

Lauryn Woodruff,
Michelle Snow,
Daniele G. Kuhn

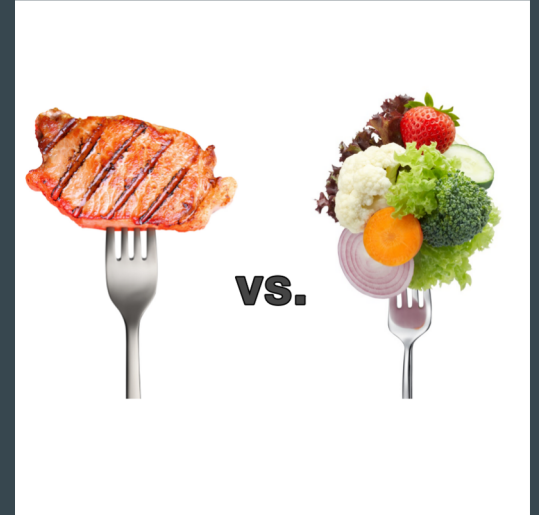
Diet Quality, Immunity, and Body Composition Among UMD Vegetarian and Non- Vegetarian Students

Study Rationale

- A vegetarian diet can be advantageous
- College students are at risk for initiating over-restrictive vegetarian and other diets (influence from marketing, social media “influencers”, etc.)
- Students may pursue vegetarianism for reasons such as weight loss, environmental activism or animal protection
- Educating young adults about how to properly execute a healthful, balanced vegetarian diet may be necessary to avoid the development of disordered eating patterns and nutritional deficiencies
- *Knowing the benefits of a balanced vegetarian diet stimulated the question of whether vegetarian college students get sick less often and are healthier than non-vegetarian college students.*

Research Question/Hypothesis

This study aimed to evaluate the health and immune status of University of Maryland *vegetarian VS non-vegetarian students* by surveying frequency of illness over the past year as well as body composition and vegetable/fruit intake in order to determine *which groups* had **better immune function and overall health.**



Study Justification

- Studies are conducted on the overall health benefits of vegetarian diets
- Studies on Pediatric diets and immunoglobulins were found but not for adults
- Few studies were found of the relationship between a vegetarian diet and frequency of illness (cold/flu) in the college age population
- We chose to analyze diet quality by vegetable and fruit intake in order to gauge the presence of antioxidants and Vitamin-C containing foods that fight illness and can improve health of both vegetarians and non-vegetarians.

Clin Pediatr (Phila). 2013 Mar;52(3):241-6. doi: 10.1177/0009922812472250. Epub 2013 Jan 24.

Impact of vegetarian diet on serum immunoglobulin levels in children.

Gorczyca D¹, Prescha A, Szeremeta K.

Author information

1 3rd Department and Clinic of Paediatrics, Immunology and Rheumatology of Developmental Age, Wrocław Medical University, 51-149 Wrocław, Poland. daiva.gorczyca@a.m.wroc.pl

Abstract

BACKGROUND: Nutrition plays an important role in immune response. We evaluated the effect of nutrient intake on serum immunoglobulin levels in vegetarian and omnivore children.

METHODS: Serum immunoglobulin levels and iron status were estimated in 22 vegetarian and 18 omnivore children. Seven-day food records were used to assess the diet.

RESULTS: There were no significant differences in serum IgA, IgM, and IgG levels between groups of children. Serum immunoglobulin levels were lower in vegetarian children with iron deficiency in comparison with those without iron deficiency. In the vegetarians, IgG level correlated positively with energy, zinc, copper, and vitamin B(6) intake. In the omnivores, these correlations were stronger with IgM level.

CONCLUSIONS: Despite negligible differences in serum immunoglobulin levels between vegetarian and omnivore children, the impact of several nutrient intakes on IgM and IgG levels differed between groups. Low iron status in vegetarian children can lead to decreased immunoglobulin levels.

