Original article

Transforming the nature of fatigue through exercise: qualitative findings from a multidimensional exercise programme in cancer patients undergoing chemotherapy

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ADAMSEN L., MIDTGAARD J., ROERTH M., ANDERSEN C., QUIST M. & MOELLER T. (2004) *European Journal of Cancer Care* **13**, 362–370

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The objective of this study was to explore the nature of fatigue in cancer patients with advanced stages of disease undergoing chemotherapy and concurrently participating in a 6-week multidimensional exercise programme (physical exercise, relaxation, massage and body-awareness training). Semi-structured qualitative interviews were conducted with 23 patients between 18 and 65 years of age prior to, during, and at termination of the programme. The findings endorsed that physical debilitation, fatigue, and uncertainty of physical capacity were the patients' motivation for participation. Throughout the programme the patients experienced exercise-induced fatigue, which they associated with a sense of increased physical strength, improvement in energy and physical well-being. This positive sense of fatigue can be seen as a contrast to the negative chemotherapy-induced fatigue, which is characterized by physical discomfort and uncontrollable exhaustion. The patients learned to manoeuvre through periods of intense fatigue by using exercise as a strategy to adjust their sense of physical debilitation. Visibility of fatigue's qualitative aspects is necessary if patients are to be encouraged to stay active and to set realistic goals. The transformation process of fatigue identified in this study supports the theory of exercise as a beneficial intervention strategy in the treatment of cancer-related fatigue.

Keywords: fatigue, exercise, chemotherapy, qualitative aspects, energy.

INTRODUCTION

Fatigue is a distressing problem, which occurs in 40–70% of cancer patients undergoing chemotherapy (Smets *et al*. 1993; Greene *et al*. 1994; Irvine *et al*. 1994; Nail & Winningham 1995). Ream and Richardson (1999) define fatigue as being an unpleasant symptom which incorporates total body feeling ranging from tiredness to exhaustion (Richardson & Ream 1996; Ream & Richardson

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Accepted 26 March 2004

European Journal of Cancer Care, 2004, **13**, 362–370

1999). Cancer-related fatigue is experienced as a persistent feeling of exhaustion and decreased physical and mental capacity unrelieved by rest or sleep (Piper *et al*. 1987; Irvine *et al*. 1991; Dimeo 2001). As such, fatigue has profound impact on patients' reported quality of life (Winningham *et al*. 1994; Nail & Jones 1995; Griffin *et al*. 1996; Longman *et al*. 1996; Stone *et al*. 1998; Curt 2000). Most authors agree that the origin of cancer-related fatigue is multifactorial, and the interaction between the different aetiologic mechanisms is complex and not well understood (Piper *et al*. 1987; Messias *et al*. 1997; Dimeo 2001). Among the few evidence-based interventions available to address the problems associated with fatigue (Richardson & Ream 1996; Ream & Richardson 1999; Mock *et al*. 2001) are behavioural therapies such as relaxation training (Lyles *et al*. 1982; Troesch *et al*. 1993; Sloman 1995; Sabo & Michael 1996). More recently, exercise has been tested in the treatment/reduction of cancer-related fatigue (Winningham *et al*. 1986a; Shephard 1993; Schwartz 1999; Dimeo 2001). There is growing evidence that aerobic exercise programmes can reduce fatigue in cancer patients undergoing chemotherapy (MacVicar *et al*. 1989; Dimeo 2001). However, most of the available studies have been small and with little control over the dose of physical activity received rendering interpretation and comparison of results difficult (Dimeo *et al*. 1999; McArdle *et al*. 2001; Ballard-Barbash *et al*. 2002). Three studies, which included patients undergoing chemotherapy, were identified. Mock *et al*. (2001) investigated the effect of a home-based moderate walking exercise programme in a population of 52 women with breast cancer (stage I and II) in adjuvant therapy. The women who exercised at least 90 min per week on three or more days reported significantly less fatigue and emotional distress as well as higher functional ability than the women who were less active during treatment. Schwartz (1999) examined the relationship between physical training, fatigue and quality of life in newly diagnosed breast cancer patients receiving chemotherapy. She found that an 8-week home-based training programme increased quality of life by decreasing fatigue (Schwartz 1999). In a study conducted by Dimeo *et al*. (1999), patients receiving high dose chemotherapy and auto-logous peripheral blood stem cell transplantation exercised 30 min daily (bed ergometer) during hospitalization. Fatigue and somatic complaints had increased significantly in the control group ($n = 32$) but not in the training group ($n = 27$) (Dimeo *et al*. 1999). The three studies mentioned above examined quantitative aspects of fatigue by means of standardized questionnaires [Profile of Mood States (POMS), Schwartz Cancer Fatigue Scale (SCFS), Piper Fatigue Scale], which has provided several benefits to the research in cancer-related fatigue. However, they provide little insight into the qualitative aspects of fatigue and how fatigue is related to patient's experiences of physical well-being and energy during exercise simultaneously with chemotherapy. The objective of this study was to examine the nature of fatigue in cancer patients undergoing chemotherapy participating in a 6-week multidimensional exercise intervention.

