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Survey for Usage of and Interest in Personalized Nutrition as a Possible Health Approach

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Survey for Usage of and Interest in Personalized Nutrition as a Possible Health Approach

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By

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Abstract

Dietary factors can lead to chronic diseases and impact certain health factors such as sleep and mood. *Personalized nutrition* is based on an individual's phenotype and genotype to meet specific dietary needs. This approach could be an intervention to benefit an individual's health. This study surveyed a population to analyze the population's view on and usage of personalized nutrition. The use of personalized nutrition was minimal, but there was interest within the population. In addition, a relationship between health and mood was found. However, the sample size was a limiting factor for this study. Future directions could include studying why the population is interested, but usage of personalized nutrition is limited and studying the knowledge of personalized dietary needs.

Introduction

Advances in technology, food science, medicine, and nutrition have led to the current understanding of the relationship between diet and different diseases. Diet impacts more than what is seen on the immediate surface. The saying “you are what you eat” seems to be becoming more accurate. Diet plays a significant role in deficiencies, risk factors for disease, sleep, mood, and much more. Gene interaction technologies and those that allow patients to see current biomarkers show that diet and nutritional needs are not universally standard among a population. Humans have specific dietary needs for different stages of life, lifestyles, genetic deficiencies, and much more. Personalized nutrition is a concept or approach to meet those specific dietary needs, resulting in a beneficial health effect.

Personalized Nutrition

Personalized nutrition, as defined by Jose Ordovas, is "an approach that uses information on individual characteristics to develop targeted nutritional advice, products, or services" [1]. It is based on the idea that meeting specific needs would be more beneficial for health than a generic approach.

A specific and personalized diet can be derived using genetic, medical, and nutritional information to increase health effectively. This beneficial effect on health is not limited to the treatment of disease but also the prevention, management, and optimization of health methods. Lactating mothers and pregnant women, for example, require specific nutritional requirements. Those wanting to achieve a particular body composition with fitness and exercise goals can also benefit from personalized nutrition

[1]. It can target specific prevention methods for diseases or illnesses one is genetically susceptible to or even those they are at a high risk of acquiring [1].

Dietary factors contribute to many common diseases, including heart disease, type 2 diabetes, cancer, and stroke [2]. The morbidity and mortality due to these chronic diseases are prevalent worldwide, the impacts of which are concerning and lead to the need for different prevention, intervention, and management techniques [3]. Personalized nutrition is a possible intervention approach to these chronic diseases and to an increase in overall public health.

Precision nutrition or nutrigenomics are more familiar terms with meanings similar to personalized nutrition. Precision nutrition is "an emerging therapeutic approach that considers an individual's genetic and epigenetic information, as well as age, gender, or particular physiopathological status" [5].

Epigenetic signatures and gene expression patterns have been shown to play a role in developing certain chronic conditions [6]. Therefore, predicting what chronic diseases a patient is at risk of can pave the way for early and personalized prevention and treatment. Understanding how nutrients and diet can play a role in that prevention and treatment is what personalized nutrition encompasses.

Nutrition as a Modifiable Factor

Personalized nutrition is partially based on a person’s genotype. In response to the Human Genome Project, personalized nutrition has “extended to other diseases mediated by gene-environment interactions” [7]. Different genes are involved in energy expenditure, appetite control, adipogenesis, and lipid metabolism. For example, a

polymorphism in the ADRB3 gene can lead to lipid accumulation, in the LEP gene can alter satiety regulation, in the BDNF gene can change responses to hypocaloric diets, and in the PPAEG gene can help with weight loss interventions [7].

Different genotypes can help explain why individuals have unique metabolisms and different responses to diet. Different molecular processes can alter certain gene expressions, including DNA methylation. Nutrition can affect DNA methylation pathways "by altering the substrates and cofactors necessary for this process, by changing the activity of enzymes regulating the one-carbon cycle or by playing a role in DNA demethylation activity" [8].

