Understanding Acceptability and Adherence to a High Chlorophyll Dietary Intervention Aimed at Reducing Colon Cancer Risk in Adults: The Meat and Three Greens (M3G) Feasibility Trial

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BACKGROUND

Preclinical models indicate dietary chlorophyll, which gives green leafy vegetables their color, binds and stabilizes heme in the lumen, preventing genotoxicity. Additionally, data from previous randomized controlled weight loss trial indicate increasing red meat consumption has deleterious effects on the gut microbiome, which is also implicated in colon cancer etiology. Because heme-containing foods are the richest sources of bioavailable iron and several other vitamins and minerals, mitigating their potential risks may be more beneficial than eliminating meat, poultry, fish and seafood in their entirety from the diet for risk reduction.

METHODS

We completed a 12-week, two-arm crossover study in which participants were randomized to immediate or delayed intervention. Each study period lasted four weeks with a four week washout period between.

During the intervention period, participants were:

- provided with recipes, frozen greens of their choice, and instructed to eat one cup of cooked greens per day; contacted weekly to monitor adherence and provide guidance on how to meet daily goals

At each study visit, participants:

- provided stool and saliva samples, underwent phlebotomy, and had anthropometric assessments
- completed validated survey instruments to assess physical activity over the past week, acceptability of the dietary intervention, and beliefs regarding dietary habits and risks for colon cancer.

The purpose of this poster is to report the preliminary outcomes of M3G:

- Accrual and Retention goal: 50 adults recruited in 9 months; 90% retained at crossover; 80% retained at completion
- Adherence: 2x weekly self-report; meeting 1 cup/day intake goals 90%of days
- Acceptability: 10 question Food Acceptability Questionnaire (FAQ), rated on a 7-point Likert scale, administered after 4 and 12 weeks

RESULTS

During the intervention period, participants achieved 73.2% adherence of daily goal (1 cup GLV). Participants consumed any amount of GLV 88.8% of days, with an average daily intake of 0.91 cups. The intervention resulted in lower total FAQ scores compared to control periods for all participants (p=0.011) and overall acceptability in the delayed group was positively associated with reported adherence days (p=0.001). Adherence and acceptability were both higher in the delayed intervention group.

RESULTS

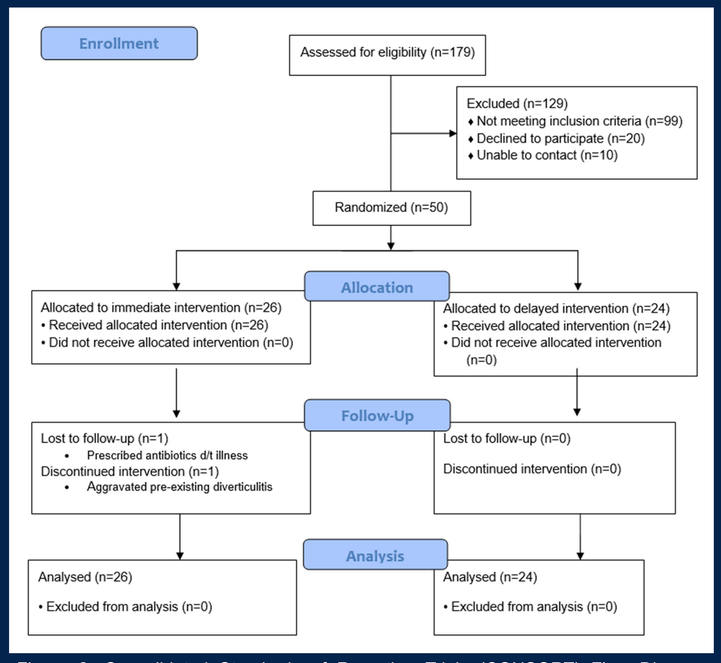

Figure 2. Consolidated Standards of Reporting Trials (CONSORT) Flow Diagram detailing participant enrollment, intervention allocation, follow-up, and data analysis.

Table 1. Baseline characteristics of participants	Total (n=50)	Immediate (n=26)	Delayed (n=24)	
	-------- mean (sd) --------			p
Red meat servings per week	10.39 (5.03)	10.5 (4.8)	10.2 (5.4)	0.846
Green leafy vegetables servings per week	0.21 (0.25)	0.20 (0.26)	0.22 (0.23)	0.852
Age (years)	48 (13.1)	47 (13)	49(13)	0.625
Body Mass Index calculated from self report	35.9 (5.1)	34.4 (3.9)	37.6 (5.7)	0.028
	-------- N (%) --------			p
Gender				1.000
Male	19 (38)	10 (39)	9 (38)	
Female	31 (62)	16 (61)	15 (62)	
Race				0.035
African-American	10 (20)	2 (8)	8 (33)	
White	40 (80)	24 (92)	16 (67)	
Education				0.332
Less than high school graduate	1 (2)	0 (0)	1 (4)	
High school graduate	4 (8)	0 (0)	4 (17)	
Some College/Technical	2 (4)	1 (4)	1 (4)	
Associate degree	19 (38)	11 (42)	8 (33)	
Bachelor's degree	13 (26)	7 (27)	6 (25)	
Professional degree	1 (2)	1 (4)	0 (0)	
Doctorate	10 (20)	6 (23)	4 (17)	
Marital Status				0.498
Single	12 (24)	6 (23)	6 (25)	
Married	29 (58)	16 (62)	13 (54)	
Widowed	2 (4)	0 (0)	2 (8)	
Separated	7 (14)	4 (15)	3 (13)	

