# Nutrition Intervention to Impact Metabolic, Microbiome and Vascular Health in Young Adults at Risk for Disease: FRUVEDomic Pilot Study


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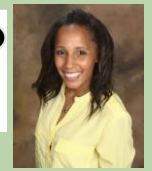


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## Public Health Relevance

Although the obesity epidemic continues to remain a problem, the metabolic syndrome (metS) affects more than 20% of U.S. adults, where it has been reported that at least 27% of college students have one component of metS. However, links between certain biomarkers of poor metabolic health have not been strongly explored which presents an urgent need to better understand as individualized medical treatment is becoming highly popular.

## Our Multidisciplinary Approach

Due to the increased popularity and necessity of exploratory, translation work, scientists from various disciplines (nutrition, metabolomics, microbiome, cardiovascular, microcirculation and physiology) worked together to implement this pilot study. As a result of this emerging science and inclusion of more multidisciplinary work, nutrition research has shifted.

**Epidemiology/Physiology** (Population recommendations) → **Molecular** (Individual Counseling)

## Objective

To design and implement a free-living, nutrition intervention, using nutrition education, culinary toolkit distribution and one-on-one counseling, to impact metabolomics, cardiovascular, and microbiome health in "at risk" young adults (18-28 years) for metS.

## Methods

**Recruitment/Randomization**

Thirty-seven young adults "at risk" for metS were recruited. All undergraduate and graduate students were invited to participate via two MIX announcements, resulting in over 200 responses. Subjects were randomized into one of 3 groups (n=12/group; 9):

1. "Fruved" diet (50% Fruit and Vegetable)
2. "Fruved+LowCHO" diet (Low Refined Carbohydrate)
3. "Fruved+LowFat" diet (Low Fat)


**Education**

Group nutrition education topics delivered before intervention:

- Nutrition 101
- Budget/Grocery Shopping Tips
- Healthy Eating Out
- Food Label Reading
- Culinary Toolkit Distribution

**Measurements**

Anthropometrics, body composition, venous blood samples, stool samples, arterial stiffness and a ~300 question lifestyle, behaviors survey were collected at baseline and post intervention. Venous blood samples were collected additionally at weeks 2 and 5 of the intervention, resulting in a total 4 repeated blood samples for metabolomic assessment.

**Intervention**

Participants underwent individual weekly consultations with the Registered Dietitian Nutritionist, using food logs, food pictures and receipt management to assess adherence and cost of the intervention.

## Results

**Table 1: Demographics**

| Variable | Frequency (n=36) | Percent |
|---|---|---|
| ***Race*** | | |
| White | 23 | 63.9 |
| African American | 4 | 11.1 |
| Hispanic | 4 | 11.1 |
| Asian | 4 | 11.1 |
| Indian/Native American | 1 | 2.8 |
| ***Appalachian Origin*** | | |
| Appalachian | 17 | 47.2 |
| Not Appalachian | 19 | 52.8 |
| ***metS Risk Category*** | | |
| High | 13 | 36.1 |
| Medium/High | 13 | 36.1 |
| Medium | 8 | 22.2 |
| Low | 2 | 5.6 |
| ***Actual metS Breakdown*** | | |
| 3 criteria | 1 | 2.8 |
| 2 criteria | 3 | 8.3 |
| 1 criteria | 11 | 30.6 |
| 0 criteria | 21 | 58.3 |
| ***Sex*** | | |
| Female | 21 | 58.3 |
| Male | 15 | 41.7 |
| ***BMI Category*** | | |
| Underweight | 0 | 0 |
| Healthy | 16 | 44.4 |
| Overweight | 14 | 38.9 |
| Obese | 5 | 13.9 |
| Morbid Obese | 1 | 2.8 |

**Table 2: Participant Blood Chemistry and Anthropometrics**

| Variable | Baseline Mean (SD) | Post Mean (SD) |
|---|---|---|
| ***BMI*** | | |
| Males (n=15) | 27.4 (4.3) | 27.2 (4.7) |
| Females (n=21) | 26.7 (7.0) | 26.5 (7.1) |
| ***Waist (cm)*** | | |
| Males | 91.5 (10.7) | 88.4 (10.4)* |
| Females | 79.2 (12.6) | 77.2 (12.2)* |
| ***Blood Pressure*** | | |
| Males | 124.1/60.1 (15.7/9.4) | 115.1*/58.9 (8.9/7.2) |
| Females | 113.3/64.1 (14.7/10.5) | 108.9/62.9 (9.4/7.5) |
| ***Body Fat %*** | | |
| Males | 25.2 (17.2) | 20.9 (8.9) |
| Females | 33.0 (10.1) | 32.6 (10.1) |
| ***Glucose (mg/dL)*** | | |
| Males | 89.6 (6.3) | 90.3 (8.2) |
| Females | 85.4 (8.2) | 85.2 (9.0) |
| ***Triglycerides (mg/dL)*** | | |
| Males | 92.7 (34.8) | 87.2 (47.9) |
| Females | 92.4 (32.1) | 96.6 (34.8) |
| ***Total Cholesterol (mg/dL)*** | | |
| Males | 185.1 (27.9) | 169.7 (30.5)* |
| Females | 173.0 (26.8) | 175.7 (25.3) |
| ***LDL Cholesterol (mg/dL)*** | | |
| Males | 115.4 (19.6) | 107.5 (23.2) |
| Females | 95.0 (19.5) | 99.7 (22.0) |
| ***HDL Cholesterol (mg/dL)*** | | |
| Males | 51.1 (12.7) | 44.7 (8.8)* |
| Females | 59.6 (13.0) | 56.5 (12.7) |
| ***C Reactive Protein (mg/dL)*** | | |
| Males | 0.2 (0.1) | 1.9 (3.1)* |
| Females | 0.5 (0.6) | 1.7 (4.0) |
| *p<0.05 | | |

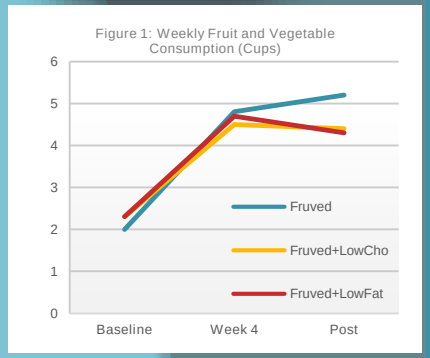


Figure 2: Macronutrient Distribution: Low-Fat Intervention

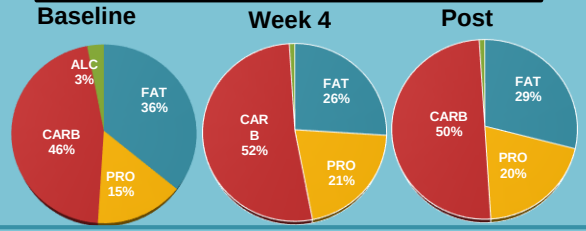


**Table 3: Average Fiber, Sugar & Empty Calorie Consumption: Low Refined CHO Intervention**

| Variable | Baseline | Week 4 | Post |
|---|---|---|---|
| Empty Calories | 1065 | 313 | 316 |
| Fiber (g) | 17 | 24 | 27 |

## Impact and Reach

The connection between nutrition and health has long been recognized, but precisely how nutrients interact with human physiology to elicit health or disease is in its infancy. With this new era of -omics (i.e genomics, metabolomics, and nutrigenomics), it allows us to measure thousands of biological events and pose questions on the relationship between diet and health at the fundamental level.

By identifying markers among those "at risk" of metS and other co-morbidities will help quantify disease risk and generate **"personalized nutrition"** prescription.

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