BLOOD SELENIUM LEVELS AND VASCULAR HEMODYNAMICS IN US ADULTS

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Introduction

Selenium (Se) is an essential micronutrient that is potentially implicated in cardiovascular health:

- Se has antioxidant properties which may influence vascular compliance and blood pressure
- Se affects nitric oxide (NO) bioavailability which may influence blood pressure [1].

The relationship between Se and cardiovascular health needs additional investigation:

- Current evidence on the relationship between Se and blood pressure is conflicting
- Little to no information exists on Se and early markers of vascular change such as:
  - Pulse wave velocity (PWV)
  - Mean arterial pressure (MAP)

To clarify this association, we evaluated the relationship of serum Se with vascular parameters in a nationally representative US sample.

Methods

Cross-sectional analysis was conducted using data from seven NHANES cycles (2003-04 and 2011–23, n=21,793).

- Demographics (age, sex, race, education, income), clinical variables (BMI, diabetes, GFR), and lifestyle factors (smoking, alcohol) were assessed via questionnaires and examination.
- Vascular measures included systolic and diastolic blood pressure (SBP, DBP), pulse pressure (PP), mean arterial pressure (MAP), and estimated pulse wave velocity (ePWV).
- Blood Se was measured by mass spectrometry.
- Participants were classified by age groups (18–35, 36–65, >65 years) and Se quartiles.
- Statistical analyses compared vascular hemodynamics across Se quartiles, adjusting for relevant covariates
  - Effect modification by age was assessed using interaction terms in the model.

Results

Overall, increasing Se quartiles were significantly associated with an increase in:

- SBP (p = 0.001)
- SBP (p < 0.001)
- ePWV (arterial stiffness, p < 0.001)
- MAP (p < 0.001)

There were some differences between the unadjusted and adjusted models:

- Unadjusted model initially showed that there was a correlation between increasing Se quartiles and pulse pressure (p = 0.01), but this relationship disappeared once the linear regression model was adjusted
- Unadjusted model initially showed no correlation between Se quartiles and PWV(p = 0.88), but adjusting the model showed a strong correlation (p < 0.001), though the effect size remained relatively small (0.13).

Table 1: Summary of sample; n = 21,793.

Demographics		Lifestyle	
Black (%)	23	Current smokers (%)	19
Hispanic (%)	23	Heavy drinkers (%)	10
Female (%)	51		
Comorbidities			
Hypertensive (%)	41		
Diabetes (%)	16		

Table 2: Statistics of Vascular Hemodynamics of Highest Se Quartile, Using Lowest Se Quartile as Reference.

Measure	Effect size	95% CI	p-value
			Model: Unadjusted
Systolic BP	1.21	(0.02, 2.41)	0.04
Diastolic BP	2.75	(1.99, 3.50)	<0.001
Pulse Pressure	–1.53	(–2.71, –0.36)	0.01
Mean Arterial Pressure	2.24	(1.49, 2.98)	<0.001
Pulse Wave Velocity	0.01	(–0.14, 0.16)	0.88
			Model: Adjusted
Systolic BP	1.76	(0.76, 2.75)	0.001
Diastolic BP	2.12	(1.38, 2.86)	<0.001
Pulse Pressure	–0.36	(–1.31, 0.59)	0.45
Mean Arterial Pressure	2.00	(1.29, 2.70)	<0.001
Pulse Wave Velocity	0.13	(0.08, 0.18)	<0.001

Modifying Effect of Age on the relationship between Se quartile and vascular hemodynamics:

- Among young adults 19-35 years: Higher Se quartiles → increased SBP (p<0.001)
- Among older adults over 65 years: Reverse relationship was seen; higher Se quartiles → decreased SBP (p<0.001).
- Similar age-modifying effects were observed with PWV (arterial stiffness) and pulse pressure.

For all age groups, higher Se quartiles were associated with an increased DBP and MAP. The degree of association, however, varied.

- Within the highest Se quartile, MAP of older adults (>65 years) was significantly lower than young adults (19-35 years) (interaction p = 0.01).

