

# The Role of Catastrophizing in the Benefits of Walking on Fatigue in Women with Fibromyalgia

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## Research article

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# Abstract

## Background

Walking is one of the most beneficial treatments for fibromyalgia patients. On the other hand, pain catastrophizing is one of the main cognitive processes that these patients present. However, it is not known how this process may affect the relationship between walking and fatigue. Therefore our goal is to analyze the associations between fatigue, catastrophizing, and walking in fibromyalgia patients, and to explore the moderation effect of walking in the association between catastrophizing and fatigue.

## Methods

A cross-sectional study was carried out with 234 women with fibromyalgia older than 18 years. We use Multidimensional Fatigue Inventory for asses fatigue and Pain Catastrophizing Scale for pain catastrophizing (differentiating between its three dimensions, namely rumination, magnification, and helplessness). An ad-hoc self-reported item was used to evaluate walking. We perform the moderation analyses with walking as moderator.

## Results

Walking moderated the relationship between rumination and fatigue (Beta = 0.21  $t = 2.24$ ,  $p = 0.026$ ) and that of magnification with fatigue (Beta = 0.26,  $t = 2.1$ ,  $p = .036$ ). Specifically, that rumination and magnification only contributed to more fatigue when patients engaged in walking behavior. Helplessness contributed to more fatigue independently of adherence to walking (Beta = 0.12,  $t = 2.1$ ,  $p = .036$ ).

## Conclusions

Patients who did not walk were highly fatigued irrespective of their cognitive profile (rumination and magnification only contributed to fatigue when patients walked). Therefore, in the field of personalized treatments, different recommendations should be provided about fatigue management in implementing walking and in its maintenance in the long term in fibromyalgia patients.

## Introduction

Fibromyalgia is a disorder characterized by chronic widespread pain and frequent comorbid symptomatology, such as sleep disturbances, cognitive impairment, emotional disorders and fatigue, among others. It was not until the year 2010, however, when the changes in the diagnostic criteria were set in place and the clinical significance of this comorbid symptomatology was clearly recognized (1). Indeed, for years pain has been the most widely investigated symptom in fibromyalgia. However, another

symptom, namely fatigue has been reported by patients as one of the most disturbing and disabling (2, 3).

Fatigue is a highly prevalent and persistent symptom among fibromyalgia patients (4) and it contributes significantly to functional limitations among sufferers (5). From a rehabilitation and prevention point of view, one of the main treatment aims in patients with fibromyalgia is to include or maintain physical function and to avoid the disabilities that could arise because of it (6, 7). In this sense, fibromyalgia treatments that have included activities and physical exercise as one of their therapeutic aims have shown positive effects on patients' health outcomes (8–10), including a significant reduction of fatigue (11, 12). Walking, which is as a form of physical exercise, has significant advantages over other physical practices due to its easy implementation and accessibility, and its practice is associated with reduced fatigue, pain, and functional limitation, which makes walking an excellent treatment option for people with fibromyalgia (13–16).

In the context of physical exercise and within models of fear of movement (17), pain catastrophizing has been repeatedly associated with more severe symptomatology and a poorer adaptation to fibromyalgia (18, 19). Pain catastrophizing is a highly prevalent coping strategy among fibromyalgia patients (20, 21) characterized by a pessimistic and exaggerated interpretation of current or anticipated pain sensations (22). This biased interpretation of events is what has been argued to lead to avoidance of movement and, ultimately, to poor overall physical status (17). Interestingly, however, the relationship between pain catastrophizing and fatigue is not well established in fibromyalgia (23–27). Past research has shown that the relationship between pain catastrophizing and physical health outcomes in people with musculoskeletal chronic pain might be contextually determined by patients characteristics. Specifically, the existence of very severe pain levels appears to impact physical status in a way that there is little room for pain catastrophizing to contribute to physical outcomes (28). Our goal is to investigate whether the relationship between pain catastrophizing and physical fatigue in people with fibromyalgia is also contextually determined. Specifically, we will test whether adherence to walking is an important contextual factor to be considered in the relationship between pain catastrophizing and fatigue. Based on the aforementioned study, we would expect that, in the worst-case scenario, namely (i.e.) when patients do not walk at all, individual status (i.e., fatigue) will be so unfavorable that there will be little room for pain catastrophizing to contribute to physical status (i.e., fatigue). On the contrary, when patients adhere to walking, we expect fatigue to be high if they walk while using maladaptive coping strategies (i.e., catastrophizing).

