



Inflammation & Health

MIDUS

Midlife in the United States

A National Study of Health & Well-Being

MIDLIFE IN THE UNITED STATES: A NATIONAL STUDY OF HEALTH AND WELL-BEING

FUNDED BY THE NATIONAL INSTITUTE ON AGING

What is Inflammation?

Inflammation is the body's natural protective response to injury or disease:

- It increases blood flow to the injured area, causing redness & swelling,
- but promotes healing by removing damaged tissue.

Localized inflammation is a healthy response.

It is short-lived and confined to the injured area, fading away when healing is complete, such as with a sprained ankle.



Systemic inflammation is associated with chronic disease.

It can affect the entire body, lasting for years, and can contribute to poor health.

Why Study Inflammation?

- Age
- Social Status
- Stress
- Sleep • Exercise
- Emotions
- Relationships
- Well-Being

Inflammation seems to interact with psychological, social & behavioral factors to put us at risk for multiple aging-related illnesses.

Systemic Inflammation

- Alzheimer's
- Cancer
- Asthma • Arthritis
- Diabetes
- Physical Disability
- Liver Disease
- Heart Disease

How is Inflammation Studied?

via the **MIDUS Biomarker Project**

A portion of MIDUS participants agreed to visit clinics where samples of their blood were taken to test biomarker levels.



Biomarkers are biological indicators that reflect underlying processes in the body.

Example: cholesterol levels are biomarkers of heart health.

Systemic inflammation can be studied by looking at levels of inflammatory biomarkers in the blood, including the following proteins:

- IL-6 (interleukin-6)
- E-selectin
- fibrinogen
- CRP (C-reactive protein)
- sICAM-1 (soluble intercellular adhesion molecule-1)

Inflammatory biomarkers usually increase with age.



What Puts Us at Risk for Higher Inflammation?

Gender, Race, & Body Weight

- ▶ Women tend to have higher levels of inflammatory biomarkers (IL-6, CRP, & fibrinogen).
- ▶ White males have the lowest levels.



- ▶ Larger waist size seems more strongly associated with inflammation than BMI (Body Mass Index, a measure of height & weight)
- ▶ except among Black men, for whom BMI is an additional risk factor.

[Stepanikova, 2017]

Childhood Trauma

Those who had traumatic childhoods (physical or emotional abuse/neglect or sexual abuse):

- ▶ were more likely to have higher levels of inflammation (CRP) as adults.
- ▶ One way this may happen:
 - ◆ Abuse survivors are more likely to experience distress as adults, which may trigger them to overeat, because as children some ate more of their favorite foods to help themselves feel better.
 - ◆ This can lead to weight gain, which is associated with increased inflammation.
- ▶ Survivors of childhood trauma were also more likely to smoke and less likely to exercise, both of which are associated with higher inflammation.



[Schrepf, 2014; Hostinar, 2015]

Social Disadvantage

Social factors such as having lower economic or educational status, being a minority, or experiencing discrimination, are associated with inflammation:

- ▶ African Americans have higher levels of inflammation (IL-6 & fibrinogen) than Whites.
- ▶ Men who have experienced discrimination showed higher levels of inflammation (E-selectin) if they:
 - ◆ reported three or more instances of major discrimination (being denied a job or a bank loan)
 - ◆ experienced repeated everyday discrimination (being insulted or treated with less respect).



- ▶ Those who were able to complete more years of schooling had lower inflammation (fibrinogen & CRP).
 - ◆ This may be because education reduces the risk of life stress, which is directly linked to increased inflammation (IL-6).

[Stepanikova, 2017; Friedman, 2009 & 2010]



Expressing Anger

- ▶ Having a temper and expressing anger (slamming doors, yelling) is associated with increased inflammation (IL-6 & fibrinogen), especially among those with a high school education or less.
- ▶ However, there seem to be racial differences in this association. Among Whites who expressed anger, those with low education had the highest levels of inflammation.
- ▶ Surprisingly, among African Americans who expressed anger, it was those with college educations who had higher inflammation.
- ▶ Why the difference? It may be socially acceptable for highly educated whites to express anger as a symbol of their status, so that it does not affect their health. Highly educated African Americans, though, may face social stigma against expressing anger, while at the same time may experience increased anger from being in racially diverse settings that may involve discrimination.



