Revista Brasileira de Enfermagem
REBEn

RESEARCH

# Association between fatigue and functional capacity in patients with intermittent claudication

*Associação entre fadiga e capacidade funcional em pacientes com claudicação intermitente*

*Asociación entre fatiga e capacidad funcional en paciente con claudicación intermitente*

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**How to cite this article:**
Batista LC, Assis CS, Wolosker N, Zerati AE, Silva RCG. Association between fatigue and functional capacity in patients with intermittent claudication. Rev Bras Enferm. 2015;68(6):653-9. DOI: http://dx.doi.org/10.1590/0034-7167.2015680524i

**Submission:** 12-01-2014 **Approval:** 07-16-2015

**ABSTRACT**

**Objective:** to characterize fatigue and exertion fatigue in patients with intermittent claudication (IC), and to test their association with sociodemographic and clinical variables, walking capacity and level of physical activity. **Method:** forty-nine participants (66.6 years; 70% male) were studied. Validated questionnaires were used to assess fatigue (DUFS), exertion fatigue (DEFS), level of physical activity (BASIC) and walking capacity (WIQ). **Results:** participants had substantial fatigue (DUFS = 20.4±8.8) and substantial exertion fatigue (DEFS = 20.4±10.8). There was an association between the DUFS and marital status (p=0,008). There was a statically significant association between DEFS with scores of the BASIC (r=.331; p=.02) and among DEFS with WIQ domains – walking distance (r=.359; p=.011) and climbing stairs (r=.331; p=.02). **Conclusion:** patients with IC have fatigue and exertion fatigue. Exertion fatigue might compromise the engagement of these patients in physical activity, one of the main components of IC treatment.
**Key words:** Intermittent Claudication; Fatigue; Walking.

**RESUMO**

**Objetivo:** caracterizar fadiga e fadiga ao esforço em pacientes com claudicação intermitente (CI) e testar sua associação com variáveis sociodemográficas e clínicas, capacidade de locomoção e nível de atividade física. **Método:** foram avaliados 49 participantes (66,6 anos; 70% do sexo masculino). Foram utilizados instrumentos validados para avaliar fadiga (DUFS), fadiga ao esforço (DEFS), nível de atividade física (BASIC) e capacidade de locomoção (WIQ). **Resultados:** os participantes apresentaram fadiga substancial (DUFS = 20,4+8,8) e fadiga substancial ao esforço (DEFS = 20,4+10,8). Observou-se associação da DUFS com convivência marital (p=0,008). Houve associação estatisticamente significativa da DEFS com escores da BASIC (r=0,331; p=0,02) e dos domínios distância caminhada (r=0,359; p=0,011) e subir escadas (r=0,331; p=0,02) do WIQ. **Conclusão:** pacientes com CI apresentam fadiga e fadiga ao esforço. É possível que a fadiga ao esforço comprometa o engajamento desses pacientes na prática de atividade física, um dos principais componentes do tratamento da CI.
**Descritores:** Claudicação Intermitente; Fadiga; Caminhada.

**RESUMEN**

**Objetivo:** caracterizar la fatiga y la fatiga al esfuerzo en pacientes con claudicación intermitente (CI) y testar su asociación con: variables sociodemográficas y clínicas, la capacidad de locomoción y el nivel de actividad física. Método: se evaluaran 49 participantes (66,6 años; 70% hombres). Se utilizó cuestionarios validados para la evaluación de fatiga (DUFS), fatiga al esfuerzo (DEFS), nivel de actividad física (BASIC) y capacidad de locomoción (WIQ). **Resultados:** los participantes presentarán fatiga substancial (DUFS=20,4+8,8) y fatiga substancial al esfuerzo (DEFS=20,4+10,8). Hubo asociación de la DUFS con convivencia marital (p=0,008). La DEFS presentó asociación estadísticamente significativa con escores de la BASIC (r=0,331; p=0,02) y con los dominios distancia recorrida (r=0,359; p=0,011) y subir escaleras (r=0,331; p=0,02) del WIQ. **Conclusión:** pacientes con CI tienen fatiga y fatiga al esfuerzo. Esta puede comprometer la participación de los pacientes en la práctica de actividad física, un componente importante del tratamiento de la CI.
**Palabras clave:** Claudicación Intermitente; Fatiga; Caminata.

