What impact does the level of physical activity, pain, and sleep quality have on the change in health status after one session of resistance training workout in persons with fibromyalgia?

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ABSTRACT

Purpose: Fibromyalgia (FM) is a syndrome characterized by pain, fatigue, poor sleep quality and cognitive impairment. One recommended treatment is resistance training. Research has shown that subjects with FM tolerate physical exercise differently. The aim of this study was to evaluate whether the level of physical activity, the number of tender points, pain intensity, and sleep quality before one session of a resistance training workout could predict change in overall health status assessed with the Fibromyalgia Impact Questionnaire (FIQ) one week after the training session.

Methods: Forty women with FM (aged median 47.5) were included. Years with symptoms varied between 8.5 and 20.5. Twenty percent (8/40) had fulltime work and 40 percent (17/40) had some kind of disability pension. A multiple logistical regression was applied to analyze whether the level of physical activity, the number of tender points, pain intensity, and sleep quality used as independent variables could predict change in overall health measured by FIQ as the dependent variable one week after the resistance training workout.

Results: No significant association could be found between the independent variables and change in FIQ.

Conclusions: The variables studied do not seem to have any influence on overall health status one week after one session of a resistance training workout in subjects with FM. The intensity of the workout was shown to be at a level that health did not deteriorate. This means that the level of training may be considered as a safe start for subjects with FM.

BACKGROUND

Fibromyalgia (FM) is often described as a syndrome characterized primarily by chronic muscular generalized pain but is also associated with symptoms such as headache, paresthesia, irritable bowel syndrome, poor sleep quality, fatigue, and cognitive impairments (Bertolucci and de Oliveira, 2013; Jay and Barkin, 2015).

The cause of FM is currently not known. However, evidence of disturbed central pain modulation, including altered levels of neurotransmitters involved in the transformation of nociceptive signals, has been shown (Sluka and Clauw, 2016). The poor quality of sleep that subjects with fibromyalgia experience has been assumed to be caused by pain (Choy, 2015). However, there is some evidence to suggest that the relationship can be the opposite, i.e. that the symptoms are caused by poor sleep (Choy, 2015; Palagini et al, 2016).

Since 1990 FM has been diagnosed by the criteria presented by the American College of Rheumatology (ACR), which include criteria for the duration and location of pain as well as a certain number of painful “tender points” in clinical examinations (Wolfe et al, 1990). The criteria are described further in the method section.

FM is more common among women than men, and the prevalence increases with higher age. The prevalence of fibromyalgia worldwide has been estimated to be about 2.7% (Queiroz, 2013).

In the latest European League Against Rheumatism (EULAR) treatments guidelines, non-pharmacological therapy was considered to be the first choice when treating subjects with FM. Pharmacological treatments should only be considered when non-pharmacological

treatments failed, and aerobic training and resistance exercise were the treatments most strongly recommended (Macfarlane et al. 2017). In a systematic review by the Cochrane Collaboration, resistance training was reported to reduce pain and tenderness, and improve strength and function in women with FM. The quality of evidence, however, was rated as low (Busch et al, 2013). However, the results of the review were confirmed by Larsson et al. in 2015 (Larsson et al, 2015). Furthermore, guidelines published in 2008, based on a systematic review by the Ottawa panel, recommended resistance training as an important part of rehabilitation for subjects with FM (Brosseau et al, 2008).

However, there are results indicating the opposite. In the short term, increased symptoms due to physical activity in daily life as well as physical exercise have been reported (Cudney, Butler, Weinert and Sullivan, 2002; Busch, 2008; Hallberg and Bergman, 2011; Harden et al, 2012; Beltrán-Carrillo, Tortosa-Martínez, Jennings and Sánchez, 2013).

Furthermore, subjects with FM who were exposed to physical tests on one or a few occasions, such as walking, cycling, isometric and dynamic loading of muscles, have reported increased symptoms both during and after the activities, compared to healthy controls (Mengshoel, Førre and Komnaes,1990; Jubrias, Bennett and Klug, 1994; Nørregaard, Bülow, Mehlsen and Danneskiold-Samsøe, 1994; Mengshoel, Vøllestad and Førre, 1995; Lund, Kendall, Janerot-Sjøberg and Bengtsson, 2003; Elvin, Siösteen, Nilsson and Kosek, 2006; Kadetoff and Kosek, 2007; Bruijn et al, 2011; Homann, Stefanello, Góes and Leite, 2011; Srikuea et al, 2013).