Participants

- University of Maryland College Park Students
- 18-29 years of age
- N= 15 (1 was excluded as outlier)
 - 10 females
 - 5 males
- Vegetarian/Vegan and Non-vegetarian
 - 9 vegetarian/ vegan
 - 7 females/2 males
 - 6 non-vegetarians
 - 3 females/3 males
- Excluded smokers, parents, and immunocompromised students



Recruiting Materials Used

**WIN A GIFT CARD
TO TARGET**

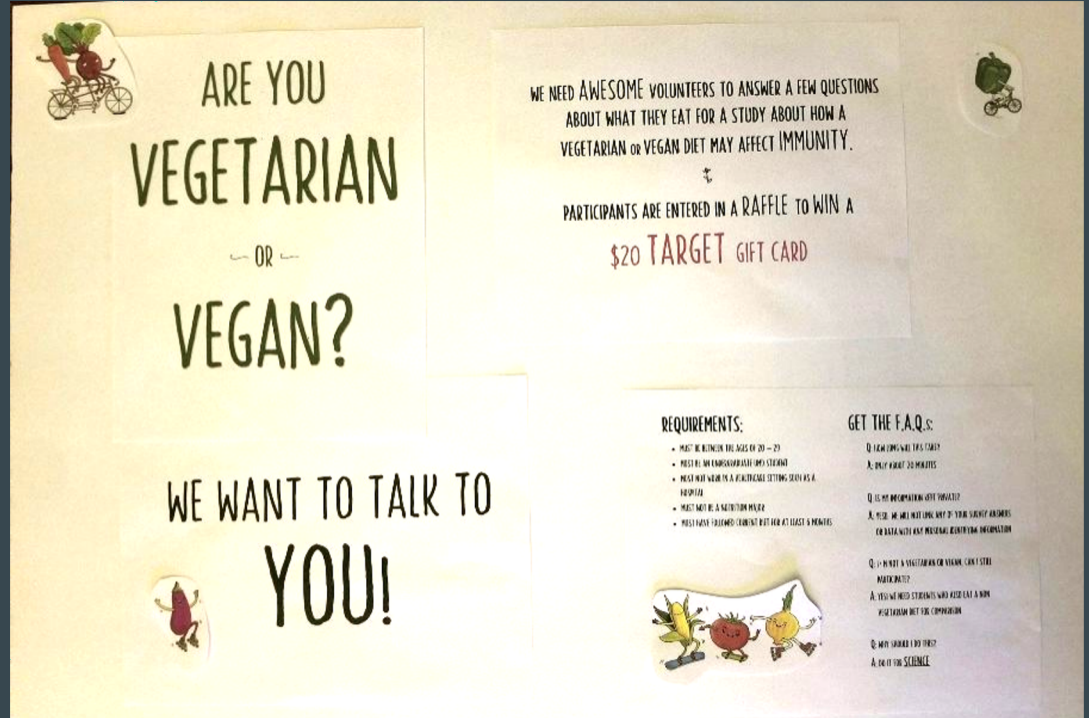


Do you want to win a gift card to Target?!

Participate in a quick nutrition study. Come to McKelidn today from 11:00am-1:00pm.

McKelidn study room 2100A

We are looking for vegetarians and non-vegetarians.



**ARE YOU
VEGETARIAN
— OR —
VEGAN?**

**WE WANT TO TALK TO
YOU!**

WE NEED AWESOME VOLUNTEERS TO ANSWER A FEW QUESTIONS ABOUT WHAT THEY EAT FOR A STUDY ABOUT HOW A VEGETARIAN OR VEGAN DIET MAY AFFECT IMMUNITY.

PARTICIPANTS ARE ENTERED IN A RAFFLE TO WIN A \$20 TARGET GIFT CARD

REQUIREMENTS:

- MUST BE BETWEEN THE AGES OF 20 – 29
- MUST BE AN EMERGENCY CONTACT STUDENT
- MUST NOT BE IN A PHYSICAL SETTING SUCH AS A HOSPITAL
- MUST NOT BE A NUTRITION MAJOR
- MUST HAVE FOLLOWED SOMEONE'S DIET FOR AT LEAST 3 WEEKS

GET THE F.A.Q.s:

Q: HOW LONG WILL THIS TAKE?
A: ONLY ABOUT 20 MINUTES

Q: IS MY INFORMATION SAFE?
A: YES, WE WILL NOT GIVE ANY OF YOUR SAFETY ANSWERS FOR DATA WITH ANY MEDICAL IDENTIFYING INFORMATION