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## INTRODUCTION

Intermittent claudication (IC) is characterized by pain, a cramping or tingling sensation in the legs, usually in the calves, triggered by exercise and relieved with rest. It is the main symptom of peripheral arterial disease (PAD) of the lower limbs (LL). In the Brazilian population, studies revealed that IC affects 9% of patients with PAD. Patients with this manifestation are associated with higher morbidity and increased risk of death, from all causes, and from cardiovascular disease[1-2].

The practice of physical activity, especially walking, is a major component of treatment for IC. Exercise promotes improvement of the IC by reducing oxidative stress, increasing nitric oxide bioavailability, redistributing blood flow to ischemic areas, increasing the pain threshold, and improving the functional capacity[3-4]. However, the literature reports low adherence of patients with IC to physical activity[5].

Personal and environmental barriers can affect the adherence to this type of treatment. Researchers[5] investigated these barriers in 150 patients using a validated questionnaire. Among other variables, lack of energy was significantly associated with low physical activity, although it does not seem to be a predictive variable in the statistical model of multivariate analysis.

Lack of energy is one of the clinical signs of fatigue. This is a complex, subjective and multifactorial phenomenon determined and expressed by physical, cognitive and emotional factors. Fatigue (Code # 00093) is a phenomenon of interest for nursing, and was a concept accepted as a nursing diagnosis by NANDA International (NANDA-I) in 1988[6].

Currently, it is defined as "an oppressive and sustained sense of exhaustion and decreased ability to perform physical and mental work at usual level". Its defining characteristics are: Inability to restore energy even after sleep, increase in rest requirements, tired, inability to maintain usual routines, increase in physical complaints, perceived need for additional energy to accomplish routine tasks, drowsy, compromised concentration, feelings of guilt for not keeping up with responsibilities, lack of energy or inability to maintain usual level of physical activity, verbalization of an unremitting and overwhelming lack of energy, decreased performance, disinterest in surroundings, introspection, compromised libido, lethargic[6].

Different instruments may be used for the assessment of fatigue. Dutch authors[7] developed and validated two scales based on defining characteristics proposed by NANDA-I, which therefore have special interest for this study. Such scales assess fatigue, and exertion fatigue, defined as, "that which is directly related to an activity"[7].

Studies have been conducted in different populations to identify the prevalence of this phenomenon, characterize it and test the effect of interventions[8-9]. However, as far as we know, no studies have investigated fatigue in patients with IC. Therefore, it is important to know if fatigue is present in this specific population, using validated instruments for such evaluation, and how it manifests itself. Also, information on the association of fatigue and exertion fatigue with physical activity and locomotion capability can be useful for the proposed nursing interventions aimed at adherence to non-pharmacological treatment of IC.

In this context, the objectives of this study were to characterize fatigue and exertion fatigue in patients with IC, and to test the association of fatigue and exertion fatigue with: (1) socio-demographic and clinical variables, (2) walking ability, and (3) the level of physical activity.

## METHOD

This was a descriptive, exploratory, cross-sectional study, with a quantitative approach.

The non-probabilistic sample consisted of 49 participants recruited at the Claudication Clinic of the Hospital of the Faculty of Medicine, University of São Paulo (HCFMUSP), from December of 2013 to July of 2014. Individuals included in the study were more than 18 years old,, had a confirmed diagnosis of PAD (Grade II Fontaine) without amputation of limbs and /or neuromuscular or orthopedic diseases, who did not require assistive devices for ambulation, or who had difficulty supporting their body and /or walking, and who agreed to participate in the study, by signing the Terms of Free and Informed Consent. Participants who were in the early postoperative period following major surgeries (six months), or who had experienced major traumatic injuries in the last six months were excluded. The study was approved by the Ethics Committee of the University of São Paulo School of Nursing (protocol 403.3067; CAAE: 19282613.0.0000.5392).

