which was first proposed to apply to human-companion animal relationships by Netting et al. [27]).”

To date, the effects of companion animals in people suffering from chronic pain have been poorly studied. In a descriptive qualitative study involving interviews to 12 patients attending a tertiary chronic pain program, living with a dog was reported to contribute to well-being through a variety of ways, such as distraction, comfort, bringing joy and happiness, and encouraging exercise and social interaction [28]. In line with these findings,

results from a study evaluating the feasibility of surveying people with chronic low back pain showed that living with a dog was associated with improved well-being in this population [29]. Importantly, though, previous results from an online survey of 173 adults self-identified as suffering from chronic pain disease suggest that simply owning a dog may not be sufficient to improve psychological health and may even be detrimental if either the dogs' characteristics or the type of interaction is not adjusted to the purpose of coping with pain [30]. This is in line with findings from a more recent study assessing how companion animal ownership promotes use of cognitive-behavioral self-management strategies in older dog and cat owners with chronic pain [31]. Although the vast majority of participants' comments about their companion animals were positive, some also mentioned challenges related to companion animal ownership that may hinder the pain management strategies [31].

Fibromyalgia is a chronic musculoskeletal pain condition that affects predominantly women [32, 33]. In the United States, for example, it was estimated that fibromyalgia affects 3.4% of women and 0.5% of men [32]. This condition tends to be comorbid with emotional disorders, requiring additional treatment considerations to optimize patient outcomes [34–36]. In comparison with other chronic pain patients or healthy controls, patients with fibromyalgia show a higher prevalence of depressive and anxiety symptoms [37]. In addition, studies suggest that patients with fibromyalgia experience higher levels of stigmatization and lower levels of social support than people with other chronic conditions [38], and these observations have been associated with higher levels of mental distress [39]. To our knowledge, only anecdotal data have been reported suggesting that dogs may play a significant role in the lives of patients with fibromyalgia [40].

The present study was designed to i) explore a potential association between dog ownership and psychological adjustment to pain (i.e., anxiety and depression levels) in patients with fibromyalgia, and ii) assess whether levels of human social support might moderate that association. We predicted dog owners to report significantly lower levels of anxiety and depression than non-dog owners, and we expected this difference to be greater among individuals with lower levels of human social support. However, and given the exploratory nature of this study, we raised no specific hypothesis about whether dog ownership would be associated with lower anxiety and depression among all dog owners but especially for those with low social support or only for those with low social support. Finally, this study also assessed whether individuals with fibromyalgia who own a dog actively use interactions with these animals as a pain coping strategy, and whether those interactions and the “quality” of the dog-owner relationship—assessed following [41]—may be associated with psychological adjustment to pain. We hypothesized that individuals who

engage more with their dogs to manage their pain and/or have higher quality relationships with their dogs exhibit lower levels of anxiety and depression. In addition, we hypothesized this association to be greater in individuals with lower levels of perceived social support.

Methods

Participants Recruitment

Recruitment of participants was assisted by the Portuguese Association of Patients with Fibromyalgia (“Associação Portuguesa de Doentes com Fibromialgia”; APDF) via postings in a private social media group with 2,600 members. Individuals in this group are people who seek support, information, and a place to share their experiences.

In the postings, the APDF conveyed the importance of generating further knowledge about psychological adjustment to pain in fibromyalgia and the role of companion animals and asked for group members with fibromyalgia diagnosed by a physician to complete an online anonymous questionnaire (hosted in Google forms). Importantly, the postings made it clear that both dog owners and non-dog owners could participate in the study. By clicking on a link to the questionnaire, subjects were led to an informed consent web page presenting a description of the study and referring to their anonymity in the sample. Once subjects reached the bottom of this page, they were given the option of continuing to the study questionnaire. They could do so by clicking on an icon at the bottom of the page that read, “I am over 18 years of age, I have a clinically established diagnosis of fibromyalgia, and I consent to participate.” Otherwise, subjects could decline to participate. No participant was compensated or rewarded in any way.

Questionnaire

The questionnaire developed for this study took 15 to 20 minutes to complete (as piloted in two patients with fibromyalgia). Responses on the questionnaire were collected between November 2018 and March 2019. The questionnaire included the following demographic questions and self-report measures.

