

Biomarkers of Inflammation Mediate an Association Between Sexual Activity and Quality of Life in Older Adulthood

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ABSTRACT

Background: Inflammatory processes underlie biological mechanisms responsible for age-related disease and quality of life. Psychological stress can activate acute-phase reactants associated with inflammation, and sexual activity can assist in the management of stress.

Aim: To test whether inflammatory biomarkers (C-reactive protein [CRP], fibrinogen, and white blood cell [WBC] count) would mediate an association between frequency of sexual activity and quality of life in older adulthood.

Methods: Older adults from England (N = 4,554; 2,049 men, 2,505 women; mean age = 66.25 ± 8.89 years) provided blood samples and completed self-report questionnaires on sexual activity, quality of life, and health-related behavior.

Outcomes: CRP (milligrams per liter), fibrinogen (grams per liter), WBC count (10⁹ cells/L), and quality of life (self-report).

Results: Frequency of sexual activity had a negative association with CRP and fibrinogen. An age-moderated effect also showed that frequency of sexual activity had a negative association with WBC count in older participants in the sample (>70 years of age). CRP mediated a positive association between frequency of sexual activity and quality of life. An age-moderated mediation effect also showed that WBC count mediated the association between sexual activity and quality of life in the oldest participants in the sample. All analyses controlled for demographic, anthropometric, and health-related factors.

Clinical Translation: More frequent sexual activity might be a useful auxiliary approach to lowering stress-related inflammation and improving quality of life.

Strengths and Limitations: Strengths of this study include the large sample and multiple control variables. Limitations include the cross-sectional nature of the data and some loss in sample representativeness.

Conclusion: Findings provide evidence that more sexually active older adults exhibit an anti-inflammatory status associated with a perception of higher quality of life. Further research using prospective designs and natural experimental methods is encouraged. **Allen MS. Biomarkers of Inflammation Mediate an Association Between Sexual Activity and Quality of Life in Older Adulthood. J Sex Med 2017;XX:XXX–XXX.**

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Key Words: C-Reactive Protein; Fibrinogen; Moderated-Mediation; Sexual Health; White Blood Cell Count

INTRODUCTION

Sexual activity and fulfillment is an important component of quality of life in older adulthood. It is associated with well-being, relationship satisfaction, and lower risk of chronic disease.¹ However, little is known about the processes through which sexual activity might exert its influence on quality of life.

Inflammatory abnormalities underlie biological processes that contribute to age-related disease and associated quality of life.^{2,3} Inflammation (and activation of the immune system) can be detected by an increase in several biomarkers including C-reactive protein (CRP), fibrinogen, and white blood cell (WBC) count. These biomarkers reflect demographic, anthropometric, behavioral, and psychosocial factors⁴ including psychological stress.⁵ Because sexual activity is associated with stress relief⁶—through physiologic changes such as oxytocin release^{7,8}—more frequent sexual activity might contribute to anti-inflammatory status and in turn a higher perceived quality of life. Of note, inflammation has emerged as a key pathogenetic mechanism triggering cardiovascular events, and research has found that more frequent sexual

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intercourse relates to a lower risk of cardiovascular events in men with sexual dysfunction.⁹ This study tested the hypothesis that sexual activity relates to quality of life through the variance shared with inflammatory biomarkers.

METHODS

Sample

This study used data from wave 6 of the English Longitudinal Study of Ageing (ELSA). The ELSA is a biannual survey that collects information on health, social, and economic circumstances of the English population at least 50 years old. The data are broadly considered representative of older adults in England. There were 10,372 participants sampled, of which 58.2% ($n = 6,039$) provided blood samples and 66.7% ($n = 6,916$) completed the Sexual Activities and Relationships Questionnaire. Overall, 43.9% of participants completed the two assessments ($N = 4,554$; 2,049 men, 2,505 women; mean age = 66.25 ± 8.89 years) and were eligible for inclusion in the study. Attrition analyses show that excluded participants were older ($t = 7.77$, $P < .001$), did less physical activity ($t = 14.13$, $P < .001$), reported poorer quality sleep ($t = 2.41$, $P = .016$), consumed fewer fruits and vegetables ($t = 2.79$, $P = .005$), had a lower alcohol intake ($t = 6.06$, $P < .001$), had a higher body mass index ($t = 3.38$, $P = .001$), had a higher WBC count ($t = 2.31$, $P = .021$), and had a higher perceived quality of life ($t = 5.91$, $P < .001$).

