

Inflammatory Marker Levels and Performance on Cognitive Tests in Breast Cancer Survivors and Healthy Controls

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Introduction

Background & Rationale

It is widely accepted that stress and inflammation can negatively affect physical health. More research is emerging that suggests that cognitive abilities, such as learning, attention, and memory, can also be negatively impacted.

These effects could be greater for older patients and patients exposed to breast cancer treatment compared to healthy controls of the same age, gender, and level of education.

To assess cognition, the current study utilized the Trail Making Test (Part B) and the D-KEFS Color Interference Test (Conditions 3 and 4), empirically validated tests of processing speed, attention, and response shifting/inhibition.

The inflammatory marker analyzed for this study was C-Reactive protein (CRP).

Hypothesis

It was hypothesized that higher levels of inflammatory markers would be associated with poorer performance on the cognitive tests.

It was also expected that the patient group that was exposed to chemotherapy would perform the poorest on cognitive testing and exhibit higher levels of inflammatory markers.

Methods

Participants

- 160 participants' data from the 8-month time point used for analysis (see Table 1) out of 502 enrolled on IRB Protocol 14-071
 - Female breast cancer survivors treated with chemotherapy (n = 38), without chemotherapy (n = 56) and healthy controls (n = 66)
- Inclusion criteria:
 - Age 60 and older at enrollment (55 and older at diagnosis)
 - Breast cancer diagnosis occurred 5-15 years prior to enrollment (for patients)
 - No history of psychiatric or neurological diagnoses

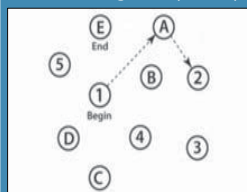
Design

- 4 study visits completed over the course of 2 years
- All study visits include cognitive testing, a questionnaire, and height & weight measurements
- At 2 study visits, participants provide a fasting blood sample and 4 saliva samples, from which inflammatory marker data is collected

Measures

Cognitive Assessment

Trail Making Test (Part B)



In Part B, participants were required to draw a line from circles containing numbers and letters in alternating numerical and alphabetical order as fast as possible.

Variables used for analysis were completion time and number of errors.

D-KEFS Color Interference Test (Conditions 3 and 4)

In Condition 3 (Inhibition), participants were presented with a page of words ("red," "green," and "blue") written in a different color ink than the word said and were asked to name the ink color instead of reading the words as fast as possible.

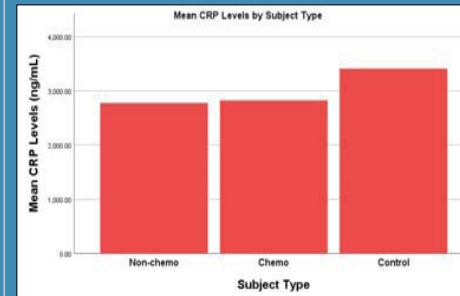
In Condition 4 (Inhibition/Switching), participants were presented with a page of words similar to Condition 3, but some words were in a box. For the words in boxes, participants were asked to read the words. For words not in a box, they were asked to name the ink color.

Variables used for analysis were completion time and number of errors.



Results

Inflammatory Markers



C-reactive protein (CRP) is a biomarker of inflammation that has been shown to be associated with cognitive functioning in previous research.

In the current sample, the control group exhibited the highest levels of CRP (\bar{x} = 3410.35 ng/mL), followed by the chemo group (\bar{x} = 2823.30 ng/mL) and the non-chemo group (\bar{x} = 2774.28 ng/mL). Normal levels of CRP tend to fall below 3000 ng/mL.

Pearson correlations were used to determine the strength of the relationship between CRP levels and cognitive test performance.

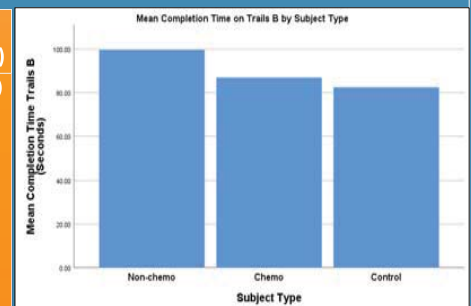
Pearson correlations:

- No significant relationships or trends were found between any test variables (completion time and number of errors) and CRP levels across the participant groups.
- Of note, the difference in mean completion time for Trails B between the non-chemo group and the control group approached significance as determined by one-way ANOVA, $F(2,157) = 1.930, p = .149$.

Table 1: Demographics and Sample Characteristics in Mean (SD) and N (% of Sample)

	Total Sample (N = 160)
Age (years)	73.44 (5.56)
Education (College or greater)*	87 (54.4%)
Race (Caucasian)*	134 (83.8%)
Ethnicity (Hispanic)*	13 (8.1%)
Marital Status (Married)*	81 (50.6%)
Smoking History (Yes)*	58 (36.3%)
Exposed to Chemotherapy (Yes)*	38 (23.8%)

Note: SD = standard deviation, * Presented as N, %



Conclusions & Future Research

No significant associations were found between CRP levels and cognitive test performance in this sample, but the largest difference in test performance was on the Trail Making Test Part B. Interestingly, the non-chemo group took the longest to complete the test and made the most errors. Only 3 tests out of a battery of tests were analyzed, which may contribute to the current findings. The findings suggest that there may be other factors besides treatment type and inflammation levels that could affect cognitive functioning. Future research will follow this sample and monitor cognitive test performance and inflammation levels over time to determine other related factors.