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Determining the Effects of Exercise and Physical Activity on the Cognitive Deficits that Result from Chemotherapy Treatment in Female Breast Cancer Patients: A Systematic Review

EXERCISE SCIENCE
SACRED HEART UNIVERSITY

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INTRODUCTION

- Each year, 266,120 new cases of invasive breast cancer are diagnosed in American women.
- Over the past decade, breast cancer mortality has significantly decreased due to improvements in early screening and awareness, advancements in medical technology, and adjuvant therapies^{1,2,3}.
- However, “chemobrain”, or cognitive deficits and abnormalities, is a complication of chemotherapeutic treatments^{3,4}.
- Cognitive deficits can include problems with a patient’s thinking, processing speed, attention, memory, and learning abilities and can decrease overall quality of life^{2,3,5-6}.

PURPOSE

- To investigate the relationship between various types of physical activity and the cognitive deficits that result from chemobrain.
- To determine if the positive effects of exercise as seen in healthy individuals would translate to patients experiencing chemobrain⁴.

METHODS

- Between November 2017 and April 2018, independent reviewers searched academic databases for pertinent literature regarding the potential positive effects of physical activity on the cognitive deficits related to chemotherapy treatment in women with a history of breast cancer.

RESULTS

Table 1: Depicts the relationship between Accelerometer Based Interventions and Cognitive Variables. Results showed improvements in white lesion matter, memory recall, working memory, and information processing speed^{16,23,28}.

Accelerometer Based Training Intervention				
Study	Variable	Breast Cancer Patient Group	Control Group	p-Value
Cooke et al (2016)	White Lesion Matter		30	0.017
	Memory Recall		28	0.001
Mackenzie et al (2016)	Working Memory/Reaction		32	0.014
Marinac et al (2015)	Information Processing Speed		136	0.02

Table 2: Depicts the relationship between 12 Week Interventions and Cognitive Variables. Results indicated that a 12-week resistance protocol yielded improvements in attention, short-term verbal memory, and working memory. A 12-week yoga intervention indicated improvements in cognitive complaints and memory problems^{13,22}.

12 Week Based Training Interventions				
Study	Variable	Breast Cancer Patient Group	Control Group	p-Value
Derry et al (2015)	Cognitive Complaints		100	0.044
	Memory Problems		100	0.003
Baumann et al (2011)	Attention		9	0.049
	Short-Term Verbal Memory		8	0.163
	Working Memory			0.049

Table 3: Depicts the relationship between Qualitative Based Studies and Cognitive Variables. Self-reported surveys and questionnaires allowed researchers to determine that physical activity improved cognitive deficits, visual problems, composite memory, executive and visual spatial function^{2,11,26}.

Qualitative Based Studies				
Study	Variable	Breast Cancer Patient Group	Non-Breast Cancer Group	p-Value
Myers et al (2015)	Cognitive Deficits		317	0.03
Crowgey et al (2014)	Visual Problems		37	0.004
	Composite Memory			0.067
Hartman et al (2015)	Executive Functioning		136	0.036
	Visual Spatial Function			0.004

DISCUSSION

- Physical activity is thought to help with cognitive functioning due to exercise-induced neurogenesis, which can improve neural plasticity.
- Establishing exact parts of the brain and inter-related mechanisms may help to improve future interventions.
- It is important that future research try to determine the acute verse chronic nature of specific effects on cognitive function, through the use of longitudinal studies and larger sample sizes^{2,7,24,29}.

SUMMARY

- Results from current research indicate that physical activity and exercise can help to lessen the cognitive deficits in breast cancer patients caused by chemotherapy treatments^{16,30}.
- Physical activity has the potential to help patients regain memory, information processing skills, and improve attention spans.
- Overall, greater levels of physical activity lead to better improvements in cognition.

CLINICAL APPLICATION

- New interventions using physical activity can help cancer survivors undergoing chemotherapy effectively improve their overall quality of life.
- Future research can also help clinicians to prescribe the most appropriate exercise type, duration, and frequency based on patients’ chemotherapy regimen²².

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