Chnages of Nutritional Needs

While personalized nutrition can be impactful in treating diseases, it can also be applied to increasing the body's health during certain stages of life. Nutrition is not a one-size fits all model. Nutrients are essential for the growth and maintenance of the body, and nutrient intake requirements are variable. Undernutrition and overnutrition are both harmful to the body [9].

Children aged 2 to 3 years have a recommended daily caloric intake of 1000 to 1400 kcal/day, but this can change during a growth spurt [9]. Those aged 11 to 12 years require 1800 to 2200 kcal/day. Adults require anywhere from 2000 to 2800 kcal/day depending upon sex, activity level, and physical condition of the body [9]. Going beyond just age, pregnant women, along with athletes, require different caloric intakes. Diet should not be seen as universal or generic, but something personally specific.

Excess weight gain during pregnancy can lead to complications. The amount of weight gain recommended during pregnancy is dependent upon BMI prior to getting pregnant. Caloric intake is not recommended to increase during the first semester. However, it is recommended to add 340 calories/per day during the second trimester and 450 calories/per day extra during the third trimester [9]. In addition to weight gain and caloric intake, vitamin requirements also change with conception. Adequate folate, iron, vitamin D, protein, and prenatal vitamins are all essential to a healthy pregnancy [9].

Just as seen in pregnancy, diet does not only consist of the number of calories but also the makeup. Nutrient deficiencies can lead to health concerns, so a diet mixed with macronutrients and micronutrients is ideal.

There are seven nutrient groups: carbohydrates, protein, fat, fiber, mineral, vitamin, and water. All groups are used differently by the body. Carbohydrates impact glycemic index, and complex carbs are preferred over simple to steadily raise the blood sugar level [9]. Proteins provide energy and are used to construct many "structural units of the body, e.g., muscle, bone, and ligaments" [9]. Fats are high-energy molecules and can serve as a reserve. There are essential fats that the body requires but cannot be synthesized, so they must be consumed in the diet. Fiber impacts digestive health [9]. Minerals are used all over the body in different ways, including bone development and electrolytes.

Research has shown that different nutrient groups also impact different diseases within the body. For example, specific proteins have decreased cancer and cardiovascular disease [10]. In addition, a high-fiber diet and a diet rich in monosaturated fats decrease the risk of cardiovascular disease [9].

Impacts of Nutrition

Diet and nutrition have not only influences on specific diseases and weight gain but also sleep and mood. Research has shown that tryptophan consumption, a high-carb diet, melatonin, and other nutrients and foods improve sleep outcomes [11]. Sleep is essential throughout the body, from immune health to energy and memory [11]. Therefore, it is crucial to understand the interaction between sleep and diet. Along with sleep, mood can be affected by diet. The brain uses glucose as a source of energy. However, if that energy source is highly refined sugars, that could lead to inflammation and stress [12]. Studies have shown that diets containing highly refined sugars correlate to depression [12]. Certain nutrients can also affect mood.

Serotonin is a neurotransmitter that helps regulate mood [12]. It is produced in the GI tract and influenced by the microbiome in the intestine. Different diets alter the microbiome. Understanding a body's personalized composition and characteristics can help ensure everything in the diet is complimenting what is needed for optimal health.

Study Approach

Diet is not best viewed through a general approach. While research has shown that all bodies have different dietary needs and can be positively impacted by specific diets, personalized nutrition has not become easily prevalent as a public intervention. This study surveyed a group of participants on their background, diet, diet beliefs, and specific markers like sleep and mood to analyze a population's overall view on personalized nutrition.

Methods

Design

This study used a sample of volunteered participants consisting of various students, family members, friends, faculty, and others. Each participant had the opportunity to willingly complete an online questionnaire consisting of 57 questions and about 5 minutes in length.

Participants

An unrepresentative sample took the survey with no screening process or prior requirements needed to take the survey. The questionnaire was provided in English. The survey was only in an online format, so internet access was needed for participation. The Institutional Review Board approved the protocol at the University of Arkansas.