Validated instruments were used, as described below, to evaluate the level of physical activity, ability to walk, fatigue and exertion fatigue.

- Baltimore Activity Scale for Intermittent Claudication (BASIC)[10] - This scale was developed to assess the physical activity in patients with PAD. Although this scale has not been translated into Portuguese, Brazilian researchers found levels of reliability that ranged from moderate to good in a study with the Brazilian population. This is a questionnaire containing five questions related to the development of IC, as well as the patient's ability to walk prior to the onset of pain, attitudes adopted due to the emergence of pain, walking speed and the ability to go up and down slopes and stairs. Each question has three possible responses, which correspond to 0, 1, and 2 points, in this order. The total score is the sum of the scores of each question, and may therefore vary from 0 to 10 points. The higher the total score, the greater the level of daily physical activity.

- Walking Impairment Questionnaire (WIQ)[11] - This is a questionnaire that has been used to obtain information on the perception of movement of individuals with IC. The Portuguese version was translated and validated in 2009. The questionnaire addresses aspects regarding the previous month, and consists of three areas: distance (distance that the individual can walk), speed (speed that the individual can walk), and stairs (number of stairs that the individual can climb). The WIQ has seven initial questions, which aim to make the differential diagnosis of IC with other diseases that cause pain in the lower limbs. After these questions

the domains are evaluated. For each domain, the patient must indicate the degree of difficulty with: walking increasing distances (ranging from walking indoors (e.g., around the home) to a distance of 1500 feet), at increasing speeds (ranging from slow to jogging), climbing different numbers of flights of stairs (ranging from one to three flights). The degree of difficulty is measured by a *5-point Likert scale*, where 0 = incapable; 1 = very difficult; 2 = reasonable difficulty; 3 = mild difficulty; and 4 = no difficulty. The scores attributed by the patient (Likert scale) for each variable of distance, speed and flights of stairs were multiplied by predetermined weights. The results are summed and divided by the maximum possible score for each domain to obtain a percentage score, which can range from zero (representing the inability to perform the tasks) to 100 (representing no difficulty in performing the task).

- Dutch Fatigue Scale (DUFS) and Dutch Exertion Fatigue Scale (DEFS)[7] - These scales were developed in accordance with the NANDA-I definition of fatigue for patients with heart failure and were translated and validated for Brazilian Portuguese[12]. The versions and adaptations of the DUFS and the DEFS contain 8 and 9 items, respectively, arranged in a 5-point Likert scale. The scores on the items are summed to assign a total score for each scale. In the DUFS, the six items must be corrected before the total scores are computed, as the some statements are oppositional in regard to one another. As the cutoff points, it was decided that a DUFS equal to or higher than a total score of 14.5 would correspond to "substantial fatigue" or "presence of fatigue"; equal to or higher that a total score of 12.5 on the DEFS would correspond to "substantial exertion fatigue" or "presence of substantial exertion fatigue".

Data were analyzed using descriptive and inferential statistics. For continuous variables, mean, standard deviation and minimum and maximum values were calculated. Categorical variables were analyzed by calculating the absolute and relative frequencies. The Pearson correlation test was used for analysis of the association between fatigue and exertion fatigue with the other variables of interest. Comparison of fatigue and exertion fatigue values according to sex, marital status, presence of diabetes and arterial hypertension, was conducted using a t-test for equality of means. For comparison with the level of education, the path analysis of the ANOVA test was used. The significance level was 5%.

## RESULTS

### Sociodemographic and clinical characterization

The participants of this study presented a mean age of 66.6 years (SD = 10.1) and had been diagnosed with PAD for 8.6 years (SD = 8.5). About 70% were male, and 79.6% had complete or incomplete elementary school. Approximately half of the participants had a clinical diagnosis of diabetes mellitus and / or arterial hypertension.

The level of physical activity, calculated using the *Baltimore Activity Scale for Intermittent Claudication* was 4.2 (SD = 2.0), with minimum and maximum values of 0 and 8, respectively. The perception of walking of participants, as verified by the *Walking Impairment Questionnaire* (WIQ), is described in Table 1.