PATIENTS AND METHODS

This paper presents data from a cross-scientific research project entitled 'Body and Cancer'. Data regarding feasibility, physical capacity and health benefits have been published recently. (Adamsen *et al*. 2003). The results showed that the multidimensional exercise programme was safe and well tolerated, provided that daily screening criteria were adhered to. Highly significant increases in physical capacity and an improved level of physical activity were achieved in cancer patients undergoing chemotherapy (Adamsen *et al*. 2003; M. Quist, M. Rørth, M. Zacho, C. Andersen, T. Møller & L. Adamsen, submitted).

The intervention programme

The intervention programme included a so-called 'body package' comprising four components: physical exercise, relaxation, massage and body-awareness training. Patients undertook activities that were classified as either high or low intensity. High-intensity activities were those that considerably raised the heart rate and included heavy resistance training and cycling on stationary bicycles. Low-intensity activities required lower energy expenditure by patients and took the forms of relaxation, massage and body-awareness training. The programme took place in specially designed workout rooms located at the hospital and was carried out over a 6-week period for 9 h per week, in the mornings (see Table 1). The patients trained in mixed groups (men and women) of seven to nine patients each (Adamsen & Midtgaard Rasmussen 2001). During the programme, time was set aside for patients to exchange experiences (work, family, illness and treatment) (Adamsen & Midtgaard Rasmussen 2003). The programme was supervised by trained physiotherapists and a specially trained nurse who participated in the physical training component (Adamsen *et al*. 2003; p. 708).

High-intensity physical training

The patients trained in groups for 1.5 h per session three times weekly. Physical training was divided into three

Table 1. Weekly schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Physical exercise (1.5 h) Relaxation (0.5 h) Massage (0.5 h)	Body awareness (1.5 h) Relaxation (0.5 h)	Physical exercise (1.5 h) Relaxation (0.5 h)		Physical exercise (1.5 h) Relaxation (0.5 h) Massage (0.5 h)

components: warm-up exercise, heavy resistance training and fitness. Warm-up exercise comprised dynamic actions with the large muscle groups, balance and coordination training (running, ball games and weight-lifting). Three machines were used for heavy resistance training including a leg press, a chest press, lat. machine (Technogym, Gambettola, Italy). [Dynamic strength is measured as the maximal weight a person is able to lift in one time. It is called 1RM (repetition maximum) and is stated in kilograms. The capacity is calculated as a percentage of 1RM]. The practical goal in the training component was to accomplish three continuous series of five to eight repetitions at 85–95% of 1RM. This selection of heavy resistance training activities was made in an attempt to involve as many muscle groups in as few exercises as possible, allowing a noticeable effect to be accomplished in a short time span (10 min, two to three times weekly) (Green 1994). Fitness training took the form of aerobic activities which involved large muscle groups over longer periods of time and which aimed to positively affect circulation and overall energy levels (Saltin & Gollnick 1983; Fentem 1994; Saltin & Pilegaard 2002). The exercise involved 10-min interval training on stationary bicycles with an intensity of 150-250 W equivalent to 60–100% of each patient's maximum pulse rate. (Adamsen *et al*. 2003; p. 709)

Low intensity physical training

Relaxation

The patients trained in groups for 0.5 h four times weekly. Groups of patients were instructed in the use of relaxation mechanisms, using principles of progressive relaxation (Lyles *et al*. 1982; Lerman *et al*. 1990). This involves switching from muscle tensing to muscle relaxation motions in each of the muscle groups. The relaxation training took place in the workout room, where the patients lay on mats with pillows and rugs. The patients used audiotapes with recorded instructions and relaxing background music.

