

Meeting Vitamin B12 Needs in Vegan and Vegetarian Diets

By Tamara Kelly-Scott, Dietetic Intern

Nutritional Problem

A vegetarian lifestyle may be a healthful eating style that can reduce the risk of chronic disease, but it also can lead to some nutritional deficiencies, such as vitamin B12, if proper diet planning and supplementation are not implemented.

Overview of Vegan and Vegetarian Diets

A vegetarian diet is based on foods derived from plants, including vegetables, whole grains, legumes and fruits, but with few or no animal products.¹ Studies have been conducted which suggest that vegetarian diets can reduce the risk of heart disease, high cholesterol, high blood pressure, and type 2 diabetes, compared to diets higher in animal foods.² Substantial evidence indicates that vegetarian diets which included whole grains as the main form of carbohydrate, unsaturated fats as the predominate form of dietary fat, an abundance of fruit and vegetables, and adequate omega 3 fatty acids can play an important role in preventing cardiovascular disease.³

A more recent article discusses the case of a 77-year-old woman who began a whole food plant-based (vegan) diet instead of surgery to reverse her symptoms of angina. Her past medical history included hypertension and hyperlipidemia, yet her symptoms were nearly resolved after one month of this lifestyle change. She ended this plant-based lifestyle after four to five months, after which all of her angina symptoms returned along with eating animal-derived products. In summary, the study concluded that a whole-food plant-based diet was associated with reversing angina symptoms in the patient with severe coronary atherosclerotic disease, and that her angina returned when she resumed consuming a 'healthy' Western diet.⁴

In addition to the health benefits of consuming a vegetarian diet, people choose this lifestyle for a variety of reasons, which include religion, weight loss, cost reduction, animal welfare, environmental health, and a rising diet trend. Regardless of the reason, making sure that deficiencies in macronutrients or micronutrients do not occur is important.

Vitamin B-12 Intake in Vegan and Vegetarian Diets

Vitamin B12 is important in the diet because it is necessary for protein metabolism, production of red blood cells, and maintenance of the central nervous system.⁵ Vitamin B12 is absent from plant foods, because it is almost found exclusively in animal products, such as organ meats, shellfish, meat, poultry, eggs, milk, and other dairy foods.⁵ A deficiency from this vitamin can occur in individuals living a vegan and vegetarian lifestyle because of limited or low consumption of animal products.⁵

B12 intake is limited in vegans because the lifestyle practices abstain from the use of all animal products. Vegans can get vitamin B12 intake from fortified cereals, fortified plant milks, nutritional yeast, and supplementation. B12 intake is limited in vegetarians because of limited animal product consumption. Depending on the type of vegetarian, vegetarians can get some vitamin B12 intake from eggs and/or milk, and B12 supplementation. However, a B12 deficiency can still occur in vegetarians.

Folic acid is abundant in a plant-based lifestyle, especially because of the fortification of folic acid in foods, such as cereals. It can actually mask a vitamin B12 deficiency until severe problems occur.⁵ Folic acid can mask this deficiency by causing the blood cells affected by B12 deficiency to return to normal, while the symptoms of the deficiency can remain.⁶ The presence of enlarged blood cells is used to determine vitamin B12 status, if they appear normal, then a deficiency in B12 can be overlooked.⁶ Vitamin B12 supplements, vitamin B12-enriched cereals and soy products can help to supplement vitamin B12 in the diet. Most importantly, making sure you are seen by a health care professional on a regular basis to obtain blood tests to determine B12 status is an important part of a health care plan for people on vegan and vegetarian diets.

Unfortunately, there aren't many studies conducted in the United States on vitamin B12 deficiency among vegan and vegetarian adults that are not elderly or pregnant. One systemic research review was conducted on vitamin B12 deficiency among vegans and vegetarians.⁷ The inclusion criteria consisted of original studies that assessed serum vitamin B12, studies written in English, non-case studies, and studies that reported actual percentages of vitamin B12 deficiency.⁷ The deficiency prevalence among infants reached 45%.⁷ The deficiency among the children and adolescents ranged from 0 to 33.3%.⁷ Deficiency among pregnant women ranged from 17 to 39%, dependent on the trimester. Adults and elderly individuals had a deficiency range of 0-86.5%.⁷ Higher deficiency prevalence was reported in vegans than in vegetarians.⁷ Vegans who do not ingest vitamin B12 supplements were found to be at especially high risk.⁷ Because of the limited research within plant-based communities, this community nutrition assessment can shine a light on a potential hidden deficiency. Vitamin B12 deficiency can cause the following symptoms and/or complications:⁸