Q: I'M NOT A VEGETARIAN OR VEGAN, CAN I STILL PARTICIPATE?
A: YES, WE NEED STUDENTS WHO KNEW HOW A NON-VEGETARIAN DIET FOR COMPARISON

Q: WHY SHOULD I DO THIS?
A: FOR THE SCIENCE

Methods

1. Students were recruited on a Friday afternoon at/around McKeldin Library
2. Students brought to “study room” & filled out consent form
3. NCI (NIH) by Meal Fruit & Vegetable Screener
4. Participant surveys & consent form marked with a number for confidentiality
5. Participants were given a quick explanation of the Tanita scale and asked to remove: shoes, socks, metal, and electronic watches.
6. Tanita scale measurements taken:
 - a. Height
 - b. Weight
 - c. Body fat %
7. Data input into Excel spreadsheet
8. A \$20 Target gift card raffle was used to generate interest



Consent Form

University of Maryland College Park

Page 1 of

Initials _____ Date _____

Project Title	Diet Quality, Immunity, and Body Composition Among UMD Vegetarian and Non-Vegetarian Students
Purpose of the Study	<i>This research is being conducted by Michelle Snow, Lauryn Woodruff, and Daniele Kuhn at the University of Maryland, College Park. We are inviting you to participate in this research project because you are a male or female, aged 20 to 28 years and are either a vegetarian or omnivore. The purpose of this research project is to assess and compare the usual fruit and vegetable intakes of vegetarian and non-vegetarian students at the University of Maryland. This data will be compared to average overall rates of self-reported illnesses to measure immunity.</i>
Procedures	<i>The procedures involve filling out an Immunity Questionnaire, Diet Questionnaire, and this consent form. We will also measure your body composition using the Tanita Scale.</i>
Potential Risks and Discomforts	<i>There are no risks from participating in this research study.</i>
Potential Benefits	<i>There are no direct benefits to participants. However, possible benefits include helping students think of the correlation between diet and immunity, as well as potentially making them aware of the types of diets there are.</i>
Confidentiality	<i>The surveys are anonymous and will not contain information that may personally identify you.</i> <i>If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law.</i>
Medical Treatment	<i>The University of Maryland does not provide any medical, hospitalization or other insurance for participants in this research study, nor will the University of Maryland provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.</i>
Right to Withdraw and Questions	<i>Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.</i> <i>If you are an employee or student, your employment status or academic standing at UMD will not be affected by your participation or non-participation in this study.</i>

University of Maryland College Park

Page 2 of

Initials _____ Date _____

	<i>If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact one of the investigators:</i> Michelle Snow 0112 Skinner Building University of Maryland College Park, MD 20742 757-705-6905 micheleimsnow@gmail.com Lauryn Woodruff 818-723-4711 lcwoodruff1001@gmail.com Daniele Grandmaison Kuhn 301-312-5305 dantelekuhn@gmail.com
Participant Rights	<i>If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:</i> University of Maryland College Park Institutional Review Board Office 1204 Marie Mount Hall College Park, Maryland, 20742 E-mail: irb@umd.edu Telephone: 301-405-0678 <i>This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</i>
Statement of Consent	<i>Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.</i>
Signature and Date	<i>If you agree to participate, please sign your name below.</i> NAME OF SUBJECT [Please Print] SIGNATURE OF SUBJECT DATE

Immunity Questionnaire

Immunity Status Questionnaire

Screening Questions	
The following questions will be used to determine if the data you provide today can be included in our study. Please answer the questions honestly and to the best of your ability. All data provided is collected and stored anonymously.	
1	Are you an undergraduate student currently attending the University of Maryland (College Park)?
2	What is your age?
3	What gender do you identify as?
4	Are you currently following a vegetarian or vegan diet? (If no, skip to question 7)
5	If you answered yes to the above question, please check the type of diet that most closely applies to you.
6	How long have you been following this diet? (Skip this question if you checked no to question 4)
7	Do you smoke?