Massage

The patients received individual treatment for 0.5 h twice weekly. Massage could be relaxing, facilitative or therapeutic. Classic, scar tissue and venous pump massages were administered as well as ultrasound and exercise therapy (Bunkan & Schultz 1998).

Body-awareness training

The patients trained in groups for 1.5 h once weekly. Special emphasis was placed on physical movement and the purpose of exercise in increasing body acceptance, awareness and knowledge and focused on balance/coordination and grounding and integration of the senses (Dychtwald 1977; Hardy *et al*. 1999). (Adamsen *et al*. 2003; pp. 708–709.)

Patient selection

Cancer patients were initially attracted to the project by posters and pamphlets at the outpatient clinic or in the ward. *Inclusion criteria*: age 18–65 years; a diagnosis of cancer (given at least 1 month prior); chemotherapy either as treatment for advanced disease or as part of an adjuvant treatment; admitted at the oncological or haematological clinic; at least one series of chemotherapy; a performance stage 0–1 (WHO). *Exclusion criteria*: documented brain or bone metastases; anticoagulation treatment; diagnosed symptomatic cardiac disease; dementia and psychotic conditions; terminal care; unable to read or write Danish. The project was approved by the Scientific Committees of the Copenhagen and Frederiksberg Municipalities (J.no. 01-273/00) and by the Danish Data Protection Agency (J.no. 2000-41-0-149).

Screening and monitoring

In accordance with the guidelines and safety precautions determined by Winningham and colleagues (1986a) and Dimeo and colleagues (1999), daily pre-exercise screening was performed. Monitoring was carried out by means of a sphygomometer (Polar Xtrainer Plus) worn by the patients during physical training as well as through observations made by the nurse (Adamsen *et al*. 2003).

Twenty-seven cancer patients gave informed consent to enter the study. Two patients withdrew, one because of progressive acute illness, and one did not perceive himself as fit enough as he was newly diagnosed (5 weeks).

Twenty-five cancer patients completed the 6-week intervention. Two patients were excluded from the dataset because their chemotherapy was terminated prior to completion of the programme. The remaining patients ($n = 23$) received chemotherapy as determined by their oncologist/haematologist (Tables 2 and 3).

Qualitative interviews

To examine and refine the nature of fatigue in patients during the exercise programme we used principles of theoretical sampling. Semi-structured qualitative interviews were conducted with 23 patients on three occasions: prior to (baseline – 1), during (after 3 weeks – 2) and on completion of the intervention (after 6 weeks – 3). The interview guides had separate focus. The first guide (1) provided demographic and patient history data (the patients' physical activity prior to and during illness), and the patients' motivation for the exercise programme. The latter two guides (2, 3) focused on the patients' feeling of fatigue during the programme; observations and perceptions of own energy and physical well-being and reactions during the programme. Researchers, who were not involved in the exercise intervention, conducted the interviews to avoid the potential of producing bias. All participants were interviewed individually at the hospital following a verbal introduction to the study. In total, 69 interviews were held. On average, the interviews were of 15–45-min duration, were tape-recorded and selectively transcribed verbatim. Thematic analysis began when the data were collected using structured interview guides. Contextual annotations were added and data were then categorized in relation to the pre-established themes in the interview guides. The data were compiled and sorted under different headings in order to identify aspects of fatigue and physical capacity prior to and during the programme, which could be seen to form unique features regarding the patients' reflections on the intervention process. Investigator triangulation was applied to minimize bias (Polit & Hungler 1999; Malterud 2001a). The quantifiable interview data were entered and treated using the EXCEL soft-

Table 2. Demographic characteristics of patients ($n = 23$)

Age (years)	40* (18–63)
Gender:	
Women	14
Men	9
BMI	26.1 (20.1–34.8)
Co-habiting:	
Yes	14
No	9
Education level:	
Lower level of education	7
Secondary school/university graduate	16
Occupational activity (during treatment):	
Yes	4
No	19
Level of physical activity before onset of disease:	
I (Sedentary)	1
II (Walking or cycling for pleasure)	10
III (Regular physical exercise – at least 3 h/week)	8
IV (Athletic – more than 4 h/week)	4

*Median.

