Higher habitual red meat intake is associated with larger body size and lower plasma oxidative DNA damage in men and women participating in a randomized controlled clinical trial

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AUBURN UNIVERSITY Research Initiative in Cancer

BACKGROUND

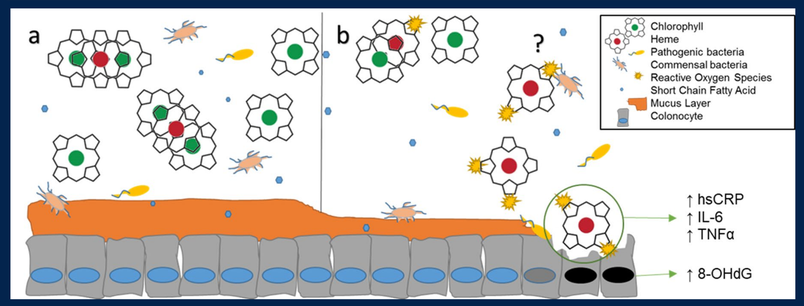

Figure 1.a) In the lumen, chlorophyll binds heme, preventing cytotoxicity. b) Heme is easily oxidized in the absence of chlorophyll; it is unknown if microbes, their metabolites, or both react with heme. Degradation of the mucin layer increases susceptibility of epithelial cells to pathogens and oxidative stress resulting in elevated systemic inflammation. Necrosis leads to compensatory hyperproliferation and DNA damage.

METHODS

Research Question: Does body size influence changes in systemic DNA damage after a chlorophyll-rich green leafy vegetable intervention is administered in obese subjects with habitually high red meat consumption?

Inclusion Criteria:

- Current green leafy vegetable (GLV) intake < 2 servings/day
- Current red meat (RM) intake ≥ 2 servings/week
- BMI >30 kg/m^2
- Ability to store and cook frozen green vegetables
- No use of antibiotics 4 weeks prior to start of study

Study Flow Diagram

Baseline Assessment: Pt receives and completes questionnaires. Two 24-hour dietary recalls, stool sample and phlebotomy obtained: 13.5cc blood sample drawn to measure serum TNFalpha, CRP, IL-6 and oxidized guanine species; plasma Vitamin K. Measure height, weight, BIA. Provide $25 incentive.

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Eligible Study Participants Randomized (n=50)

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Control: low green veg + Red meat | 2 svg green veg/day + Red meat

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Intervention: Provide cooler w/4W supply of frozen green veg, diet instructions, & food records. RD will instruct via telephone & follow up weekly

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4W Follow-up: Repeat Questionnaires. Draw 9.7 cc SST (for cytokines) & obtain stool sample and two 24-hour dietary recalls. Record weight. Provide $25

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4W Washout: Instructed to resume original diet, then assigned to crossover study arm

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8W Crossover: Repeat Questionnaires. Draw 9.7 cc SST & obtain stool sample and two 24-hour dietary recalls. Provide $25 incentive and 4W supply frozen green veg.

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2 svg green veg/day + Red meat | Control: low green veg + Red meat

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12W Follow-up: Repeat all measures/procedures as 4W and 8W. Provide w/$25

RESULTS

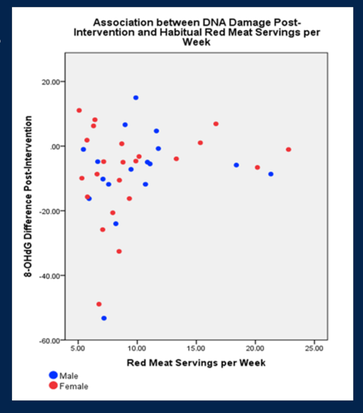
High RM eaters:

- RM servings per week was positively associated with baseline 8OhdG (r=0.484; p= 0.036)
- Baseline 8OhdG was negatively associated with waist to hip ratio (r=-0.488; p= 0.034)
- Body fat percentage was positively associated with average hip circumference (r=0.565; p=0.012)

Low RM eaters:

- A significantly greater reduction in DNA damage was seen in low RM eaters (p=0.017) after completion of intervention phase
- RM servings per week was positively associated with baseline 8OhdG (r=0.698; p= 0.001)
- A negative association was seen in females between RM servings per week and change in DNA damage post-intervention (r= -0.582; p=0.037)
- Baseline DNA damage was negatively associated with change in DNA damage post-intervention (r= -0.625; p=0.004)
- A positive association was seen between average waist and hip circumference (r=0.545; p=0.016)

a.