Also in the long term, worsening of health has been reported after different kinds of physical training. Increased symptoms were described one to three days after each session of mixed physical exercises (Santen et al, 2002). Dropouts due to increased symptoms after resistance exercise (Larsson et al 2015) and after different types of

physical exercises have also been reported (Norregaard, Lykkegaard, Mehlsen and Danneskiold-Samsoe, 1997; Richards and Scott, 2002; Schachter, Busch, Peloso and Sheppard, 2003). In addition, several authors have described the risk of deterioration in subjects with FM when starting expanded physical activity and have firmly recommended not starting at too high intensity (Ambrose, Lyden and Clauw, 2003; Mannerkorpi and Iversen, 2003; Jones, Burckhardt and Bennett, 2004; Mannerkorpi and Henriksson, 2007; Cazzola et al, 2010).

Subjects diagnosed with FM are a heterogeneous group. Previous studies and clinical experience have shown that different individuals tolerate physical exercise differently. To avoid deterioration of health, it would be beneficial if it were somehow possible to predict which subjects will respond with deterioration and which will improve as a result of physical training at a given intensity. Several experts believe that it is important to take into account the FM subjects' symptoms and how accustomed they are to physical activity when recommending the start of exercise in order to avoid deterioration of health (Mannerkorpi and Iversen, 2003; Mannerkorpi, 2005; Mannerkorpi and Henriksson, 2007; Thomas and Blotman, 2010). Some of the important symptoms in FM are lowered pain threshold, widespread pain and impaired sleep quality (Choy, 2015; Jay and Barkin, 2015). Thus the aim of this study was to evaluate whether the level of physical activity, the number of tender points, pain intensity, and sleep quality before one session of a resistance training workout could predict change in overall health status assessed with the FIQ one week after the training session.

METHODS

Design

In this study a before-and-after design was applied.

Subjects

The inclusion criteria were: (1) meeting the diagnostic criteria for FM from 1990, (2) age between 18 and 65, (3) female gender, (4) having no injury or disease that might prevent the performance of the intervention, (5) having sufficient skills in Swedish to be able to complete the evaluation forms on their own.

The exclusion criteria were: failing to carry out at least 75% of the repetitions in the intervention program.

Recruiting process

Personnel in two health centers in the south of Sweden received oral and written information about the study. Furthermore, posters with the same information were placed in the waiting rooms. Participants were recruited from these two health care centers in two ways. When visiting the doctor, he/she informed briefly about the study and asked if the patient's name and address could be sent to one of the authors of the study (AP). Subjects who had read the posters took contact by themselves by telephone or e-mail. More detailed information about the study was then sent by mail to both groups. When agreeing to participate the subjects had to sign informed consent before they attended.

The same information was also sent by e-mail to two local patient associations for further distribution to its members. Before the start of the study, it was planned that the participants would be recruited only from health care centers and patient associations, but due to the difficulty of getting enough participants within reasonable time, recruitment requests were extended to Facebook groups for individuals with FM and also Facebook groups including people from certain locations in southern Sweden. The information posted in those groups was the same as in the posters in the two health care centers.

Forty-one participants, twenty-two from health care centers, three from patient associations, twelve from FM Facebook groups and four from Facebook location groups volunteered for the study. The median age was 47, BMI was 26.7 (median) and number of years with symptoms was median 14.5. The activity level was low in 16, medium in 14 and high in 10 of the subjects. The number of tender points was 17 (median), pain intensity 8 (median) and sleep quality 2.75 (median). All baseline characteristics are presented in table 1. One subject did not meet the inclusion criteria and was consequently excluded.