Demographics

The demographics section of the questionnaire included questions on participants’ gender, age, living conditions (i.e., alone vs not alone), professional status (employed vs unemployed), years of education, dog ownership status (dog-owner vs non-owner), and duration of illness (i.e., time from a clinical diagnosis of fibromyalgia).

Fibromyalgianess

To further validate the participants’ clinically diagnosed fibromyalgia status the Fibromyalgia Survey Questionnaire (FSQ; [42]) was used. The FSQ

questionnaire, which includes the Widespread Pain Index (WPI) and Symptom Severity Scale (SSS), assesses the key symptoms of fibromyalgia and allows administration in survey research [42]. The WPI assesses pain presence (0= no, 1= yes) in the preceding week in 19 anatomical areas (total score ranging 0–19). The SSS quantifies the severity of fatigue, trouble thinking and/or remembering, and waking up tired and/or unrefreshed, which is coded 0–3 (0= not present; 3= extreme), as well as the presence (0= no, 1= yes) of pain cramps in the lower abdomen, depression, and headache in the past 6 months (total score ranging 0–12). In this study, Cronbach’s alpha of the SSS was 0.61. The fibromyalgianess scale (FS), defined as the sum of the (0–19) WPI and the 6-item (0–12) SS scale, has a range of 0–31 [46].

According to the American College of Rheumatology, patients with fibromyalgia syndrome have a WPI ≥ 7 and SSS score ≥ 5 OR WPI of 4–6 and SSS score ≥ 9 along with two other criteria, namely, the presence of symptoms at a similar level for at least 3 months, and absence of another disorder that would otherwise sufficiently explain the pain [43]. Only data of participants who met the WPI and SSS criteria were included in the analysis.

Pain Intensity

The average intensity of pain that participants’ experience in general was assessed using the Portuguese version of the Numeric Pain Rating Scale (NPRS) [44]. The NPRS ranges from 0 (no pain) to 10 (worst pain imaginable). It has good test-retest reliability and convergent validity, and also superior sensitivity to other common pain rating scales [45].

Perceived Social Support

Participants’ perceived levels of social support were assessed using the Portuguese version of the Multidimensional Scale of Perceived Social Support (MSPSS; [46]). This 12-item scale yields a global perceived support score, as well as subscale scores for support from family, friends, and significant others. Items are rated from 1 (“strongly disagree”) to 7 (“strongly agree”). Total score is the sum of the 12 items and ranges from 12 to 84. The mean total score was used in this study and was calculated by averaging the ratings for all 12 items. Following Zimet et al. [47], mean scores ranging from 1 to 2.9 were considered low support; scores of 3 to 5 were considered moderate support; and scores from 5.1 to 7 were considered high support. The MSPSS total score has been shown to have excellent internal consistency, strong test-retest reliability over a 2–3 months’ period, and established validity as evidenced by a significant negative association with depressive symptoms [47, 48]. In this study, Cronbach’s alpha was 0.92.

Anxiety and Depression

The Portuguese version of the Hospital Anxiety and Depression Scale (HADS; [49]) was used to evaluate participants' symptoms of anxiety and depression. The HADS consists of two subscales, one measuring anxiety (HADS-A) and the other measuring depression (HADS-D). Each subscale comprises 7 items. Subjects assess how each item applies to them on a scale ranging from no feelings of anxiety or depression (0) to severe feelings of anxiety or depression (3). The anxiety subscale analyzes a state of generalized anxiety (including anxious mood, restlessness, anxious thoughts, panic attacks), whereas the depression subscale focuses on a state of lost interest and diminished pleasure response ("lowering of hedonic tone"). This scale ranges from 1 to 21. Snaith [50] posits a score of 11 or higher indicating probable presence ("caseness") of a mood disorder and a score of 8–10 being just suggestive of the presence of the respective state. The HADS has been found to be reliable [50]. In this study, Cronbach's alpha was 0.75 for the HADS-A and 0.79 for the HADS-D.

Pain Coping Strategies

Dog owners were asked to report the number of days during a week they use interactions with their dogs for the specific purpose of coping with pain. As in Bradley & Bennett [30], five different interactions were considered: i) patting or stroking the dog, ii) talking to the dog, iii) playing games or doing tricks with the dog, iv) going for a walk with the dog, and v) sitting or laying down with the dog. The means of the number of days per week dog owners used each type of strategy were calculated.

