

ORIGINAL REPORT

ASSOCIATION OF FEAR OF MOVEMENT AND LEISURE-TIME PHYSICAL ACTIVITY AMONG PATIENTS WITH CHRONIC PAIN

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Objective: The aim of this study was to clarify the association of fear of movement and physical activity among patients with chronic musculoskeletal pain.

Methods: The sample comprised 93 patients participating in a multidisciplinary pain management programme. The purpose of the programme was to regain overall functioning by means of physical and functional exercises, education and personal pain management training. Tampa Scale of Kinesiophobia and Leisure Time Physical Activity questionnaires were completed at baseline, and at 6-month and 12-month follow-ups.

Results: At baseline, low and medium kinesiophobia groups showed more leisure-time physical activity than did the high kinesiophobia group ($p=0.024$). At a 6-month follow-up the high kinesiophobia group had increased their physical activity index to the level of the low and medium kinesiophobia groups and maintained that change to 12-month follow-up. The effect sizes of the change in the physical activity index and pain intensity at the 12-month follow-up were both moderate (0.56) in the high kinesiophobia group.

Conclusion: The change in physical activity and kinesiophobia was associated with the level of baseline kinesiophobia. Multidisciplinary rehabilitation seems to produce favourable effects in terms of physical activity and pain among the high kinesiophobia patients.

Key words: kinesiophobia; physical activity; multidisciplinary rehabilitation; exercise; chronic pain.

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INTRODUCTION

In patients with chronic low back pain, there is strong evidence of improvement in function, and moderate evidence of reduction in pain, with intensive multidisciplinary bio-psycho-social rehabilitation with a functional restoration approach (1). A meta-analysis of psychological interventions for chronic low back pain revealed that multidisciplinary approaches, including cognitive behavioural components, had positive short-term

effects on pain interference and positive long-term effects on return to work compared with active control conditions (2).

Psychological factors are implicated in the transition from acute phase to chronic low back pain (3). Earlier studies have demonstrated that fear of movement and fear of (re)injury are better predictors of functional limitations than biomedical parameters (4). Pain-related fear can be more disabling than the pain itself (5). Crombez et al. (6) showed that pain-related fear was the best predictor of behavioural performance in trunk extension, flexion and weight-lifting tasks when separating out the effects of pain intensity. High levels of fear avoidance beliefs relate to increased levels of disability (7, 8). In particular, fear of movement is significantly associated with disability in chronic low back pain (9). Decreasing the fear of movement is one goal of pain management and rehabilitation; a reduction in pain-related anxiety seems to predict improvement in functioning, affective distress, pain and pain-related interference with activity (10). However, although this goal is widely accepted, the authors of earlier studies have not determined whether the decrease in fear of movement increases physical activity among participants in pain management programmes. It has been shown that a low level of physical activity in patients with back pain is associated with a high level of fear-avoidance beliefs (11), that high fear-avoiders benefit more from an exercise programme in terms of disability (12), and that kinesiophobia decreases during an intensive physical therapy programme in chronic low back pain (13).

The association between fear avoidance and leisure-time physical activity (LTPA) is equivocal. Smeets et al. (14) found that patients with low back pain had a reduced level of aerobic fitness compared with healthy subjects. Activity during leisure time was strongly associated with reduced aerobic fitness. However, fear avoidance, as measured by the Tampa Scale of Kinesiophobia (TSK), was not associated with aerobic fitness. In a study by Leonhardt et al. (15), increased physical activity was not associated with fear-avoidance beliefs, as measured with the Fear-Avoidance Beliefs Questionnaire (FABQ), in patients with acute and chronic low back pain. Leonhardt et al. (15) concluded that fear-avoidance beliefs do not limit activity *per se*, but there might be avoidance of specific movements. On the other hand, Elfving et al. (11) found that low-level self-reported physical activity was significantly associated with higher scores for TSK and pain catastrophizing in patients with chronic, non-specific low back pain.

The objective of the present paper was to study the association between fear of movement and physical activity among patients with chronic pain attending a multi-disciplinary bio-psycho-social pain management programme.

MATERIAL AND METHODS

Patients

The sample comprised 93 chronic musculoskeletal pain patients who had been referred to a pain management programme at ORTON Rehabilitation Centre by specialists at Helsinki University Hospital between 2003 and 2007. The exclusion criteria were primary fibromyalgia and diagnosed psychiatric disorder. The pain problem of the patients had been thoroughly examined by an anaesthesiologist, neurologist or specialist of physical and rehabilitation medicine at the pain clinic of Helsinki University Hospital in order to identify conditions for specific treatment. Pain medication and other conditions had been optimized. The purpose of the pain management programme was to increase the functional capacity of the patients after the medical treatment.