The findings might have important repercussions on the design of programs to improve fatigue, as this symptom is highly disabling (3, 4) but has scarcely been the focus of research in previous literature (2). This contextual approach to coping is consistent with modern models of pain, such as the psychological flexibility model in which Acceptance and Commitment Therapy is grounded (29).

## Methods

# Participants

All participants met diagnostic criteria for fibromyalgia according to the American College of Rheumatology (1, 30). In addition to this, our inclusion criteria also included: being a female (for homogeneity purposes because almost all fibromyalgia patients are females), being over 18 years of age, and having the physical and mental ability to provide informed consent and to complete the surveys. Likewise, having a medical recommendation to walk and / or not presenting physical comorbidity that prevented walking was included as an inclusion criterion. The sample included 234 women with fibromyalgia, who were between the ages of 30 and 78 with a mean of 57.03, and Standard Deviation (SD) of 9.07. Most participants had completed primary (53.2%) and secondary studies (26.4%) only. The majority of them were married or in a stable relationship at the time of assessment (53%). The remaining participants were either single (11%) or divorced/widows (36%). Only a small percentage of participants were working when the study was conducted (12%). The rest of them were housewives (33.8%), retired (32%), on sick leave (10%), or unemployed (12.1%). Patients had experienced fibromyalgia for an average of 12.14 years (SD = 8.45; 1–46 years range). Their average pain severity score was 7.15 (SD = 1.52) on a scale ranging from 0 to 10, with higher scores indicating more severe pain.

# Instruments

**General fatigue.** The Spanish version of the Multidimensional Fatigue Inventory (31) was used to assess fatigue. This is a questionnaire with 20 items ranged on a five-point Likert response scale with anchors 1= “Completely agree” to 5= “Strongly disagree”. The General Fatigue dimension, which is composed of 4 items and has a score range of 4 to 20, was selected for the present study purposes. The other dimensions in the questionnaire are Physical Fatigue, Mental Fatigue, Reduced Activity, and Reduced Motivation. Higher scores indicate greater presence of fatigue. The internal consistency of the general fatigue scale in the present study was .76.

**Pain Catastrophizing.** The Spanish version of Pain Catastrophizing Scale (32) has 13 items grouped into 3 dimensions: rumination, magnification, and helplessness. Responses in the scale use a 5-point Likert scale with anchors 0= “Not at all” to 4= “All the time”. Higher scores point to a higher tendency to catastrophize about pain. The Cronbach’s alpha values in the present study were .78 for magnification, .87 for rumination, and .89 for helplessness, and .94 for total pain catastrophizing.

**Walking.** The walking behavior proposed by Gusi et al. (33) for fibromyalgia

patients was selected. However, the minimum daily time was reduced to 30 minutes and at least 2 days a week because the targeted population was highly sedentary and because of the difficulties in adherence to physical exercise in patients with fibromyalgia (34, 35). An ad-hoc self-report item was used to assess whether they adhered to walking according to the prescribed pattern (1= “yes”/0= “no”).

# Procedure

We selected a convenience sample by contacting several patients' associations of different Spanish regions. In total, 268 participants agreed to participate in the study and met our initial inclusion criteria. Finally, effective responses were obtained from 234 patients (25 patients did not attend the scheduled assessment appointment, 6 questionnaires were left blank, and 3 questionnaires contained a large amount of missing data that could not be retrieved because the participants could no longer be reached). The study followed the ethical principles for research with human participants (Helsinki declaration) and was approved by the (blinded for review) University Ethics Committee.