Recruitment

Participants were recruited through social media, groupme, email, and word-of-mouth.

Measures

The online questionnaire collected information on demographics, education levels, diet patterns, views on personalized nutrition, mood, and more. Reference the appendix for the full-length survey.

Background. Participants were asked to record information on their sex, age, education level, race, and ethnicity.

Views on Personalized Nutrition. Participants were asked to complete an online questionnaire that included multiple questions about their knowledge of personalized nutrition, their beliefs on if it is needed, and their willingness to follow a personalized diet.

Diet Patterns. Participants were asked if they followed a specific dietary pattern and which specific pattern they followed. Questions about supplemental use were also asked.

Pregnancy. A sub-sample of the population who have been pregnant or are currently pregnant was asked about their diet. Questions asked if they followed a specific diet plan, how well it worked, their supplement use and if they would be interested in a personalized nutrition plan.

Mood. Participants were asked to report how often they have felt happy in the past month. The answer options on the questionnaire included “all the time,” “very often,” “often,” “rarely,” or “very rarely.”

Procedures

The online questionnaire was delivered via the Qualtrics software.

Statistical Analyses

Using the Qualtric software, the data was analyzed using stats iQ. Descriptions of different variables were obtained to see the overall percentages for each category. Lastly, a relationship analysis between health and mood was run.

Results

Participant Demographics

A total of 66 participants participated in the online questionnaire. **Table 1** illustrates the participant demographics including: gender, race, and ethnicity. The table shows the total number of participants for each demographic category as well as the percent out of the total participant population that demographic represents.

Table 1. Population Demographics

Population Demographics		
	Total (n)	**Percent Sample (%)**
Gender		
Female	55	83.33%
Male	9	13.63%
Non-Binary	2	3.03%
Race		
Asian	7	10.60%
Black/African American	3	4.54%
Indian/Alaskan	0	0%
White	55	83.33%
Hawaiian/Pacific Islander	0	0%
Other	2	3.03%
Prefer not to say	2	3.03%
Ethnicity		
Hispanic	4	6.06%
Non-Hispanic	60	90.90%
Prefer not to say	2	3.03%

Table 1: Population Demographics (gender, race, and ethnicity) for the total surveyed population (n=66)

Personalized Nutrition Views

Figure 1 shows the sample population percentages on (a) beliefs that diet should be personalized to certain dietary needs and (b) the amount of which have heard of the term personalized nutrition. The yellow in (a) represents those that say it is neither true nor false that our diet needs to meet our personalized needs and is (15.63%). The green in (a) represents those that belief our diets should meet our personalized needs (84.38%).

The yellow in (b) represents those that haven't heard of personalized nutrition (45.31%). The green in (b) represents those that have heard of personalized nutrition (54.69%).

