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Original Article

Therapeutic Horseback Riding in Breast Cancer Survivors: A Pilot Study

Claudia Cerulli, PhD,[1] Carlo Minganti, PhD,[1] Chiara De Santis, DR,[2] Eliana Tranchita, MD,[1]
Federico Quaranta, MD,[1] and Attilio Parisi, MD[1]

Abstract

Purpose: To evaluate the physiologic and psychological effects of an equine-assisted therapy protocol (EAT) in breast cancer survivors.

Methods: Twenty women (mean age, 45.61 ± 2.71 years) whose breast cancer treatment had concluded at least 6 months previously underwent a screening protocol to certify their eligibility to participate in noncompetitive sports. The patients were randomly assigned to an intervention group ($n = 10$) or a control group ($n = 10$). Intervention patients participated in a 16-week EAT protocol consisting of 2 hours of activity per week. All patients were tested before and after the intervention for maximal oxygen consumption (VO_2max), fat mass percentage, total body water percentage, strength of principal muscular groups (measured on five weight-lifting machines [leg press, leg extension, leg curl, shoulder press, vertical traction]), and quality of life using the Functional Assessment of Chronic Illness Therapy-Fatigue questionnaire (FACIT-F).

Results: After intervention, the intervention group showed an improvement in VO_2max (28.29%; $p < .001$), a decrease in fat mass percentage (change, − 7.73%; $p < 0.002$), an increase in total body water percentage (6.90%; $p = 0.027$), and an increase in strength (leg press, 17.75% [$p = 0.018$]; leg extension, 21.55% [$p = 0.005$]; leg curl, 26.04% [$p < 0.001$]; shoulder press, 49.72% [$p = 0.003$]; vertical traction, 19.27% [$p = 0.002$]). Furthermore, the increase in the three FACIT-F scores (FACIT-F trial outcome: 9.29% [$p = 0.010$]; Functional Assessment of Cancer Therapy-General total score, 14.80% [$p = 0.022$]; FACIT-F total score, 11.48% [$p = 0.004$]) showed an increase in quality of life. No significant changes for any variable were found for the control group.

Conclusions: EAT had positive effects on both physiologic and psychological measures, enhancing quality of life of breast cancer survivors. Results suggest a new method for rehabilitation intervention strategies after cancer in a nonmedical environment.

Introduction

Breast cancer is the most frequently diagnosed cancer and the primary cause of cancer death in women worldwide, accounting for 23% (1.38 million) of the total number of new cancer cases and 14% (458,400) of the total cancer deaths in 2008.[1,2]

Despite the increased incidence, early detection and improved treatments for breast cancer have resulted in a growing number of survivors. Breast cancer survivors, however, face challenges related to their illness and treatments, including risk for recurring cancer, persistent physiologic and psychological adverse effects, and an overall decrease in quality of life. Systematic reviews and meta-analyses have demonstrated that exercise interventions are particularly appropriate in cancer populations because they have the potential to improve physical and psychological health.[3–6]

Among the various intervention activities of particular interest are activities involving horses. Therapeutic riding in particular[7] invites the participation of people with a wide range of physical, cognitive, and/or emotional disabilities, using the equine–human relationship to strengthen self-esteem, self-confidence, and social competence. All and Loving[8] reported that through the recreational aspects of horseback riding, therapeutic riding provides an overall benefit to an individual. Funk and Smith[9] consider therapeutic riding to be the use of horses and riding to improve

[1]Department of Movement, Human and Health Sciences, Division of Health Sciences, University of Rome Foro Italico, Rome, Italy.
[2]Therapeutic Riding Centre ''Il Giardino di Filippo,'' Viterbo, Italy.

all aspects of a person's well-being. These activities combine the benefits of physical activities with psychological benefits derived from interaction between human being and animal; however, it remains unclear whether these reported curative effects can be attributed specifically to the assistance by a horse or to the horse–human relationship.[10]

No previous studies support the hypothesis that horseback riding, organized as equine assisted therapy (EAT), provides physiological and psychological benefits in breast cancer survivors. Thus, this study was performed to investigate the effects of an EAT protocol on the physiologic and psychological outcomes in a sample of women who had undergone breast cancer surgery.