Dog owners were also asked to fill in the Chronic Pain Coping Inventory-42 (CPCI-42; [50]), which assesses how many days during a week, participants use specific cognitive and behavioral pain-coping strategies to aid in pain management. This instrument is a shortened version of the CPCI [51]. The CPCI-42 has 42 items distributed among eight scales including: guarding, resting, asking for assistance, relaxation, task persistence, exercise/stretch, seeking social support, and coping self-statements. This measure has been reported to have high correlations with the CPCI and has good test-retest reliability, internal consistency, and validity [51]. It has previously been used in patients with fibromyalgia [52]. In this study, Cronbach's alpha for the combined items assessing dog-related pain coping strategies was 0.72 suggesting that this group of items could be used reliably to measure a single construct. Cronbach's alphas for each of the eight scales in the CPCI-42 ranged from 0.74 to 0.89.

Dog-Owner Relationship

The relationship participants perceive themselves as having with their companion dog was assessed using a back-translated version of the Monash Dog-Owner Relationship Scale (MDORS; [41]). In contrast to other

methods that have been proposed to evaluate the relationship between humans and companion animals (e.g., the Pet Attitude Scale [53], the Lexington Attachment to Pets Scale [54]), the MDORS is a multidimensional scale, developed following the social exchange theory of relationships. Moreover, this scale focuses exclusively on the relationship between owners and their companion dogs. The MDORS consists of 28 items arranged into three subscales. The dog-owner interaction subscale (9 items) assesses both general activities related to the care of the dog and more intimate activities; it indicates the amount of time spent together as well as the opportunity for shared emotional experiences and reciprocal interactions. The perceived emotional closeness subscale contains 10 items related to social support, affectional bonding, psychological attachment, companionship and unconditional love. The perceived costs subscale (9 items) considers the monetary aspects and increased responsibility and restrictions placed on the owner because of the dog. All items in each scale are scored 1–5. The dog-owner interaction and the perceived costs sub-scales range both from 9 to 45 points. The perceived emotional closeness sub-scale ranges from 10 to 50. Higher scores indicate a higher level of interaction, a higher level of emotional closeness, and higher costs. Since it is not appropriate to sum the three subscale scores together at present (as each represents a different and at least partially independent aspect of the human companion dog relationship) [41], only subscales scores were used in this study. Obtained Cronbach's alphas were 0.79 for the dog-owner interaction subscale, 0.84 for the emotional closeness subscale, and 0.76 for the costs subscale.

Sample Size

The minimum sample size for this study was calculated using Soper's a priori sample size calculator for multiple regression [55]. For an effect size 0.25 (considered between medium and large; [56]), a power of 0.8, a significance level of .05, and 3, 4 or 5 predictors, the minimum required sample size was 48, 53, or 57 participants (respectively are required for a multiple linear regression analysis).

Statistical Analyses

Patient characteristics were obtained from the demographic questions and self-report measures described above. These included: age, gender, living conditions, professional status, years of education, dog ownership status, years since the clinical diagnosis of fibromyalgia (duration of illness), widespread pain (WPI), symptom severity (SSS), disease status (FSQ), average pain intensity (NPRS), perceived social support (MSPSS), and correspondent levels. For dog owners, the mean week days of using specific cognitive and behavioral pain-coping strategies to aid in pain management (CPCI-42) was also obtained, in addition to the mean days of using each of

the following dog-related pain coping strategies: patting or stroking the dog, talking to the dog, playing games or doing tricks with the dog, going for a walk with the dog, and sitting or laying down with the dog. The perceived “quality” of the dog-owner relationship was obtained for each of the three dimensions of the MDORS: dog-owner interaction, emotional closeness, and costs. Categorical variables were described using absolute (number of cases) and relative frequencies (percentage of cases), quantitative normally distributed variables were described by mean and standard deviation (SD), while non-normally distributed quantitative variables were described by medians and interquartile range intervals (IQR). For the comparison of sociodemographics and variables related with the disease between dog owners and non-owners, Mann-Whitney *U* test was used for continuous and discrete variables (non-normal distributed data), while χ^2 test was employed for categorical ones. To compare mean scores for coping strategies with and without dog, a paired sample *t* test was used (as difference variable follows normal distribution).