- strange sensations, numbness, or tingling in the hands, legs, or feet
- difficulty walking (staggering, balance problems)
- anemia
- a swollen, inflamed tongue
- yellowed skin (jaundice)
- difficulty thinking and reasoning (cognitive difficulties), or memory loss
- paranoia or hallucinations
- weakness
- fatigue

There is confusion and mythology within the vegan and vegetarian community about the need to supplement vitamin B12. Some in this community believe that there is no need to supplement B12.⁹ On the other hand, some vegetarians fear becoming vegan solely on the belief that vegans suffer from B12

deficiency.⁹ Although vitamin B12 intake is a true health concern in the vegan and vegetarian community, there are many vegans that do not have a B12 deficiency.

Despite the confusion, it is imperative to get the recommended dietary allowance for B12, as seen in the chart below. Fortified foods are one way of supplementing, as well as supplementation with vitamin B12 supplements or vitamin B12 injections. Because vitamin B12 absorption is inversely related to dosage, recommended intake depends on how often the vitamin is consumed. The RDA of 2.4 mcg assumes consumption of small amounts of vitamin B12 from food throughout the day.¹⁰ Those who consume fortified foods, including breakfast cereals, plant milks, and vegetarian meats can opt for two servings per day of foods fortified with at least 1.5 mcg of B12 per serving.¹⁰ For vegans who get all of their B12 from a single daily supplement, 25 to 100 mcg is recommended to compensate for much lower absorption.¹⁰

Recommended Dietary Allowance (RDA) for Vitamin B12			
Life Stage	Age	Males (mcg/day)	Females (mcg/day)
<i>Infants</i>	0-6 months	0.4 (AI)	0.4 (AI)
<i>Infants</i>	7-12 months	0.5 (AI)	0.5 (AI)
<i>Children</i>	1-3 years	0.9	0.9
<i>Children</i>	4-8 years	1.2	1.2
<i>Children</i>	9-13 years	1.8	1.8
<i>Adolescents</i>	14-18 years	2.4	2.4
<i>Adults</i>	19-50 years	2.4	2.4
<i>Adults</i>	51 years and older	2.4	2.4
<i>Pregnancy</i>	all ages	-	2.6
<i>Breast-feeding</i>	all ages	-	2.8

Parameters of Assessment

PARAMETERS	VEGAN AND VEGETARIAN Diet AND VITAMIN B12 DEFICIENCY
Statement of Nutritional Problem	Vitamin B-12 is important in the diet because it is necessary to help produce red blood cells and prevent anemia. ⁵ Because vitamin B12 is almost found exclusively in animal products, a deficiency of this vitamin can occur in individuals eating a vegan or vegetarian diet.

	There aren't many studies in the United States on vitamin B12 deficiency among vegetarians.	
Definition of Community	The internet, plant-based blog community of registered dietitian Sharon Palmer, who has over 30,000 followers. A sample size of 41 followers will be surveyed.	
Purpose of the Assessment	To obtain information from men and women who eat a vegan diet on their knowledge of vitamin B12, supplementation habits, and medical observation in order to determine if a program or intervention should be developed.	
Target Population	Men and women over 18 years old who are on a vegan diet	
Overall Goal of Assessment	Identify men and women's knowledge, attitudes, and practices on vitamin B12 supplementation in a plant-based lifestyle	
Objectives of Assessment	<p>On a sample of 41 women and men over the age of 18 years old:</p> <ul style="list-style-type: none"> • Assess knowledge and awareness of vitamin B12 deficiency among vegans. • Identify how participants meet daily vitamin B12 needs. • Assess each individual's personal assessment of their health status relating to B12. 	
Types of Data Needed: Community Conditions	<ul style="list-style-type: none"> • Types of test available for vitamin B12 deficiency • Types of supplementation available for vitamin B12 deficiency • Services available for those eating a vegan diet. • Educational materials available from dietitians and health practitioners 	
Types of Data Needed: Target Population Method of obtaining the answer: Survey	<ul style="list-style-type: none"> • Demographic data • Individual lifestyle Factors 	<p>1) What is your age?</p> <p>2) What is your gender?</p> <p>3) How long have you been on a vegan diet?</p> <p>4) What sources of B12 do you include in your diet on a daily basis?</p>