All patients participated in the routine pain management programme and all measurements were part of the rehabilitation. The Social Insurance Institution both funded rehabilitation services for patients and provided income security (rehabilitation allowance) during participation in the rehabilitation. The patients did not receive any extra compensation for participation in the rehabilitation.

The ethics committee of the Hospital District of Helsinki and Uusimaa and the review board of the ORTON Research Institute approved the study protocol. All patients gave their informed consent for participation in the study.

Intervention

The purpose of the pain management programme was to regain overall functioning. The group rehabilitation design comprised physical and functional exercises, evaluation of the patient's social situation, psychological assessment of pain-related stress factors, and personal pain management training. The programme was conducted by a multidisciplinary rehabilitation team, including a physician, psychologist, social worker, two physiotherapists and occupational therapist, according to the International Association for the Study of Pain (IASP) recommendations for pain treatment services (IASP, 2010). The rehabilitation team had been trained in a bio-psycho-social frame of reference and a cognitive-behavioural working approach. The team offered an activating approach, encouraging the patients towards individual exercise in order to regain function and improve self-management of the pain. The pain management group size varied between 8 and 10 patients, the programme comprised 3 phases over a time-frame of 6–7 months, totalling 19 (3+13+3) days.

During the initial 3 days rehabilitation phase, patients encountered each of the team members for basic evaluations, and received individual physical exercise and training schedules from the physiotherapist. Individual training goals were defined. During the 13 days rehabilitation phase, the patients had interventions with the physician and social worker, psychologist and occupational therapist twice, and physiotherapists 6 times, all for approximately 60 min per intervention. The exercise and training programmes were re-assessed and adjusted according to the physical conditions of the patients at that time. The final 3 days rehabilitation stage comprised interventions with each team member. Again, the exercise and training programmes were, when necessary, re-assessed and adjusted according to the physical conditions of the patients. The requirement from the financier was that the programme contained scheduled activities 35 h per week. In addition to individual appointments there were discussion groups and lectures lead by team members. Physical exercise included water gymnastics, gym exercises, balance, relaxation and flexibility training, Pilates-type exercises and outdoor walking.

Measurements and evaluations

Questionnaires were completed for baseline data after providing general information about the pain management programme, before any

interventions. Six-month follow-up data was completed during the last 2 days of the third phase of the pain management programme. Follow-up data at 12 months was collected via a postal questionnaire.

Kinesiophobia

The Finnish version of the Tampa Scale of Kinesiophobia (TSK-FV) was used to assess fear of movement/(re)injury. The original English version (16) was translated into Finnish and then translated back into English by authorized translators. The English versions were then compared, and both the translators and the original author of the article resolved differences by the consensus procedure. TSK-FV is a 17-item questionnaire, in which each item has a 4-point Likert scale with the following alternatives: strongly disagree, disagree, agree, strongly agree. After inverting items 4, 8, 12, and 16, a sum-score is calculated. The range of score is 17–68, with a higher number indicating greater fear of movement. The original English questionnaire has demonstrated good internal consistency, test-retest stability, and validity (17). The Dutch and Swedish (18–20) versions have also shown acceptable levels of reliability and validity. For the purpose of the study, we classified the patients into tertiles based on distribution of TSK in the study population. The TSK tertile I (low kinesiophobia, range 17–33) consists of 30 subjects, the II tertile (medium kinesiophobia, range 34–40) consists of 29 subjects and the III tertile (high kinesiophobia, range 41–68) consists of 34 subjects.

Physical activity

We measured LTPA according to the recommendations by Sallis et al. (21), using a questionnaire that included items for frequency and intensity of average number of LTPA bouts, which last at least 20–30 min. We measured frequency by means of multiple-choice questions that assessed the number of physical activity sessions on a 5-level scale. We assessed intensity with a multiple choice question in which subjects indicated the type of LTPA on a 4-level scale. We used the LTPA index for the final analysis, taking into account both the frequency and intensity of LTPA according to the MET-values (1 MET = 1 metabolic equivalent = 1 kcal/kg/h). One MET (1 kcal/kg/h) is consumed when reading or watching TV, 4 METs (4 kcal/kg/h) when walking, riding a bike or doing light gardening, 7.5 METs (7.5 kcal/kg/h) when jogging, cross-country skiing, swimming or playing ball games, and 12 METs (12 kcal/kg/h) when training for competitive sports such as running or cross-country skiing (21). The LTPA index is calculated by multiplying the weekly frequency of LTPA sessions by the MET-value of the intensity of LTPA. The range of the index is from 0 to 60. A value of 60 represents a daily (computed as 5 times per week) LTPA of the highest intensity. LTPA has proven to be a reliable and valid estimator of cardio-respiratory fitness (22). LTPA has been shown to be associated with a lower risk of overweight, hypertension, musculoskeletal disorders (23) and cardiovascular risk (24) and improved quality of life (25).