Insert table 1 about here

Outcome measures

Level of physical activity

The shorter version of International Physical Activity Questionnaire (IPAC) was used in this study. The respondents filled in information about how physically active they had been during the last week. They were asked to fill in the number of days and the average time they had performed very strenuous and moderately strenuous activities and to what extent they had been walking. Examples of very strenuous activities given in the questionnaire were heavy lifting, heavy construction and gardening, aerobics, running or cycling at a high pace. Examples of moderately strenuous activities were cycling, swimming, moderate construction and gardening. The amount of very strenuous and moderately strenuous activities, and how much they walked, was used to calculate the number of MET-minutes/ week the participants achieved. MET is an acronym for metabolic equivalent of task, and it is a measure of how much energy a person uses for a certain activity in relation to the resting metabolism (Ainsworth, 1993). Based on the participant's answers, each person's level of physical activity was classified as low, moderate or high according to the following criteria in the guidelines. Low: this is the lowest level of physical activity and includes those

individuals who do not meet the criteria for categories moderate or high. Moderate: any one of the following three criteria: (1) three or more days of very strenuous activities, at least 20 minutes per day, (2) five or more days of moderate-strenuous activities or walking at least 30 minutes, (3) five or more days of any combination of walking, moderate-strenuous or vigorous strenuous activities achieving a minimum of at least 600 MET-min/ week. High: any one of the following two criteria: (1) very strenuous-intensity activity on at least three days and accumulating at least 1500 MET-minutes/week, (2) seven or more days of any combination of walking, moderate-strenuous or very-strenuous activities achieving a minimum of at least 3000 MET-minutes/week (Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ), 2016). IPAQ has been translated into Swedish and has been found to have moderate criterion validity (Ekelund et al, 2006).

Tender points

One part of the diagnostic criteria for FM from 1990 is the test of pain due to pressure at 18 specified tender points on the body (Wolfe et al, 1990). The pressure on the points was applied with the thumb and with a force of about 4 kg. In order to increase reliability when it comes to applying the right pressure, the investigator put a weight of 4 kg over the fingertip of the thumb just before the test, in order to get a feeling of how much pressure should be applied. A similar procedure was used in the study where the diagnostic criteria were developed (Wolfe et al, 1990). The examinations of the tender points were performed by one of the authors (AP). The intrarater reliability for digital pressure on tender points has been shown to be very good (Tunks et al, 1995). The interrater reliability has been found to be moderate to good (Cott et al, 1992; Tunks et al, 1995). The number of painful points has been linked to the odds of being work-disabled (White, Speechley, Harth and Ostbye, 1999). In addition, the diagnostic criteria also include pain for at least three

months, pain in all quadrants of the body and pain in the spine or anterior chest (Wolfe et al, 1990).

Pain intensity

Pain intensity was estimated with an 11-point numerical pain rating scale (NPRS), reaching from zero to ten. High points indicate more intense pain and low points indicate a lower intensity of pain. The subjects estimated how much pain they have had on average during the last week. This instrument has been considered valid, reliable and appropriate for the estimation of pain in people with generalized pain (Farrar et al, 2001; Mintken, Glynn and Cleland, 2009; Salaffi, Sarzi-Puttini, Ciapetti and Atzeni, 2011).

Sleep quality

Karolinska Sleep Questionnaire (KSQ) is a self-assessment instrument which measures a number of different aspects of sleep. The part of the instrument used in this study measured the quality of sleep. The respondents rated their sleep for the last three months on a six-point scale, ranging from never to always. The four questions that evaluated the quality of sleep were: (1) difficulty falling asleep, (2) repeated awakening with difficulty falling back to sleep, (3) too early awakening, (4) disturbed/restless sleep. The alternative “never” gives six points and “rarely” five points and so on. This means that lower scores indicate poorer sleep quality. The instrument is available in Swedish and has been tested with regard to the psychometric properties and was found to have satisfactory construct validity and internal consistency (Nordin, Åkerstedt and Nordin, 2013).

Fibromyalgia Impact Questionnaire

Fibromyalgia Impact Questionnaire (FIQ) is an instrument designed to assess the health status of people with FM (Hedin, Hamne, Burckhardt and Engstrom-Laurent, 1995). The

questionnaire consists of ten subscales. The different subscales deal with the estimation of limitation in various physical activities, the number of days feeling well, the percentage of sick leave and the estimation of symptoms that are common in patients with FM. The total score for the instrument ranges between 0 and 100. The higher the score, the greater the impact of FM is in the person's life. The first subscale consists of ten questions on various everyday activities such as shopping, cooking, and walking. The second subscale consists of the question: "How many days did you feel well in the last seven days?" The third subscale consists of the question: "How much were you on sick leave during the past week due to your fibromyalgia?" The rest consist of seven 100 millimeter visual analogue scales for the estimation of the following symptoms: impact of pain or other fibromyalgia symptoms on the respondent's work; intensity of pain; fatigue during the days; the feeling of tiredness when you wake up in the mornings; stiffness; feeling tense, nervous or anxious; and feeling depressed. The questions in the instrument focus on the symptoms and activity limitations that existed in the last week. The instrument has been translated into Swedish and found to be reliable and valid. (Hedin, Hamne, Burckhardt and Engstrom-Laurent, 1995). It has also been proved to be sensitive to change (Bennett, 2005).