## Statistical analysis

First, descriptive and bivariate Pearson correlation analyses were performed. Next, an analysis of mean differences in catastrophizing and fatigue will be conducted based on adherence to walking. Finally, the moderation analyses were conducted with model 1 from the PROCESS Macro version 3.4 (36). Walking (yes/no) was used as the moderator, catastrophizing as an independent variable, and fatigue as the outcome. Pain catastrophizing was centered before the analyses. Four models were tested, one for each catastrophizing dimension (total score and three dimensions). Statistical significance was set at an alpha level of 0.05. In the post-hoc analyses, non-centered variables will be used to facilitate the interpretation of results.

## Results

### Means, standard deviations and Pearson correlations between study variables

Table 1 shows the means, standard deviations, and Pearson correlations between the study variables. Statistically significant correlations were found between all variables. The strongest correlations ( $> .70$ ) were found between the different dimensions of pain catastrophism. The weakest correlations were revealed between fatigue and pain catastrophism (total score and the three dimensions).

Table 1  
Means, standard deviations, and Pearson correlations between study variables

	Mean (SD)	Magnification	Helplessness	Pain catastrophism	Fatigue
Rumination	10.16 (4.04)	.71**	.78**	.91**	.29**
Magnification	6.61 (3.10)		.74**	.87**	.18**
Helplessness	15.01 (5.61)			.95**	.35**
Pain catastrophism	31.80 (11.68)				.32**
Fatigue	16.91 (2.90)				

\*\*  $p < .01$ , \*  $p < .05$ .

# Mean differences in study variables as a function of adherence to walking

More than half of the patients (58.15%) adhered to the walking behavior as a way of exercising. General fatigue, rumination, helplessness, and pain catastrophism were higher in patients who didn't adhere to the walking exercising behavior. The largest effect sizes were found for helplessness and general fatigue (both with moderate effect sizes).

Table 2  
Mean differences between walking and not walking groups in pain catastrophism and fatigue

	Walking n = 132	Not walking n = 95	t	p	d-Cohen
Rumination	9.68 (4.18)	10.82 (3.75)	2.134	.034	.29
Magnification	6.29 (2.95)	7.04 (3.21)	1.810	.072	.24
Helplessness	14.04 (5.80)	16.44 (4.95)	3.269	.001	.45
Pain catastrophism	30.02 (11.92)	34.30 (10.73)	2.829	.005	.38
Fatigue	16.41 (3.15)	17.59 (2.40)	3.181	.002	.42

## Multivariate linear regression and moderation analyses

Table 3 shows the results of the regression analyses, including walking as a moderator. The prediction of fatigue from catastrophizing dimensions, walking, and their interaction, evidenced a significant direct contributions of helplessness and direct contributions of walking (in all cases). Regarding the moderation analyses, the results revealed that walking moderated the relationship between rumination and fatigue (Beta = 0.21 t = 2.24, p = 0.26) as well as the association between magnification and fatigue (Beta = 0.26, t = 2.1, p = .036). The assessed models predicted significant variance of fatigue (all p < .001), which ranged from 8–15%.

Table 3  
Prospective prediction of fatigue from pain catastrophism, walking, and their interaction

	R <sup>2</sup>	F	p	Beta	t	p	95% Confidence Interval (CI)
Dependent Variable (DV) = Fatigue	.14	11.674	< .001				
Pain Catastrophism				0.03	1.25	.210	-0.02, 0.08
Walking				-0.92	-2.46	.014	-1.66, -0.18
Interaction				0.06	1.92	.056	< 0.01, 0.13
DV = Fatigue	.13	11.152	< .001				
Rumination				0.06	0.81	.418	-0.09, 0.21
Walking				-1.01	-2.71	.007	-1.75, -0.28
Interaction				0.21	2.24	.026	0.03, 0.40
DV = Fatigue	.08	6.469	< .001				
Magnification				0.01	0.02	.985	-0.18, 0.18
Walking				-1.09	-2.86	.005	-1.85, -0.34
Interaction				0.26	2.10	.036	0.02, 0.50
DV = Fatigue	.15	12.786	< .001				
Helplessness				0.12	2.10	.036	< 0.01, 0.23
Walking				-0.81	-2.16	.031	-1.55, -0.07
Interaction				0.08	1.13	.256	-0.06, 0.22