**Table 1 -** Perception of walking of the study participants, verified by the *Walking Impairment Questionnaire* (N = 49), São Paulo, Brazil, 2014

| Domains | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|
| Distance (% scores) | 21.3 | 21.4 | 0.5 | 89.3 |
| Speed (% scores) | 21.4 | 16.4 | 0 | 60.9 |
| Stairs (% scores) | 48.0 | 36.3 | 0 | 118.8 |

### Characterization of fatigue and exertion fatigue

Among study participants, 26.5% (n = 13) showed substantial fatigue. The mean score on the DUFS was 20.4 (SD = 8.8), with minimum and maximum values of 8 and 37, respectively. The item with the highest score was "Has your interest in sex or sexual activity diminished recently?" (3,3 ± 1.8); the item that had the lowest score in DUFS was "are you still capable of carrying out routine everyday activities?" (1.8 ± 1.4).

It was found that 30.6% (n = 15) showed significant fatigue on exertion. The mean score of DEFS was 20.4 (SD = 10.8), with minimum and maximum values of 9 and 45, in that order. The item with the highest score was "Do you find it fatiguing to walk up and down the stairs?" (3.2 ± 1.9); the item "Do you find it fatiguing to take a shower?" received the lowest score in DEFS (1.4 ± 1.2).

**Table 2 -** Association of fatigue (DUFS) and exertion fatigue (DEFS) with sociodemographic and clinical variables, São Paulo, Brazil, 2014

| Variables | DUFS | | p* value | DEFS | | p* value |
|---|---|---|---|---|---|---|
| | Mean | Standard deviation | | Mean | Standard deviation | |
| Sex | | | | | | |
| Female | 20,4 | 7,7 | 0,980 | 21,6 | 11,7 | 0,606 |
| Male | 20,5 | 9,3 | | 19,9 | 10,5 | |
| Marital status | | | | | | |
| With partner | 18,5 | 8,4 | **0,008** | 24,2 | 13,8 | 0,223 |
| Without partner | 25,8 | 7,7 | | 19,0 | 9,2 | |
| Diabetes mellitus | | | | | | |
| No | 21,9 | 10,2 | 0,260 | 22,0 | 9,7 | 0,284 |
| Yes | 19,0 | 7,1 | | 18,7 | 11,6 | |
| Arterial hypertension | | | | | | |
| No | 20,2 | 9,6 | 0,897 | 20,9 | 10,8 | 0,816 |
| Yes | 20,6 | 8,6 | | 20,1 | 10,9 | |

*Note:*
**t-test;*
*Level of significance = 5%*

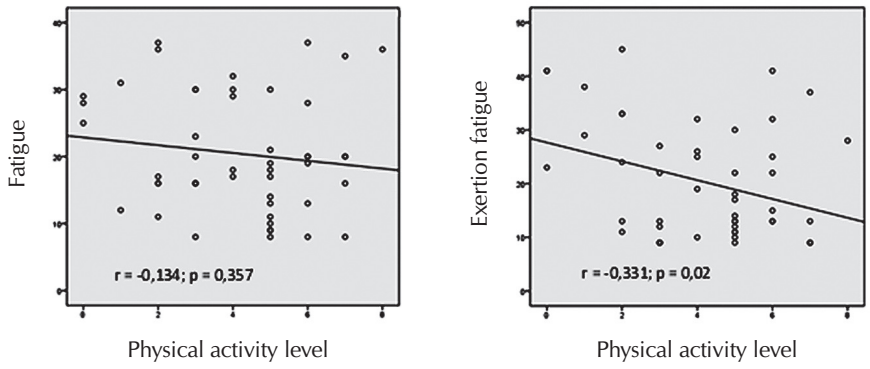


**Figure 1 -** Correlation of fatigue and exertion fatigue with physical activity, assessed by the Baltimore Activity Scale for Intermittent Claudication in the study participants São Paulo, Brazil, 2014