Linear Regression Analyses

For each outcome—anxiety score (HADS-A) and depression score (HADS-D)—a separated multiple linear regression was performed with HADS-A and HADS-D considered as the dependent variable and dog ownership as the independent variable together with mean pain intensity and social support level. Other variables measured in the entire sample (socio-demographics and variables related with the disease) that correlated with the outcomes at $P < .2$ in a simple regression were also included (Table S1 in Supplementary Materials). In the final multivariate models, only the significant variables were maintained, together with a priori variables (mean pain intensity and social support level). These linear regression models were checked with visual analysis of histogram to access the normality of residuals, and a *t* test was used to determine if mean residual were equal to zero. Also, homoscedasticity was verified by plotting residuals against the fitted values.

A subanalysis with dog owners was also performed. For each outcome—anxiety score (HADS-A) and depression score (HADS-D)—a separated multiple linear regression was performed with HADS-A and HADS-D considered as the dependent variable.

Sociodemographics, variables related with the disease, coping strategies, and dog relationship variables that correlated with the outcomes at $P < .2$ in a simple regression were also included (Table S2). In the final multivariate models, only the significant variables were maintained, together with the a priori variables (mean pain intensity and social support level).

Ethical Statement

This study was approved by the CHUP/ICBAS Ethics Committee 2019/CE/P020(P297/2019/CETI).

Results

At least 125 individuals accessed the online questionnaire. One individual declined participation after reading the consent information. The remaining 124 participants (all women) fully completed the questionnaire. Out of these participants, 18 did not comply with the WPI and SSS criteria, and thus their data were excluded from analysis.

Social and demographic as well as fibromyalgia specific characteristics of the remaining 106 participants who were included in the study are summarized in Table 1. For dog-owner participants ($n = 64$), coping strategies, including dog coping strategies, and perceived “quality” of the dog-owner relationship summary statistics are presented in Table 2. Results showed that participants reported using interactions with dogs to manage pain (mean = 4.93 days per week and standard deviation, $s = 0.189$) more frequently, on average, than coping strategies not involving their dogs (mean = 2.92 days per week; $s = 0.166$) [$t(74) = 8.79$; $P_{un} < 0.001$].

Regression Analyses on the Total Sample

Results for the linear regression analyses for anxiety (HADS-A) and depression (HADS-D) are displayed in Table 3 and Table 4, respectively. Both HADS-A and HADS-D scores were associated with mean pain intensity. There was a significant interaction between perceived social support and dog ownership considering both anxiety and depression. For patients with low social support, owning a dog was associated with an average 4.67 rise in anxiety levels. For moderate and high levels of social support, owning a dog was associated with an average 0.87 and 3.22 decrease in anxiety levels, respectively. Considering depression, the pattern was similar. For low social support, owning a dog was associated with an average 4.26 rise in depression levels. For moderate and high levels of social support, dog ownership was associated with 1.02 and 0.41 decrease in depression levels, respectively. Interactions between dog ownership and social support are shown in Figure 1, for anxiety and depression.

Sub-Analyses for Dog Owners

The linear regression analysis for anxiety scores (HADS-A) of dog owners shows that patting and stroking the dog was significantly associated with an average 0.83 decrease in anxiety levels ($P < .001$), even adjusting for pain intensity and perceived social support. Additionally, patients with high and moderate levels of social support also have significantly less anxiety levels when compared with patients with low levels of social support ($\beta = -4.47$; $P < .001$ and $\beta = -2.340$; $P = .03$, respectively).

Table 1. Participant characteristics and outcomes

	Dog Owners (n = 64)	Non-Owners (n = 42)	Total (N = 106)	P-value
Social demographics				
Age in years, median (IQR)	44 (40–52)	44 (37–52)	44 (40–52)	.963*
Households, median (IQR)	2 (1–4)	2 (1–3)	2 (1–3)	.110*
Professionally active, n (%)	32 (50)	25 (59.5)	57 (54)	.336 [†]
Years of education, median (IQR)	14 (9–16)	13 (9–16)	14 (9–16)	.573*
Fibromyalgia				
Years since the diagnosis, median (IQR)	5 (2–9)	4 (3–8)	5 (2–8)	.950*
WPI, median (IQR)	11 (8–14)	9.5 (8–13)	10 (8–14)	.478*
SSS, median (IQR)	8 (7–9)	8 (7–9)	8 (7–9)	.596*
Total FSQ, median (IQR)	18 (15–22.5)	18 (15–21)	18 (15–22)	.788*
Pain intensity [‡] , median (IQR)	7 (6–8)	7 (6–8)	7 (6–8)	.296*
Social support				
Perceived social support [§] , median (IQR)	4.5 (3.2–5.3)	3.9 (3.1–4.9)	4.3 (3.1–5.1)	.229*
Perceived social support levels, n (%)				.462 [†]
Low	14 (22)	8 (19)	22 (21)	
Moderate	32 (50)	26 (62)	58 (55)	
High	18 (28)	8 (19)	26 (24)	
Outcomes [¶]				
Anxiety, median (IQR)	14 (10–16)	14 (11–16)	14 (11–16)	.638*
Anxiety diagnosis, n (%)	47 (73)	33 (79)	80 (76)	.548 [†]
Depression, median (IQR)	12 (8–15)	11 (9–14)	11 (8–15)	.842*
Depression diagnosis, n (%)	35 (55)	22 (52)	57 (54)	.816 [†]

