Fit for life after cancer: does exercise timing matter?

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ABSTRACT

Objectives To assess the effects of a single exercise session per week for 6 weeks on quality of life (QoL), fatigue and exercise participation in male and female cancer survivors with follow-up at 6 months. A secondary aim was to identify if the timing of exercise delivery determined its effect.

Methods An exploratory prospective cohort study design was implemented. Twenty-five patients undergoing or who had completed cancer treatment (11 active treatment; 14 completed treatment) undertook exercise and educational sessions (Fit for Life) 1×/week. The Brief Fatigue Inventory (BFI), the European Organisation for Research and Treatment of Cancer QoL C-30 (EORTC QLQ C-30) and the Godin Leisure Time Exercise Questionnaire (GLTEQ) were used to assess fatigue, QoL and exercise levels, respectively. Participants were evaluated before and after the intervention, and after 6 months.

Results There was a significant group × time interaction for the GLTEQ at 6 months post in favour of exercising during active treatment (p=0.01). No other group × time interactions were observed across the EORTC QLQ C-30 or BFI. There was a significant main effect for time for EORTC QLQ C-30 Global with a significant increase observed between pre and 6 months post.

Conclusions Exercise 1×/week delivered during treatment may impact on long-term exercise participation in adult cancer survivors. This lower volume programme may improve QoL, but has minimal effect on fatigue suggesting an insufficient exercise dosage to impact this variable. This study generates interesting proof of concept results and may be helpful in the development of larger randomised controlled trials.

INTRODUCTION

Cancer survivors often suffer from impaired quality of life (QoL), fatigue and reduced exercise engagement. Exercise has been shown to help combat the physical and psychosocial side effects of treatment with both time of exercise delivery (during treatment (DT) vs post-treatment (PT)) and training frequency (sessions/week) highlighted as possible determinants of the response noted. Recent reviews have suggested that exercise provides physical benefits when delivered both during and after cancer treatment, but may have an additional psychosocial impact when delivered during treatment. In addition, a training frequency of 3×/week has been recommended as optimal for improving QoL and outcomes associated with QoL such as aerobic capacity (VO2peak) and fatigue. However, exercise participation among cancer survivors remains poor. In addition, the expectancy that sedentary cancer survivors can achieve ~150 min/week of exercise may be unrealistic with barriers to participation such as lack of time commonly reported. Therefore, we aimed to assess the effects of a single weekly exercise session (60 min) provided as part of a clinical service for oncology patients on QoL, fatigue and exercise participation over 6 weeks with follow-up at 6 months post (6 m POST). A secondary aim was to identify if the timing of the delivery of the exercise intervention determined its effect.

METHODS

Experimental design
An exploratory prospective cohort study comprising a 6-week training and education intervention. Outcomes were measured at PRE, POST and 6 m POST.

Participants
Following institutional ethical approval, 25 male and female cancer survivors volunteered to participate (see table 1 for clinical characteristics). Individuals were screened for eligibility which included: (1) undergoing or having completed treatment for cancer, and (2) an Eastern Cooperative Oncology Group status of 0–2. Individuals were excluded if: (1) they...
Short report

Table 1  Demographic and clinical characteristics of participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>20–40</td>
<td>1 (4)</td>
</tr>
<tr>
<td>40–65</td>
<td>20 (80)</td>
</tr>
<tr>
<td>&gt;65</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20 (80)</td>
</tr>
<tr>
<td>Male</td>
<td>5 (20)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td>20 (80)</td>
</tr>
<tr>
<td>Prostate</td>
<td>4 (16)</td>
</tr>
<tr>
<td>Lung</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Treatment stage</td>
<td></td>
</tr>
<tr>
<td>Active treatment</td>
<td>11 (44)</td>
</tr>
<tr>
<td>Completed treatment</td>
<td>14 (56)</td>
</tr>
<tr>
<td>Treated with chemotherapy</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5 (5)</td>
</tr>
<tr>
<td>No</td>
<td>20 (80)</td>
</tr>
</tbody>
</table>

required assistance to mobilise; (2) were <6 weeks post-surgery; or (3) had dementia or a psychiatric illness which may preclude informed consent and/or active exercise participation. The intervention was provided as a clinical service to patients attending for cancer treatment and physiotherapy services; therefore, allocation to the groups was not randomised. Point of commencement (DT vs PT) was self-selected, with patients offered access to the programme at all treatment stages when attending hospital appointments. Participants were fully informed of all experimental procedures prior to providing written informed consent.

Training intervention

Supervised exercise and educational sessions (1×/week for 6 weeks). Exercise sessions: cardiovascular, resistance and balance exercises. Sessions lasted 60 min (12 exercise stations – 2.5 min per exercise × 2). Educational sessions: exercise pacing (×2), healthy eating (×2), stress management (×1) and behaviour change (×1).

Assessments

Fatigue

Assessed by the Brief Fatigue Inventory (BFI), comprising nine questions under four headings. Each question was rated on a scale of 1–10. A mean BFI score of 0, 1–3, 4–6 and 7–10 indicates no fatigue, mild fatigue, moderate fatigue and severe fatigue, respectively. 8

Quality of life

Assessed by the European Organisation for Research and Treatment of Cancer QoL C-30. A change in subscale score of >10 is acknowledged as clinically meaningful.

Exercise participation

Assessed by the Godin Leisure Time Exercise Questionnaire (GLTEQ). Individuals self-report the frequency and duration of mild, moderate and strenuous exercises over a 1-week period.

Statistical analysis

Data were analysed using a 2×3 repeated analysis of variance with between-factors ‘group’ (ie, DT vs PT) and within-factor ‘time’ (ie, PRE, POST, 6 m POST) using SPSS (Version 23.0). Significance was set at p<0.05. Significant interactions and main effects were analysed using Tukey’s post hoc tests.