Table 3. Patient characteristic: diagnosis and treatment ($n = 23$)

	n	Diagnosis	Stage	Treatment	Status
Oncological					
	6	Colon	4 adjuvant	5 FU + LV	NED
			2 advanced		NC
	5	Breast	3 adjuvant	CEF, CMF, T	NED
			2 advanced	E	NC
	2	Ovary	1 adjuvant	TOPO, CARBO	NED
			1 advanced	T	NC
	2	Testis	2 advanced	P, ET, B	1 PR, 1 NC
	1	Sarcoma	Advanced	I	NC
	1	Small cell lung cancer	Advanced	T, P, E, ET	NC
	1	Unknown primary	Advanced	G, P, T	NC
	1	Cervix	Adjuvant	CARBO, V, ET	NED
Haematological					
	1	Hodgkin's disease	Advanced	ABVD	NC
	1	Non-Hodgkin's lymphoma	Advanced	CHOP	NC
	1	Myelomatosis	Advanced	VAD	NC
	1	Acute lymphoblastic leukaemia	Maintenance	Mercaptopurine, Methotrexate, COP	NED

5 FU, 5-flourouracil; LV, leucovorin; CEF, cyclophosphamide epirubicin fluorouracil; CMF, cyclophosphamide methotrexate 5-fluorouacil; T, taxanes; E, epirubicin; TOPO, topotecan; CARBO, carboplatin; P, cisplatin; ET, etoposide; G, gemcitabine; B, bleomycin; V, vincristine; I, ifosfamide; ABVD, doxorubicin bleomycin vinblastine dacarbazine; CHOP, cyclophosphamide doxorubicin vincristine prednisone; VAD, vincristine doxorubicin dexamethasone; COP, cyclophosphamide vincristine prednisone; NED, no evidence of disease; NC, no change; PR, partial remission.

ware program. The method used to present the results reflects the patients' own perception of the changes in fatigue, physical performance, well-being and energy in course of the programme.

FINDINGS

The interview findings are reported under three headings reflecting the most outstanding themes and reported changes across the interviews.

Physical debilitation and fatigue as motivation for joining the program

Quite clearly the most frequent reason for signing up to the programme was that the patients were experiencing physical debilitation, fatigue, and felt out of shape during their illness and chemotherapy. A typical citation prior to the onset of the programme was 'My body has slumped. It is weak and I am out of breath from just going up the stairs to the first floor. I never felt this way before. I want to do something myself to become stronger, if possible' (man, 44 years old, colon cancer). The majority of the participants ($n = 17$) expressed the need for support to break away from their increasing sense of fatigue. 'I cannot do this alone. I just lie on the sofa and become more sluggish and lazy. Earlier on I could just get up and go. Now, I need a good kick to do anything' (woman, 34 years old, Non-Hodgkin's lymphoma). Despite the diagnostic and prognostic prospects, the patients wanted to improve their physical shape. Among the patients who were highly physically active (i.e. exercised more than four times a week prior to their illness), was an 18-year-old secondary school student with leukaemia who had a good prognosis, and who, prior to his illness, undertook between 12 and 14 h of physical training per week (karate, football, weight-lifting and cycling). The following is his description of the impact of his illness: 'Before the illness I was super strong – on the top. I was good at everything – I could run a lot without feeling tired. Now, I have hit rock bottom and I cannot do much of anything' (man, 18 years old, acute lymphoblastic leukaemia). At termination of the programme, he told, 'I feel like I've grown and I weigh more now, actually three kilos. I can also lift much more than before. When I train here, I still feel as though I have the resources to train further. My body is in balance now.' Among the patients who did not exercise prior to their illness (sedentary), was a 53-year-old man who had progressive colon cancer. His goal at the start of the programme was: 'Even though I have never been the big athlete, I don't feel anywhere near as strong as I did before I was sick. I feel, though, that it doesn't matter because I am tired and don't have the energy for it.' During the programme he was able to resume working and cycling daily (total of 10 km). 'I came onboard and have improved as much as I could. Day by day I felt the energy to do a little more. I feel quite proud of myself'. Some patients experienced the programme as a 'kick-start' and turning point to a new lifestyle, which included exercise. When the patients did not exercise as a self-care strategy the reason given was insecurity of the extent to which they should risk exercising considering their illness and treatment. At the termination of the programme, the majority of the patients were no longer uncertain about using their bodies. One participant stated, 'I now have a good sense of what my body can do. I am not afraid of exercise, although my limits shift continuously' (woman, 57 years old, myelomatosis).

