



# Adaptive Tango Dance Intervention Reduces Inflammation in African-American Female Caregivers of Alzheimer's Disease Patients

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## Purpose

With more kills than breast cancer and prostate cancer combined, Alzheimer's disease (AD) is the sixth leading cause of death in the United States. Additionally, individuals with a parental history of AD have ten times the risk to become afflicted with AD, and African-Americans have twice the risk of developing AD than Caucasians<sup>1</sup>. This neurodegenerative disease, caused by beta-amyloid plaques and tau protein tangles<sup>2</sup>, is negatively impacting the lives of millions today. Informal family caregiving of AD has been associated with the independent risk factors seen in AD, mainly an increase of stress and inflammatory markers<sup>4</sup>. The African-American caregivers of AD patients are most often middle-aged adults, women, and are more vulnerable to developing chronic health problems<sup>5</sup>. To combat the increasing incidence of AD, it is important to focus prevention efforts in these individuals at high risk. The focus of this study is to investigate the implementation and effects of a dance-based intervention on inflammatory biomarker levels in African-American caregivers of AD.

## Participants/Methods

Participants include African-American adults (45 or older) with parental history of AD. Individuals with any significant neurologic disease, major depression within the last two years, history of alcohol or substance abuse, or history of mental health illnesses were excluded from the study. All participants were enrolled in and consented for the VA funded study, ACT. Participants attended two clinic visits (pre and post-intervention) and 20 adapted tango dance sessions over a 12-week period held by Dr. Hackney at the Atlanta VA Medical Center. Clinic visits involved a collection of vital signs and a blood draw for inflammatory marker analysis.

## Results

**Table 1:** Participant Demographics

	Experimental (Dance) (n = 24)	Control (n = 10)
Age	60.33 +/- 8.00	58.10 +/- 8.20
Income	\$19,000 or less: 16.7% \$20,000 - \$39,000: 20.8% \$40,000 - \$59,000: 41.7% \$60,000 - \$79,000: 0.0% \$80,000 or more: 20.8%	\$19,000 or less: 10.0% \$20,000 - \$39,000: 20.0% \$40,000 - \$59,000: 20.0% \$60,000 - \$79,000: 30.0% \$80,000 or more: 20.0%
Level of Education	HS/Vocational: 8.3% Some College/Associate's Degree: 25.0% Bachelor's Degree: 41.7% Postgraduate: 25.0%	HS/Vocational: 10.0% Some College/Associate's Degree: 0.0% Bachelor's Degree: 50.0% Postgraduate: 40.0%
BMI	30.33 +/- 5.57	31.55 +/- 3.61
Blood Pressure	131.01 +/- 12.88 / 72.79 +/- 7.89	136.63 +/- 15.29 / 76.70 +/- 5.99
HR	73.12 +/- 12.90	70.28 +/- 12.26

**Table 3:** Pre and Post Biomarker Level Differences

	Experimental (Dance) (n = 24)	Control (n = 10)
Plasma (pg/mL)		
TGFa	-0.25 +/- 0.66	0.27 +/- 0.76
*IFNg	<b>-1.45 +/- 2.99</b>	<b>1.37 +/- 2.14</b>
IL-10	-0.45 +/- 2.33	0.25 +/- 1.65
MDC	-40.05 +/- 145.55	53.51 +/- 185.10
IL-9	-0.13 +/- 0.35	0.06 +/- 0.31
**IL-7	<b>-0.49 +/- 0.83</b>	<b>0.55 +/- 0.95</b>
IL-8	-0.64 +/- 2.86	0.87 +/- 1.67
*MCP-1	<b>-4.05 +/- 30.30</b>	<b>21.57 +/- 36.46</b>
*TNFa	<b>-0.19 +/- 0.54</b>	<b>0.42 +/- 0.70</b>
(ng/mL) CRP	-0.08 +/- 0.27	0.01 +/- 0.44
(ng/mL) SAP	0.02 +/- 0.06	0.02 +/- 0.10

**Table 1** shows that the average participant demographic is middle aged, has a college or postgraduate degree, and has relatively normal BMI and blood pressure levels.

**Table 3** shows results of plasma biomarker levels (measured in pg/ml) in the Experimental group vs. Control. Significant correlations were seen in plasma IFNg, MCP-1, TNFa, and especially IL-7.

All correlations were done using Pearson's R correlations to assess the statistical difference between racial groups.

