Nutrition and MPNs
Inflammatory cytokines correlate with symptom burden and a worse prognosis

Adapted from Craver et al, 2018
Challenges of treatment in MPN

- Impact of physical symptoms is under-recognized
- Most therapies focus on blood counts
- Treated with “watch and wait” management
- All patients undergo antiplatelet therapy (thrombosis)
- FDA approved drugs for MF: JAK inhibitors

Definite cure: bone marrow transplant

Significant Risks of Transplant
• Symptom burden has a major impact on the quality of life of MPN patients
• Need to focus on identifying therapies for managing symptoms
• In addition to preventing disease progression
Anti-inflammatory diet: Mediterranean Diet

• The Mediterranean diet has proven to be beneficial in metabolic diseases, which are characterized by chronic subclinical inflammation.

• Among persons at high cardiovascular risk, a Mediterranean diet supplemented with EVOO or nuts reduced the incidence of major cardiovascular events, as well as hsCRP and IL-6 levels (P= 0.005).
Properties of the Mediterranean Diet

- Fiber
- Resveratrol
- Mono-unsaturated fatty acids

Hypothesis

Following a Mediterranean dietary pattern might reduce inflammatory cytokines in MPN patients thus relieving their symptom burden and may also blunt disease trajectory.
Study Design

Dietary Intervention

Follow-up

Enrollment

n = 28

• Blood draw
• Stool sample
• Urine sample
• Dietician visit / call

Med. diet

n = 15

USDA

n = 13

Avocados are naturally FULL of
nutrition, so there’s no need for special
labels. They’re full of flavor, think of all
the meals you can healthify with
avocado!

HEALTH TIP
Avocados are one of the pale
fruits that contain heart
healthy monounsaturated fat
(“good for you” fat) that
helps boost your HDL.
cholesterol post eating bad
(LDL) cholesterol.

Tips for saving leftover avocado

Fact

To store unused 1/2 of avocado, wrap
firmly with plastic wrap and place in
refrigerator.

1. Peel the skin off and get the pit as
close to the surface of the fruit as
possible.

2. If browning occurs, gently scrape the
exposed flesh with a butter knife.

Recipe:

Avocado Toast with Lemon and Kale

You will need:

• 1 cup shredded kale (no stems)
• 1/2 lemon
• 1 teaspoon olive oil
• 4 slices multigrain bread, 4 oz total
• kaiser roll and black pepper
• 4 ounces avocado (1 small half)
• 2/8 teaspoon canola
• 4 thin slices radish
• 1 teaspoon chia seeds

Directions:

1. In a bowl combine the kale, olive oil, juice of 1/4 lemon and 1/8 teaspoon salt.
2. Mash with your hands for about 1 minute, until the kale softens.
3. Slice the avocado half, reserving 1/2 of one avocado for this slice. Scoop the rest into a small bowl and mash gently with a fork. Season with 1/2 to 1 teaspoon salt, black pepper and juice from 1/4 of a lemon.
4. Toast the slices of whole wheat bread.
5. Spread the avocado mash across the toasted bread; top with slices and sprinkle with canna, salt and pepper (more lemon juice if desired).
6. Top each with the remaining kale, radish and chia, finish with pinch salt and black pepper to taste.

Anti-aging tool for your skin!

The food pyramid is a great guide to good nutrition. So if you’re not sure your eating the fruits and vegetables that you need, take a glance at all the bright strips of the food pyramid – they’ll help keep you on track to make sure you’re achieving your nutrition goals.