Intervention

The intervention was performed in two health care centers. It comprised one session of a resistance training workout using body weight exercises, an exercise with dumbbells and an exercise with a cable machine as resistance. The following movements had to be carried out by the participants: (1) press from shoulder level to straight arms over the head in a standing position with two 1 kg dumbbells, (2) push-up against a wall, in standing position with the feet in self-chosen distance from the wall, (3) seated rowing in the cable machine with 10 kg as resistance, (4) bodyweight box squats to a box of a height that

allowed the participant to reach a position where the thighs were parallel with the floor, (5) partial sit-ups, with bent legs, where the head and shoulder blades had to be lifted from the floor, (6) standing on knees and hands and alternately lifting the opposite arm and leg, (7) heel raises. Instructions for each separate movement were given just before it was carried out. Every exercise was performed in one set with 15 repetitions. If the participant was not able to manage 15 repetitions, she was encouraged to do as many as possible. Each new exercise started three minutes after the previous exercise began. The workouts lasted about 20 minutes. The subjects performed the workout individually. The workout was instructed and supervised by one of the authors (AP), who is a physiotherapist experienced in working with subjects who have FM.

Procedure

The timing of the different measurements and the resistance training workout are presented in figure 1. The number of tender points was evaluated in conjunction with the diagnostic criteria seven days before the workout. The questionnaires IPAQ, NPRS, KSQ and FIQ (FIQ1) were filled in by the participants just before the workout. The participants had to complete the FIQ a second time (FIQ2) seven days after the workout session and hence they received an envelope containing the questionnaire. They were instructed to complete the instrument one week after the training session and send it back to the investigator in a prepaid envelope.

Insert figure 1 about here

Statistics

A multiple logistic regression was performed using IPAQ, the number of tender points, NPRS, and KSQ as the independent variables, and FIQ2 – FIQ1 = FIQ change as the

dependent variable. The variables included in the regression model were dichotomized according to levels described in the Method section. The IPAQ short version was dichotomized to those who had a low physical activity level and those who had a moderate or high level of physical activity. The numbers of tender points have previously been divided into the following categories: 0–5, 6–10, 11–14, 15–18 (White, Speechley, Harth and Ostbye, 1999). In the present study, the scores were dichotomized to those who had 11–14 and 15–18 painful points. The NPRS has been classified into the categories 0–3 mild pain, 4–7 moderate pain and 8–10 severe pain (Silverman et al, 2010). In the present study, the scores were dichotomized to those with severe pain (8–10) and those with mild and moderate pain (0–7). Regarding sleep quality, as measured by KSQ, a score of three or less on the individual scales is an indication that sleeping problems are so severe that further clinical examination is indicated (Stockholm University, 2015). Accordingly, the scores were dichotomized to those who estimated three or lower and to those who rated higher than three on average on the four different scales measuring sleep quality. The dependent variable, FIQ change, was dichotomized to those whose health had deteriorated (higher scores) and those whose health had improved or had not changed. All independent variables were entered into the equation in one step using the enter method. In addition to the above-mentioned logistical regression analysis, the following statistical calculations were carried out. The results from FIQ1 and FIQ2 were compared between the dichotomized groups for all of the independent variables using Mann-Whitney U-test. The difference between FIQ1 and FIQ2 was tested for every dichotomized group and for the whole group using Wilcoxon signed-rank test. The number of participants was calculated using 10 individuals per independent variable in the logistic regression model (Norman and Streiner, 2008), resulting in 40 individuals. A significance level for all analyses was set at $p<0.05$. It was predetermined that if a participant did not complete at

least 75% of the total amount of repetitions in the workout she should be excluded from the analyses. All statistical analyses were performed using SPSS statistics version 23.

Ethics

This study was carried out as part of the program for a master's thesis at Lund University, and according to Swedish law no approval was needed from the Regional Research Ethics Committee. As required for this type of study, however, an application was sent to the Advisory Committee for Research Ethics in Health Education at Lund University and they had no objections to the study. All participants were given verbal and written information about the study and had to sign an informed consent document before they attended.