8	Do you currently work or volunteer in a hospital, clinic, or school environment?	Yes <input type="checkbox"/> No <input type="checkbox"/>
9	Do you take immune suppressing drugs?	Yes <input type="checkbox"/> No <input type="checkbox"/>
10	Are you a nutrition studies major (Example: Dietetics, Food Science, etc)	Yes <input type="checkbox"/> No <input type="checkbox"/>
11	Are you a parent of school-aged children?	Yes <input type="checkbox"/> No <input type="checkbox"/>
Health Status		
Please answer the following questions to the best of your memory and knowledge.		
12	Over the past year, how many times have you been sick with a respiratory infection, common cold or the flu, with any of the following symptoms not related to seasonal allergies: <ul style="list-style-type: none"> • Congestion • Fever • Sore throat • Cough 	_____
13	Over the past year, how many times has a sickness (as defined in the previous question) resulted in taking over the counter cold or flu medications?	_____
14	Over the past year, how many times has a sickness (as defined in the previous question) resulted in a visit to an urgent care center, hospital, or a primary care doctor?	_____
	Have you ever been diagnosed with sepsis?	Yes <input type="checkbox"/> No <input type="checkbox"/>
	Did you take the flu shot over the past year?	Yes <input type="checkbox"/> No <input type="checkbox"/>

Immunity Status Questionnaire

We developed a survey to gather information about frequency of illness, gender, age, and type of diet consumed.

Flaws

- We did not formulate questions clearly enough
- We wanted to exclude participants who worked with young children so we included a question asking if they worked in a “hospital, clinic, or school environment”. Later we realized that they were checking yes because they worked at UMD
- Not validated
- Relied heavily on subjective memory

National Cancer Institute - Eating at America's Table Quick Food Scan

OMB# 0925-0450 EXP. DATE: 07/31/2000

NATIONAL INSTITUTES OF HEALTH EATING AT AMERICA'S TABLE STUDY QUICK FOOD SCAN



- The person who completed the telephone interviews for the Eating at America's Table Study should fill out this questionnaire.
- Use only a No. 2 pencil.
- Be certain to completely blacken in each of the answers, and erase completely if you make any changes.
- Do not make any stray marks on this form.
- When you complete this questionnaire, please return it in the postage-paid envelope to:

National Cancer Institute
EPN, Room 313
6130 Executive Blvd., MSC 7344
Bethesda, MD 20892-7344

BAR
CODE
LABEL
HERE

NOTIFICATION TO RESPONDENT OF ESTIMATED BURDEN
Public reporting burden for this collection of information is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and reviewing the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: NIH, Project Clearance Office, 001, Rockledge Drive, MEC 7730, Bethesda, MD 20892-7730, ATTN: PRA (3025-0450). Do not return the completed form to this address.

PLEASE DO NOT WRITE IN THIS AREA



SERIAL

INSTRUCTIONS

- Think about what you usually ate last month.
- Please think about **all** the fruits and vegetables that you ate **last month**. Include those that were:
 - raw and cooked,
 - eaten as snacks and at meals,
 - eaten at home and away from home (restaurants, friends, take-out), and
 - eaten alone and mixed with other foods.
- Report how many times per month, week, or day you ate each food, and if you ate it, how much you usually had.
- If you mark "Never" for a question, follow the "Go to" instruction.
- Choose the best answer for each question. Mark only one response for each question.

1. Over the last month, how many times per month, week, or day did you drink **100% fruit juice** such as orange, apple, grape, or grapefruit juice? **Do not count** fruit drinks like Kool-Aid, lemonade, Hi-C, cranberry juice drink, Tang, and Twister. Include juice you drank at all mealtimes and between meals.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never	1-3	1-2	3-4	5-6	1	2	3	4	5 or more
(Go to	times	times	times	times	time	times	times	times	times
Question 2)	last month	per week	per week	per week	per day	per day	per day	per day	per day

1a. Each time you drank **100% juice**, how much did you usually drink?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less than ¼ cup	¾ to 1 ¼ cup	1 ½ to 2 cups	More than 2 cups
(less than 6 ounces)	(6 to 10 ounces)	(10 to 16 ounces)	(more than 16 ounces)

2. Over the last month, how often did you eat **lettuce salad (with or without other vegetables)**?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Never	1-3	1-2	3-4	5-6	1	2	3	4
(Go to	times	times	times	times	time	times	times	times
Question 3)	last month	per week	per week	per week	per day	per day	per day	per day

2a. Each time you ate **lettuce salad**, how much did you usually eat?