Post-hoc analyses were planned to analyze significant moderations in more depth and are presented in Tables 4 and Figs. 1 and 2. These analyses revealed that rumination and magnification only contributed to more fatigue when patients engaged in walking behavior. Different to rumination and magnification, helplessness contributed to more fatigue irrespective of adherence to walking (Beta = 0.12, t = 2.1, p = .036).

Table 4  
Conditional effects of rumination/magnification on fatigue at walking (yes/no)

Walking	Beta (rumination)	t	p	95% CI
No	0.061	0.812	.417	-0.09, 0.21
Yes	0.273	4.755	< .001	0.16, 0.39
Walking	Beta (magnification)	t	p	95% CI
No	< 0.01	0.019	.985	-0.18, 0.18
Yes	0.261	3.128	.002	0.10, 0.42

## Discussion

This study aimed to provide further evidence for the relationship between pain catastrophism and fatigue in patients with fibromyalgia by exploring the contextual (i.e., moderating) role of adherence to walking in this relationship. Past research has shown that low adherence to exercising, such as walking, imposes a significant physical burden in patients with fibromyalgia, including increased sense of overall fatigue (13–16). Past research had also evidenced that the contribution of psychological variables, such as pain catastrophizing, on physical outcomes might decrease when the patient status is more severe, for example (e.g.) pain severity (28). Our results provide an interesting novel insight in this complex and contextually-determined relationship between psychological factors and outcomes. Particularly, helplessnessness contributed to more fatigue irrespective of adherence to walking, which contradicts our hypotheses. On the contrary, rumination and magnification only contributed to fatigue when the context was favorable (i.e., high adherence to walking), which supports our hypotheses. The results are discussed in the context of the psychological flexibility model and personalized interventions.

To date, the associations between pain catastrophism and outcomes in fibromyalgia patients have been mostly focused on pain, but less frequently to fatigue. Also, interestingly, it was assumed that the relationship between pain catastrophizing and outcomes (i.e., fatigue) was linear (i.e., not contextually determined). The results of the present study showed that, while a modest bivariate association existed between pain catastrophism and fatigue, this association was no longer significant when adherence to walking and its interactions with catastrophizing were considered, with the exception of helplessness. This suggests that the relationship between rumination and magnification with fatigue is largely explained by adherence to walking, which was confirmed in the post hoc analyses of conditional effects after the moderation analyses.

Different to rumination and magnification, helplessness was still associated with fatigue in the multivariate analyses. Helplessness refers to a feeling of being powerless when faced with the

impossibility to control symptoms (32). Previous studies have shown the relevance of helplessness as the best predictor of the affective dimension of pain (37) and the disease impact in fibromyalgia patients with high pain (18) or high chronicity (38). Novel to the literature is the fact that helplessness contributed to greater fatigue across adherence to walking status and after controlling for the contribution of this variable. This is important as it suggests that, at the clinical level, this might be a key intervention target to decrease fatigue, even in the patients who do not walk. Cognitive-behavioral therapy techniques have been successfully implemented to achieve the desired changes in helplessness (39).

As noted earlier, pain catastrophism has been associated widely and consistently to different symptoms in patients with fibromyalgia including pain, depression, distress, or cognitive and functional impairments (40–43). Its relationship with fatigue, however, has been more rarely investigated and the results to date are not consistent. For example, Thompson et al. (27) found significant associations between pain catastrophism and pain severity, but not with disability and fatigue. On the contrary, Lukkanahatai et al. (25) revealed that fatigue was associated with several symptoms and psychological factors, including pain catastrophism. Our results suggest that the discrepancy in findings might be due to the fact that the hypothesized linear association between some catastrophizing components, such as magnification and rumination, and fatigue might be more complex than that (i.e., contextually determined or moderated by a third factor). This is consistent with past research (28) and with the psychological flexibility model of pain, the model in which Acceptance and Commitment Therapy is based, which states that the context in which a behavior occurs (e.g., pain catastrophism) is important to determine its influence on outcomes (44). Thus, the present study provides further support for this contextual relationship between psychological processes and outcomes in chronic pain.