[Boylan, 2013 & 2015]

Reacting Badly to Stress

A study of how people respond to minor hassles & frustrations (such as getting caught in traffic, arguments over household chores) showed that:

- ▶ Reactions to stressful events, not how frequently they occur, predict inflammation.
- ▶ Those whose *positive feelings decreased* in response to stressors (they became less calm, less cheerful) had elevated levels of inflammation (IL-6).
- ▶ Women whose *negative emotions (sadness, anger) increased* in response to stressors had elevated inflammation (CRP), if they were also less physically active, or if they smoked.



[Sin, 2015]

Poor Sleep & Relationship Quality

Poor sleep has been associated with inflammation, but with differences between women and men.

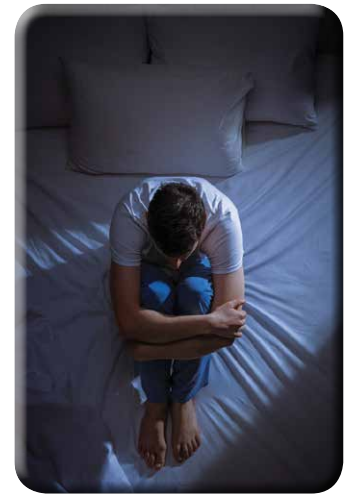
In Women:

- ▶ Those who took longer to fall asleep showed increased inflammation (IL-6 & CRP) that promoted higher insulin resistance (which can lead to diabetes).

In Men:

- ▶ Those who spent more time lying awake during the night showed increased inflammation (IL-6), especially for those who reported *poor* relationship quality (feeling lonely, difficulty maintaining close friendships).
- ▶ When sleep quality declined (snoring, bad dreams), inflammation levels were also higher (IL-6 & E-selectin), except among those with *better* relationships (that were warm & trusting).

[Kim, 2016;
Friedman, 2011]



Scientific interest in reducing inflammation has grown because it may prevent multiple aging-related diseases.



What Protects Us from Inflammation?

Daily Uplifting Events



- ◆ Those who experienced minor positive events on more days (taking a leisurely walk, having a good conversation) had less inflammation (IL-6).
- ◆ This was especially true among those with lower incomes.
- ◆ Positive events that involved interacting with others were more predictive of lower inflammation than non-interpersonal events.

[Sin, 2015]

Exercise

- ◆ Among those who did not exercise, inflammation (CRP) was higher in overweight & obese adults compared to normal weight adults.
- ◆ However, overweight adults (BMI of 25-29) who reported regular exercise had inflammatory levels similar to normal weight adults.
- ◆ In obese adults (BMI > 29) inflammation (sICAM-1) was lower in those reporting over 5 hours/week of moderate exercise (mowing, brisk walking) or more than 2.5 hours/week of vigorous exercise (running, aerobics).



[Strohacker, 2017]

Well-Being

- ◆ refers to people who are satisfied with their lives and feel their talents are being used toward something meaningful. **Well-Being:**



Helps offset the impact of chronic conditions:

- ◆ Having multiple chronic conditions (such as heart disease, diabetes, asthma) is associated with *increased* inflammation, but those who had higher well-being showed *less* inflammation (IL-6 & CRP).
- ◆ This pattern, in turn, was linked to a lower risk of becoming disabled (being unable to perform daily activities such as walking up stairs or carrying groceries).

[Friedman, 2012, 2015]

Helps offset educational disadvantage:

- ◆ Those with a high school degree or less who *also* had high levels of well-being showed the same *lower* levels of inflammation (IL-6) as those with college degrees.

[Morozink, 2010]

Other Psychological Resources

Help offset social disadvantage:

- ◆ Men with less income, less education, and less prestigious jobs but who had more psychological resources (optimism, sense of control, self-esteem) showed lower inflammation (IL-6).

[Elliot, 2016]



Future Directions

What Comes First?

MIDUS currently has data on inflammation from only one time period. This makes it difficult to determine what came first— does inflammation lead to poor health, or does the presence of disease promote chronic inflammation?

A Second Round of Data:

MIDUS is now collecting a second round of biomarker data to help answer these questions.

If you have previously been part of the **Biomarker Project**, we hope you will agree to take part again, because the more people who return, the more valid our results will be.



Thank You!

We are grateful for the continued involvement of all our MIDUS participants who are helping us discover ways we can all age well.

Please Stay in Touch

Send updates in your address, phone(s), and/or email(s) to:

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Publications about inflammation, including those summarized here, can be found on our website:

MIDUS.wisc.edu