IQR, interquartile range; WPI, Widespread Pain Index: score ranging from 0, no pain, to 19, strongest pain; SSS, Symptom Severity Score: score ranging from 0, lowest severity, to 12, highest severity; FSQ, Fibromyalgia Survey Questionnaire total score, FSQ + SSS: scores ranging from 0 to 31.

*Mann-Whitney test used to compare variable distributions between dog owners and non-owners.

[†] χ^2 test used to compare variable proportions between dog owners and non-owners.

[‡]Measured by the Numeric Pain Rating Scale (NPRS): scores ranging from 0, no pain, to 10, worst pain imaginable.

[§]Perceived social support, measured by the Multidimensional Scale of Perceived Social Support (MSPSS) scale: scores ranging from 1 to 7, from low to high perceived social support. Categorical levels: low (1 to 2.9), moderate (3 to 5) and high support (5.1 to 7).

[¶]Anxiety and depression scores, measured by HADS-A and HADS-D, respectively, range from 1, absence, to 21, indicative of severe feelings of anxiety and depression. A score of 11 or higher in HADS-A and HADS-D was considered for the diagnoses of anxiety and depression, respectively.

The results of the linear regression analysis for depression scores (HADS-D) in dog owners reveal that emotional closeness between patients and their animals was significantly associated with an average 0.25 reduction in depression levels ($P < .001$), even adjusted for pain intensity and perceived social support. Additionally, patients with high levels of social support also show significantly less depression levels than patients with low levels of social support ($\beta = -3.71$; $P = .003$).

Discussion

The present study explored the role of companion dogs on the psychological adjustment to pain in individuals diagnosed with fibromyalgia. We had hypothesized that individuals who engage more with their dogs to manage their pain and/or have higher quality relationships with their dogs exhibit lower levels of anxiety and depression. We also had hypothesized this association to be greater in individuals with lower levels of perceived social support as supported by Garrity et al. [22] and Pruchno et al. [23]. Interestingly, and contrary to this idea, the results showed that, in individuals scoring lower in human social support, owning a dog was associated with higher, rather than lower, levels of anxiety and depression. As opposed, in individuals with moderate to high

levels of social support, dog ownership was associated with reduced levels of anxiety and depression.

Antonacopoulos and Pychyl [57] reported similar results to those here obtained. These authors showed that among individuals living alone with low levels of human social support, the loneliness levels of dog owners and non-owners did not differ significantly. However, among individuals living alone with high levels of human social support, dog owners were significantly less lonely than non-owners. In face with these observations, Antonacopoulos and Pychyl [57] hypothesized that for people with high levels of social support, dogs may provide an additional source of emotional support to cope with loneliness. In contrast, among individuals with low levels of human social support, owning a dog might not be sufficient to compensate for a lack of supportive relationships. Also, in a qualitative study focusing on senior dog and cat owners, Wells and Rodi [58] concluded that “individuals who benefited most from pet ownership were likely to already be well-supported in their social relationships and not dependent on the pet for company or to boost self-esteem” (147).