Pain intensity

We rated the average pain intensity during the past week on a 0–100-mm visual analogue scale (VAS) ranging from “no pain” to “worst possible pain”. The VAS has been widely used and has shown an acceptable reliability (26).

Depressive symptoms

We measured depressive symptoms with the 21-item Beck Depression Inventory, version II, (BDI-II) (27). The 21 items are scored 0–3, ranging from 0 to 63. According to the reference levels given in the BDI-manual, 0–13 equals minor depression, 14–19 mild depression, 20–28 moderate depression, and 29–63 severe depression. The Finnish version has shown acceptable levels of reliability and validity (28).

Disability

We used the Finnish version of the Oswestry Disability Index (ODI) to assess activity limitations. The ODI contains 10 items: pain intensity, personal hygiene, lifting, walking, sitting, standing, sleeping, sexual

activity, social activity and travelling. Each item is scored on a 6-point scale, where 0 represents no limitation and 5 represents maximal limitation. From this, a percentage score (0–100) is calculated, with a higher score indicating greater disability. The Finnish version of the ODI has been found to be reliable and valid (29).

Statistical analyses

The results are expressed as means with a standard deviation (SD). The most important descriptive values were expressed with 95% confidence intervals (95% CI). We compared the groups using the analysis of variance (ANOVA) and χ^2 test. We used a bootstrap-type (30) (5000 replications) random coefficient regression for statistical comparison of the changes in repeated measurements. We obtained CIs for the mean of changes by bias-corrected bootstrapping (5000 replications). We calculated the effect size ("d") using Cohen's method (31) for paired samples (mean baseline scores minus the mean follow-up scores, divided by the pooled standard deviation). An effect size of 0.20 was considered to be small, 0.50 was medium, and 0.80 was large. We obtained CIs for the effect sizes by bias-corrected bootstrapping (5000 replications).

RESULTS

Sample and clinical data at baseline

The male:female ratio differed in the kinesiophobia tertiles ($p=0.019$): in the low kinesiophobia group, 80% were females, while in the high kinesiophobia group less than 50% were females. The low kinesiophobia group showed less disability on ODI (mean 31, SD 11) than the medium (mean 37, SD 9) and high (mean 39, SD 14) kinesiophobia groups ($p=0.013$). The high kinesiophobia group had more depressive symptoms (mean 16, SD 7) than the medium and low kinesiophobia groups ($p=0.028$), (mean 14, SD 8 and mean 12, SD 6, respectively). The patients' baseline demographic and clinical data are shown in Table I. The mean LTPA index of the high kinesiophobia group was lower (mean 17, SD13) than in the low and medium kinesiophobia groups, (mean 26, SD 16) ($p=0.012$) (Table II).

Table I. Patients' demographic and clinical data at baseline

	Tampa Scale of Kinesiophobia tertiles			p-value
	17–33 (n=30)	34–40 (n=29)	41–68 (n=34)	
Females, n (%)	24 (80)	20 (69)	16 (47)	0.019
Age, years, mean (SD)	43 (8)	45 (8)	44 (8)	0.72
Body mass index, kg/m ² , mean (SD)	25.2 (3.4)	26.8 (5.6)	27.9 (4.3)	0.062
Cohabiting/in a relationship, n (%)	19 (63)	23 (79)	25 (74)	0.38
Education, n (%)				
Primary school	4 (13)	6 (21)	10 (29)	
Secondary school	7 (23)	6 (21)	4 (12)	
College	15 (50)	12 (41)	12 (35)	
Graduate	4 (13)	5 (17)	8 (24)	0.55
Employment status, n (%)				
Employed	18 (60)	18 (62)	16 (47)	
Unemployed	9 (30)	10 (35)	16 (47)	
Pension/student	3 (10)	1 (3)	2 (6)	0.54
Duration of pain, years, n (%)				
≤1	1 (3)	3 (10)	2 (6)	
1–4	20 (67)	20 (69)	24 (71)	
≥5	9 (30)	6 (21)	8 (24)	0.78
Pain category, n (%)				
Lower extremities	1 (3)	2 (7)	1 (3)	
Neck	8 (27)	7 (24)	10 (29)	
Headache	4 (13)	1 (3)	2 (6)	
Chest	2 (7)	1 (3)	0	
Back	12 (40)	16 (55)	16 (47)	
Upper extremities	3 (10)	2 (7)	5 (15)	0.75
Pain intensity, VAS, mean (SD)	60.1 (22.4)	64.8 (25.6)	68.1 (21.1)	0.38
Oswestry index, mean (SD)	30.9 (10.8)	36.8 (8.6)	39.4 (13.7)	0.013
Beck Depression Inventory, mean (SD)	11.8 (5.7)	13.5 (7.5)	16.4 (6.9)	0.028