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
About ½ cup	About 1 cup	About 2 cups	More than 2 cups

Fruit & Vegetable Food Frequency Questionnaire

We used the Fruit and Vegetable Screener from the National Cancer Institute (NCI).



Benefits of using this survey:

- Better at measuring usual intake
- Short - only 28 total questions asking frequency and serving sizes of fruits and vegetables
- Validated method
 - Used the newer “By-Meal” Screener which is slightly more accurate than All Day Screener
 - While underestimates true intake as compared to 24 hour recall, considered appropriate for evaluating groups

Flaws in our method:

- Serving sizes may be inaccurate because we did not provide reference serving cups for the participants
- Reliability of memory over past month
- Under and Over-reporting of intake
 - Subject #9 reported 22 servings of combined fruit/veg yet weighed <100 lbs and BMI was underweight
 - “Individual attitudes about body weight strongly influenced reported intake, even if asked to report usual food intake during the previous year” (Johansson, et al, 1998)
- Relies on memory over past month

Scoring the Screener

No tool easily available to score the screener

Developed a tool from scratch in Excel using drop down lists, formulas and macros

Daily servings of fruit and vegetable is automatically calculated

AutoSave FFO_Scoring_Final - Excel Michelle Snow

File	Home	Insert	Page Layout	Formulas	Data	Review	View	Developer	Help	Acrobat	Search	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
RESET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20											
1	Never	1-3	Never	1-2	1-3	1-3	1-2	3	1-2	3-4	Never	Never	1-3	Never	1																
1a	0	0.067	100% fruit juice			0.067	0.214	3	0.214	0.5	0	0	0.067	0	1																
Fruit	0	0.0335	1-2 times per week			0.0888	0.214	4.875	0.34775	0.5	0	0	0.067	0	1																
2	1-3	1-3	1	1	1	1-2	1-2	1-2	1	5-6	1-3	1-3	2	1-2	3-4																
2a	0.067	0.067	0.2	1 time per day		0.214	0.214	0.214	1	0.786	0.067	0.067	2	0.214	0.5																
Veg	0.0335	0.01675	0.1	2 times per day		0.107	0.107	0.107	1	0.1965	0.067	0.1005	1	0.107	0.25																
3	1-3	1-2	1-3	1-2	1-2	1-3	3-4	1-2	Never	1-3	1-2	1-3	1-3	Never	1-3																
3a	0.067	0.214	0.067	0.214	0.214	0.067	0.5	0.214	0	0.067	0.214	0.067	0.067	0	0.067																
4	0.0134	0.0428	0.0335	0.107	0.1605	0.0335	0.25	0.107	0	0.0134	0.107	0.0335	0.0134	0	0.0134																
4a	Never	Never	1-2	1-3	1-2	1-2	1-2	3	Never	1-3	1-2	1-2	1-2	1-3	1-3																
5	0	0	0.214	0.067	0.214	0.214	0.214	3	0	0.067	0.214	0.214	0.214	0.067	0.067																
5a	0	0	A	B	B	C	C	C	C	B	C	B	A	B	B																
Veg	0.0134	0.0428	0.0335	0.107	0.1605	0.0335	0.25	0.107	0	0.0134	0.107	0.0335	0.0134	0	0.0134																
6	0.75	.25	0	.75	0	1.25	1.25	1.25	1.25	.75	.75	.75	.75	.75	.75																
6a	every	Never	every	1-2	Never	1-2	3-4	1-2	3-4	5-6	1-2	3-4	3-4	3-4	every																
7	1	0	1	0.214	0	0.214	0.5	0.214	0.5	0.786	0.786	0.214	0.5	0.5	1																
7a	1	0	1	.5	0	.5	.5	.5	.5	1.5	1	.5	.5	.5	.5																
Fruit	1	0	1	0.107	0	0.107	0.25	0.107	0.25	1.179	0.786	0.107	0.25	0.25	0.5																
8	5-6	Never	1-3	Never	Never	1-3	1-2	3-4	3-4	1-3	1-2	1-3	Never	Never	1-2																
8a	0.786	0	0.067	0	0	0.067	0.214	0.5	0.5	0.067	0.214	0.067	0	0	0.214																
Veg	0.0134	0.0428	0.0335	0.107	0.1605	0.0335	0.25	0.107	0	0.0134	0.107	0.0335	0.0134	0	0.0134																

