

Plant power



Bachelor thesis Liselotte Verheij

Registration number: 921218875070
Study: Business and consumer studies
Course code: YSS-82312
Group: Food Quality and Design
Supervisor: Bea Steenbekkers
Date: June 27, 2017



WAGENINGEN
UNIVERSITY & RESEARCH

Table of Contents

Abstract	3
1. Introduction.....	4
2. Method	5
Literature study	5
Interviews	5
Sample	5
3. Results of the literature study	6
3.1 A plant based diet.....	6
3.2 Advantages of eating a plant based diet	6
3.3 Food choice model	7
3.4 The food pyramid	7
3.5 Replacing nutrients usually retrieved from animal products.....	8
4. Results of the empirical study	10
Interviews	10
5. Discussion and recommendations for further research.....	11
6. Conclusion	12
7. References.....	13
Appendix 1: Interview questions.....	16
Appendix 2: Interviews.....	17
Respondent 1	17
Respondent 2	18
Respondent 3	19
Respondent 4	20

Abstract

Based on interviews and a literature review a study was made on how to follow a plant-based diet without nutrient deficiencies. The Dutch recommendation for a healthy diet, based on the food pyramid, are explained. The results of the literature study show how people who follow a plant based diet can still obtain all essential nutrients. The conclusion of the literature study is that following a plant-based diet and taking up all essential nutrients at the same time is very well possible. The main nutrient not available in plant-based foods is vitamin B12. This vitamin can be obtained through supplements or through fortified foods. Apart from this it is important to eat a variety of foods and carefully choose suitable food combinations. Four interviews were conducted to evaluate the knowledge of possible nutrient deficiencies associated with a plant-based diet and how to prevent these in daily life. The opinions about B12 supplementation were mixed. Two respondents take supplements, because B12 is not available in plant-based foods. The other two respondents do not take supplements as they believe that they would obtain sufficient vitamin B12 from fortified foods. All respondents had knowledge of nutrition and essential nutrients and paid attention to what they eat most of the time.

1. Introduction

Globally there is a growth of the population and also an increase in wealth. A result of this is an increase in demand of food, especially of animal origin (Sabaté & Soret, 2014). Thereby the Food and Agriculture Organization of the United Nations (FAO) reported that approximately 843 million people all over the world suffer from hunger and even more have food deficiencies (Wu et al., 2014). Simultaneously climate change is happening. This has negative effect on the food production (Ronald & Adamchak, 2010). This being said the world does need more food with the growing number of people. People need food to survive: it provides them with nutrients and energy. The question arises what needs to be changed in how the food is produced and consumed today, in order to keep feeding the world in a sustainable way.

Food consumption is causing a lot of waste (Sabaté & Soret, 2014). Thereby the production of food today causes more greenhouse gas emissions than before and the usage of too much water (Wu et al, 2014). The land we use is damaged, deforestation takes place and the biodiversity is affected (Honey, 2016). It is known that the livestock production is responsible for 80% of the greenhouse gas emissions from the agriculture sector which is 22% of the worldwide total emissions (McMichael et al., 2007). Thereby livestock eats about half of global grain production (Goodland, 1997). This is food that could have also been eaten by humans. With the rising economies in developing countries the consumption of dairy and meat will increase in the future and thereby also the livestock production (Delgado, 2003). Simultaneously people eat less grains and vegetables (Graça, Oliveira, Calheiros, 2015). So to meet the needs of the future generations a diet with less animal products should be eaten. However the meat consumption increased with 60% between 1990 and 2009 (Henchion et al., 2014). Nowadays the meat consumption on a global level is 42 kg per person per year. It is predicted that it will be doubled by 2050. In Europe the meat consumption is already 76 kg per person per year (Pohjolainen, Vinnari & Jokinen, 2015). Recently following a plant based diet has received a lot of attention, for the environment and health reasons mostly (Mendes, 2013). But not many people do follow this diet (Lea, Crawford & Worsley, 2006b).

According to a study of Pohjolainen (2015) an obstacle for people to eat more or a complete diet of plant based foods is often that they believe that they will get food deficiencies. Thereby is stated that eating meat is a routine for people that they enjoy. In this paper is discussed what people that follow a complete or almost complete plant based diet do or should eat to include the nutrients that they miss by not eating animal products. The goal of this paper is to show if it is possible to follow a plant based diet without getting food deficiencies. So the main question is *How to follow a plant based diet and getting in all necessary nutrients?*

To answer this question a couple of sub questions will be answered. First it is important to get some background information through two questions *What is a plant based diet?* and *What are the advantages of a plant based diet?* Because there is an obstacle to eat a plant based diet it is important to know how consumers make decisions in choosing food . There will be given some background information in how people make food choices so *the food choice model* will be explained. To know if and which nutrients are missed the following question will be answered *What is the recommended daily intake for a healthy diet according to the Dutch food pyramid?*

Knowing this the question remains *What are the alternatives for the nutrients usually retrieved from animal products?*

By doing interviews two questions will be answered: *What is the knowledge on getting in all nutrients without eating animal products of people that eat plant based?* and *How do current plant based eaters make sure they get in all nutrients without eating animal products?*

2. Method

Literature study

For this research a literature study is done. All the literature is gathered via Wageningen University. Wageningen university enabled to use search engines for the literature study. Several engines are used: Scopus, the WUR library, google scholar. Also articles which I came across in courses of my minor about food and sustainability are used. At the beginning the search subjects were really global like 'plant based diet' and 'healthy vegan diet'. When it was getting clear which nutrients were missed based on scientific research the search subjects became more specific. So then there could be searched more specific like: 'plant based diet and B12' or 'plant based diet and fortified food'. To make it easier to know what which article said a table is made with articles which had outcomes that were very important for this study.