	<ul style="list-style-type: none"> • Assess knowledge and awareness of vitamin B12 deficiency among vegans • Assess health practices of a plant-based lifestyle as it relates to vitamin B12. 	<p>5) At what levels do you supplement vitamin B12 (through dietary supplements) in your diet?</p> <p>6) Do you believe that vitamin B12 need to be supplemented in a vegan diet?</p> <p>7) The following describes my belief on the role of vitamin B12 in plant-based diets:</p> <p>8) Have you ever been diagnosed by your health care practitioner with a vitamin B12 deficiency?</p> <p>9) Do you have your B12 levels tested annually by your health care practitioner?</p>
--	---	---

Data Collection

Data was collected between October 13, 2016 to October 26, 2016 via a survey created on the Survey Monkey website. Survey participants were recruited via national social media promotion, requesting vegans to participate in an online survey about vitamin B12. Participants were men and women, ages 18 years and older, who are on a strict plant-based (vegan) diet, which includes no animal foods, such as dairy, meat, or eggs. Participants are a part of a plant-based social media community,

which consists of over 30,000 followers. A sample of 41 from this community was targeted. Survey conducted is below.

Vitamin B12 Intake among people eating plant-based diets

SURVEY

Tamara Kelly-Scott, an Eastern Michigan University graduate student under the direction of preceptor Sharon Palmer, RDN and Dr. Mona Al Audhi, EMICH nutrition professor, is conducting a survey to explore vitamin B12 intake among people eating vegan diets.

This online survey will ask knowledge based questions on vitamin B12 as well as basic demographic questions such as gender and age. We invite your participation, which should only take 10-15 minutes of your time. This survey is anonymous and the results of this study may be used in reports, presentations, or publications but your name will not be known.

Completing the last question of the survey enters you into a raffle to win a \$25.00 Amazon gift card. You will be contacted via email if you are drawn for a gift card after the survey close date of October 23, 2016.

***For men and women, ages 18 years and older, who are on a strict plant-based (vegan) diet, which includes no animal foods, such as dairy, meat, or eggs.**

1. What is your age range?

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

2. What is your gender?

- Male
- Female

3. How long have you been on a plant-based (vegan) diet?

- Less than one year
- 1-3 years
- 4-7 years
- 7-15 years
- 16-25 years
- More than 25 years

4. Have you ever been diagnosed by your health care practitioner with a vitamin B12 deficiency?

- Yes

No

5. Do you have your B12 levels tested annually by your health care practitioner?

Yes

No

6. What sources of B12 do you include in your diet on a daily basis?

Nutritional Yeast

Vitamin B12-fortified plant milk (i.e., soy or almond milk)

Vitamin B12 supplements

None

Other (please specify)

7. Do you believe that vitamin B12 needs to be supplemented in a plant-based (vegan diet)?

Yes

No

8. At what levels do you supplement vitamin B12 (through dietary supplements) in your diet?

6 mcg/day

500 mcg/day

1000 mcg/day

2500 mcg/week

10,000 mcg/week

None

Other (please specify)

9. The following describes my belief on the role of vitamin B12 in plant-based diets:

The body can fill in nutritional gaps for vitamin B12 if you eat a healthy, whole foods, plant-based diet.

Vitamin B12 is the one essential nutrient that absolutely must be supplemented in a plant-based diet.

Vegetarians who eat small amounts of dairy and eggs do not need to worry about supplementing with vitamin B12.

You can get adequate vitamin B12 in a plant-based diet from fresh vegetables that are in contact with the soil.

Absorption of vitamin B12 supplements may be very poor, increasing the need for the nutrient above the RDA.