RESULTS

Twenty-five participants completed the study (age=57.24±10.5 years). Fatigue: The BFI demonstrated no significant main effect for time (p=0.08) or significant interaction for group × time (p=0.06). At POST, fatigue increased (+49%) and decreased (−15%) in the DT and PT groups, respectively. Fatigue decreased at 6 m POST versus POST in both groups (DT, −48%; PT, −7%). QoL: No significant main effect for time for Function-QoL (p=0.08) or Symptom-QoL (p=0.11) was noted. However, there was a significant main effect for time for Global-QoL (p=0.015). Pairwise comparison showed a significant increase between PRE and 6 m POST time intervals (57.89±20.93 vs 70.13±16.89, +21%) (p=0.01). There was no significant interaction for group × time (p>0.05). At POST, Global-QoL decreased by 13% and increased by 19% in DT and PT groups, respectively. At 6 m POST, Global-QoL increased by 35% in the DT with no change in the PT compared with POST. Exercise participation: The GLTEQ demonstrated no significant main effect for time (p=0.12). A significant interaction for group × time (p=0.01) was noted with the DT group showing a significantly greater GLTEQ score at 6 m POST (50.97±26.57) vs PT group (35.62±14.87) (figure 1). At POST, GLTEQ decreased by 22% and increased by 30% in DT and PT, respectively. At 6 m POST, GLTEQ increased by 70% and 2% versus POST in DT and PT, respectively.

DISCUSSION

These results suggest that an exercise-based intervention delivered 1×/week for 6 weeks may have minimal impact on fatigue levels, but may lead to significant long-term improvements in Global-QoL. Overall, the intervention delivered demonstrated no long-term effect on exercise participation but these preliminary results indicate that there was a significantly larger increase in long-term exercise participation in those who began exercising during active cancer...
Fatigue is a common side effect associated with cancer and can negatively impact QoL and exercise participation. Therefore, strategies which can attenuate fatigue may positively impact survivorship. In the current study, exercise delivered 1×/week for 6 weeks had no significant effect on fatigue levels irrespective of the timing of the intervention delivery. Of note, while non-significant in this preliminary study, DT demonstrated an increase in fatigue (+49%) from PRE to POST, while fatigue levels fell in PT (−15%) over the same period. Similar observations have previously been reported with better fatigue responses observed in groups exercising after treatment, most likely explained by increases in fatigue noted in response to ongoing cancer treatment/s.

At 6 m POST, fatigue levels had fallen in both groups but this did not reach statistical significance. Previously, an 8-week (60 min 3×/week) deep-water exercise programme led to reductions in fatigue when measured at 8 weeks and 6 months. Current recommendations for improving outcomes such as fatigue suggest a training frequency of 3×/week. Therefore, the training frequency in the current study may have been too low to exhibit an improvement in this measure. Further research with adequate numbers to confer statistical power in outcomes of fatigue is required to fully elucidate the exercise frequency/volume question.

The present study demonstrates that exercise and education delivered 1×/week for 6 weeks can lead to long-term improvements in Global-QoL with significant improvements seen at 6 m POST, independent of group. This is in line with the findings from a recent systematic review which concluded that additional exercise, when compared with normal care, can lead to significant improvements in Global-QoL at 6-month follow-up. Interventions which exhibit sustained and longer term health benefits warrant careful consideration, particularly given the increasing life expectancy in cancer survivorship.

In the current exploratory study, the prescribed exercise programme improved Global-QoL, but had no impact on QoL subscales of function and symptom. This could be related to the lack of change in fatigue, as fatigue may substantially impact QoL. Indeed, a recent study in prostate cancer survivors identified disruption of daily living and increased dependency on others as negative factors associated with fatigue. Therefore, exercise and educational programmes developed to improve QoL should be sufficiently tailored to address fatigue to impact on the multidimensional aspects of QoL.

Long-term exercise engagement is an important lifestyle choice and is considered essential for the maintenance of long-term health. The current study demonstrated that a low-intensity exercise and education-based intervention completed during treatment led to greater long-term lifestyle change (figure 1). A cancer diagnosis is a period in which patients may show greater motivation for lifestyle changes. It is possible that participants who received an exercise-based intervention during treatment were more receptive to the health promotion message, in what has been previously referred to as the teachable moment, and therefore found it easier to maintain lifestyle changes upon completion of treatment. In addition, increased patient/doctor contact for the DT group may have encouraged continued exercise engagement. The influence of the oncologist on exercise participation has previously been noted in the literature. However, in this study, oncologist contact time was not recorded so this potential confounding factor cannot be controlled for in the analysis conducted.

**STUDY LIMITATIONS**

The main study limitations were the small number of participants and the non-randomised allocation of the exercise timing. In addition, as the exercise intervention was provided as part of oncology care services, individuals self-selected when to commence the intervention suggesting that more motivated individuals may have chosen during ‘active treatment’. However, despite these limitations, the results generate interesting proof of concept results that may be helpful in the development of larger randomised controlled trials in the area.

**CONCLUSION**

In summary, Global-QoL at 6 m POST increased following 6 weeks of exercise 1×/week, independent of treatment stage. Beginning exercise during treatment appears to be more effective for improving long-term exercise participation possibly due to greater motivation for lifestyle changes, but increased fatigue levels during the intervention period were noted.
Further research in this area is warranted to confirm these findings.

Contributors CM and AD were responsible for study design and data collection. DOC analysed the data and wrote the manuscript. OL critically reviewed the manuscript. All authors have read and approved the final version of the manuscript.

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