Results

One participant did not complete the FIQ questionnaire the second time and her data was therefore excluded from the analysis, resulting in 40 subjects fulfilling the study. No subject failed to perform the minimum of 75% repetitions stated as exclusion criteria. FIQ1 for the whole group was 67.5 (59.3–74.8) (median) (IQR) and FIQ2 was 67.0 (57.3–78.0) (median) (IQR). Table 2 presents a description of the dichotomized groups, from each independent variable, related to the results from FIQ1, FIQ2, age and years with symptoms. Significant differences in both FIQ1 and FIQ2 were found between those with higher and those with lower rated pain. Also between those with poor and less poor sleep quality, equivalent results were found although not significant. No significant differences were found between FIQ1 and FIQ2 in the whole group or in any of the dichotomized groups for the independent variables. Twenty-two (55%) of the subjects had a higher score in FIQ2 than in FIQ1. Eighteen (45%) had the same score or lower. In the logistic regression analysis, no significant association could be found between the independent

variables and the dependent variable FIQ change (change in health status). More detailed information is presented in table 3.

Insert table 2 about here

Insert table 3 about here

DISCUSSION

This is to our knowledge the first study to investigate whether the level of physical activity, the number of tender points, pain intensity and sleep quality before exercise could predict change in health status after one session of a resistance training workout in subjects with FM. The results showed that none of the studied variables could predict change in health status as measured by FIQ. Those who had higher pain intensity had a significantly lower overall health status. In those who had poor sleep quality a similar association was observed although not significant. Neither of these groups or any of the other dichotomized groups, for the independent variables, showed a clear deterioration, in terms of health status, as a result of the resistance training workout. This suggests that a resistance training workout of the intensity performed in this study seems safe, even for those with less favorable results in the studied variables.

The variables included in this study are all known as important for the health status in subjects with FM (White, Speechley, Harth and Ostbye, 1999; Jay and Barkin, 2015; Segura-Jiménez et al, 2015). Eighty percent of the individuals had 15 or more painful points and over 50% estimated eight or higher on the NPRS. Sixty percent of the participants showed signs of poor sleep quality. When it comes to physical activity, 40% were relatively inactive. Several experts believe that the level of symptoms and previous physical activity are important to take into account when initiating physical training for a

person with FM (Mannerkorpi and Iversen, 2003; Mannerkorpi, 2005; Mannerkorpi and Henriksson, 2007; Thomas and Blotman, 2010). These affirmations justify the choice of variables included in this study.

The number of participants in this study was tailored to the recommended level of ten observations per independent variable (Norman and Streiner, 2008). Other statisticians have recommended a larger number of observations per independent variable (Peng, So, Stage and St. John, 2002). The low number of participants could be seen as a weakness in our study, in particular regarding the variable “number of tender points”, where one group only had eight subjects.

This study was not blinded as the same person collected the data, instructed the participants during the intervention and analyzed the results. It cannot be excluded that the subjects might have been influenced by the instructor in their effort when doing the exercises or in their experience of the workout. It is unknown, however, in which direction this might have influenced the results. The results would probably have been more reliable if different persons had collected the data, led the workout session and analyzed the results (Karanicolas, Farrokhyar and Bhandari, 2010). However, the variables were rated by the participants and FIQ2 was completed at home one week after the workout. These conditions might have reduced the possible bias effects. In addition, the design of the included instruments does not give much room for interpretation when calculating the results.

There are several different possible explanations for the main results of this study. One could be that the studied variables do not seem to be important when it comes to change in health status due to resistance training. Another explanation might be that the intensity

of the workout was quite low. The intensity was markedly lower than in the studies testing isometric and dynamic loading, mentioned in the background section and also compared to the American College of Sports Medicine guidelines for resistance exercise for those with FM (Mengshoel, Førre and Komnaes, 1990; Jubrias, Bennett and Klug, 1994; Lund, Kendall, Janerot-Sjøberg and Bengtsson, 2003; Elvin, Siösteen, Nilsson and Kosek, 2006; Kadetoff and Kosek, 2007; American College of Sports Medicine, 2013; Srikuea et al, 2013). However, several training studies where dropouts due to increased symptoms were reported had a comparable intensity in the beginning (Vertappen et al, 1997; Jones et al, 2002; Larsson et al, 2015).