Methods

Patients

Twenty women who had had mastectomy (mean age, 45.61 ± 2.71 years) took part in this study. Patients were recruited from Belcolle Hospital (Viterbo, Italy) and met the following eligibility criteria: (1) age 40–50 years, (2) conclusion of all cancer-related treatments at least 6 months previously, (3) mastectomy; (4) no external physical activity for at least the preceding 12 months; and (5) medical eligibility for noncompetitive athletic activity.

Because systemic cancer treatment has detrimental effects on the cardiovascular system,[11] all patients underwent heart echocardiography to evaluate their ejection fraction and ensure that they could perform moderate physical activity without risks of cardiovascular complications. Exclusion criteria included diagnosis of any other major illness or disease and other contraindications to physical exercise.

The Ethics Board at the National Reference Center for Animal Assisted Therapies (Experimental Zoo prophylactic Institute of Venice, Italy) approved the study. Before initiating the study, all patients were given a complete verbal and written explanation about the study's objectives, as well as the risks and benefits that were involved. All patients provided written informed consent.

The total sample size ($n = 20$) was estimated through an *a priori* power analysis. The analysis was carried out with G*Power software (G*Power, version 3.1.3; Franz Faul, Universität Kiel, Germany) assuming an univariate approach for between effects, within effects, and interactions. The following were taken into account for the procedure:[12] effect size $f = 0.33$ (calculated from $\eta^2 p = 0.10$ – medium effect), $\alpha = 0.05$, power of 0.80, and a correlation between repeated measures of $r = 0.50$.

Experimental Design

This study was a two-group, pilot, randomized, controlled, clinical trial. All patients underwent a series of baseline assessments over 7 days, including functional assessment (i.e., VO_2max, bioelectrical impedance test, maximal strength of principal muscular groups) and psychological measurements (Functional Assessment of Chronic Illness Therapy-Fatigue [FACIT-F]). After completion of all baseline assessments, patients were randomly divided into two groups: the intervention group ($n = 10$) and the control group ($n = 10$).

Patients randomly assigned to the control group were instructed not to begin any new formal physical exercise program. After the 16-week intervention period, all patients underwent the same series of assessments completed at baseline. Relevant patients' medical information included height, body mass, body–mass index (BMI), and cancer treatment history are reported in Table 1.

EAT protocol

The EAT was held at the Therapeutic Riding Centre of Italian Equestrian Federation ''Il Giardino di Filippo'' (Viterbo, Italy). The therapeutic riding setting included the patient, the horse, and a therapist specialized in equestrian rehabilitation.

All the intervention group patients received two 1-hour therapeutic riding treatments for week, for 16 weeks. Each riding session consists of three phases: (1) warm up, horse caring, and grooming; (2) riding; and (3) unsaddling and grooming activity.

Sessions 1–3 were required to establish the human–horse relationship and ethologic and metacognitive comprehension of the horse (grooming, information and nomenclature of saddlery tools, horse behavioral codes, management of the horse, hand walk). Sessions 4–8 provided patients with riding basic elements: mounting and dismounting; position and control on the horse with exercises that help participants to create balance and correct postural lines necessary for mounted work. Sessions 9–20 allowed patients to consolidate the acquired position ability and horse control at walk (walk-stop-walk, rising walk on stirrups). Sessions 21–32 were structured to improve the ability of autonomous horse management (diagonals and transversals, sitting trot, trekking outside the court/ring).

Patients' heart rates were recorded during all the riding sessions with recorder belts (Team System recorder belt; Polar, Kempele, Finland), and data were downloaded onto a portable computer using the specific software (Polar Precision software, version 4; Polar).