10. Write in your email address in order to be entered into the raffle.

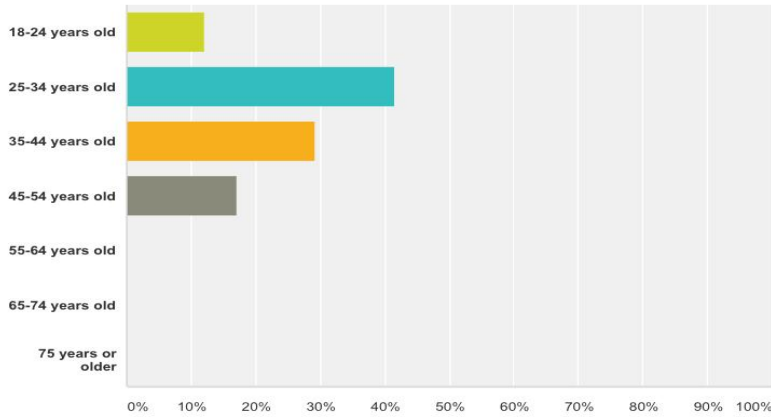
Analysis and Interpretation of Data

The survey revealed the following results:

Demographic Data

What is your age range?

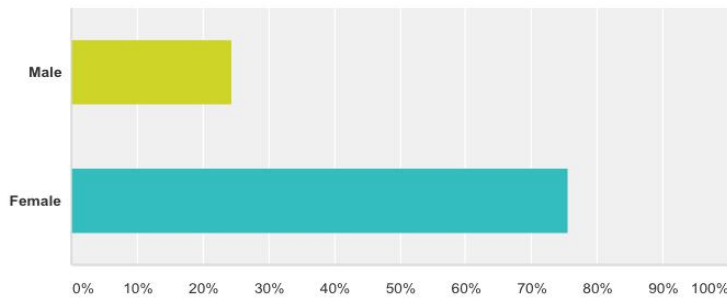
Answered: 41 Skipped: 0



Answer Choices	Responses	Count
18-24 years old	12.20%	5
25-34 years old	41.46%	17
35-44 years old	29.27%	12
45-54 years old	17.07%	7
55-64 years old	0.00%	0
65-74 years old	0.00%	0
75 years or older	0.00%	0
Total		41

What is your gender?

Answered: 41 Skipped: 0

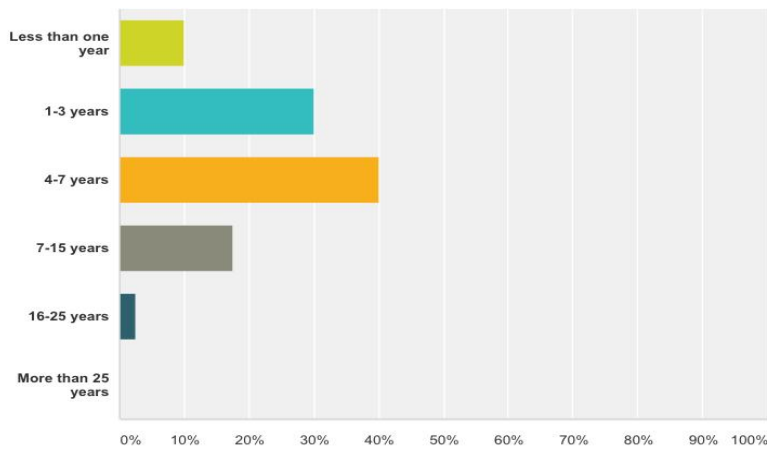


Answer Choices	Responses	Count
Male	24.39%	10
Female	75.61%	31
Total		41

Individual Lifestyle Factors

How long have you been on a plant-based (vegan) diet?

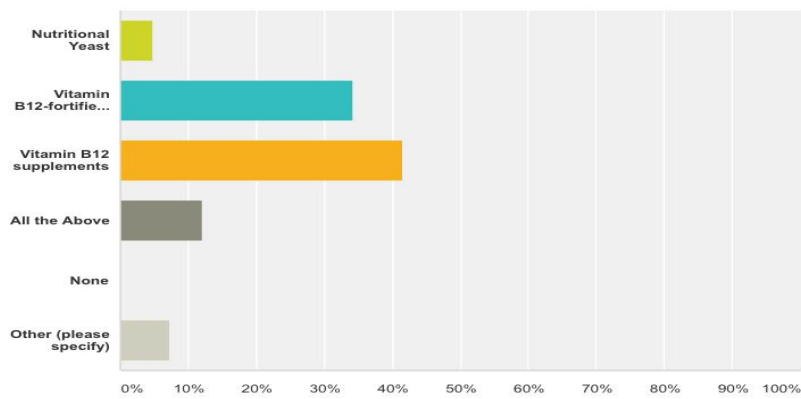
Answered: 40 Skipped: 1



Answer Choices	Responses
Less than one year	10.00% 4
1-3 years	30.00% 12
4-7 years	40.00% 16
7-15 years	17.50% 7
16-25 years	2.50% 1
More than 25 years	0.00% 0
Total	40

What sources of B12 do you include in your diet on a daily basis?

