European Journal of Oncology Nursing 18 (2014) 206–210

Contents lists available at ScienceDirect

European Journal of Oncology Nursing

journal homepage: www.elsevier.com/locate/ejon

Depressed mood in breast cancer survivors: Associations with physical activity, cancer-related fatigue, quality of life, and fitness level

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Keywords:
Depression
Cancer-related fatigue
Breast cancer
Survivorship
Fitness

A B S T R A C T

Purpose: One out of five cancer survivors suffer from depression after oncology treatment. The aim of this study was to examine the relationship between depression and quality of life (QoL), cancer-related symptoms, physical activity level, health-related fitness, and salivary flow rate in breast cancer survivors.
Method: 108 breast cancer survivors in the year after the conclusion of treatment were included in this cross-sectional study. Demographic and clinically relevant information, cancer-related fatigue (Piper Fatigue Scale), QoL (QLQ-Br23 module), pain intensity VAS scale, salivary flow rate, physical activity level (Minnesota Leisure Time Physical Activity Questionnaire), and health-related fitness were assessed in all participants. Depressed mood was measured with the Profile of Mood States (POMS) Depression subscale.
Results: Significant positive correlations between depressed mood and fatigue, systemic side effects, perceived shoulder pain, and breast-arms symptoms (r ranged between .57 and .28, $P < .01$) were found. In addition, significant negative correlations between depressed mood and body image, future perspective, force handgrip, and physical activity level (r ranged between −.41 and −.19; $p < .05$) were found. Regression analyses revealed that cancer-related fatigue, physical activity level, systemic side effects, and body image were significant predictors of depressed mood, and when combined, they explained 39.6% of the variance in depressed mood.
Conclusions: Cancer-related fatigue, physical activity level, and QoL partially explain the variability of depressed mood in breast cancer survivors. This paper facilitates a better understanding of the relationship between depressed mood and possible factors associated with it.

Introduction

One out of five breast cancer survivors suffer from depression after oncology treatment, similar to other common cancer types (Khan and Amatya, 2013). This cancer-related symptom is twice as high in breast cancer survivors compared with the general female population 12 months after diagnosis (Burgess et al., 2005). Frequently, depression appears to be associated with other cancer-related symptoms such as pain (Kyranou et al., 2013), and fatigue (Laird et al., 2011; Thornton et al., 2010). The contributions of different physical, psychological, and related oncology process factors to fatigue have been explored previously (Cantarero-Villanueva et al., 2011). To the best of our knowledge, no similar approach has been used to study depressed mood.

The mechanisms involved in the genesis of depression in breast cancer survivors are not well understood. Factors related to the patient, such as loneliness, rather than to the disease or treatment increase the risk of depression (Jaremka et al., 2013). Nevertheless, recurrence of disease is clearly associated with depression in this population (Burgess et al., 2005). Loss of hope and uncertainty about the future could be an important factor associated with psychological problems such as depression (Burgess et al., 2005).

Neuroendocrine-immune models have been used to explain the genesis of depression in breast cancer survivors (Thornton et al., 2010). Saliva plays a relevant role in the immune response (Diaz-Arnold and Marek, 2002). Salivary flow rate is a recognized marker of autonomic nervous system function that could be affected by perceived stress, depression, or oncology treatment (Arhakis et al., 2013).

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http://dx.doi.org/10.1016/j.ejon.2013.10.008

The relationship between depression and physical activity could be bidirectional. On the one hand, cancer patients decrease their level of physical activity following a cancer diagnosis (Kwan et al., 2012). Besides, oncology treatment as surgery could have a large impact on the patient's mood (Frazzetto et al., 2012). For other side, physical activity has a protective effect against depression (Bäckmand et al., 2003). Consequently, the contributions of physical activity and health-related fitness to depression need to be understood.

The presence of depression has been associated negatively with quality of life (QoL) in breast cancer survivors (Frazzetto et al., 2012), as has the presence of concomitant cancer-related symptoms such as fatigue or pain (Laird et al., 2011; Thornton et al., 2010). Changes in different aspects of QoL, such as sexual functioning, side effects, or loss of future perspective, could influence the loss of the meaning of health and life after a cancer diagnosis (Frazzetto et al., 2012). Understanding the contribution of these correlates of QoL and the presence of different cancer-related symptoms in explaining depression is a recognized gap in research on cancer-related symptoms during the survivorship phase (Lueboonthavatchai, 2007)

A clear understanding of the variables that explain depressed mood in breast cancer survivors could make possible to implement adequate strategies to reduce this disturbing psychological problem, which has an increased risk of noncompliance with hormone therapy during the survivorship phase (Hadji et al., 2013) and a reduced QoL (Sheppard et al., 2013).