The subjects in our study had more severe symptoms and worse health status before the workout compared to the subjects who performed different physical tests and to those who dropped out due to increased symptoms (Mengshoel, Vøllestad and Førre, 1995; Verstappen et al, 1997; Srikuea et al, 2013; Larsson et al, 2015). The more severe symptoms at baseline gave probably less room for deterioration. This might be another explanation.

How the intensity was experienced by the subjects is not known, which could be regarded as a weakness of this study. As 60% of the individuals already were physically active at a medium or high level they might have experienced the intensity as low. A question that examined the perceived intensity of the workout would have given valuable information and could have been included in the follow-up questionnaire.

It is also possible that if the evaluation with FIQ had been done before and after several sessions or a longer period of training, as in the training studies reporting increased symptoms or dropouts due to increased symptoms, a different result might have been

obtained. In most of those studies the participants were encouraged to increase the intensity of the workouts over time, which may have been an important factor for the deterioration (Norregaard, Lykkegaard, Mehlsen and Danneskiold-Samsoe, 1997; Verstappen et al, 1997; Jones et al, 2002; Richards and Scott, 2002; Schachter, Busch, Peloso and Sheppard, 2003; Larsson et al, 2015).

Physical exercise is an important part of the treatment of FM. In addition to the positive effect on symptoms, another important reason to exercise is the general health benefits it provides. Working out has been shown to reduce the risk of developing a variety of diseases such as cardiovascular disease, diabetes type 2 and cancer in the general population (Swedish National Institute of Public Health, 2010). Exercise is also an effective treatment for mental health disorders such as depression and anxiety (Swedish National Institute of Public Health, 2010), which are common among those with FM (Jay and Barkin, 2015).

Pain due to delayed onset muscle soreness (DOMS), may occur as a result of exercise that a person is unaccustomed to, both among healthy individuals and in those with FM (Valkeinen et al, 2006; Kim and Lee, 2014). In addition to DOMS, subjects with fibromyalgia can experience worsening of health by an increase of other symptoms such as fatigue, stiffness (Santen et al, 2002; Bruijn et al, 2011), nausea and numbness (Mengshoel, Saugen, Forre and Vøllestad, 1995). In order to avoid severe increase of symptoms, it is probably preferable to start at a low intensity (Mannerkorpi, 2005; Nijs, Mannerkorpi, Descheemaeker and Van Houdenhove, 2010; Palstam A et al, 2016), which could be a way to increase the likelihood for the person to continue to train. It is estimated that approximately 40% of patients with FM exhibit fear of movement and an avoidance behavior against physical strain (Nijs et al, 2013). For this reason, it is a good idea for

subjects with fibromyalgia to get help from a physiotherapist or any professional with similar skills, at least in the beginning (Meyer and Lemley, 2000; Mannerkorpi and Henriksson, 2007; Busch et al, 2008; Nijs, Mannerkorpi, Descheemaeker and Van Houdenhove, 2010; Thomas and Blotman, 2010; Palstam A et al, 2016).

CONCLUSIONS

The studied variables – physical activity, the number of tender points, pain intensity and sleep quality before one resistance training workout – could not predict change in the overall health status assessed by FIQ one week after the workout. Subjects with higher pain scored lower health both before and after the intervention. The intervention applied was at a level of intensity that was shown not to deteriorate the health status of the participants, not even among those with the most severe symptoms or those who were least physically active. Subjects diagnosed with FM often visit a physiotherapist, at least in the early period of the disease. The exercises applied in this study could safely be used at least in the beginning of the training and in subjects with a background equivalent to that in this study. Whether other symptoms also common in subjects with FM would predict change in health status after training remains to be investigated. To learn more about why some individuals with fibromyalgia experience increased symptoms as a result of exercise, more studies need to be done of both qualitative and quantitative nature.

DECLARATION OF INTEREST

The authors report no declarations of interest.