Figure 1. Personalized Nutrition Views

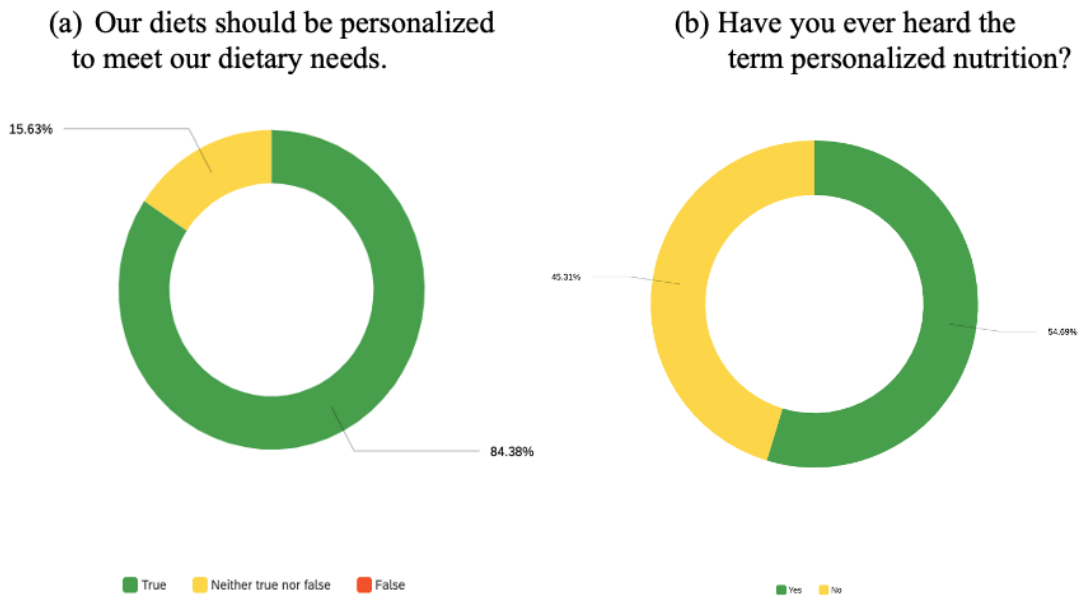

Figure 1. (a) the green is true and the yellow is neither true nor false. (b) the green is yes and the yellow is no.

Diet Patterns

Table 2 shows dietary patterns of 66 participants. The answers ranged from flexitarian, vegetarian, ketogenic, time restricted feeding, low carbohydrate, mediteranean, other, and none. The others catergory included (1) vegetarian and intermittent fasting, (2) interstitial cystitis diet and vegetarian, and (3) low sodium and sugar.

Table 2. Specific Dietary Patterns

Specific Dietary Patterns		
Diet	**Count (n)**	**Percentage (%)**
Flexitarian	2	3.1%
Vegetarian	4	6.3%
Ketogenic	1	1.6%
Time restricted feeding	3	4.7%
Low carbohydrate	6	9.4%
Mediterranean	2	3.1%
Other	3	4.7%
None	43	67.2%

Table 2: The specified dietary patterns of the sample population. The others category includes (1) vegetarian and intermittent fasting, (2) interstitial cystitis diet and vegetarian, and (3) low sodium and sugar.

Pregnancy

The online questionnaire had a sub-sample of 19 women who where pregnant or who are currently pregnant. Questions asked if the women followed a specific nutrition plan while pregnant and if they would be interested in following a personalized nutrition plan. **Table 3** shows the responses of the 19 women. 70% of the sub-sample did not follow a nutrition plan while pregnant, but 57.9% were interested in following one.

Table 3. Pregnant sub-sample

While pregnant, did you follow a specific nutrition plan?		
Answer	Count (n)	Percent (%)
Yes	6	30%
No	14	70%
In previous or current pregnancies, would you be interested in following a personalized nutrition plan?		
Yes	11	57.9%
No	8	42.1%

Table 3: The answer count and percentage from the pregnant sub-sample.

Mood

The relationship between mood and health was analyzed. The results are shown in **Table 4.** The table combines question 56 and question 57. Question 56 asks participants to report how they would say their health was, in general. Question 57 asks the participants how often they felt happy in the past month. There was a significant association between good health and happiness levels ($p < 0.01$).

Table 4. Linear Regression: Relationship between breakfast and GPA

	Q57: In the past month, how often have you felt happy?			
Q56: In general...your health is:	All the time	Very often	Often	Rarely
Excellent	0.0%	0.0%	3.4%	0.0%
Very good	60.0%	85.0%	13.8%	16.7%
Good	40.0%	15.0%	51.7%	0.0%
Fair	0.0%	0.0%	24.1%	83.3%
Poor	0.0%	0.0%	6.9%	0.0%

Table 4: Relationship analysis between the reported health and happiness of the sample population.