p-values are based on analysis of variance (ANOVA) and χ^2 tests.

n and % values indicate values within tertiles.

VAS: visual analogue scale; SD: standard deviation.

Table II. Mean values (standard deviation; SD) of physical activity, pain intensity and disability at baseline, mean changes (95% confidence interval (CI)) and effect sizes (95% CI) of the change from baseline to 12-month follow-up in Tampa Scale of Kinesiophobia (TSK) tertiles

	TSK tertile at baseline			p-value*
	I (TSK 16–33) (n=30)	II (TSK 34–40) (n=29)	III (TSK ≥41) (n=34)	
Baseline, mean (SD)				
LTPA	26 (16)	26 (16)	17 (13)	0.012
Pain	60 (22)	65 (26)	68 (21)	0.17
Oswestry	31 (11)	37 (9)	39 (14)	0.004
Change from baseline to month 12				
LTPA				
Mean (95% CI)	1 (–3 to 5)	2 (–3 to 6)	8 (3–13)	0.023
Effect size (95% CI)	0.06 (–0.19 to 0.36)	0.10 (–0.19 to 0.43)	0.56 (0.20–0.91)	
Pain				
Mean (95% CI)	–7 (–17 to 3)	–11 (–19 to –2)	–14 (–25 to –4)	0.33
Effect size (95% CI)	0.29 (–0.16 to 0.78)	0.38 (0.1–0.76)	0.56 (0.20–1.00)	
Oswestry				
Mean (95% CI)	–4 (–9 to 1)	–4 (–8 to 0)	–6 (–11 to –1)	0.58
Effect size (95% CI)	0.30 (0–0.70)	0.29 (0–0.62)	0.36 (0.03–0.70)	

*Indicates p-value for difference of linear change between TSK tertiles.

LTPA: leisure-time physical activity.

Changes at 6-month and 12-month follow-ups

Six months after admission to the pain management programme, patients with high kinesiophobia had increased their physical activity to the same level as the low and medium kinesiophobia groups and had maintained their physical activity up to 12-month follow-up (Fig. 1). There were no changes in low and medium kinesiophobia groups at the 6-month or 12-month follow-ups. The mean change in physical activity in the whole sample was 4 (95% CI 1–7) ($p=0.008$). The mean change in the LTPA index among patients with high kinesiophobia was 8 (95% CI 3–13) ($p=0.023$), while patients with low kinesiophobia showed a mean change of 1 (95% CI –3 to 5) and the mean change for patients with medium kinesiophobia was 2 (95% CI –3 to 6) (Table II). The mean change in TSK was –2.0 (95% CI –3.5 to –0.5) ($p=0.01$).

Although the mean pain intensity (VAS) in the high kinesiophobia group decreased twice as much as in the low kinesiophobia group (–14 (95% CI –25 to –4) vs 7 (95% CI –17 to 3) and –11 (95% CI –19 to –2)), there were no statistical differences between the groups ($p=0.33$).

The effect sizes of the change in the LTPA index and pain intensity at the 12-month follow-up were both moderate in the high kinesiophobia group, while they were small in the low and medium kinesiophobia groups. The effect size of the change in disability was small in all kinesiophobia groups (Table II).

Association of the change in kinesiophobia with physical activity

There were no associations between kinesiophobia and physical activity when exploring the whole sample ($r=0.10$). However, the association of change in kinesiophobia with physical activity was different in the 3 kinesiophobia sub-groups (Fig. 2). Among patients with low kinesiophobia, association was strong ($r=0.48$), but only 4 (13%) patients had increased their physical activity and showed a decrease in kinesiophobia. In the medium and high kinesiophobia group associations were weak ($r=0.10$ and $r=0.23$), but favourable changes in physical activity and kinesiophobia were observed in 10 patients (35%) in the medium kinesiophobia group, and in 14 patients (41%) in the high kinesiophobia group.