NCI Fruit & Veg Screener

Results

Mean Intakes

Vegetarians

6.39 cups

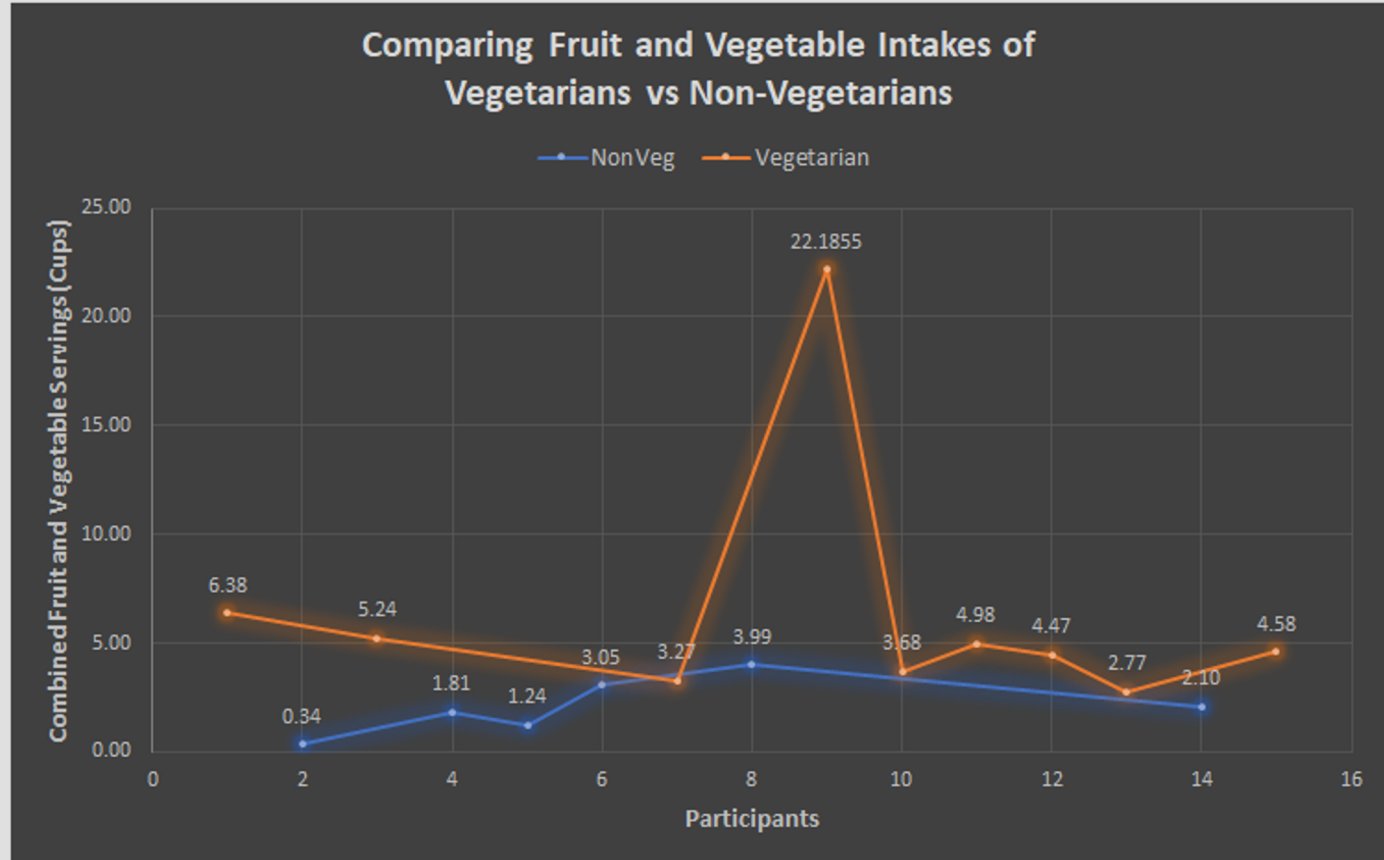
Veg (excluding outlier)