Discussion

Previous research has shown how dietary factors play a role in chronic disease development and treatment. In addition, nutrigenomics has paved the way for understanding gene influences on metabolism. While gene-diet interaction is becoming more and more understood, dietary public health interventions seem limited [1]. Personalized nutrition can be an intervention, prevention, and management technique beneficial to one's health. This study surveyed 66 participants to get a population's view on personalized nutrition.

Personalized nutrition could be a possible intervention for chronic diseases. However, lack of public understanding could be a potential varier for future directions. While 84% of the sample agreed that diets should meet personalized needs, only 54% had heard of the term personalized nutrition. This brings further questions surrounding the effectiveness of implementing personalized nutrition in public. For example, how accessible are the programs?

As previously discussed, different diets can positively influence sleep, mood, and the prevention of chronic diseases. However, 33% of the sampled population followed a specific diet pattern. The reasoning behind the participants following those diet patterns was not asked. That is a limitation of this study.

A sub-category of 19 women out of the 66-sample population was asked about their pregnancy diet. 70% of them did not follow a specific nutrition plan. However, 57.9% were interested in following a personalized nutrition plan. These numbers lead to the same questions about the availability of personalized nutrition plans. If over half of them would be interested, why is it that only 30% followed a specific plan? Cost, availability, and public knowledge could all be possible causes of this difference. Future questions could be their thoughts on whether pregnant women have different dietary needs.

As previously stated, health and diet influence mood. The sample population was asked to report their health and happiness beliefs. There was a strong relationship seen between the two variables in this study ($p<.01$). 83% of the population that reported their health as fair also stated they were rarely happy. Factors outside of health could have been confounding factors in this relationship.

This study gave a small glimpse into personalized nutrition views and usage within our sample population. The poll raised possible future directions. What kept some from following personalized nutrition plans? What were some reasonings behind diet patterns? How aware is our public of different dietary needs? Is the public aware of their specific dietary needs?

While personalized nutrition could be an effective technique to benefit health, it was not widely known or used in our sample population. The sample size of 66 was insufficient to apply the results to a broader population.

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Appendix

Nutrition and Food Survey

Start of Block: Default Question Block

Q2 You are invited to participate in a research study about food and nutrition.

The purpose of this study is to understand the opinion of females in the community about new food and nutrition concepts through an online survey. The survey will take 5-10 minutes to complete.

Your response will be completely anonymous unless you agree to provide your email contact. This email will only be used to contact you to invite you to participate in future related studies and does not obligate you to participating.

If you do not want to be included in this study, you may refuse to participate. Also, you may refuse to participate at any time during the survey. Your job, your grade, your relationship with the university, etc. will not be affected in any way if you refuse to participate.

At the conclusion of the survey you will have the right to request feedback about the results. You have the right to contact the principal researcher as listed below for any concerns that you may have. You may contact the principal researcher, Dr. Jamie I. Baum, Phone: (479) 575-4474, Email: baum@uark.edu. If you have questions about your rights as a research participant, please contact Ro Windwalker, the University's IRB coordinator, at 479-575-2208 or irb@uark.edu.

I have read the above statement and have been able to ask questions and express concerns, which have been satisfactorily responded to by the investigator. I understand the purpose of the study as well as the potential benefits and risks that are involved. I understand that participation is voluntary. I understand that significant new findings developed during this research will be shared with my university. I understand that no rights have been waived by participating.

By proceeding with the survey, you agree to the above.

- ○ I agree (1)
- ○ I disagree (2)

Skip To: End of Survey If You are invited to participate in a research study about producing food and nutrition products throu = I disagree

End of Block: Default Question Block

Start of Block: Block 1

Display This Question:

If You are invited to participate in a research study about producing food and nutrition products throu = I agree

Q3 Which best describes your sex?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

Q4 What is your current age?

_____

Q5 What is your race? (Please select all categories that apply)

- [ ] Asian (1)
- [ ] Black/African American (2)
- [ ] Hawaiian/Pacific Islander (3)
- [ ] Indian/Alaskan (4)
- [ ] White (5)
- [ ] Other (6)
- [ ] Prefer not to say (7)

Q6 What is your ethnicity?