Table 1. Characteristics of Study Patients

Characteristic	*Intervention group* (n = *10*)	*Control group* (n = *10*)
Age (y)	45.3 ± 4.32	46.0 ± 2.78
Height (cm)	161.30 ± 4.00	163.13 ± 3.87
Body mass (kg)	61.45 ± 9.45	68.63 ± 11.6
Body–mass index (kg/m^2)	23.51 ± 2.89	25.81 ± 4.82
Cancer stage		
I	3	1
II	5	5
III	2	4
Cancer side		
Left	4	4
Right	5	6
Bilateral	1	/
Chemotherapy protocol	10	10
Radiation therapy	5	6
Hormonal therapy	5	4
Time since last chemotherapy (mo)	12 ± 8.9	13 ± 7.4

Values expressed with a plus/minus sign are the mean ± standard deviation.

Measures

Cardiorespiratory fitness. Estimated maximal oxygen uptake (VO_2max) was obtained using the Åstrand–Rhyming cycle ergometer test according to suggested guidelines.[13,14] The test was conducted on a Monark bike ergometer, model 839E (Monark Exercise, Vansbro, Sweden), and a heart rate monitor (Polar Electro Inc., Lake Success, NY) was used to record the heart rate response. After 2 minutes of warm-up, the cycle ergometer resistance was selected at 50–75 W and the pedal rate was set at 50–60 revolutions per minute so participants would reach a steady-state equivalent to 85% of their age-predicted heart rate max (i.e., 220 – age in years). The test was terminated when the difference in the heart rate between minutes 5 and 6 of exercise was 5 beats or less. The measured heart rate was used to estimate VO_2max, with a correction factor for age.

The test was ended immediately if symptoms of cardiorespiratory problems occurred (angina pectoris, serious dyspnea, dizziness, extreme paleness, turning blue, abnormal course of heart rate). Test failure was defined as patient inability to complete the 6 minutes of the test, failure to reach minimum heart rate of 120 beats per minute, or heart rate variation more than 5 beats per minute during the last minute of the steady-state phase.

Body composition. Body composition was assessed via a portable multifrequency digital bioelectrical impedance device (Handy 3000®; DS Medica, Milano, Italy).[15] With this device, all measurements and collected data can be stored and immediately recovered. Results of total body analyses are expressed as absolute and percentages of body mass values. Among the principal measures that can be determined with this device, fat mass percentage and total body water percentage were take into account for the analysis.

Patients were instructed to prepare for the bioelectrical impedance analysis by fasting for 4 hours, abstaining from physical activity for 12 hours, abstaining from alcohol and diuretics (unless prescribed) for 48 hours, being well hydrated (water only), and voiding before assessment.

Maximal strength of principal muscle groups. Maximal strength of the principal muscle groups was assessed by using an inertial measurement system (Free-Power®; Sensorize, Rome, Italy). The device was designed to assess muscular strength and power in an applied setting.[16] The instrument may be attached to a weight bar or weight pack of any resistance training equipment, and acceleration data measured are sent via a Bluetooth® device to a laptop computer. Software estimates maximal strength by using a mathematical relationship between force, power, and velocity, measured in correspondence of at least three submaximal increasing loads. This approach was chosen because is considerably safer and requires less time to administer than the direct one maximal repetition (1-RM) assessment, which can lead to injury if not properly administered.

Maximal strength was evaluated for each of five weightlifting machines (Technogym SpA – Italy): leg press (LP), leg extension (LE), leg curl (LC), shoulder press (SP), and vertical traction (VT). Equipment for the upper arm that involves main use of pectoral muscles was not included to avoid damaging the breast prostheses or hurting the patients.

The week before the test session, patients were instructed on proper lifting technique for each machine, and familiarization trials were performed to ensure proper execution of the exercise protocol. Prior to the test, patients performed a 5-minute warm-up on a cycle ergometer and two 5-repetitions sets with the 30% of the presumed 1-RM. Patients were asked to perform at least two repetitions at 30%, 50%, and 70% of the presumed 1-RM; to perform with a full range; and to exert maximal effort throughout the movement. The rest periods between the loads lasted 4 minutes each.