Results here obtained suggest that also among patients with fibromyalgia, owning a dog may only benefit individuals with moderate/high social support. In contrast, for patients with low social support, results seem to

Table 2. Characteristics on dog related measures and coping strategies for the 64 dog-owners (median and interquartile range, IQR)

	n = 64
Number of owned dogs, median (IQR)	1 (1–2)
Dog-owner interaction*, median (IQR)	35 (31–39)
Perceived emotional closeness†, median (IQR)	46 (40–49)
Perceived costs‡, median (IQR)	18 (12–21)
Dog coping§	
Patting or stroking the dog, median (IQR)	7 (4–7)
Talking to the dog, median (IQR)	7 (5–7)
Playing games or doing tricks with the dog, median (IQR)	6 (4–7)
Going for a walk with the dog, median (IQR)	2 (0–7)
Sitting or laying down with the dog, median (IQR)	7 (3–7)
CPCI-42 subscales¶	
Guarding, median (IQR)	3 (2–4)
Resting, median (IQR)	4 (3–6)
Asking for assistance, median (IQR)	2 (1–6)
Relaxation, median (IQR)	2 (1–3)
Task persistence, median (IQR)	3 (2–4)
Exercise stretch, median (IQR)	2 (0–4)
Seeking social support, median (IQR)	1 (0–3)
Coping self-statements, median (IQR)	4 (2–6)

*Subscale of the (MDORS), with scores ranging from 9 to 45, higher scores indicate a higher level of interaction.

†Subscale of the (MDORS), with scores ranging from 10 to 50, higher scores indicate a higher level of emotional closeness.

‡Subscale of the (MDORS), with scores ranging from 9 to 45, higher scores indicate higher costs.

§Measured in days per week participants use specific cognitive or behavioral pain-coping strategies to aid in pain management.

¶CPCI-42, Chronic Pain Coping Inventory-42 items. Range scale is 0–7 for each subscale, obtained as the mean number of days per week participants use specific cognitive or behavioral pain-coping strategies (item) to aid in pain management.

suggest that dog ownership may pose an additional burden leading to increased levels of anxiety and depression. However, and because of the observational nature of the data here obtained, plausible alternative interpretations of the results might be possible, notably involving the effect of some confounding variable(s) not considered in the tested models. Emotion regulation skills or other sources of resilience, such as social connectedness, should be explored in future studies.

There are findings suggesting that dog-human interactions, and dog walking most particularly, may foster a sense of belonging and closeness within individuals' social world, including strangers, community, and society (for a discussion regarding the role play by dogs and dog walking in "strengthening the social fabric communities," see Wood and Christian [59]). Thus, it might be interesting to test whether, dog walking, notably when used as a self-management strategy in the context of chronic pain, may promote social connectedness and lead to improved psychological adjustment, irrespective of levels of social support.

Participants in this study appeared not to engage frequently in dog walking to cope with pain. They did, however, report using interactions with their companion dogs

Table 3. Regression coefficients from linear regression model for anxiety (HADS-A) as dependent variable and pain intensity, dog ownership and perceived social support as predictors (N = 106)

	Anxiety* Levels	
	β	P
Pain intensity†	0.504	.045
Dog ownership	4.670	.002
Perceived social support‡:		
Low	ref	
Moderate	2.509	.075
High	2.256	.195
Interaction: dog ownership* perceived social support:		
Low	ref	
Moderate	−5.535	.002
High	−7.889	<.001

The bold values indicate significance at $P < .05$.

*Anxiety score, measured by HADS-A, ranging from 1, absence, to 21, indicative of severe feelings of anxiety.

†Measured by the Numeric Pain Rating Scale (NPRS): scores ranging from 0, no pain, to 10, worst pain imaginable.

‡Measured by the Multidimensional Scale of Perceived Social Support (MSPSS) scale: scores ranging from 1 to 7, from low to high perceived social support. Categorical levels: low (1 to 2.9), moderate (3 to 5) and high support (5.1 to 7).

(e.g., patting and stroking) to manage pain more frequently than the other pain coping strategies, which are commonly encouraged in psychological treatment. This seems interesting and calls for the attention of healthcare providers to the role of dogs in patients' lives, and to the importance of discussing dog ownership when trying to engage patients in chronic pain self-management regimens. Also, this observation calls for a review of current instruments to assess pain coping strategies so to consider human-animal interactions.