**Table 2:** Mean Data for Pre and Post Intervention Plasma Biomarker Levels by Experimental and Control Groups

Plasma (pg/mL)	Experimental (Dance) (n = 24)	Control (n = 10)
<b>Pre-Intervention</b>		
TGFa	1.19 +/- 1.36	1.13 +/- 1.58
*IFNg	11.68 +/- 7.03	11.18 +/- 6.17
IL-10	10.71 +/- 4.67	10.66 +/- 4.54
MDC	979.67 +/- 355.42	843.48 +/- 288.69
IL-9	0.60 +/- 1.10	0.33 +/- 0.56
**IL-7	4.45 +/- 1.19	3.99 +/- 1.35
IL-8	7.54 +/- 12.26	3.64 +/- 2.19
*MCP-1	170.78 +/- 53.22	166.26 +/- 52.13
*TNFa	5.23 +/- 1.78	5.45 +/- 1.90
(ng/mL) CRP	0.35 +/- 0.37	0.40 +/- 0.61
(ng/mL) SAP	0.27 +/- 0.10	0.28 +/- 0.08
<b>Post-Intervention</b>		
TGFa	0.52 +/- 0.81	0.88 +/- 0.75
*IFNg	6.83 +/- 7.45	10.18 +/- 5.35
IL-10	6.38 +/- 5.51	8.93 +/- 3.66
MDC	600.30 +/- 515.30	763.76 +/- 380.98
IL-9	0.25 +/- 0.60	0.21 +/- 0.26
**IL-7	2.47 +/- 2.02	3.91 +/- 1.54
IL-8	4.56 +/- 9.72	3.75 +/- 2.02
*MCP-1	109.68 +/- 84.69	164.79 +/- 85.79
*TNFa	3.15 +/- 2.69	5.00 +/- 2.30
(ng/mL) CRP	0.20 +/- 0.31	0.39 +/- 0.27
(ng/mL) SAP	0.20 +/- 0.17	0.27 +/- 0.12

**Table 2** shows plasma biomarker mean levels for pre and post-intervention blood draws by the Experimental and Control groups. Differences between pre and post were significant with IFNg, MCP-1, TNFa, and especially IL-7 as further analyzed in Table 3.

\*Significant correlation where p < 0.05  
\*\*Significant correlation where p < 0.01

## Conclusion

- Dance sessions lowered IFNg, MCP-1, TNFa, and IL-7 levels compared to controls, and the differences in these decreases in biomarker levels were significant
- Biomarkers in blood plasma show significant changes as a result of dance-intervention, thus indicating cognitive and mood benefits associated with the regulation of inflammation leading to AD

## Future Directions

- Further biomarker-specific research: deepen our understanding of IFNg, MCP-1, and IL-7 and their role in pathways involved with AD
- Further intervention-specific research:
- Clinical applicability: allow routinely-practiced exercise programs to be an option for at-risk individuals/caregivers of AD

## REFERENCES

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- Von Känel R, Mausbach BT, Mills PJ, Dimsdale JE, Patterson TL, Ancoli-Israel S, Ziegler MG, Allison M, Chatillion EA, Grant I. Longitudinal Relationship of Low Leisure Satisfaction but not Depressive Symptoms With Systemic Low-Grade Inflammation in Dementia Caregivers. *J Gerontol B Psychol Sci Soc Sci.* 2014; 69(3):397-407.
- Pinquart, M. and S. Sorensen, Ethnic differences in stressors, resources, and psychological outcomes of family caregiving: a meta-analysis. *Gerontologist.* 2005. 45(1): p. 90-106.

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# Demographics

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# Blood Data

Plasma (pg/mL)	Experimental (Tango)	Control
<b>Pre-Intervention</b>	<b>(n = 24)</b>	<b>(n = 10)</b>
TGFa	1.19 +/- 1.36	1.13 +/- 1.58
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IL-9	0.60 +/- 1.10	0.33 +/- 0.56
<b>**IL-7</b>	<b>4.45 +/- 1.19</b>	<b>3.99 +/- 1.35</b>
IL-8	7.54 +/- 12.26	19.99 +/- 50.48
<b>*MCP-1</b>	<b>170.78 +/- 53.22</b>	<b>166.26 +/- 52.13</b>
TNFa	18.84 +/- 65.60	5.45 +/- 1.90
(ng/mL) CRP	0.35 +/- 0.37	0.40 +/- 0.61
(ng/mL) SAP	0.27 +/- 0.10	0.28 +/- 0.08
<b>Post-Intervention</b>	<b>(n = 24)</b>	<b>(n = 10)</b>
TGFa	0.52 +/- 0.81	0.88 +/- 0.75
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# Blood - LOCF

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<b>**IL-7</b>	<b>-0.49 +/- 0.83</b>	<b>0.55 +/- 0.95</b>
IL-8	-0.64 +/- 2.86	-15.49 +/- 50.77
<b>*MCP-1</b>	<b>-4.05 +/- 30.30</b>	<b>21.57 +/- 36.46</b>
TNFa	-6.31 +/- 29.96	0.42 +/- 0.70
(ng/mL) CRP	-0.08 +/- 0.27	0.01 +/- 0.44
(ng/mL) SAP	0.02 +/- 0.06	0.02 +/- 0.10