Discussion

- We found that higher Se levels were associated with increased blood pressure, MAP and ePWV.
- Further, age modified the relationship, with older adults having a decrease in SBP, PP, MPA, and ePWV not seen in younger adults.
- This result suggests that Se does not uniformly impact vascular hemodynamics in all age groups.

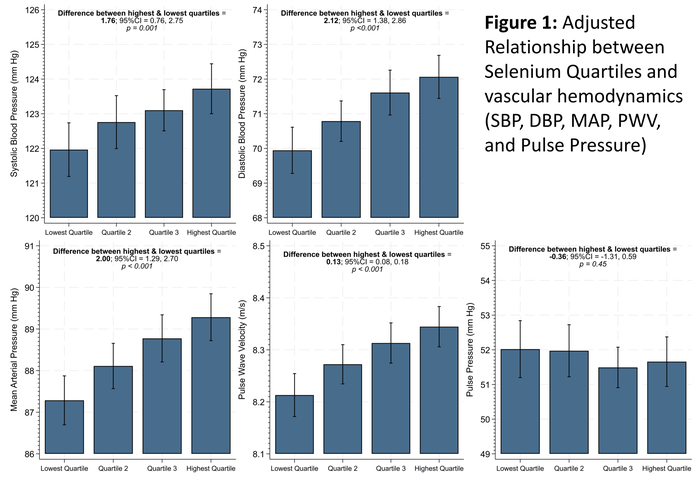

Figure 1: Adjusted Relationship between Selenium Quartiles and vascular hemodynamics (SBP, DBP, MAP, PWV, and Pulse Pressure)

Discussion

This study's strengths include its large, nationally representative sample and comprehensive assessments. However, as a cross-sectional analysis, causality cannot be determined, and residual confounding is possible.

Conclusion

We found that the relationship between Se and vascular hemodynamics is nuanced and dependent on age. The mechanisms responsible for the opposite effects of Se on vascular hemodynamics by age need further study.

References

[1] Leszto, K. et al. Selenium as a Modulator of Redox Reactions in the Prevention and Treatment of Cardiovascular Diseases. Antioxidants 13, 688 (2024).

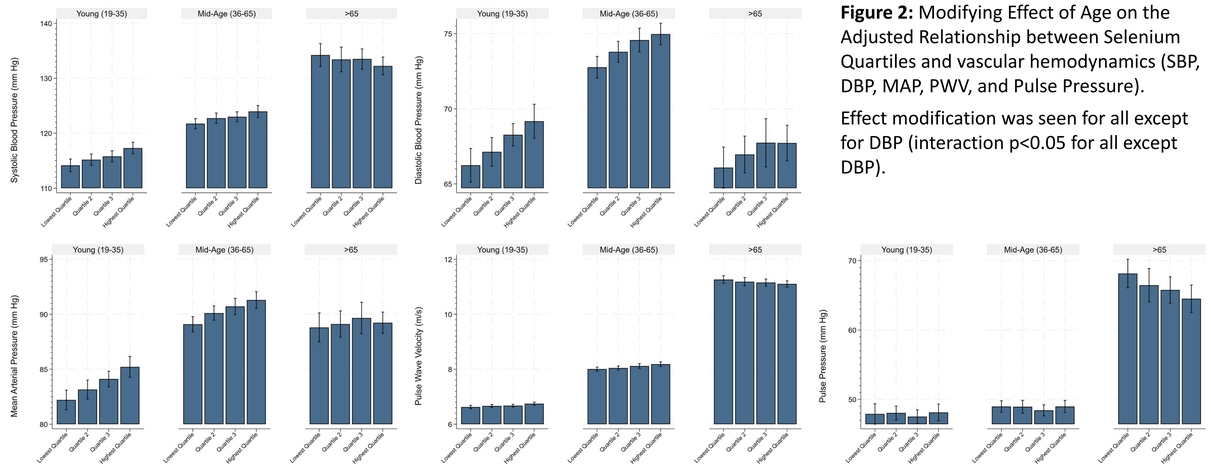

Figure 2: Modifying Effect of Age on the Adjusted Relationship between Selenium Quartiles and vascular hemodynamics (SBP, DBP, MAP, PWV, and Pulse Pressure).

Effect modification was seen for all except for DBP (interaction p<0.05 for all except DBP).