Measurements

Sexual Activity

The ELSA Sexual Relationships and Activities Questionnaire is a self-completion questionnaire that participants were instructed to complete in private. To assess recent sexual activity, participants responded to three questions: (i) "How many times have you had or attempted sexual intercourse (vaginal, anal or oral sex) during the past month?" (ii) "Apart from when you attempted sexual intercourse, how frequently did you engage in other sexual activities (kissing, fondling and petting) during the past month?" (iii) "How often did you masturbate in the past month?" Response categories were 1 (not at all), 2 (once in the past month), 3 (two or three times in the past month), 4 (once a week), 5 (two or three times a week), 6 (once a day), or 7 (more than once a day). An average of the three scores was taken as the frequency of recent sexual activity. The full questionnaire is available online (<http://www.elsa-project.ac.uk>).

Quality of Life

Overall quality of life was measured using the 19-item Control, Autonomy, Self-Realization, and Pleasure Questionnaire (CASP-19).¹⁰ The CASP-19 was developed for use in older adults and is based on a model that conceptualizes quality of life as needs satisfaction. The questionnaire uses 19 statements to assess four dimensions of control (eg, "My age prevents me from

doing the things I would like to"), autonomy (eg, "I can do the things that I want to do"), self-realization (eg, "I feel that life is full of opportunities"), and pleasure (eg, "I look forward to each day"). Items are scored as 1 (never), 2 (not often), 3 (sometimes), or 4 (often). A composite score can be computed and was used as the measurement of quality of life ($\alpha = 0.89$).

Clinical Assessment

A trained nurse collected anthropometric data (body weight and height) and blood samples. Body weight was measured using a Seca 877 scale (Seca, Hamburg, Germany) and height was measured using a portable stadiometer. Participants did not wear shoes for anthropometric measurements but wore light clothing. Body mass index was calculated as weight (kilograms) divided by height (meters) squared. Blood samples were taken from the left or right arm using a vacutainer or butterfly needle, and no more than two attempts were made to extract blood. Measurement of CRP was carried out using the N Latex CRP mono immunoassay on the Behring Nephelometer II Analyzer (CSL Behring, King of Prussia, PA, USA). Fibrinogen analysis was carried out using the Organon Teknika MDA 180 analyzer (Organon Teknika BV, Turnhout, Belgium), using a modification of the Clauss thrombin clotting method. WBC count was analyzed using the Sysmex XE2100 analyzer (Sysmex, Copenhagen, Denmark) and electrical impedance technology (Coulter principle) was used to count the WBCs combined with hydrodynamic focusing and flow cytometry to differentiate the blood cells. These were the only biomarkers of inflammation assessed in the ELSA. All analyses were carried out according to standard operating procedures by state-registered medical laboratory scientific officers at the Royal Victoria Infirmary (Newcastle, UK).

Control Variables

Participants provided their data of birth, sex, and ethnicity. Ethnicity was coded as 1 (white) or 2 (non-white). Participants also provided self-report information on past and current smoking, their participation in physical activity, quality of their sleep, their usual consumption of fruits and vegetables (diet), and their usual alcohol intake. Higher scores represent a healthier diet, better quality sleep, and higher level of physical activity and alcohol consumption. Detailed information on these measurements is available in the [Supplement Materials](#).

Statistical Analyses

Linear regression models were used to test associations between sexual activity and inflammatory markers and quality of life. All models controlled for age, sex, ethnicity, physical activity, past smoking, current smoking, sleep, body mass index, diet, and alcohol intake. Because age moderates vulnerability to stress-induced change in functional immune measurements¹¹ and desire for sexual activity differs as a function of sex,¹² moderator analyses further tested whether associations between sexual activity and outcomes varied as a function of age and sex.

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