Our results have also shown a contribution of (adequate) adherence to walking on reduced fatigue, which is consistent with previous studies (11, 12). The novelty of the current investigation lies in the fact that the contribution of walking remained in multivariate models that included pain catastrophism (total scores and dimensions) and in the fact that low adherence to walking imposed such a burden in patients that minimized the contribution of two of the three catastrophizing components, namely rumination and magnification. Again, this supports the importance of walking and suggests that reducing rumination and magnification in patients with low adherence to walking is likely to be less effective for fatigue. Thus, in the line of personalizing interventions, it is possible that, if we want to maximize the effectiveness of an intervention addressed to reduce rumination or magnification, adherence to walking should be encouraged first. This is just speculative at this stage, but the fact that these two catastrophizing factors only contributed to fatigue when patients walked supports this idea. As noted earlier, according to our findings this personalization is not likely to be necessary when trying to reduce helplessness in order to minimize fatigue, which supports prioritizing the latter catastrophizing component when attempting to reduce fatigue levels in people with fibromyalgia, especially in those with low adherence to walking.

This study has some limitations. First, the associations must be interpreted according to the observational nature of the design, which does not allow causality inferences. Second, this study is based on self-reported data; in this sense, a relevant limitation is the fact that walking has been assessed using

self-reports. It should be noted in this regard that the current study is part of a larger project that previously assessed this same behavior by means of self-administered questionnaires and pedometers and a high consistency was found between measures. An additional shortcoming refers to the homogeneity of the sample, which was composed by fibromyalgia patients only. Thus, there is no guarantee that the results can be generalized to other chronic pain populations, due to the important differences between this population and other populations with chronic pain.

While this study has some shortcomings, their findings could have important clinical implications for practices in the field of psychological and interdisciplinary treatments and personalization in chronic pain (45) and in fibromyalgia (46). First, the results support the benefits of walking as a form of physical exercise upon fatigue, in this case after having controlled for the influence of pain catastrophism. These results are consistent with the positive effects of walking on different symptoms among fibromyalgia patients (8–10).

In relation to personalized treatments, what our findings suggest is that slightly different recommendations should be provided to reduce fatigue according to the walking pattern of individuals. In particular, among patients who do walk, when attempting to regulate fatigue by reducing catastrophizing, tapping into any catastrophizing component might be adequate according to our findings. In this regard, cognitive-behavioral therapy has proven to be effective in reducing catastrophizing (47) and specific protocols for fibromyalgia patients are available (48). By contrast, in the presence of patients who don't walk it would probably be more advisable to focus on the helplessness component of catastrophizing, as well as to promote adherence to walking combining motivational and volitional strategies (14, 49). We encourage researchers to test the previous hypotheses in well-planned randomized controlled trials including fibromyalgia patients with low and high adherence to walking.

## Conclusions

In the line of personalizing interventions, it is possible that, if we want to maximize the effectiveness of an intervention addressed to reduce rumination or magnification, adherence to walking should be encouraged first, since low adherence to walking imposed such a burden in patients that minimized the contribution of rumination and magnification on the fatigue. When helplessness is present, to minimize fatigue, it is necessary to prioritize the modification of the levels of this component in people with fibromyalgia. Thus, if the cognitive-behavioral pattern of the patients is known, an effective treatment can be carried out to reduce the levels of a symptom as disturbing as fatigue.

## Abbreviations

i.e.

namely

e.g.

for example

SD  
Standard Deviation  
DV  
Dependent Variable  
CI  
Confidence Interval

## Declarations

**Ethics approval and consent to participate:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Bioethics Committee of Rey Juan Carlos University (Reference PI17/00858). Informed consent was obtained from all individual participants included in the study.