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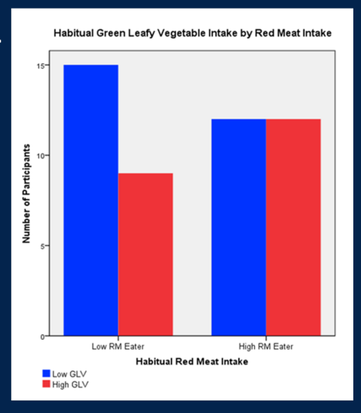

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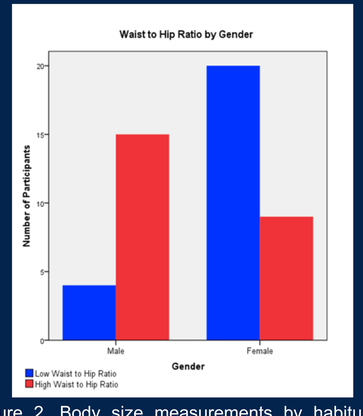

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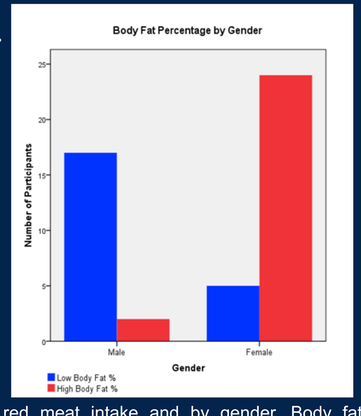


Figure 2. Body size measurements by habitual red meat intake and by gender. Body fat percentage obtained from handheld Body Impedance Analysis device. Variables were dichotomized at median. a) No significant association between red meat servings per week and change in DNA damage post-intervention in either males (r=0.282; *p*=0.273) or females (r=0.045; *p*=0.837). b) 31.25% of low RM eaters were also low GLV eaters (*p*=0.382). c) 41.7% of participants with relative low waist to hip ratio were female (*p*=0.001). d) 35.4% of subjects categorized with low body fat % were male (*p*<0.001).

RESULTS

Table 1. Descriptive statistics for study participants

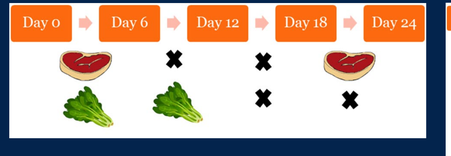
	Total (n=38)	Low RM Eater (n=19)	High RM Eater (n=19)	
	Mean (SD)			*p*
GLV Servings Per Day	0.23 (0.3)	0.25 (0.3)	0.21 (0.2)	0.676
RM Serving per Week*	9.88 (4.6)	6.68 (1.0)	13.08 (4.6)	<0.001
BMI (kg/m2)	35.09 (4.5)	34.87 (4.9)	35.31 (4.2)	0.768
Age	49.24 (13.4)	49.95 (13.8)	48.53 (13.2)	0.748
Height (inches)*	67.89 (4.8)	66.32 (4.3)	69.47 (4.9)	0.042
Weight (pounds)*	229.96 (35.9)	218.08 (35.9)	241.84 (32.5)	0.039
Baseline DNA Damage	41.87 (18.4)	47.72 (22.6)	36.02 (10.7)	0.052
DNA Damage Change Post-Intervention*	-7.53 (14.2)	-13.03 (17.4)	-2.03 (6.9)	0.017
Waist Circumference	111.74 (11.6)	108.17 (8.5)	115.31 (13.3)	0.058
Hip Circumference*	120.04 (7.6)	117.58 (6.8)	122.50 (7.7)	0.044
Waist to Hip Ratio	0.93 (0.1)	0.92 (0.1)	0.94 (0.1)	0.413
Body Fat %	37.97 (7.3)	38.14 (6.9)	37.80 (7.8)	0.889
	N (%)			*p*
Gender				0.146
Male	15 (39.5)	7 (29.2)	12 (50)	
Female	23 (60.5)	17 (70.8)	12 (50)	
Race				0.488
African American	8 (21.1)	6 (25)	4 (16.7)	
Caucasian	30 (78.9)	18 (75)	20 (83.3)	
Education				0.510
HS or GED	1 (2.6)	0 (0)	1 (4.2)	
Some college, no degree	3 (7.9)	2 (8.3)	2 (8.3)	
Associate's Degree	2 (5.3)	1 (4.2)	1 (4.2)	
Bachelor's Degree	13 (34.2)	8 (33.3)	10 (41.7)	
Master's Degree	12 (31.6)	8 (33.3)	5 (20.8)	
Professional Degree	1 (2.6)	0 (0)	1 (4.2)	
Doctorate	6 (15.8)	5 (20.8)	4 (16.7)	
Marital Status				0.646
Single	9 (23.7)	25 (6)	20.8 (5)	
Married	21 (55.3)	54.2 (13)	62.5 (15)	
Widowed	2 (5.3)	0 (0)	8.3 (2)	
Divorced	6 (15.8)	20.8 (5)	8.3 (2)	

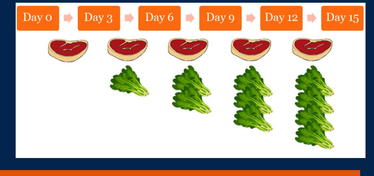
*significant at 0.05 level

CONCLUSION

Both body size and RM intake are known to influence systemic oxidative DNA damage; reduction of oxidative DNA damage can be beneficial in reducing risk for colon cancer. DNA damage was reduced in both high RM eaters and low RM eaters, however, reduction was greater in low RM eaters.

Future Directions:





FUNDING

This study is made possible by Auburn University Research Initiative in Cancer, AU College of Human Sciences, AU Department of Nutrition, Dietetics and Hospitality Management, AU Harrison School of Pharmacy, and AU OVPRED.