RESULTS

Table 2. Responses to Food Acceptability Questionnaire by Intervention Group	Immediate				Delayed			
	Intervention Period	Control Period	Change from Control		Intervention Period	Control Period	Change from Control	
	-------- mean (sd) --------			p	-------- mean (sd) --------			p
Q1	5.08 (1.35)	6.00 (1.09)	-0.83 (1.03)	0.001	5.17 (1.49)	5.42 (1.21)	-0.25 (1.917)	0.529
Q2	5.04 (1.46)	5.88 (1.33)	-0.87 (1.325)	0.005	5.04 (1.73)	5.46 (1.22)	-0.42 (2.145)	0.351
Q3	4.5 (1.41)	5.42 (1.50)	-0.92 (1.53)	0.007	4.42 (1.53)	5.21 (1.25)	-0.79 (1.817)	0.044
Q4	4.58 (1.72)	5.08 (1.69)	-0.50 (1.956)	0.223	4.25 (1.62)	4.71 (1.68)	-0.46 (2.536)	0.385
Q5	6.04 (1.2)	5.71 (1.23)	0.33 (1.129)	0.162	5 (1.67)	5.29 (1.16)	-0.29 (2.095)	0.502
Q6	6.42 (1.21)	6.25 (1.03)	0.17 (1.239)	0.517	6.3 (0.97)	5.63 (1.21)	0.65 (0.982)	0.004
Q7	4.46 (1.82)	5.04 (1.68)	-0.58 (1.932)	0.153	3.38 (1.5)	4.92 (1.72)	-1.54 (2.322)	0.004
Q8	4.71 (1.4)	5.21 (1.25)	-0.50 (1.414)	0.097	4.13 (1.51)	5.25 (1.48)	-1.13 (2.252)	0.022
Q9	5.71 (1.12)	6.13 (0.61)	-0.42 (1.1)	0.076	5.5 (0.89)	5.46 (1.18)	0.04 (1.517)	0.894
Q10	5.46 (1.25)	6.00 (0.93)	-0.54 (1.25)	0.045	5.25 (1.33)	5.17 (1.13)	0.08 (2.083)	0.846
Total	51.79 (8.72)	56.46 (8.40)	-4.67 (7.545)	0.006	48.17 (9.18)	52.50 (9.73)	-4.33 (15.024)	0.171

Table 3. Food Acceptibility Questionnaire	
Q1	How well do you like these foods?
Q2	How well do you like the taste of these foods?
Q3	How appealing or unappealing do you find the appearance of these foods?
Q4	How boring are these foods?
Q5	How easy or difficult has it been for you to prepare these food?
Q6	How easy or difficult has it been for you to purchase these foods?
Q7	How easy or difficult has it been for you to maintain your current diet at restaurants?
Q8	How much effort does it take for you to stay on this diet?
Q9	How satisfied or dissatisfied do you feel after eating a meal on this diet?
Q10	Overall, how satisfied or dissatisfied are you with this diet?

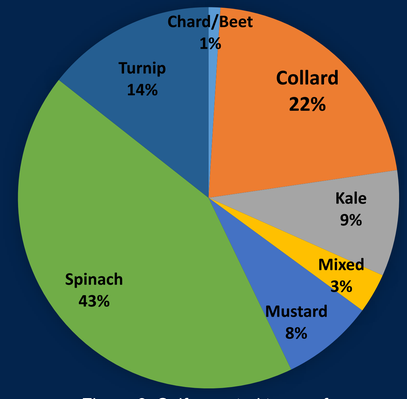

Figure 3. Self-reported types of greens consumed during intervention period, by frequency.

CONCLUSION

This 12-week crossover RCT aimed to increase GLV consumption, though the primary adherence target of 1 cup GLV per day was not achieved. However, average daily consumption was acceptable. Spinach was the preferred green, possibly due to minimal flavor and texture. Acceptability varied between groups. Adherence and acceptability were both higher in the delayed intervention group which may moderate secondary aims related to inflammatory markers and oxidative DNA damage.

Future Directions: Biological specimens are being analyzed to determine if secondary aims were achieved. We will submit an NIH R15 application in June 2019 which will be comprised of two semi-controlled feeding studies, in order to investigate quantity and frequency of GLV necessary for reducing deleterious effects of RM.

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.