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Dietary fatty acid intake is associated with paraoxonase 1 activity in a cohort-based analysis of 1,548 subjects

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Abstract

Background: Paraoxonase 1 (PON1) is a cardioprotective, HDL-associated glycoprotein enzyme with broad substrate specificity. Our previous work found associations between dietary cholesterol and vitamin C with PON1 activity. The goal of this study was to determine the effect of specific dietary fatty acid (DFA) intake on PON1 activity.

Methods: 1,548 participants with paraoxonase activity measures completed the Harvard Standardized Food Frequency Questionnaire to determine their daily nutrient intake over the past year. Eight saturated, 3 monounsaturated, and 6 polyunsaturated DFAs were measured by the questionnaire. To reduce the number of observations tested, only specific fatty acids that were not highly correlated ($r < 0.8$) with other DFAs or that were representative of other DFAs through high correlation within each respective group (saturated, monounsaturated, or polyunsaturated) were retained for analysis. Six specific DFA intakes – myristic acid (14 carbon atoms, no double bonds – 14:0), oleic acid (18:1), gadoleic acid (20:1), α -linolenic acid (18:3), arachidonic acid (20:4), and eicosapentaenoic acid (20:5) – were carried forward to stepwise linear regression, which evaluated the effect of each specific DFA on covariate-adjusted PON1 enzyme activity.

Results: Four of the 6 tested DFA intakes – myristic acid ($p = 0.038$), gadoleic acid ($p = 6.68 \times 10^{-7}$), arachidonic acid ($p = 0.0007$), and eicosapentaenoic acid ($p = 0.013$) – were independently associated with covariate-adjusted PON1 enzyme activity. Myristic acid, a saturated fat, and gadoleic acid, a monounsaturated fat, were both positively associated with PON1 activity. Both of the tested polyunsaturated fats, arachidonic acid and eicosapentaenoic acid, were negatively associated with PON1 activity.

Conclusions: This study presents the largest cohort-based analysis of the relationship between dietary lipids and PON1 enzyme activity. Further research is necessary to elucidate and understand the specific biological mechanisms, whether direct or regulatory, through which DFAs affect PON1 activity.

Keywords: Paraoxonase 1, Dietary fatty acid intake, Saturated fats, Monounsaturated fats, Polyunsaturated fats, ω -3 fatty acids, Cardiovascular disease

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