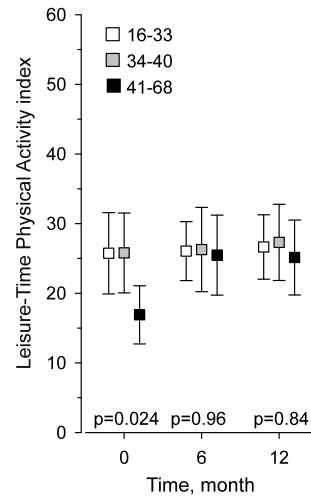


Fig. 1. Mean physical activity index with 95% confidence interval at baseline and 6-month and 12-month follow-up in kinesiophobia tertiles.

DISCUSSION

At the 6-month follow-up, the high kinesiophobia group had increased their LTPA to the level of the low and medium kinesiophobia groups. The change was maintained at 12-month follow-up. There were no significant changes in subjects with low and medium kinesiophobia at the 6-month or 12-month follow-up. At the time of admission to the pain management programme, the LTPA index was significantly lower in subjects with high kinesiophobia than in subjects with low or medium kinesiophobia. A decrease in pain intensity was greatest in the high kinesiophobia group, although the difference between groups was not statistically significant. At baseline, there was no difference in pain intensity between the kinesiophobia groups. The effect sizes of the change of pain intensity were moderate in the high kinesiophobia group and small in the low and medium kinesiophobia groups. The association of change of kinesiophobia and physical activity was different in the 3 kinesiophobia

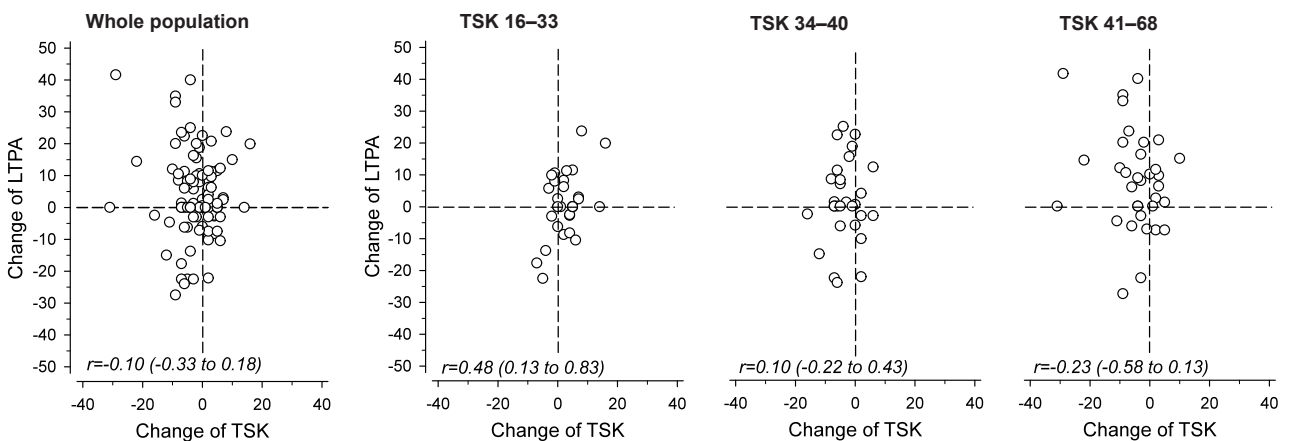


Fig. 2. Scatter-plots showing change of Tampa Scale of Kinesiophobia (TSK) and change of physical activity, in whole study population and in TSK tertiles.

groups. In the high kinesiophobia group, physical activity increased and kinesiophobia decreased in 41% of subjects. The respective change was observed in 35% of subjects in the medium kinesiophobia group, whereas in the low kinesiophobia group this change occurred in only 13% of subjects.

The pain management programme seems to produce positive effects in terms of physical activity among patients with high kinesiophobia. This multidisciplinary rehabilitation provides the opportunity to monitor the pain problem from different viewpoints in order to increase overall functioning and decrease pain and disability. There are one-to-one meetings with team members, lectures and discussion groups that provide information, cognitive and other rehabilitative elements. In addition, the pain management programme provides positive experiences of various physical activities (e.g. walking, water gymnastics, gym and Pilates-type exercise) in a safe environment. Most patients are aware of benefits of exercising and physical activity, but they do not feel safe to start or continue their activities without external support or guidance. Also, peer support of the rehabilitation group plays an important role in the rehabilitation process. One may learn how others have managed to solve problems related to activities of daily living, physical activity and exercise. As far as we know, this is the first time that an increase in physical activity has been demonstrated in conjunction with a decreased fear of movement in patients with moderate disability.