Sparingly

Fats, oils, sweets

2-3 servings daily

Milk, yogurt, cheese

Meat, poultry, fish, dry beans, eggs, nuts

Sparingly

Fruit

2-4 servings daily

Vegetables

3-5 servings daily

Foods

2 servings daily

Grains

6-11 servings daily

Breads, cereal, rice, pasta

Fact #1

• Grain group: choose at least 1/2 that are whole grain
• Vegetable groups include green and orange
• Fruit group: choose a variety of fruits of different colors
• Milk group: choose 1/2 to 1 cup of cheese (low-fat or fat-free)
• Meat and beans group: lean meats, chicken, eggs, nuts, and fish
• Choose fiber-rich and polyunsaturated oils
• Discretionary calories: in amount of 300 to 300 calories can be used on foods with fat or sugar like desserts

FOOD PYRAMID: Portion Size

• One ounce equivalent or served grains: one-half cup cooked pasta, rice or cereal; one bread slice or a 1-oz serving of cereal
• One serving of vegetables: one-half cup cooked vegetable, one-half cup cooked vegetables, or one cup of fresh vegetables (such as spinach or salad)
• One serving of fruits: one-half cup fruit juice, one piece of medium-sized fruit, one apple, one banana, or one orange
• One serving of milk: one-half cup milk, one cup cooked milk, or one-quarter cup milk
• One serving equivalent of milk: one cup yogurt or milk, 1-2 ounces low-fat or fat-free natural cheese, or 2 ounces process or packaged cheese
• One ounce equivalent of meat or beans: one-quarter cup cooked canned beans or one-half cup cooked lean meat or one-half cup cooked vegetable or one tablespoon peanut butter or one meat loaf
• One serving of oils: one tablespoon vegetable oil or one tablespoon low-fat mayo, or two tablespoons light salad dressing

Fact #1

Following the Food Pyramid

UCI
<table>
<thead>
<tr>
<th>Questions</th>
<th>Criteria for 1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you use olive oil as main culinary fat?</td>
<td>Yes</td>
</tr>
<tr>
<td>2. How much olive oil do you consume in a given day (including oil used for frying, salads, out-of-house meals, etc.)?</td>
<td>≥4 tbsp</td>
</tr>
<tr>
<td>3. How many vegetable servings do you consume per day? (1 serving: 200 g [consider side dishes as half a serving])</td>
<td>≥2 (≥1 portion raw or as a salad)</td>
</tr>
<tr>
<td>4. How many fruit units (including natural fruit juices) do you consume per day?</td>
<td>≥3</td>
</tr>
<tr>
<td>5. How many servings of red meat, hamburger, or meat products (ham, sausage, etc.) do you consume per day? (1 serving: 100–150 g)</td>
<td>&lt;1</td>
</tr>
<tr>
<td>6. How many servings of butter, margarine, or cream do you consume per day? (1 serving: 12 g)</td>
<td>&lt;1</td>
</tr>
<tr>
<td>7. How many sweet or carbonated beverages do you drink per day?</td>
<td>&lt;1</td>
</tr>
<tr>
<td>8. How much wine do you drink per week?</td>
<td>≥7 glasses</td>
</tr>
<tr>
<td>9. How many servings of legumes do you consume per week? (1 serving: 150 g)</td>
<td>≥3</td>
</tr>
<tr>
<td>10. How many servings of fish or shellfish do you consume per week? (1 serving 100–150 g of fish or 4–5 units or 200 g of shellfish)</td>
<td>≥3</td>
</tr>
<tr>
<td>11. How many times per week do you consume commercial sweets or pastries (not homemade), such as cakes, cookies, biscuits, or custard?</td>
<td>&lt;3</td>
</tr>
<tr>
<td>12. How many servings of nuts (including peanuts) do you consume per week? (1 serving 30 g)</td>
<td>≥3</td>
</tr>
<tr>
<td>13. Do you preferentially consume chicken, turkey, or rabbit meat instead of veal, pork, hamburger, or sausage?</td>
<td>Yes</td>
</tr>
<tr>
<td>14. How many times per week do you consume vegetables, pasta, rice, or other dishes seasoned with sofrito (sausage made with tomato and onion, leek, or garlic and simmered with olive oil)?</td>
<td>≥2</td>
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doi:10.1371/journal.pone.0043134.t001
Adherence among MPN patients to a Mediterranean dietary pattern

Mediterranean adherence score increased over time in both cohorts
Reduction in symptom burden by adhering to a Mediterranean Diet