From chemotherapy-induced fatigue to exercise-induced fatigue

The patients were asked to describe their feelings of fatigue in the course of the exercise intervention. The majority of the patients stated that the chemotherapy released an unusual feeling of fatigue and abnormal weakness such as being 'terribly tired', 'incredibly tiredness'. The quote from one patient was: 'The day after my chemo I feel the tiredness constantly in my body, and it is still difficult for me to rid myself of the feeling' (man, 59 years old, colon cancer). Half way through the programme two-thirds of the patients stated that they experienced a sense of fatigue, which they associated with a feeling of physical strength and increased physical capacity. One patient expressed it as follows: 'You get a pleasant feeling of tiredness. I am tired but now I know why. It is natural because I did a lot of exercise. Of course I feel tired. After my chemo, I am also tired but it feels more like I have the flu or a hangover' (woman, 28 years old, leukaemia). The positive sense of fatigue can be seen as a contrast to chemotherapy-induced fatigue, the latter can be characterized as negative because it primarily is associated with physical discomfort and uncontrollable exhaustion. The newly acquired energy or exercise-induced fatigue, that the patients describe sometimes dissolve their feeling of chemotherapy-related fatigue. 'I have undergone many chemotherapy treatments and I am tired, but after physical training I am tired in a nice way. I still don't jump out of bed but I have a good feeling and am a little replenished with energy even if I am tired' (woman, 46 years old, breast cancer). In the course of the programme the patients stated that they distinguished between different types of fatigue. This allowed them to better manoeuvre through

periods of intense fatigue by, for example, using exercise as a strategy to control their own bodies. 'I have learned to separate the issues. Now I look differently at my side effects. I vomited, had eye infections and fungus in my mouth and vagina and was so tired. Before I just lay in bed when I felt like that. After participating in the programme I know that I would feel even worse if I continued that way. So I have begun to jog with my husband. After running I am tired but in a different way. I can run about 20–30 min. I won't hurt myself by being active, on the contrary, the tiredness diminishes. My other side effects will still be here but they don't seem so worrisome now because I have more vigour' (woman, 42 years old, ovary cancer). Regarding the one-third of the patients who failed to report any or little changes in fatigue, the study shows that they did not experienced cancer-related fatigue as a specific problem in their daily life before they entered the programme, thus explaining unaltered fatigue during the programme.

Increased strength and energy

At the termination of the programme 72% of the patients reported increased physical capacity and 87% reported increased energy, which they stated as the reason for their experience of alteration in fatigue. One man highlighted what it meant to be challenged physically and pushed himself: 'I've become more alive. My body was near shrinking away but now I have more energy. It's cool to test my body's strength to the max. When I have finished training here in the mornings, my body feels awake' (man, 42 years old, colon cancer). Others stressed that they experienced changes in the shape of their bodies. 'I can see that I have more muscles and that my body has become tighter. I've gained some weight since I've been here but the kilos seem to be distributed differently on my body, I think' (woman, 35 years old, cervix cancer). The patients reported that they previously had to ration their energy carefully to ensure that there was enough to carry out daily activities such as picking up the children and cooking. 'My energy was quickly used up and when there was no more, I couldn't do much about it. The only thing left was to sleep' (woman, 35 years old, sarcoma). At the end of the programme, several stated that they no longer felt compelled to reserve their energy for anyone or anything. 'I still need to plan my activities but my physical training has had a positive impact on my daily activities – I can do more. Actually, I feel less tired or at least I don't have to take an afternoon nap, which earlier on I could not have done without. Now I just fall asleep a little earlier in the evenings but I also sleep better' (woman, 35 years old, sarcoma). Furthermore, 92% of the participants reported improvement in physical well-being, and that they still had energy left to carry them over to the following day or at least until the evening. 'On days of treatment, the effect of the exercise goes away quickly but generally speaking it has improved my well-being' (man, 29 years old, testis cancer).