There are a few limitations of the present study. First, we registered only the leisure-time activity and we do not know anything about the occupational physical activities. However, if we had taken occupational activities into account, the sample size would have been much smaller, as 38% of subjects were out of work. Secondly, the LTPA index is based on self-reporting, and people have a tendency to over-report their physical activity (32). Motion sensors, such as pedometers or accelerometers, are more objective methods of assessing physical activity. However, these devices have limitations, they tend to underestimate walking and overestimate jogging activity and they fail to detect arm movements, resistance exercise and the performance of external work (33). Moreover, motion sensor devices are not suitable for use in physical activities in water, which is often most suitable for patients with chronic pain. Heart rate measurement devices can be used in water, and energy expenditure can be calculated for assessment of physical activity. The 12-month follow-up data of physical activity would have been lost if motion sensors or heart rate measurement had been used.

The information on LTPA was collected using the same method for all patients at every time-point. One would also have expected increased physical activity in the low and medium kinesiophobia groups if there had been a strong tendency towards over-reporting. However, this was not the case, and the low and medium kinesiophobia groups reported no change in LTPA. It should also be noted that the patient sample included mixed pain syndromes, which may have influenced the assessment of disability on the ODI. Thus, future studies should focus more on different subgroups (back pain and neck pain and different pain modalities, such as neuropathic pain). In future studies, use of objective measurement of LTPA could

provide more detailed information about association of the kinesiophobia and physical activity.

The present study confirms earlier studies with regard to the connection between chronic musculoskeletal pain and fear of movement. However, this is the first time that a decrease in fear of movement has been shown to be associated with an increase in physical activity. This is therapeutically important, because it confirms our assumptions about rehabilitation mechanisms among chronic pain patients: by decreasing fear and increasing physical inactivity, we may be able to break the vicious circle of pain and disability (20), although the causal relationship of fear of movement and physical activity remains unresolved.

The primary goal of the pain management programme is to enhance functional capacity and reduce distress. If the management programme decreases patient's fear of movement and increases LTPA, it probably also has an impact on the patient's general state of health and well-being. Physically active adults have better cardio-respiratory and muscular fitness. There is also strong evidence that physical activity has a favourable effect in terms of coronary heart disease, high blood pressure, stroke, type 2 diabetes, metabolic syndrome, colon cancer, breast cancer and depression (34). In addition, modest evidence indicates that physically active adults sleep better and have a better health-related quality of life (34, 35).

One explanation might lie in structure of the TSK; some items might not be specifically related to fear of movement. There are different factor solutions (5, 18, 36) of TSK. Most popular seems to be a two-factor solution proposed by Clark et al. (36), where one factor is termed "activity avoidance", which reflects the belief that activity may result in (re)injury or increased pain. The second factor is termed "pathological somatic focus", relating to beliefs about underlying and serious medical problems. However, preliminary factor analyses of present data provided 5-factor solution (data not shown). This might be due to the particular study sample, or there might be cultural reasons. Content validity of the TSK needs clearly to be explored with a larger sample, including measures of disability and functioning as well as psychosocial dimensions.

The second explanation for this issue might be that not all pain patients having high TSK score are fear-avoiders, who reduce their activity during painful periods. Hasenbring et al. (37) has pointed out that some patients tend to finish their activities despite pain, thus further aggravating the pain themselves. An association has been shown between activity fluctuations and disability, rather than the mean activity level, over time (38). In low back patients, the relationship between physical activity and pain is U-shaped rather than linear. Both inactivity and excessive activity represented an increased risk for low back pain (39). This might also be the case with other musculoskeletal problems. Another point of view is that pain-related fear has been measured by different questionnaires in various studies. Although researchers have found the correlation between TSK and FABQ to be significant (40), TSK and FABQ measure different dimensions of pain-related fear. FABQ is probably a more generic measure, while high scores in TSK might be due to fear of a specific movement or movement direction, e.g. bending forward.

The present findings should be replicated in a larger sample, providing an opportunity to study more closely different subgroups of pain syndromes and use novel methods to document physical activity by means of direct measurements. The present findings encourage a further development of the content of pain management programmes.

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