Comparing to COMFORT-I study: ruxolitinib decrease MPN-SAF by $\geq 50\%$ in 46.1% and placebo decreased MPN-SAF by $\geq 50\%$ in 5.3%
Specific Mediterranean Diet components

- **ASA24®** (24-hour food recall) nutrition profile

- Reports:
  - Daily calories
  - Daily food group targets
  - Nutrients
  - Saturated fat
  - Added sugars
  - Alcohol
  - Sodium

<table>
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<tr>
<th>Nutrients</th>
<th>Target</th>
<th>Actual Eaten</th>
<th>Status</th>
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<tbody>
<tr>
<td>Calcium (mg)</td>
<td>1290</td>
<td>372</td>
<td>Under</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>130</td>
<td>191</td>
<td>OK</td>
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<tr>
<td>Cholesterol (mg)</td>
<td>No Daily Target</td>
<td>0</td>
<td>OK</td>
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<tr>
<td>Choline (mg)</td>
<td>425</td>
<td>156</td>
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<tr>
<td>Copper (mg)</td>
<td>0.9</td>
<td>1.9</td>
<td>OK</td>
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<tr>
<td>Folate (µg DFE)</td>
<td>400</td>
<td>518</td>
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<tr>
<td>Iron (mg)</td>
<td>8</td>
<td>10</td>
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<tr>
<td>Linoleic Acid (g)</td>
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<tr>
<td>Magnesium (mg)</td>
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<tr>
<td>Niacin (mg)</td>
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<td>13</td>
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<td>Phosphorus (mg)</td>
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<td>707</td>
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<tr>
<td>Potassium (mg)</td>
<td>4700</td>
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<tr>
<td>Protein (g)</td>
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<td>Riboflavin (mg)</td>
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<tr>
<td>Saturated Fat (g kcal)</td>
<td>No Daily Target</td>
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<tr>
<td>Selenium (µg)</td>
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<tr>
<td>Sodium (mg)</td>
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<tr>
<td>Thiamin (mg)</td>
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<td>Under</td>
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<tr>
<td>Total Fat (g kcal)</td>
<td>20</td>
<td>41</td>
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<tr>
<td>Total Fiber (g)</td>
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<td>37</td>
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<tr>
<td>Vitamin A (µg RAE)</td>
<td>700</td>
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<tr>
<td>Vitamin B12 (µg)</td>
<td>2.4</td>
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<td>Under</td>
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<tr>
<td>Vitamin B6 (mg)</td>
<td>1.5</td>
<td>1.9</td>
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<tr>
<td>Vitamin C (mg)</td>
<td>75</td>
<td>167</td>
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<tr>
<td>Vitamin D (µg)</td>
<td>15</td>
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<tr>
<td>Vitamin E (mg AT)</td>
<td>15</td>
<td>12</td>
<td>Under</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>90</td>
<td>309</td>
<td>OK</td>
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<tr>
<td>Zinc (mg)</td>
<td>8</td>
<td>6</td>
<td>Under</td>
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Fiber intake during weeks 3-12 med/usda next to each other

Recommended:

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<thead>
<tr>
<th></th>
<th>Age 50 or younger</th>
<th>Age 51 or older</th>
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<tbody>
<tr>
<td>Men</td>
<td>38 grams</td>
<td>30 grams</td>
</tr>
<tr>
<td>Women</td>
<td>25 grams</td>
<td>21 grams</td>
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Daily intake

Recommended:
Microbiome: fairly unexplored field in MPN

Interested in how the Mediterranean diet might influence the microbiome of MPN patients

Adapted from Wang and Roy 2017
Methods

RNA/DNA shield fecal collection tubes

Weeks: 1, 3, 6, 15

Established collaboration with Whiteson Lab

Changing the intestinal microbiota through an anti-inflammatory diet (Med diet) might increase the overall bacterial diversity in the MPN gut microbiome
Microbiome profile of patients on study
Work in Progress

- Measurement of inflammatory biomarkers
- Microbiome analysis
- Testing the role of different diets in animal MPN models
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