DISCUSSION

Detailed and precise descriptions were offered by the patients of how illness and treatment had changed their physical shape and brought with it various side effects. In fact they stated how their physical capacity was limited compared to previously, including their exercise habits and daily activities. This finding is in agreement with research showing that general weakness and physical inactivity are characteristic features in 40–70% of cancer patients in advanced stages of the disease (Bruera *et al*. 1989; MacVicar *et al*. 1989; Berglund *et al*. 1993; Richardson & Ream 1997). It was evident that the patients had not received concrete guidance from their treating oncologist/haematologist (doctor or nurse) about the option to exercise during illness and chemotherapy. This is consistent with the literature showing that cancer patients are encouraged to rest during illness (MacVicar *et al*. 1989; Dimeo *et al*. 1998; Winningham 2001). The combination of a training facility at the hospital and professional supervision was crucial and confirmed the patients' understanding that the training programme was a supplement to medical treatment. The aim of the structured and supervised programme was to assist the patients to feel and test their own physical reactions (e.g. strength, condition, dizziness, overpowering fatigue, fainting, cold sweats, etc.) and as such gain self-assurance and awareness of own resources and limitations by testing their physical ability.

Prior to participation in the programme few of the patients had started physical activity at their own initiative although some had been in longer-term treatment regimes. This result is in line with Richardson and Reams' (1997) conclusion that 89% of the patients reported fatigue at some point during their treatment period, but they made few attempts to alleviate it. Resting and napping were the dominant self-care activities when fatigued, with 84% of the patients performing these activities (Richardson & Ream 1997). In studies developed by MacVicar and colleagues (1989), Schwartz (1999) and Winningham (2001), the authors argued that exercise should be presented as a self-care strategy. This is refuted by the results of this study because the cancer patients included

required exercise to be carried out under guidance and observation in order to regain their sense of security about their own physical potentials and limitations.

The literature describes physical exercise as having potential importance in the quantitative reduction of fatigue. The qualitative data in this study highlight the experience of cancer patients having a comfortable sense of fatigue while simultaneously improving their physical form and increasing their strength. The data analysis shows that the patients described different forms of fatigue. The sensation of fatigue which results from exercising (i.e. exercise-induced fatigue) is experienced as a positive and natural tiredness and is furthermore associated with an after-effect of improved physical well-being, tranquillity, release, relaxation, and, for some, typically improved sleep. It is a sense of fatigue that is desirable because the after-effects are familiar as they were felt during sports activities undertaken prior to their illness. This feeling of fatigue is comparable with descriptions of exhaustion in sports physiology among healthy people/athletes and by one famous cancer survivor (Lance Armstrong) (Armstrong 2000; Andersen *et al*. 2001). This sense of fatigue contrasts with chemotherapy-induced fatigue which can be characterized as negative because of its connection with the experience of physical discomfort (e.g. uncontrollable exhaustion, influenza-like symptoms) and it does not provide the after-effect of release. It is not a sense of fatigue which is desired but rather is imposed on the body from the outside through medication, and usually leads to a passive physical state. The results of this study show that it is possible for cancer patients to transform the nature of fatigue – from a negative chemotherapy-induced fatigue into positive exercise-induced fatigue. Based on the above, it follows that a reduction in the sensation of fatigue cannot be interpreted as an overall improvement to the life situation per se. However, a complete, partial or periodic reduction in chemotherapy-induced fatigue would affect the cancer patient's daily life. Although causal relationships between the physiological and psychological dimensions reported by the patients cannot be ascertained within the design of the present study, the interview data indicated that the patients felt more self-sufficient and in control as they experienced a transformation in fatigue despite each patient's overall profile of side effects.