The analyses performed on the data from participants who owned companion dogs also unveiled an interesting pattern of results with levels of depression and anxiety being significantly associated with distinct variables, irrespective of human social support: while depression was associated with perceived emotional closeness with the dog, anxiety was associated with the use of pain coping strategies involving the dog. The closer the owners in this study perceived their relationship with their dogs, the lower they scored on depression. As noted, this was so regardless of human social support, which is important in that it suggests that dog ownership, when involving close emotional ties, might make a positive contribution to depressive states even in patients who face a lack of human social support. It was also interesting to note that, when controlling for perceived emotional closeness with the dog in the performed analyses, no pain coping strategy assessed by the CPCI-42 was found significantly associated with depression, not even those that are commonly emphasized in psychotherapies by virtue of correlating significantly with less depression in patients with fibromyalgia [52]. This suggests that perceived emotional

closeness with the dog may positively affect depression beyond those pain coping strategies.

Although having no apparent effect on depression, the use of interactions with dogs with the specific aim of managing pain was found significantly associated with anxiety. Specifically, results showed that patting and stroking the dog was associated with a significant reduction in anxiety levels. Again, this was so regardless of human social support. Thus, the suggestion that owning a dog may have a negative effect for individuals with low

Table 4. Regression coefficients from linear regression model for depression (HADS-D) as dependent variable and pain intensity, dog ownership and perceived social support as predictors (N = 106)

	Depression* Levels	
	β	P
Pain intensity [†]	0.710	.010
Dog ownership	4.264	.010
Perceived social support [‡] :		
Low	ref	
Moderate	1.819	.233
High	-0.686	.716
Interaction: dog ownership* perceived social support:		
Low	ref	
Moderate	-5.284	.006
High	-4.677	.042

The bold values indicate significance at $P < .05$.

*Depression score, measured by HADS-D, ranging from 1, absence, to 21, indicative of severe feelings of depression.

[†]Measured by the Numeric Pain Rating Scale (NPRS): scores ranging from 0, no pain, to 10, worst pain imaginable.

[‡]Measured by the Multidimensional Scale of Perceived Social Support (MSPSS) scale: scores ranging from 1 to 7, from low to high perceived social support. Categorical levels: low (1 to 2.9), moderate (3 to 5) and high support (5.1 to 7).

social support may not stand when those individuals actively pat and stroke the dog to manage pain. Interestingly, the fact that participants in this study reported using interactions with dogs to manage pain more frequently than any other pain coping strategy calls for a review of current instruments to assess pain coping strategies (so to include strategies involving interactions with companion animals).

The association between anxiety and patting and stroking the dog—but not with any other pain coping strategy involving the dog—is in line with accumulated experimental evidence reporting anxiety reducing effects of tactile interacting with dogs [60–63]. Such effects are likely to result from activation of the oxytocin system via pleasant tactile stimulation (for a thorough discussion regarding the role of oxytocin in the psychophysiological effects of human-animal interactions see Beetz et al. [64]). This seems particularly relevant in that, in addition to anxiolytic effects, oxytocin is also known to have anti-nociceptive and analgesic effects.

Evidence has been found that oxytocin, together with other neuropeptides and neurotransmitters, plays a role in the integration of the stress axes, monoaminergic systems, and the pain processing peptides in the pathophysiological mechanisms responsible for the symptoms in fibromyalgia [65]. Some even consider that oxytocin might be the ideal candidate to treat fibromyalgia [66]. Thus, further exploring the effects of dog-human interactions for patients with fibromyalgia, notably from a psychophysiological perspective might prove a valuable line of investigation. Recently, oxytocin nasal spray has been made available. Its application for patients with fibromyalgia is under research to find out the appropriate dose, route, and/or period of administration so to induce positive therapeutic effects in patients with fibromyalgia [67].