The aim of this study was to examine the relationship between depressed mood and QoL, cancer-related symptoms, physical activity level, health-related fitness, and salivary flow rate in breast cancer survivors.

Methods

Participants

Participants were recruited for this cross-sectional study from two major hospitals in the metropolitan area of Granada based on their participation in oncology rehabilitation programs. The inclusion criteria involved patients aged between 25 and 65 years who had finished oncology treatment for stage I–IIIa cancer, except hormone therapy. The exclusion criteria included the presence of other oncology processes or other conditions that could be a contraindication to exercise (diabetes, chronic obstructive pulmonary disease, uncontrolled hypertension, liver or kidney failure, and ischemic heart disease). The study was approved by the Ethical Local Granada Hospital Committee and follows the modified Helsinki Declaration and current Spanish legislation for clinical trials (Royal Decree 223/2004 February 6).

Two oncologists and one nurse facilitated the recruitment of patients from the hospitals. Participants were recruited thought a phone call after finishing oncology treatment. After arriving in the physical therapy unit of the Faculty of Health, participants gave their written informed consent, provided a medical history (previous cardiovascular disease, hypertension, obesity, or psychiatric comorbidities), and completed a questionnaire. After finishing the questionnaire (45 min), they carried out the physical and salivary flow measurements. The physical assessments were carried out by one physiotherapist with more than five years of experience in the treatment of oncology patients. Salivary samples were processed by a nurse with more than seven years of experience in the management of biological markers.

Participant depressed mood was assessed using the Spanish version of the profile of mood states (POMS), which showed high reliability (Cronbach's alpha ranking between .76 and .91) (Andrade et al., 2002) and acceptability between breast cancer survivors. Participants were scored using a five-point Likert-style scale (0 = not at all, 4 = extremely). The obtained score was converted into a *t*-score.

To assess the functional state and cancer-related symptoms, we used the Spanish version of The European Organization for Research and Treatment of Cancer Breast Cancer-Specific Quality of Life questionnaire (EORTC QLQ-BR23), which showed adequate reliability (Cronbach's alpha ranged between .46 and .94) (Sprangers et al., 1996), to obtain data about perceived body image, sexual functioning, arm symptoms, breast symptoms, and systemic therapy side effects.

The revised Piper fatigue scale was used to assess cancer-related fatigue with high reliability (Cronbach's alpha = .96) (Cantarero-Villanueva et al., 2013). This scale comprises 22 items subdivided in four dimensions (behavioral/severity, affective meaning, sensory, and cognitive/mood). In this study, we used the total fatigue score as result of the sum of score of four dimensions and divided by four.

To assess the physical activity level, we used the Spanish version of the Minnesota Leisure Time Physical Activity Questionnaire (Elosua et al., 2000). This questionnaire included a list of physical activities. The assessor asked the participants about what type of leisure time physical activities they had practiced during the last year. Then, the participants estimated the duration of the activities performed in min/week. The Spanish version showed adequate reliability (intraclass correlation coefficient range between .76–.92) (Elosua et al., 2000).

Salivary flow rate is a recognized marker of autonomic system influence (Granger et al., 2012). Participants were asked to sit and chew paraffin for 3 min, periodically expectorating the saliva accumulated in the mouth into a plastic container. Salivary volume was calculated to the nearest .1 ml. Salivary flow rate (ml/min) was determined by dividing the volume by the collection time.

Health-related fitness was the focus of the functional and strength measurements. The multiple-sit-to-stand test was used to assess functional state. This test is described elsewhere (Netz et al., 2004). Briefly, patients rise from sitting in a chair until they reach full knee extension. This movement is repeated 10 times. Squat jump performance was used to test lower body muscular strength. An infrared photocell mat (Ergo-jump Globus, Codogne, Italy) was used in this test. The best of three trials was used in this study. The jump was performed with hands held on the hips and 90-degree knee flexion. A digital handgrip dynamometer (TKK 5101 Grip-D; Takey, Tokyo, Japan) was used to measure the force handgrip on the side affected by surgery. This measurement is an adequate correlate of general health in breast cancer survivors (Cantarero-Villanueva et al., 2012). The subject stands with the arm adducted at the side and the elbow bent at 90°. The subject is then asked to squeeze the handle as forcefully as possible. The patient performed the test twice, with a 3-min rest period between measurements. The mean value of two trials was scored.

Statistical analyses

The mean and 95% confidence interval were reported for continuous variables with a normal distribution. Pearson's and Spearman's correlation analyses were applied whenever appropriate. The correlation analyses were carried out between depressed mood and the other study variables. The assumptions of normality, linearity, and homoscedasticity were investigated by the residual scatterplots. Stepwise multiple regression analysis was used to explore which variables could explain the variation in depressed mood (dependent variable). The requirements for an independent variable to be included in the multiple regression