**Consent for publication:** not applicable.

**Availability of data and materials:** The datasets during and/or analysed during the current study available from the corresponding author.

**Competing Interest:** The authors declare that they have no conflict of interest.

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### Authors' contribution statements

SANROMÁN, Lucía: conception and design of the work, analysis and interpretation of data; drafted the work; approved the version to be published; agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CATALA, Patricia: interpretation of data; revised the word critically for important intellectual content; approved the version to be published; agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

ECIJA, Carmen: analysis and interpretation of data; revised the word critically for important intellectual content; approved the version to be published; agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

SUSO-RIBERA, Carlos: interpretation of data; revised the word critically for important intellectual content; approved the version to be published; agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

SAN ROMAN, Jesús: interpretation of data; revised the word critically for important intellectual content; approved the version to be published; agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

PEÑACOBÁ, Cecilia: conception and design of the work, acquisition of data; drafted the work; approved the version to be published; agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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## Figures

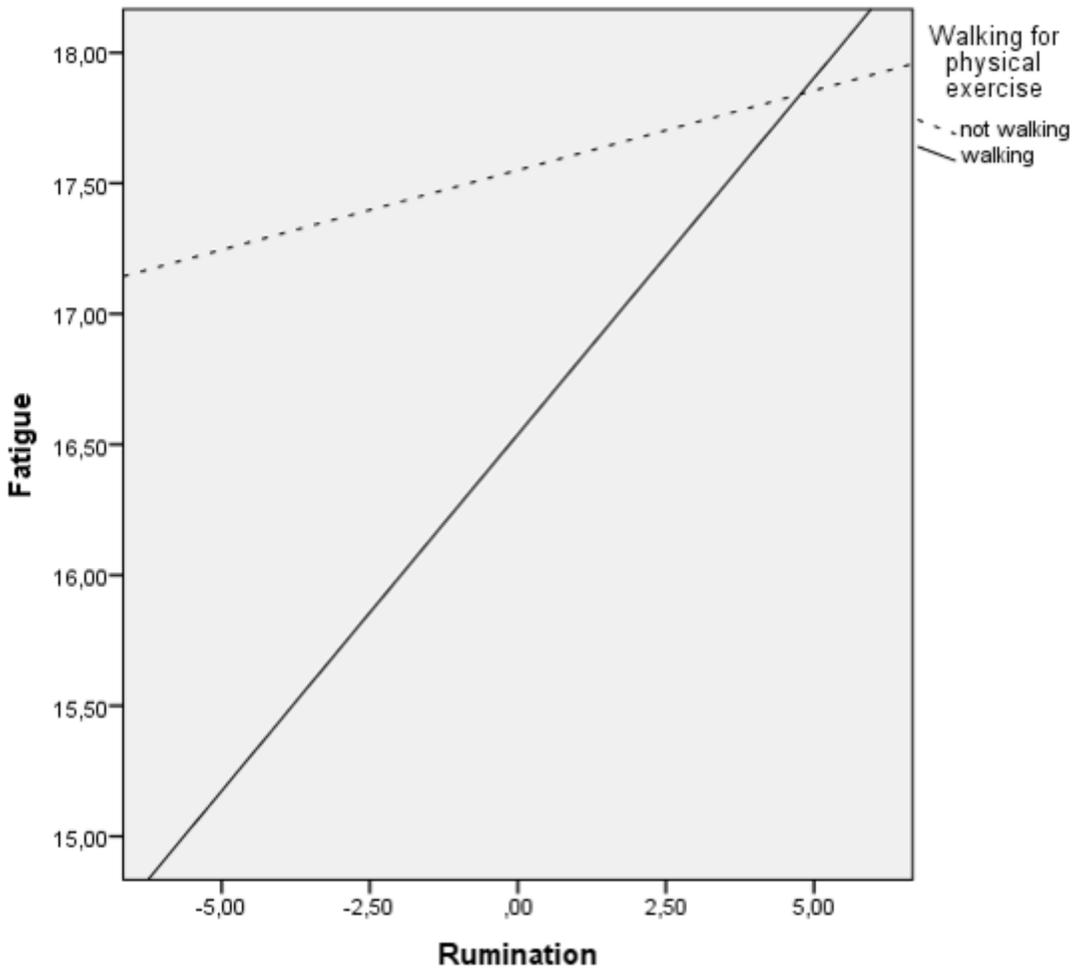


Figure 1

Relationship between rumination and fatigue at walking for physical exercise

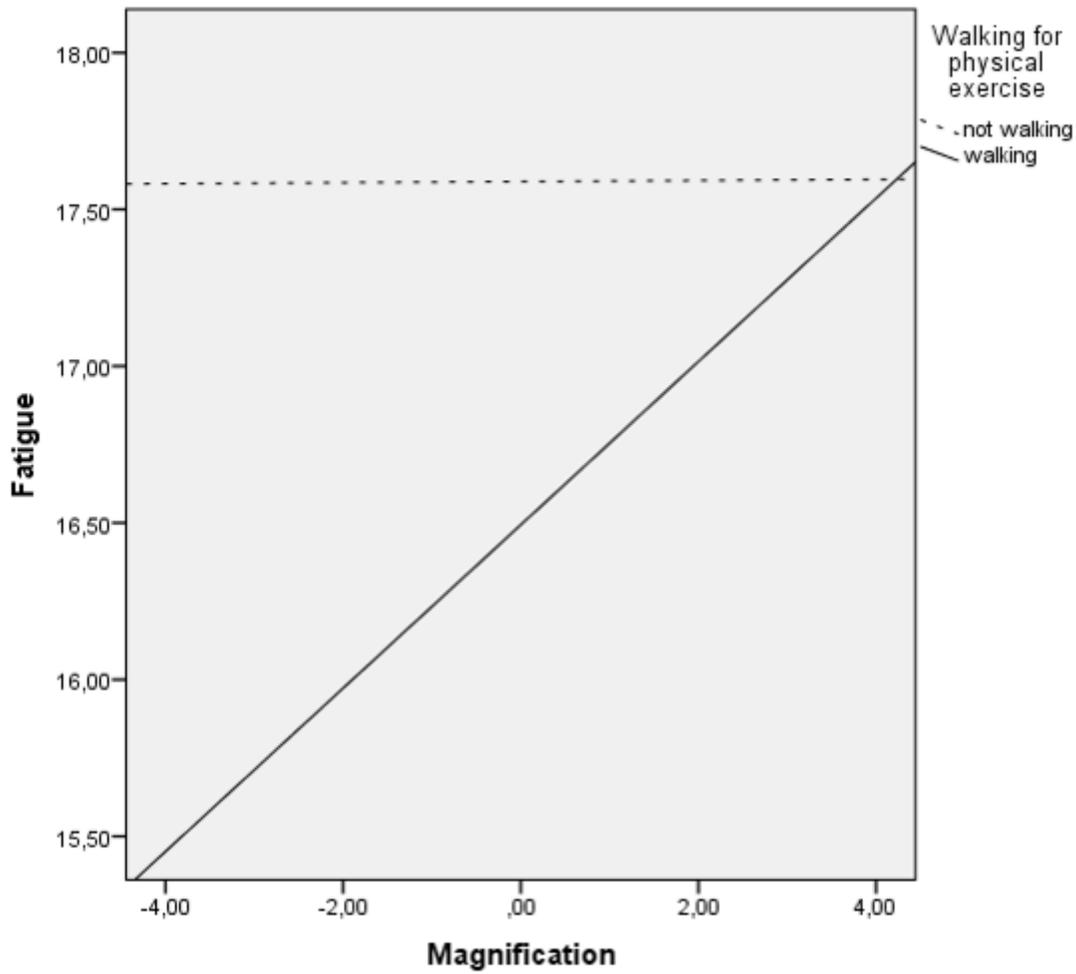


Figure 2

Relationship between magnification and fatigue at walking for physical exercise