Answered: 41 Skipped: 0

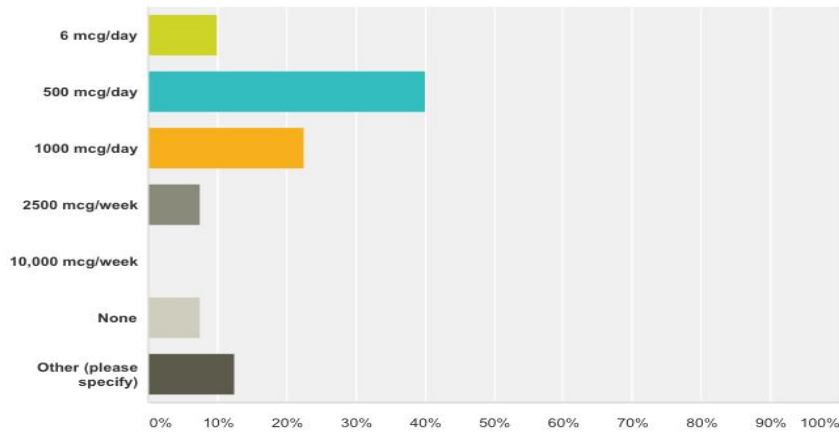


Answer Choices	Responses
Nutritional Yeast	4.88% 2
Vitamin B12-fortified plant milk (i.e., soy or almond milk)	34.15% 14
Vitamin B12 supplements	41.46% 17
All the Above	12.20% 5
None	0.00% 0
Other (please specify)	7.32% 3
Total	41

Three participants or 7.32% chose the other box and stated that they use a mixture of nutritional yeast, vitamin B12 plant milk, and B12 Supplements.

At what levels do you supplement vitamin B12 (through dietary supplements) in your diet?

Answered: 40 Skipped: 1



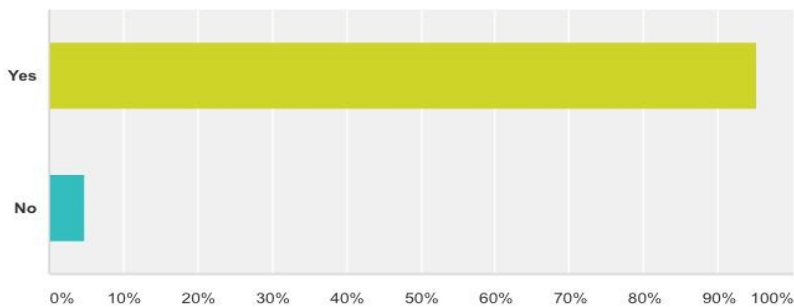
Answer Choices	Responses	Count
6 mcg/day	10.00%	4
500 mcg/day	40.00%	16
1000 mcg/day	22.50%	9
2500 mcg/week	7.50%	3
10,000 mcg/week	0.00%	0
None	7.50%	3
Other (please specify)	12.50%	5
Total		40

Five participants or 12.5% chose the other box and stated that they do not know their supplement levels.

Assess Knowledge and Awareness

Do you believe that vitamin B12 needs to be supplemented in a plant-based (vegan diet)?