The results confirm that changes in the cancer patient's sensation of fatigue from exercise cannot be understood without simultaneously placing focus on his/her experience with physical capacity, energy and well-being. It has been suggested (Dimeo 2001; Winningham 2001) that fatigue may originate from alterations in the muscular energetic system, which is affected by treatment, illness and inactivity. This is why maintenance of functional capacity requires physical activity using large muscle groups to promote the adoption of the aerobic biological energy system. The combined conditioning and muscle strengthening training that the patients undertook within this exercise intervention is a plausible explanation for the transformation in the nature of fatigue, as the patients experienced increased physical capacity, energy and strength simultaneously (objective physiological measurement confirms this fact.) (Adamsen *et al*. 2003; M. Quist, M. Rørth, M. Zacho, C. Andersen, T. Møller & L. Adamsen, submitted).

The findings of this study might gain impact by triangulation of methods in which the various aspects of the intervention are examined using different methods: physiological tests (VO_2max, RM), self-report questionnaires (HAD, The Hospital Anxiety and Depression Scale; SF-36, The MOS 36-item short-form health survey; EORTC QLQ-C30, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire C30). In studies with small populations, the above-mentioned questionnaires often are insufficiently sensitive to detect changes resulting from a specific intervention. We therefore chose to supplement the project with our own testing methods (semi-structured interviews and patient diary). In general detailing of data collection and well-recognized methods strategies are to improve the quality of the research (Kirk & Miller 1986; Layder 1998; Malterud 2001a). Interviewing was chosen as the research method in order to ensure that the physical exercise was performed at lowest risk by using the patients' information as the basis for making adjustments to the programme and subsequently evaluating the programme. The interviews were generated and used with the intention of detecting the results of this specific intervention, despite the small population (Kirk & Miller 1986; Schein 1987). The patients' experiences provided an introspective lens through which data was collected to validate the effect of the intervention (Layder 1998; Denzin & Lincoln 2000), and as such, related to core components of clinical knowledge, as argued by Malterud (2001b). We interviewed the patients three times during their participation in the exercise intervention to get a profound understanding of their fatigue experience. Reference is made to the validity of the questions asked of the patients and whether the latter had enough of an experiential basis from which to answer the questions. The patients had followed the programme consistently over 6 weeks, which gave them the necessary experience to evaluate the effect of the intervention on their bodies, and thus could provide valid interview material.

Patients in this study were attracted to the project by posters and pamphlets at the outpatient clinic or in the ward. Thus, all eligible patients were not systematically informed about the project. The population in this study might have comprised a group characterized by exceptionally motivational resources for physical training because they were relatively young and physically active pre-illness together with the fact that they were self-appointed.

The cancer patients in the present study were dissimilar in a number of ways, including age, sex, diagnosis, cytostatic treatment, etc. Nevertheless, the interviews showed that their physical experiences while participating in the programme were similar across the board, which points to synchronic reliability and implies a similarity in observations within the same time-frame (Kirk & Miller 1986). Regardless of the fact that the patients' experiences were linked to this specific exercise intervention, we assume that the findings regarding transformation of chemotherapy-induced fatigue are generalizable beyond the immediate context and may be applied to similar exercise interventions designed for cancer patients undergoing chemotherapy. This study identified a conceptualization of fatigue that forms a valuable and necessary basis for a larger controlled study, only hereby can we conclude whether the observed changes in patients' sense of fatigue are a result of this specific exercise intervention. A randomized study to evaluate the effects of this exercise intervention on physical capacity, quality of life and fatigue is presently carried out.

In conclusion, the results of our study show that cancer patients can transform their experience of chemotherapy-induced fatigue characterized by physical discomfort into an exercise-induced fatigue characterized by physical well-being and renewed energy. Visibility and articulation of fatigue's qualitative aspects are necessary if patients are to be encouraged to stay active, and to set realistic goals bearing in mind the state of the disease and treatment status. The transformation process of fatigue identified in this study supports the theory of exercise as a beneficial intervention strategy in the treatment of cancer-related fatigue, and must be taking into consideration in the development of exercise programmes for cancer patients undergoing chemotherapy.

ACKNOWLEDGEMENTS

The exercise programme was supported by grants from The Danish Medical Research Council, Ministry of Culture's Media and Grants Secretariat, The Egmont Foundation, The Lundbeck Foundation, The Hede Nielsen Foundation, and Copenhagen Hospital Cooperation. The researchers wish to thank, first and foremost, the patients who kindly agreed to take the time to enrich us with their experiences from and about the programme.

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