Quality of life. The patients' quality of life (QoL) was assessed by using the last version of Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F version 4) questionnaire.[17–19] FACIT-F includes the Functional Assessment of Cancer Therapy-General (FACT-G), which contains general questions divided into four primary QoL domains (a total of 27 items): physical well-being (7 items; point range, 0–28), social/family well-being (7 items; 0–28), emotional well-being (6 items; 0–24), and functional well-being (7 items; 0–28). It also contains an additional fatigue subscale (13 items; 0–52) directly related to the effect of fatigue on daily activities. Each item is anchored by a five-point Likert scale based on how true the individual considers each statement to be during the previous week (0 = not at all, 4 = very much). Three scores can be derived: the FACIT-F trial outcome index (TOI) corresponding to the sum of the physical and functional well-being and fatigue subscales (range, 0–108), the FACT-G total score corresponding to the sum of the first four subscales (physical, social, emotional, and functional well-being; range, 0–108), the FACIT-F total score corresponding to the sum of the FACT-G and the fatigue subscale (range, 0–160). Higher scores are associated with greater QoL.

Statistical analysis

The SPSS statistical package, version 19 (IBM, Chicago, IL), was used for the analysis. All data are expressed as means ± standard deviations. The Shapiro–Wilk test was applied, before the analysis, to test the normal distribution of the data. No outliers or non-normal distribution were detected for any variables.

For all variables, separate two-way analyses of variance (ANOVAs) (group [intervention, control] × time [pre, post]) with repeated measures were used. When significant interaction was observed, follow-up tests were conducted by splitting the sample into two subgroups (i.e., intervention and control) and running separate repeated-measures ANOVAs to explore the different effect of time on the two groups.

Before the analysis, the Levene test for homegenity of variance was also performed to verify the assumptions underlying this statistical test. The significance level for all comparisons was set at $p \leq 0.05$. In addition, effect size was calculated for all variables as partial eta-squared (η^2_p).

Results

Cardiorespiratory fitness and body composition

Patients' cardiorespiratory fitness and body composition measures before and after the intervention protocol are

Table 2. Patients' Cardiorespiratory Fitness and Body Composition Measures Before and After Equine-Assisted Therapy Protocol

Variable	*Before intervention*	*After intervention*	p *value*	η^2p	*Change (%)*
VO_2max (ml/kg per min)					
Intervention	24.39 ± 4.84	31.29 ± 4.95	< 0.001	0.876	28.29
Control	31.49 ± 10.59	32.26 ± 10.10	> 0.05*	–	2.45
FAT (%)					
Intervention	28.96 ± 4.49	26.72 ± 5.34	0.002	0.673	−7.73
Control	30.17 ± 3.98	30.55 ± 4.40	> 0.05*	–	1.26
TBW (%)					
Intervention	52.05 ± 4.51	55.64 ± 7.56	0.027	0.436	6.90
Control	51.43 ± 2.82	51.34 ± 2.79	> 0.05*	–	−0.17

*Cut off for significance was > 0.05.
VO_2max, maximal oxygen consumption; FAT (%), fat mass percentage; TBW (%), total body water percentage.

reported in Table 2. VO_2max showed a significant main effect for time ($p < 0.001$) and for the interaction effect for groups by time ($p = 0.001$). Follow-up analysis showed a significant increase ($p < 0.001$; η^2p = 0.876) only in the intervention group (control group $p = 0.572$). In the same way, significant differences for time ($p = 0.010$) and for the interaction between groups and time ($p = 0.001$) were noted for fat mass percentage, with a significant decrease ($p = 0.002$; $\eta^2 = 0.673$) only for the intervention group (control group $p = 0.221$). Total body water percentage showed a significant differences (time $p = 0.020$; interaction $p = 0.15$), with a significant increase ($p = 0.027$; $\eta^2 = 0.436$) only for the intervention group (control group $p = 0.585$).

Maximal strength of principal muscle groups

The repeated-measures ANOVA results revealed a statistically significant difference for time (LP, $p = 0.156$; LE, $p = 0.042$; LC, $p = 0.018$; SP, $p = 0.008$; and VT, $p = 0.156$). The interaction effect for group by time was significantly different for all five variables (LP, $p = 0.005$; LE, $p = 0.037$; LC, $p < 0.001$; SP, $p = 0.017$; VT, $p = 0.005$). Therefore, as reported in Table 3, maximal strength significantly improved in all the lifting machine only for the intervention group.