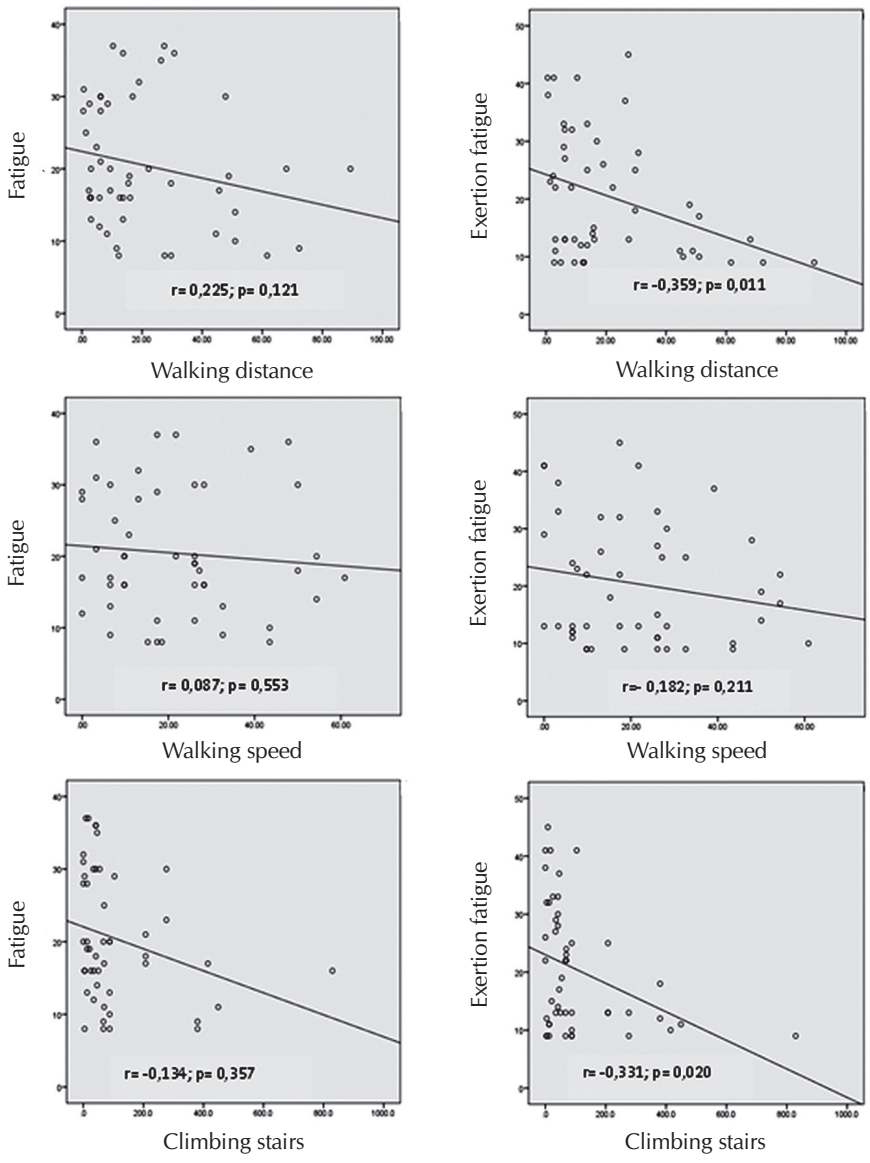


**Figure 2 -** Correlation of fatigue and exertion fatigue with the domains of the Walking Impairment Questionnaire in the study participants, São Paulo, Brazil, 2014

**Association of fatigue and exertion fatigue with sociodemographic and clinical variables**

The participants who were living with partners (married, common-law marriage) showed a lower level of fatigue when compared to participants without partners (18.5±8.4 versus 24.2 ± 13.8, respectively; p = 0.008). For other sociodemographic variables analyzed in this study, there was no association found with fatigue or exertion fatigue. Table 2 shows the association between sociodemographic variables and comorbidities with fatigue and exertion fatigue.

The level of physical activity (BASIC) presented a negative and statistically significant correlation with exertion fatigue (DEFS), but not with fatigue (DUFS), as shown in Figure 1.