- ○ Hispanic (1)
- ○ Non-Hispanic (2)
- ○ Prefer not to say (3)

Q7 What is your highest level of education completed?

- ○ Elementary or lower (1)
- ○ High school (2)
- ○ College or University (3)
- ○ Graduate school (Master's or Doctorate) (4)
- ○ Professional School (e.g., J.D. or M.D.) (5)
- ○ Other (please specify) (6)

_____

Q8 Where did you grow up?

- ○ Urban (1)
- ○ Rural (2)
- ○ Suburb (3)

Q9 Have you ever taken a nutrition course or do you have a degree in nutrition?

- ○ Yes (1)
- ○ No (2)

Q10 Have you ever taken a food science course or do you have a degree in a food science-related field?

- ○ Yes (1)
- ○ No (2)

End of Block: Block 1

Start of Block: Block 8

Q36 Have you ever been diagnosed as having one of the following conditions (Select all that apply)?

- [ ] High blood pressure (1)
- [ ] High cholesterol (36)
- [ ] Heart disease (37)
- [ ] Heart attack (38)
- [ ] Stroke (39)
- [ ] Heart valve problems (40)
- [ ] Deep vein thrombosis (blood clots in the legs) (41)
- [ ] Anemia (42)
- [ ] Anxiety (43)
- [ ] Emphysema (44)
- [ ] Chemical dependency (e.g., alcoholism) (45)
- [ ] Depression (46)
- [ ] Other mental health disorder (47)
- [ ] Hypothyroid (low) (48)
- [ ] Hyperthyroid (high) (49)
- [ ] Diabetes (Type I) (50)
- [ ] Diabetes (Type II) (51)

- [ ] Multiple Sclerosis (52)
- [ ] Rheumatoid Arthritis (53)
- [ ] Degenerative osteoarthritis orwear-and-tear arthritis (54)
- [ ] Stomach/duodenal ulcers (55)
- [ ] Epilepsy/Seizures (56)
- [ ] Headaches/Migraines (more than 1per week) (57)
- [ ] Endometriosis (58)
- [ ] Osteoporosis (59)
- [ ] Lung Cancer (60)
- [ ] Breast Cancer (61)
- [ ] Prostate Cancer (62)
- [ ] Colon Cancer (63)
- [ ] Skin Cancer (64)
- [ ] Bone Cancer (65)
- [ ] Leukemia Cancer (66)
- [ ] Lymphoma Cancer (67)
- [ ] Other Cancer (68)
- [ ] Bladder Problems (69)

☐ Kidney Problems (70)

End of Block: Block 8

Start of Block: Block 2

Q11 Do you follow any specific dietary patterns?

- ○ Yes (1)
- ○ Maybe (2)
- ○ No (3)

Q12 If you follow a dietary pattern, which dietary pattern do you follow?

- ○ Mediterranean (1)
- ○ Flexitarian (2)
- ○ Vegetarian (3)
- ○ Vegan (4)
- ○ Ketogenic diet (5)
- ○ Intermittent fasting (6)
- ○ Time restricted feeding (7)
- ○ Low carbohydrate (8)
- ○ Other (please specify) (9) _____
- ○ I do not follow a specific dietary pattern. (10)

Q13 Are you currently trying to lose weight?

- ○ Yes (1)
- ○ No (2)

Q14 Have ever heard the term personalized nutrition?

- ○ Yes (1)
- ○ No (2)

Q15 Our diets should be personalized to meet our nutrition needs.

- ○ True (1)
- ○ Neither true nor false (2)
- ○ False (3)

End of Block: Block 2

Start of Block: Block 3

Q17 Where you active as a child?

- ○ Somewhat active (1)
- ○ Moderately active (2)
- ○ Extremely active (3)
- ○ No (4)

Q18 How often do you exercise?

