

**Physical Activity, Exercise, and Inflammatory Markers in Older Adults:
Findings from The Health, Aging and Body Composition Study**

**Journal of the American Geriatrics Society
Volume 52 Issue 7 Page 1098-1104; July 2004**

Lisa H. Colbert, PhD, MPH, Marjolein Visser, PhD, Eleanor M. Simonsick, Russell P. Tracy, PhD, Anne B. Newman, MD, MPH, Stephen B. Kritchevsky, PhD, Marco Pahor, MD, Dennis R. Taaffe, PhD, Jennifer Brach, PhD, Susan Rubin, MS, and Tamara B. Harris, MD, MS

FROM ABSTRACT:

Objectives: To examine the association between physical activity and inflammatory markers, with consideration for body fatness and antioxidant use.

Participants: Black and white, well-functioning men and women (N=3,075), aged 70 to 79.

Measurements: Interviewer-administered questionnaires of previous-week household, walking, exercise, and occupational/volunteer physical activities.

Analysis of covariance was used to examine the association between activity level and serum C-reactive protein (CRP), interleukin-6 (IL-6), and plasma tumor necrosis factor alpha (TNF) with covariate adjustment.

Antioxidant supplement use (multivitamin, vitamins E or C, beta carotene) was evaluated as an effect modifier of the association.

Results: Higher levels of exercise were associated with lower levels of CRP, IL-6, and TNF.

Use of antioxidant supplements modified the CRP and IL-6 associations such that concentrations were low in those taking supplements (e.g., CRP=1.79-1.84 across exercise levels) and higher in nonsupplement users who did no exercise (2.03) than in those who did the most (1.72).

Among nonexercisers, higher levels of other physical activity were related to lower levels of CRP and IL-6 but not TNF, even after accounting for body fat.

Conclusion: Inflammatory markers are lower in older adults with higher levels of exercise and nonexercise activity and in antioxidant supplement users regardless of exercise level.

THESE AUTHORS ALSO NOTE:

“Certain serum cytokines and acute-phase proteins serve as markers of systemic inflammation, including tumor necrosis factor alpha (TNF), C-reactive protein (CRP), and interleukin-6 (IL-6).”

“Inflammation is related to a variety of chronic diseases and conditions including rheumatoid arthritis, hypertension, cardiovascular disease, peripheral vascular disease, diabetes mellitus, osteoporosis, and cancer.”

“Chronic inflammation is also associated with increased age 12 and obesity.”

Inflammation is linked to disability and total mortality in the elderly.

“Numerous studies suggest that acute bouts of intense or prolonged exercise can stimulate an inflammatory response.”

But regular exercise of various duration and intensity decreases resting levels of TNF and CRP levels.

Higher levels of physical activity are associated with lower plasma concentrations of IL-6 and CRP.

Physical activity and fitness are related to lower levels of the inflammatory markers.

Physical activity may reduce systemic inflammation is through its effect on reduced body weight and fatness.

“Obesity is associated with inflammation, and adipose tissue is a known source of proinflammatory cytokines.”

“Lifestyle factors such as antioxidant use may modify the association between physical activity and inflammatory marker levels.”

The inflammatory markers were measured in serum (CRP and IL-6) or plasma (TNF).

Because they alter inflammatory markers, the authors also assessed smoking and drinking habits, medications (including Celecoxib, oral salicylates such as aspirin, nonsteroidal antiinflammatories such as ibuprofen, and oral corticosteroids) and supplements used in the previous 2 weeks.

Use of antioxidant supplements was defined as multivitamin, vitamin E or C, or beta-carotene.

RESULTS

The median value for IL-6 was 1.83 (1.27-2.81 pg/mL).
For TNF was 3.16 (2.45-4.11 pg/mL).
For CRP was 1.67 (0.99-3.11 mg/L).

"BMI and levels of IL-6, TNF, and CRP were lower in those who exercised, as were prevalence of hypertension, cerebrovascular disease, peripheral vascular disease, respiratory disease, and diabetes mellitus."

There is a significant trend toward a lower IL-6, TNF and CRP concentration with increasing amount of exercise.

BMI was significantly related to CRP, IL-6, and TNF.

"Taking an antioxidant supplement was associated with CRP levels similar to those seen in those who exercised 180 min/wk or more and did not take supplements."

"The current findings point to a significant association between exercise and nonexercise physical activities such as household and occupational or volunteer work and lower levels of inflammatory markers."

TNF and IL-1 are important in initiating the inflammatory response, whereas IL-6 is released later in the cascade.

IL-6 is the primary stimulus for liver synthesis of CRP.

"All three of the inflammatory markers examined have been related to measures of body fatness. These relationships with measures of BMI are not surprising, given that IL-6 and TNF are produced within adipose tissue." Increased IL-6 then stimulates liver production and secretion of CRP.

Lowering body fat with regular exercise may be partially responsible for the lower levels of inflammatory markers, but it is not the only mechanism.

"Those who took supplements tended to have lower IL-6 and CRP levels regardless of exercise level."

"The data suggest that exercise and nonexercise physical activity is associated with lower levels of systemic inflammation as indicated by the plasma markers IL-6, CRP, and TNF."

This work adds to the growing number of studies suggesting that physical activity is associated with reduced levels of inflammatory markers.

“As a result, physical activity should be strongly encouraged in older adults, for it not only improves physical function and the maintenance of independence, but may also attenuate chronic low-level systemic inflammation.”

KEY POINTS FROM DAN MURPHY:

- 1) Tumor necrosis factor alpha (TNF), C-reactive protein (CRP), and interleukin-6 (IL-6) are serum cytokines and acute-phase proteins and they are markers of systemic inflammation.
- 2) Inflammation is related to a variety of chronic diseases and conditions including rheumatoid arthritis, hypertension, cardiovascular disease, peripheral vascular disease, diabetes mellitus, osteoporosis, obesity, cancer, disability and total mortality.
- 3) Intense or prolonged exercise increase the inflammatory response.
- 4) Regular mild to modest exercise decreases levels of the inflammatory markers TNF, IL-6 and CRP levels.
- 5) Physical activity and fitness are related to lower levels of the inflammatory markers.
- 6) Physical activity reduces body weight and fatness, which adds to the reduction of systemic inflammation.
- 7) Adipose tissue is a source of proinflammatory cytokines, so obesity is associated with inflammation.
- 8) Antioxidant supplements (multivitamin, vitamins E or C, beta carotene) also lower level of inflammatory markers, but not as much as regular exercise.
- 9) Both exercise and nonexercise physical activities such as household and occupational or volunteer work lower levels of inflammatory markers.
- 10) Physical activity is associated with reduced levels of inflammatory markers.
- 11) Physical activity should be strongly encouraged in older adults because it improves physical function and reduces chronic low-level systemic inflammation.