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Tables with captions

Table 1. Baseline characteristics (n=40)

Age Median (IQR)	47.5 (40.3–57.0)
BMI Median (IQR)	26.7 (24.3–31.7)
Highest education (n) - Compulsory school - Upper secondary school - College	 **4** (10%) **30** (75%) **6** (15%)
Percentage of full-time work (n) - 0–24% - 25–49% - 50–74% - 75–99% - 100%	 **13** (32.5%) **5** (12.5%) **10** (25%) **4** (10%) **8** (20%)
Sick leave (n) - 0% - 25% - 50% - 75% - 100%	 **32** (80%) **1** (2.5%) **3** (7.5%) **1** (2.5%) **3** (7.5%)
Disability pension (n) - 0% - 25% - 50% - 75% - 100%	 **23** (57.5%) **1** (2.5%) **6** (15%) **2** (5%) **8** (20%)
Years with symptoms Median (IQR)	14.5 (8.5–20.5)
Activity level IPAQ (n) - Low - Medium - High	 **16** (40%) **14** (35%) **10** (25%)
Tender points (0–18) Median (IQR)	17 (15–18)
Pain intensity NPRS (0–10) Median (IQR)	8 (6.3–8.0)
Sleep quality KSQ (0–6) Median (IQR)	2.75 (2–4)

IQR: Interquartile Range; BMI: Body Mass Index; IPAQ: International Physical Activity Questionnaire; NPRS: Numeric Pain Rating Scale; KSQ: Karolinska Sleep Questionnaire

Table 2. Dichotomized independent variables, described in relation to FIQ1, FIQ2, age and years with symptoms

	FIQ1 Median (IQR) (n=40)	FIQ2 Median (IQR) (n=40)	Age Median (IQR) (n=40)	Years with symptoms Median (IQR) (n=40)
Tender points				
≥15 (n=32)	68.0 (60.3–74.8)	68.0 (58.5–78.0)	50.0 (44.0–57.0)	13.5 (8.5–23.5)
≤14 (n=8)	62.0 (31.8–78.3)	62.0 (34.5–75.0)	38.5 (34.5–45.0)	17.0 (7.3–19.5)
	p= 0.272#	p= 0.104#		
IPAQ (points)				
Low (n=16)	69.0 (61.5–74.5)	62.5 (56.3–73.3)	44.0 (40.5–55.5)	10.0 (5.3–16.5)
Med+High (n=24)	67.0 (53.5–78.5)	69.5 (61.3–78.8)	48.0 (39.5–57.0)	17.5 (11.3–27.8)
	p= 0.562#	p=0.180#		
KSQ sleep quality (points)				
≤3.0 (n=24)	71.0 (60.0–81.8)	68.0 (62.3–81.8)	49.5 (41.3–57.0)	15.0 (8.0–23.0)
>3.0 (n=16)	63.5 (47.8–70.8)	63.5 (46.0–73.3)	46.5 (38.5–56.3)	13.5 (10.0–21.5)
	p= 0.053#	p= 0.073#		
NPRS (points)				
8–10 (n=21)	72.0 (67.5–82.0)	74.0 (64.0–82.0)	51.0 (44.0–57.5)	15.0 (8.0–23.5)
0–7 (n=19)	60.0 (45.0–64.0)	62.0 (46.0–67.0)	44.0 (36.0–56.0)	14.0 (10.0–22.0)
	p<0.000#	p= 0.018#		

FIQ1 and 2 : Fibromyalgia Impact Questionnaire first and second time; IQR: Interquartile Range; n: number of participants; IPAQ: International Physical Activity Questionnaire; KSQ: Karolinska Sleep Questionnaire; NPRS: Numeric Pain Rating Scale; #p-value: Mann Whitney U-test between dichotomized groups

Table 3. Multiple logistic regression between FIQ change and independent variables

Dichotomized variables	Odds ratio (95% CI)	p-value
Tender points ≥15 (n=32) ≤14 (n=8)	2.85 (0.45–18.26)	0.269
IPAQ Low (n=16) Med+High (n=24)	0.28 (0.07–1.13)	0.073
KSQ ≤3.0 (n=24) >3.0 (n=16)	0.53 (0.13–2.14)	0.375
NPRS 8–10 (n=21) 0–7 (n=19)	0.58 (0.14–2.48)	0.466

FIQ: Fibromyalgia Impact Questionnaire; CI: Confidence interval; IPAQ: International Physical Activity Questionnaire; KSQ: Karolinska Sleep Questionnaire; NPRS: Numeric Pain Rating Scale; Dependent variable: FIQ change 0=same or better (n=18) , 1=worse (n=22)

Figur 1.