QoL

The three scores that can be derived from the FACIT-F outcome (FACIT-F trial outcome, FACT-G total score, and FACIT-F total score) in the intervention and control groups before and after EAT are reported in Table 4. Analyses highlighted a significant main effect only for the interaction (FACIT-F trial outcome, $p = 0.013$; FACT-G total score, $p = 0.025$; FACIT-F total score, $p = 0.020$), with follow-up analysis showing, for the intervention group, a significant increase in all the scores.

Discussion

This study is believed to be the first to assess the effect of EAT in breast cancer survivors. The findings show that patients who underwent the EAT protocol had significantly improved aerobic capacity, body composition, strength, and QoL.

In the intervention group, VO_2max significantly increased by 28.3%, while the control group showed no

Table 3. Maximal Strength of Principal Muscle Groups Before and After Equine-Assisted Therapy Protocol, Evaluated by Five Weight-Lifting Machines

Variable	*Before intervention*	*After intervention*	p-*Value*	η^2p	*Change (%)*
Leg press (kg)					
Intervention	97.48 ± 22.79	114.88 ± 17.09	0.018	0.478	17.85
Control	85.63 ± 20.94	79.13 ± 17.78	> 0.05*	–	−7.59
Leg extension (kg)					
Intervention	42.64 ± 10.70	51.83 ± 9.21	0.005	0.608	21.55
Control	44.38 ± 13.55	44.25 ± 10.83	> 0.05*	–	−0.29
Leg curl (kg)					
Intervention	41.70 ± 9.61	52.56 ± 11.39	< 0.001	0.894	26.04
Control	39.50 ± 6.78	36.76 ± 9.12	> 0.05*	–	−6.94
Shoulder press (kg)					
Intervention	10.74 ± 4.82	16.08 ± 5.43	0.003	0.651	49.72
Control	16.84 ± 5.66	17.20 ± 8.05	> 0.05*	–	2.14
Vertical traction (kg)					
Intervention	43.90 ± 8.64	52.36 ± 7.57	0.002	0.676	19.27
Control	38.63 ± 10.16	33.88 ± 11.41	> 0.05*	–	−12.30

*Cut off for significance was > 0.05.

Table 4. Functional Assessment of Chronic Illness Therapy-Fatigue Outcomes Before and After Equine-Assisted Therapy protocol

Variable	*Before intervention*	*After intervention*	p-*Value*	η^2p	*Change (%)*
FACIT-F trial outcome					
Intervention	81.28 ± 9.71	88.83 ± 5.09	0.010	0.541	9.29
Control	72.08 ± 6.40	68 ± 4.92	> 0.05*	–	−5.66
FACT-G total score					
Intervention	74.24 ± 8.11	85.23 ± 4.20	0.022	0.678	14.80
Control	70.67 ± 65.89	65.89 ± 14.66	> 0.05*	–	−6.76
FACIT-F total score					
Intervention	114.94 ± 14.07	128.13 ± 5.90	0.004	0.616	11.48
Control	103.67 ± 7.60	98.89 ± 20.79	> 0.05*	–	−4.60

Higher scores are associated with greater quality of life.
*Cut off for significance was > 0.05.
FACIT-F, Functional Assessment of Chronic Illness Therapy-Fatigue; FACT-G, Functional Assessment of Cancer Therapy-General.

significant variations. In addition, if comparisons with the reference population are considered with particular attention, it is important to take into account that cancer survivors in the current study do not differ much from the average sedentary population both in the intervention and control groups.[20]

However, the effects of the EAT protocol on cardiorespiratory fitness are meaningful and similar to those obtained in other studies that evaluated the effects of physical activity in breast cancer patients and survivors.[21–23] This result, however, is explained by the fact that the EAT patients worked at a medium rate of 65%–70% of their maximum theoretical heart rate (220 − age).