- ○ Never (1)
- ○ 1-2 times per week (2)
- ○ 3-4 times per week (3)
- ○ 5-6 times per week (4)
- ○ At least one a day (5)

Q19 Select all training styles you focus on (select all that apply).

- ☐ None (1)
- ☐ Endurance training (2)
- ☐ Resistance training (3)

Q20 What is your motivation for physical activity (select all that apply):

- ☐ Staying healthy (1)
- ☐ Losing weight (2)
- ☐ Love the challenge (3)
- ☐ Time to destress (4)
- ☐ I don't participate in physical activity (5)
- ☐ Other (please specify) (6) _____

End of Block: Block 3

Start of Block: Block 4

Q21 How often do you get sick?

- ○ Never (1)
- ○ 1-2 times per year (2)
- ○ 3-4 times per year (3)
- ○ 5-6 times per year (4)
- ○ More than 7 times per year (5)

Q22 How often you get physically injured from working out or physical activity?

- ○ Never (1)
- ○ A few aches and pains sometimes (2)
- ○ 1-2 times per year (3)
- ○ 3-4 times per year (4)
- ○ 5 or more times per year (5)

Q23 Have you ever had/ or have an eating disorder?

- ○ No (1)
- ○ Yes, medically diagnosed (2)
- ○ I do/ have struggled with food, but not medically diagnosed with a disorder (3)

End of Block: Block 4

Start of Block: Block 5

Q24 Do you believe supplements are beneficial?

- ○ Yes (1)
- ○ No (2)
- ○ Only if medically needed (3)

Q25 Have you ever taken supplements?

- ○ Yes (1)
- ○ No (2)
- ○ Not consistently (3)

Q26 Why do you take supplements?

- ○ I don't take supplements (1)
- ○ Athletic performance (2)
- ○ Overall health and bodily function (3)
- ○ To treat a medical deficiency or other diagnosis (4)
- ○ Mental health (5)

Q27 Would you be interested in a supplement that was designed specifically for your individual needs?

- ○ Yes (1)
- ○ Maybe (2)
- ○ No (3)

End of Block: Block 5

Start of Block: Block 7

Q37 Would you be interested in a snack containing supplements developed for your nutritional needs?

- ○ Yes (1)
- ○ No (2)
- ○ Maybe (3)

Q37 Write 3-5 words that you think describe personalized nutrition.

_____

End of Block: Block 7

Start of Block: Block 8

Q38 Are you pregnant or have you been pregnant in the past?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Are you pregnant or have you been pregnant in the past? = No

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Q39 If you have been pregnant or are pregnant, did you follow a specific nutrition plan?

- ○ Yes (1)
- ○ No (2)

Q40 If you followed a specific nutrition plan, how well did it work for you?

- ○ Worked great (1)
- ○ It was okay, but didn't meet all of my needs (2)
- ○ Not good, and I wouldn't recommend it (3)

Q41 Did you take any nutritional supplements while pregnant?

- ○ Yes (1)
- ○ No (2)

Q43 Would you be interested in following a personalized nutrition plan when you are pregnant or when you were pregnant?

- ○ Yes (1)
- ○ No (2)

End of Block: Block 8

Start of Block: Block 9

Q44 During the past 7 days, how many times did you eat FRUIT like apples, bananas, oranges, melon or any other fruit? COUNT fresh, frozen, canned, and dried fruit. DON'T COUNT juices.

- ○ 1-3 times in the past week (1)
- ○ 4-6 times in the past week (4)
- ○ 1 time a day (5)
- ○ 2 times a day (6)
- ○ 3 or more times a day (7)
- ○ I did not drink any sweetened fruit drinks or teas during the past week (8)

Q45 During the past 7 days, how many times did you eat VEGETABLES that are not deep-fried? These are vegetables like carrots, broccoli, collards, green beans, corn, green salad, or other vegetables that are not deep-fried. COUNT canned, frozen, or fresh vegetables. ALSO COUNT vegetables that are raw, boiled, broiled, baked, grilled, stir-fried, or microwaved.