Fatigue (DUFS) did not show a correlation with the domains of the WIQ. However, exertion fatigue (DEFS) showed a statistically significant correlation with the walking and stairs domains of the WIQ, as shown in Figure 2.

## DISCUSSION

This study identified the frequency of occurrence of fatigue and exertion fatigue in patients with IC, and characterizes the phenomenon in that particular group. It also allowed for the verification of the association of fatigue and exertion fatigue with sociodemographic and clinical variables, with the level of physical activity (BASIC) and with the perception of their walking ability (WIQ).

The availability of studies using validated instruments to investigate the presence and characteristics of fatigue, in patients with IC, are important as they can help with knowledge about the manifestations of this phenomenon in this specific population. In addition, the results of these studies can offer assistance to other research in which the management of fatigue is the therapeutic target, to enable the engagement of patients with IC in physical activity.

The data found in this study regarding sociodemographic characteristics of the participants converge with the literature[13]. A nationwide study showed that the prevalence of PAD increases with age, affecting 21.6% of people over 60 years[2].

Atherosclerotic cardiovascular disease is often accompanied by other comorbid conditions. In this study, the most frequent were arterial hypertension and diabetes mellitus. A study evaluating the PAD risk factors, in the Brazilian population, found that the prevalence of hypertension and diabetes in these patients was 45.5% and 15.7%, respectively[2]. Both conditions are recognized as leading causes of PAD in Hispanics and those of African descent[14]. In Brazil, it is estimated that 20% of patients with PAD have diabetes, and that the risk of diabetic men developing the disease is 6.6 times higher than in non-diabetics[14]. With regard to arterial hypertension, there is evidence of a prevalence of 90% among patients with PAD. Pressure levels above 150/90 mmHg are observed in about 25% of patients with arterial hypertension[14].

The literature demonstrates that patients with IC have low levels of physical activity, evidenced both by tests that assessed functional capacity and by questionnaires. In the Brazilian population, a study showed the correlation between the level of physical activity estimated by BASIC and the level obtained by pedometer[15], where the mean score of BASIC was 4.2 (SD = 1.9), which corroborates our findings.

Regarding walking ability, different methods are available for review. Studies have demonstrated that both direct investigation, by means of running or treadmill testing, as well as the indirect investigation by questionnaires, are able to predict the functional capacity of patients[16-17].

The IC affects the functional capacity of patients in a negative way. Brazilian authors found that the distance traveled, free of pain, in patients with IC corresponded to 70% of the total distance traveled by individuals without symptoms, which suggests that IC is limiting these patients[18]. In this study, participants had lower scores in the distance and speed domains compared to the stairs domain. These findings are corroborated by different researchers, even after intervention with exercises[19].

As far as we know, this is the first study that systematically evaluated fatigue in patients with IC. Fatigue was identified in 26.5% of participants and exertion fatigue in 30.6%. In fact, studies show that the prevalence of fatigue is quite variable in different groups of patients studied[8,20].

In a study that used the same scales for assessing fatigue and exertion fatigue in heart failure patients and healthy volunteers, the mean scores of the DUFS and the DEFS were lower than those observed in this study, suggesting higher fatigue level in patients with IC[21]. Regarding the scores of the items on the scales, it is interesting to mention that patients with heart failure also attributed higher scores to the decreased interest in sexual activity on the DEFS (3.0+1.6), walking up and down stairs (3.3+1.3), and showering (1.4+0.8) received the highest and lowest scores in the DEFS, respectively, which coincides with the findings of this study. This suggests that the items that most contribute to fatigue in these two groups of patients (IC and heart failure) are the same, although the "weight" of their contribution is particular to each of them.

In this study, the highest scores assigned by the participants in activities such as walking, when compared to scores attributed to activities of daily living, suggests that fatigue does not compromise self-care (e.g., bathing, dressing, cooking), but it affects activities related to physical activity.

Regarding the association of fatigue and exertion fatigue with the sociodemographic and clinical variables, only the DUFS showed a statistically significant association with marital status, namely, unmarried participants had higher fatigue scores. In fact, this finding differs from data available in the literature.