4.42 cups

Non vegetarians

2.09 cups

P-value of 0.006 →
Significant difference
in intake between
groups even after
excluding outlier



Immunity Results

Mean Frequencies of Illness

Vegetarian

1.94 times

Non-vegetarian

2.23 times

P-value of 0.678 →

No significant difference between groups



Anthropometric Results

Mean Weight

Mean Fat %

All

151.11 lb

Veg

138.38 lb 31%

Non-veg 181.20

Veg

28%

Mean BMI

Non-Veg

36%

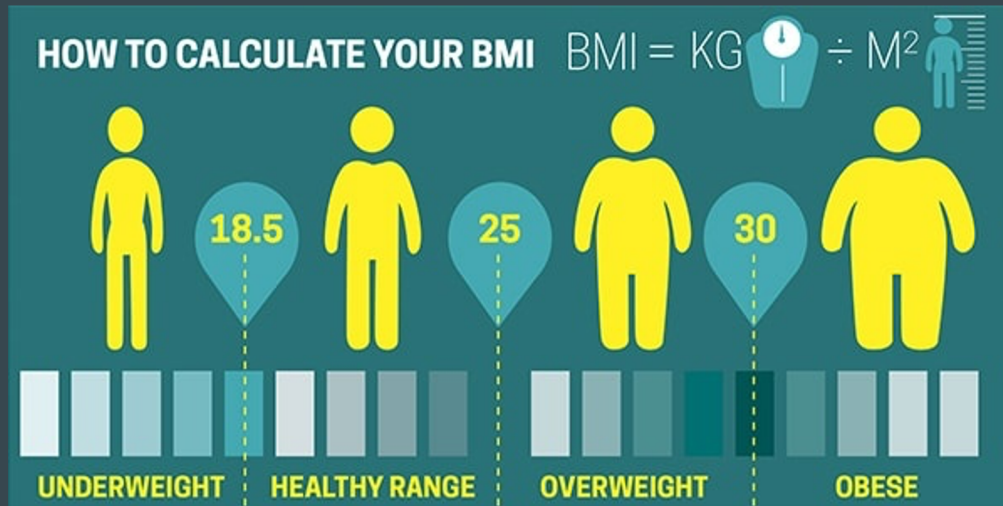
All

24.99

Veg

23.06

Non-veg 27.87



Conclusion

- On average, vegetarians were found to have lower fat percentages and decreased BMI.
- Consumption of fruits and vegetables was higher in vegetarian students at 4.42 servings versus non-vegetarians at 2.09 servings with p-value 0.006. Excel was used to perform a two-tailed T-Test.
- Rates of illness were lower in vegetarians at 1.9 times over the past year versus 2.3 for non-vegetarians with a p-value of 0.678, which lacked statistical significance.
- We found that University of Maryland students following vegetarian diets had increased diet quality but there is not enough data to correlate this with better immunity outcomes.

Discussion

- While there was a statistical significant difference in intakes of vegetables and fruits for vegetarians, we weren't able to get conclusive results about differences in immunity status.
- This could be due to our small sample size, or to the way we measured illness. A blood test measuring biomarkers of immune status may be more indicative of true immune status.
- However, we did confirm that having a vegetarian/vegan diet allowed for adequate fruit & vegetable consumption in line with the 2015 dietary guidelines.
 - 2015-2020 Guidelines: 4 ½ cups of fruits/vegetables (2 ½ Vegetable and 2 Fruit)
 - Non-veg: 2.09 cups veg/fruit (1.73/0.35) Veg: 4.42 cups veg/fruit (3.25/1.17)

Study Limits



- Small sample size
- Inaccuracies of Tanita scale
- Measurements not taken after fasting or other restrictions (exercise, caffeine, etc.)
- Could not collect biochemical data
- Participants may have over or under-reported intakes
- Illness frequency was self-reported and may not have been accurate
- Only evaluated fruit and vegetable intake, not a full dietary analysis

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