- ○ I did not eat any non-fried vegetables during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day (6)
- ○ 2 times a day (7)
- ○ 3 or more times a day (8)

Q46 During the past 7 days, how many times did you eat LEAN PROTEIN like chicken and poultry, pork, seafood, eggs, legumes (beans and peas), nuts, seeds or soy products.

COUNT baked, broiled, grilled, steamed, microwaved, sauteed. DON'T COUNT fried foods or processed meat (e.g. sausage).

- ○ I did not eat any lean protein during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day (6)
- ○ 2 times a day (7)
- ○ 3 or more times a day (8)

Q47 During the past 7 days, how many times did you eat WHOLE GRAINS like whole grain bread or cooked whole grains. COUNT 100% whole wheat, rye or other whole grain breads, whole wheat pasta, oatmeal, brown rice, or other cooked whole grains. DON'T COUNT white bread, white rice, or regular pasta.

- ○ I did not eat any whole grains during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day 2 times a day (6)
- ○ 3 or more times a day (7)

Q48 During the past 7 days, how many times did you eat or drink DAIRY like milk, cheese, yogurt. COUNT cow's milk or milk product of any type including full-fat, whole,

reduced fat (1%or 2%), or fat-free (skim) dairy. DON'T COUNT small amounts of milk added to coffee or tea or milk that comes from a plant such as almonds, soy, rice etc.

- ○ I did not eat any DAIRY during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day 2 times a day (6)
- ○ 3 or more times a day (7)

Q49 During the past 7 days, how many times did you eat SWEETS like candy, cookies, cake, pastries, pie, or ice cream?

- ○ I did not eat any sweets during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day 2 times a day (6)
- ○ 3 or more times a day (7)

Q50 During the past 7 days, how many times did you EAT BREAKFAST? Breakfast is defined as a meal eaten within 2 to 3 hours of waking before 10 a.m.

- ○ I did not eat breakfast during the past week (1)
- ○ 1-3 days in the past week (4)
- ○ 4-6 days in the past week (5)
- ○ 7 days in the past week (6)

Q52 During the past 7 days, how many times did you eat FAST FOOD (include take out and delivery? Fast food restaurants include traditional burger-and fries, Mexican, fried chicken, sandwich or sub-shops, and pizza.

- ○ I did not eat any fast food during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day (6)
- ○ 2 times a day (7)
- ○ 3 or more times a day (8)

Q53 During the past 7 days, how many times did you drink WATER that was not sweetened like tap water, filtered water, bottled water, sparkling water, or carbonated water?

- ○ I did not drink any water during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day (6)
- ○ 2 times a day (7)
- ○ 3 or more times a day (8)

Q54 During the past 7 days, how many times did you drink REGULAR SODA or pop like Coke, Pepsi, Sprite, Dr. Pepper or other regular soda? DON'T COUNT diet or zero calorie sodas.

- ○ I did not drink any regular soda during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day (6)
- ○ 2 times a day (7)
- ○ 3 or more times a day (8)

Q55 During the past 7 days, how many times did you drink SWEETENED DRINKS or SPORTS DRINKS like sweet tea, lemonade, Kool-Aid, Gatorade or other sweetened fruit drinks or teas? DON'T COUNT 100% pure fruit juice or zero calorie or diet drinks

- ○ I did not drink any regular soda during the past week (1)
- ○ 1-3 times in the past week (4)
- ○ 4-6 times in the past week (5)
- ○ 1 time a day (6)
- ○ 2 times a day (7)
- ○ 3 or more times a day (8)

End of Block: Block 9

Start of Block: Block 10

Q56 In general, would you say your health is:

- Excellent (1)
- Very good (4)
- Good (5)
- Fair (6)
- Poor (7)

Q57 In the past month, how often have you felt happy?

- All the time (1)
- Very often (4)
- Often (5)
- Rarely (6)
- Very rarely (7)

End of Block: Block 10