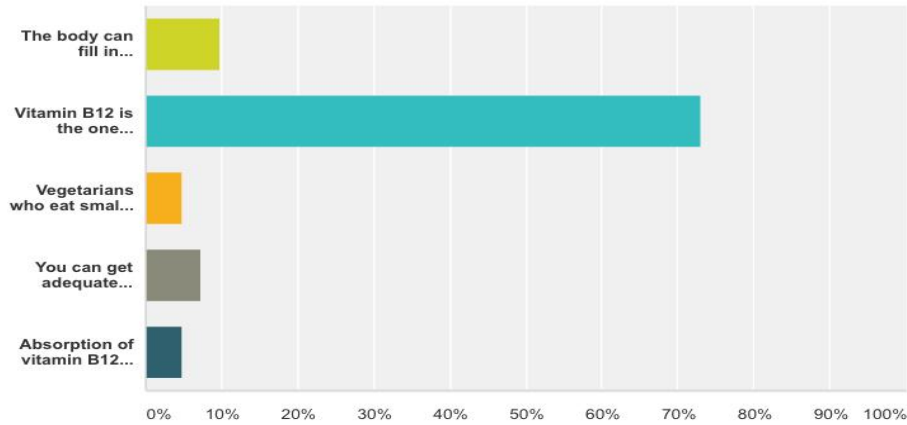
Answered: 41 Skipped: 0



Answer Choices	Responses	Count
Yes	95.12%	39
No	4.88%	2
Total		41

The following describes my belief on the role of vitamin B12 in plant-based diets:

Answered: 41 Skipped: 0

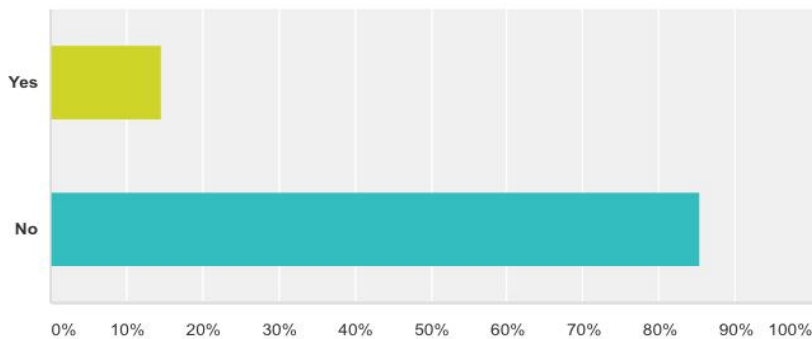


Answer Choices	Responses
The body can fill in nutritional gaps for vitamin B12 if you eat a healthy, whole foods, plant-based diet.	9.76% 4
Vitamin B12 is the one essential nutrient that absolutely must be supplemented in a plant-based diet.	73.17% 30
Vegetarians who eat small amounts of dairy and eggs do not need to worry about supplementing with vitamin B12.	4.88% 2
You can get adequate vitamin B12 in a plant-based diet from fresh vegetables that are in contact with the soil.	7.32% 3
Absorption of vitamin B12 supplements may be very poor, increasing the need for the nutrient above the RDA.	4.88% 2
Total	41

Assess Health Practices

Have you ever been diagnosed by your health care practitioner with a vitamin B12 deficiency?

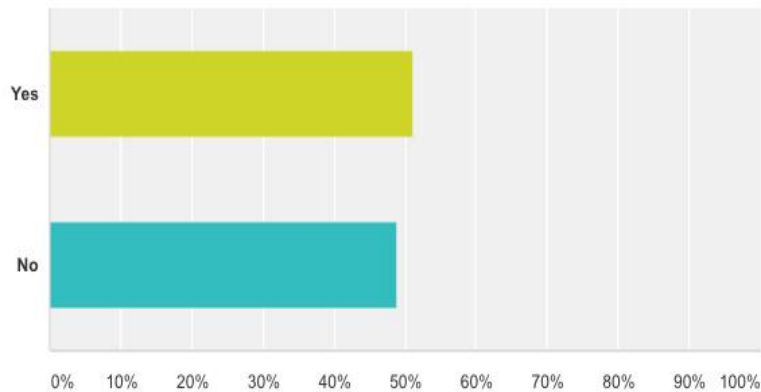
Answered: 41 Skipped: 0



Answer Choices	Responses
Yes	14.63% 6
No	85.37% 35
Total	41

Do you have your B12 levels tested annually by your health care practitioner?