Data from the body impedance analysis shows an improvement in body composition only in the EAT group. Fat mass percentage decreased by an average of about 7.73%, and total body water percentage increased by 6.90%. This outcome is extremely important considering that weight gain and changes in body composition, including fat gain and loss of lean tissue, is a common and persistent problem for many breast cancer survivors and is associated with adverse health consequences and overall poorer QoL.[24–26]

Analysis of the variables related to maximal strength in the EAT group showed a significant increase for both the upper limbs (SP, 50%; NT, 19.3%) and the lower extremity (LP, 18%; LC, 26%; and LE, 22%).

The scarce existing literature on expenditure of energy in equestrian sports makes it difficult to compare the current study results. However, Douglas and colleagues[27] performed a systematic review of the literature on performance in equestrian athletes. The main research findings were that as a horse progresses through the gaits (walk, trot, and canter), the rider's heart rate and oxygen consumption increase, probably because of higher levels of tonic muscular contraction.

Furthermore, although in the EAT group the main pace of each session was walking, particular attention was given to position and seat of the patients, and numerous exercises were proposed to be carried out both in a stationary position and in motion. This involves a major effort of the musculature of torso and lower limbs to maintain balance in the saddle. Stronger upper limbs can be explained by the work of grooming, saddling, unsaddling, mounting, and controlling the horse with the reins, as well as by the fact that after a period of physical activities the patients regained trust in their ability to use the limbs affected by the mastectomy and implant of the breast prosthesis.

Associated with these positive physiologic results was improvement in the psychological aspects, as evidenced by the analysis of the data obtained from the FACIT-F. The three scores that can be derived were significantly improved in the EAT group. FACT-G score, which includes data for physical, social, emotional, and functional well-being and thus is more sensitive to psychosocial interferences, increased 14.8%. The FACIT-F total score, which includes all the FACT-G subscale items plus the fatigue subscale, increased 11.5%. Furthermore, the FACIT-F trial outcome that considers physical and functional well-being and the fatigue subscale increased 9.29%.[28–30]

The healing power of pets is accepted as one of the many forms of complementary therapies; QoL benefits derived from contact with animals are evident on psychological, physical, social, and behavior levels.[31] In this context, the psychosocial benefits of equine activities are increasingly reported, and therapeutic riding programs have improved QoL in people with disabilities.[32] Furthermore, it is important to note that the phenomenon of equine–human bonding differs from the relationship between humans and other animals. Establishing a relationship with a horse requires close physical contact, and an intimacy develops between horse and rider through grooming and riding. The equine–human relationship is multidimensional and has the capacity to provide not only physiologic support but also an emotional/psychological effect. The initial contact between horse and patient is physical; it then opens up to a ''dialogue'' passing through their bodies. This ''body feeling'' initiates the psychological rehabilitation of the breast cancer patient, who needs to restructure a body image drastically changed by mastectomy. This plays a decisive role for her femininity, self-esteem, and self-confidence.

This study show that EAT provides physiologic and psychological benefits among breast cancer survivors and meets the physical activity guidelines for reducing mortality and improving QoL.[3,4,6]

Although these results are positive and promising, some limitations to the methodologic approach should be considered upon interpreting the results. Inclusion of a control group receiving usual care means that the significant results may have been due to the additional attention received rather than the intervention. Patients in the intervention group may have been particularly receptive to EAT or these particular modes of exercise, creating a self-selection bias, and the results may not apply to those with no interest in EAT. This may limit the generalizability of the findings but does not invalidate the results. Finally, this study investigated the short-term benefits of the EAT intervention but not the longer-term results. It may be meaningful to investigate whether the improvement is sustained over the long term with participants who continue to practice EAT.

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Author Disclosure Statement

No competing financial interests exist.

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Address correspondence to:
Claudia Cerulli, PhD
Department of Movement
Human and Health Sciences
Division of Health Sciences
University of Rome Foro Italico
P.za Lauro de Bosis 15
Rome 00135
Italy

E-mail: claudia.cerulli@uniroma4.it