In a study that examined the predictive factors of nursing diagnoses in patients undergoing kidney transplantation, tiredness and disease state were associated with the presence of fatigue, but marital status was not[22]. In another study examining fatigue and exertion fatigue in individuals without chronic diseases, the authors found that being female, dyspnea, and depression were associated with scores on both the DUFS and the DEFS scales[23]. No studies were found in the investigated literature showing a relationship between marital status and fatigue. Regarding this study, it is possible that people who do not live with partners have more trouble dealing with the factors contributing to fatigue.

With regard to comorbidities, although in this study no association was found with hypertension, fatigue and exertion fatigue, a study showed that patients who suffered a stroke, with arterial hypertension identified by ambulatory measurement, showed a 3.1 time higher chance of presenting fatigue, as assessed by the Fatigue Severity Scale, than those with lower levels of diastolic blood pressure[24]. There are several pathophysiologic mechanisms that may explain the relationship between high blood pressure and fatigue, including frequent interruptions of sleep and nonrestorative sleep in hypertensive patients with obstructive sleep apnea[25].

An association with a diagnosis of high blood pressure might not be observed in this study, because it was treated as a dichotomous variable and was obtained from medical record reports. Studies are needed to assess the relationship between blood pressure levels and their association with fatigue and exertion fatigue, as evaluated by the DUFS and the DEFS.

Similarly, the literature indicates an association between fatigue and diabetes. When comparing patients with and without type 2 diabetes, the authors found that those with this disease had significantly higher scores in three scales rating fatigue: the *Fatigue Severity Scale, Assessment of Fatigue Scale,* and, the *Visual Analog Scale for Fatigue*[26]. In that study, the small sample size compromised the results. Still, it is noteworthy that in this study other scales for assessing fatigue were used and differences can be determined in relation to that which was shown in the literature.

Although it is impossible establish causal relationship, the results of this study showed that exertion fatigue, but not fatigue, showed a negative association of moderate magnitude, and was statistically significant with the level of physical activity, and the distance and climbing stairs domains of the WIQ.

This means that the higher the level of exertion fatigue, the lower the level of physical activity, as measured by the BASIC, and the shorter distances traveled and the number of flights of stairs that patients climb, as measured by the WIQ. Clinically, it is interesting to note that, although the patients with IC present fatigue, it is likely that exertion fatigue limits the engagement in physical activity, including walking. Further studies are needed to confirm this hypothesis.

It is well established that physical activity is an important component of the treatment of patients with IC[3-4]. If, indeed, exertion fatigue is a barrier to engagement and adherence to treatment in this population, the identification of this phenomenon and the proposal of measures for their management can contribute to improving the functional capacity and quality of life of patients with IC.

This study presents limitations. A non-probabilistic sample was recruited in a highly complex service, where patients with more severe disease receive care. This may have contributed to the findings relating to reduced functional capacity, as well as the prevalence of fatigue. As this is a single-center study, the external validity may be compromised. Another relevant aspect is the study design, which did not assert a causal relationship between fatigue, physical activity level and the walking ability of the participants. Thus, it is suggested that other studies assessing fatigue in patients with IC are performed to enable a better understanding of the phenomenon in this group of patients, as well as their consequences.

## CONCLUSION

The results of this the study showed that, as occurs in other chronic diseases, patients with IC present fatigue and exertion fatigue. Both were characterized mainly by diminished interest in sex or sexual activity and activities that require more physical effort, such as climbing stairs, to the detriment of activities of daily living. These results contribute to existing knowledge, since until now there was a lack of studies available in the literature that evaluated fatigue characteristics in this specific population.

Furthermore, exertion fatigue was associated with the level of physical activity and the distance and stairs domains. Recognizably, fatigue contributes to impaired functional capacity. The scope of this study was not to investigate fatigue as a cause of low level physical activity (BASIC) and the impairment of walking ability (WIQ domains), however, the findings provide support for further investigations in this direction.

Indeed, if fatigue in those with IC is identified as a component that affects patient engagement and adherence to physical activity, appropriate interventions can be tested for the management of fatigue, aiming to improving the functional capacity and quality of life of these individuals.

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