Answered: 41 Skipped: 0



Answer Choices	Responses	
Yes	51.22%	21
No	48.78%	20
Total		41

The survey sample of the plant-based community shows that the majority of plant-based eaters are between 25 to 34 years old, approximately 42 % of the sample population. Out of the one million Americans that are vegan, according to 2013 statistical findings, 79% are women, which aligns with these survey results indicating approximately 75% are female.¹¹ These survey results also state that 40% of the sample populations have been living a vegan lifestyle for 4 to 7 years. Forty percent take a 500 mcg/day supplement as their main source of B12. Ninety-five percent of the sample population believes that vitamin B12 should be supplemented in the diet, and that vitamin B12 is one essential nutrient that absolutely must be supplemented in a plant-based diet. Eighty-five percent of the population has not been diagnosed with B12 deficiency, and approximately half of the population get their B12 levels tested annually.

A scientific review of vitamin B12 deficiency among vegetarians and vegans revealed that a deficiency was found in 62% of pregnant women, 25-86% of children, 21-41% of adolescents, and 11-90% of elderly.¹² Higher rates of deficiency were reported among vegans compared to vegetarians, and among individuals who had adhered to a vegetarian diet since birth compared to those who had adopted this diet later in life.¹² The main finding of this review is that vegetarians and vegans should take preventive measures to ensure adequate intake of this vitamin, including regular consumption of supplements containing B12.¹² Nevertheless, our survey reports that only 14.6% of the population have been diagnosed with B12 deficiency, though 48.8% do not receive annual testing by a health practitioner.

Conclusion

This sample population is a good representation of the plant-based community. From the survey results, approximately 92% of the population takes some form of vitamin B12, which verifies that there is an awareness of the need for B12 in the vegan diet. However, almost half do not get annually checked by their health practitioner. There is a definite need to bring recognition among the vegan community to receive a nutritional assessment annually by healthcare professionals. More research should be conducted on this community as it relates to vitamin B12 consumption and deficiency, as there is limited data available. Despite the awareness of the need for vitamin B12 in the diet, education can be beneficial for individuals in this community so that they can ensure they are meeting nutritional needs, as well as receiving appropriate nutrition assessment.

By Tamara Kelly-Scott, Dietetic Student

References

1. Wikipedia. Plant-based diets. https://en.wikipedia.org/wiki/Plant-based_diet. Accessed October 13, 2016.
2. Webmed. Plant-Based Diet for Heart Health. <http://www.webmd.com/heart-disease/guide/plant-based-diet-for-heart-health>. Accessed October 13, 2016.
3. Hu FB. Plant-based foods and prevention of cardiovascular disease: an overview. *Am J Clin Nutr*. 2003;78(3 Suppl):544S-551S.
4. Massera D, Graf L, Barba S, Ostfeld R. Angina rapidly improved with a plant-based diet and returned after resuming a Western diet. *J Geriatr Cardiol*. 2016;13(4):364-6.
5. Medline Plus. Vitamin B12. <https://medlineplus.gov/ency/article/002403.htm>. Accessed October 13, 2016.
6. Alliance for Natural Health International. Vitamin B12. <http://anhinternational.org/2013/09/04/fighting-forest-fires-with-teaspoons-folic-acid-fortification-and-vitamin-b12-deficienc>. Accessed October 13, 2016.
7. Pawlak R, Lester SE, Babatunde T. The prevalence of cobalamin deficiency among vegetarians assessed by serum vitamin B12: a review of literature. *Eur J Clin Nutr*. 2014;68(5):541-8.
8. Skerrett P. Vitamin B12 deficiency can be sneaky, harmful. Harvard Health Publications. <http://www.health.harvard.edu/blog/vitamin-b12-deficiency-can-be-sneaky-harmful-201301105780>. Updated October 18, 2016. Accessed October 20, 2016.
9. Jones-Shoeman C. Vegan Vitamin B12 Deficiency is a Myth. http://www.naturalnews.com/029531_vitamin_B12_vegan.html. Accessed November 1, 2016.
10. Messina V. Plan Healthful Vegan Diets. <http://www.todaysdietitian.com/newarchives/021115p40.shtml>. Accessed November 1, 2016.
11. The Huffington Post. Veganism Is A Woman's Lifestyle, According To Statistics. http://www.huffingtonpost.com/2014/04/01/vegan-woman-lifestyle_n_5063565.html. Updated April 1, 2014. Accessed October 26, 2016.
12. Pawlak R, Parrott SJ, Raj S, Cullum-dugan D, Lucus D. How prevalent is vitamin B(12) deficiency among vegetarians. *Nutr Rev*. 2013;71(2):110-7.