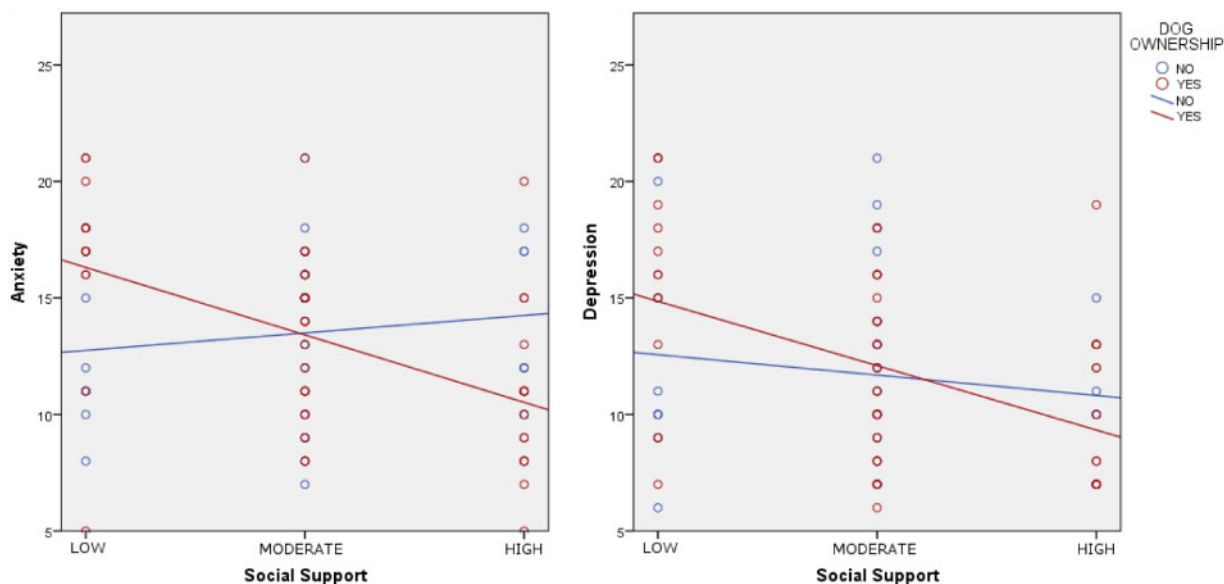


Figure 1. Dog ownership and social support interactions for anxiety (left) and depression (right).

In this scenario, interactions with dogs (and/or other companion animals) as a therapeutic intervention may be of clinical relevance avoiding concerns regarding side effects and pharmacological interactions.

Several limitations to the current study need consideration. First, and as already acknowledged, the use of observational data precludes attribution of causality. However, and as highlighted by Janevic et al. [31], most research on companion animals and human health and well-being is observational in nature. This is due to the practical and ethical considerations inherent to randomly assigning companion animal ownership in the context of research studies. Also according to Janevic et al. [31], the most fruitful direction for future research in this field may be to consider how existing pets can be thought of as a resource for managing health conditions, which, like chronic pain, are biopsychosocial in nature. In this sense, a study is now being planned to assess the impact of integrating companion dogs into a chronic pain self-management routine in patients with fibromyalgia.

Another limitation of the present study regards the low response rate that was obtained, potentially due to the online nature of our questionnaire. One could also argue that, due to the use of an online questionnaire, participants' fibromyalgia diagnosis could not be firmly established in this study. However, the use of the WPI and SSS criteria for including participants' data in the analyses increases confidence that obtained results do refer to patients with fibromyalgia. Importantly to notice, internet-mediated approaches have been increasingly used as a tool that can tap into the experiences of larger specialized groups of people—including patients with fibromyalgia [68–70]. Moreover, research has shown that online questionnaires are commensurate to paper-and-pencil formats in terms of reliability and internal validity [71–73]. For example, it has been shown that converting the fibromyalgia impact questionnaire to an online questionnaire did not significantly affect its total mean scores [74].

The fact that all respondents were recruited via postings in a social media group for fibromyalgia needs also to be highlighted as a limitation of this study. It may be that patients with fibromyalgia are involved in social media groups may be different from those who are not (e.g., struggling more with their conditions, possibly with greater mood symptomatology). As another limitation, one should refer to the fact that all participants in this study were women. To some extent, this does represent the sex distribution of fibromyalgia [32]. Some men, however, do present this condition, meaning that results obtained here cannot be generalized to both genders.

This study focused on dogs; no information was collected regarding the ownership of other companion animals and notably cats, which may also play a role in pain management [31]. Future research is needed to evaluate which patients might benefit the more from which species of companion animal. Finally, one should recognize that,

as with most research involving companion animals, it is possible that it is the people who are more enthusiastic about their companion animals who agree to participate, skewing results to be more positive than they would be in the general population of people who own companion animals.

Conclusion

Despite limitations, the results here reported are of relevance in that they argue against conclusive and simplistic interpretations of approaches considering only dog ownership status. In this study, by exploring the particular features of the relationship with dogs, we unveiled its importance. Future research should now be planned to ascertain whether, as suggested, dog ownership, regardless of human social support, when involving emotional ties and active use of the dog as a coping mechanism, may indeed contribute to positive outcomes on the clinical condition of patients with fibromyalgia.

Supplementary Data

Supplementary data are available at *Pain Medicine* online.

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