Interviews

For information about what the knowledge is of plant based eaters explorative interviews have been done. The main goal was to find out how plant based eaters eat and what they do or not do to not miss the nutrients when not eating animal products and why. For the interview a list with questions was set up. This was more for guidance that all the information needed was given at the end of the interview, then to really follow it strictly. Another important thing was to let the respondent make up their own answers and not put words in their mouths. So do not make a judgement about what they say and not give too many examples. In the interview different subjects are discussed. At first the reason for becoming a vegan. Then a question was asked about what in general is a healthy diet. After that the difference between a general diet and a plant based diet is discussed. Then a question if this difference has an influence on the proper nutrient intake according to the respondent. Another subject is how in practice the respondents make sure they do not get food deficiencies.

Sample

Four people are interviewed; all students from Wageningen University aged between 20-24 years. The sample consisted of three women and one man. Two respondents were from the Netherlands, one was from Germany and the other from South America. All respondents study different programmes. Besides choosing plant based respondents, the respondents are chosen on a random basis.

3. Results of the literature study

3.1 A plant based diet

A plant based diet is also called a vegan diet. The definition of a vegan diet is eating vegetarian and in addition also not consuming any other animal products, such as eggs and dairy (Cherry, 2006). From an animal focused perspective, it is inconsistent to be a vegetarian and not a vegan, and therefore some people practice a vegan lifestyle (van der Kooi, 2010). This vegan lifestyle also includes exercising, drinking no or very little alcohol and not smoking; elements of a healthy lifestyle (Dyett, et al., 2013). Veganism is seen as more than just a dietary choice, but a lifestyle based on ideologies (Mendes, 2013). According to a study of Radnitz, Beezhold and Dimatto (2015) about the lifestyle choices of different vegans, the ideologies can be based on animal welfare on the environment or on health reasons. The number of people eating a plant based diet has increased in the last couple of years, **but the number is still low**. This increase can be explained by an increase in knowledge about health benefits, an increase in availability of substitutes for animal products and awareness about how the livestock production is producing (Radnitz, Beezhold, Dimatto, 2015). People following a vegan diet tend to eat more fresh produce and a minimum of processed foods. They eat a variety of grains, fruits, vegetables, legumes, nuts and seeds (Crawford & Worsley, 2006). Vegan food is not necessarily healthy. There are grain-based foods high in sugar, -salt and unhealthy fats (Radnitz et al., 2015). The decision to follow a plant based diet results from a higher number of benefits while following the diet than the number of barriers resulting from behavioural change (Lea, Crawford & Worsley, 2006a).

3.2 Advantages of eating a plant based diet

Health

A major problem all over the world is obesity, which is linked to impaired quality of life and a reduced life expectancy. Two-third of the people in the United States is overweight. The rate of obesity in developing countries is also increasing (Johnson, et al., 2015). The question arises whether there is something wrong with the way we eat. People that eat a plant-based diet tend to be thinner (Craig, 2009). Thereby can a vegan diet contribute to controlling weight gain (Rossi & Garner, 2014). An advantage of following a vegan diet over a vegetarian diet is that it provides more protection to obesity, abnormal high blood pressure, type-2 diabetes and cardiovascular diseases (Le & Sabaté, 2014). A study showed that health concerns for a person eating a plant-based diet were lower than for a vegetarian diet (Lea, et al., 2006a). One reason for this can be that vegans prefer and eat more home cooked meals over eating fast food meals. Plant based diets consist mostly of foods that are low in fat, saturated fat and cholesterol and are high in fibre, folate, vitamin C. This is because of the high intake of fruits, vegetables, legumes, and whole grains (Dyett, et al., 2013).

Environment

When there is less livestock production, there will also be a reduction in demand for feed. This means that there will be more land left to produce food for human consumption (Westbroek, et al., 2014). Greenhouse gas emission of meat production and of vegetables production differs a lot. The largest difference is with beef and lamb in comparison to legumes. The environmental impact of legumes is much lower (Tilman & Clark, 2014). Thereby to make 1 kg of animal products takes about 100 times more water than to make 1 kg of grain products (Marlow et al., 2009).

Preventing animal welfare issues

According to an article of Rossi & Garner (2014) animal agriculture has changed from a small system with family farms to an industrial system where there is a large supply of cheap animal products. Animal agriculture caused a steady supply of protein for consumption for humans, but it also caused the transmission of viruses carried by animals. The mass production of animal produce is causing that diseases and viruses can spread easily. Also the mass production has an negative influence on animal

welfare. This negative influence exists because the animals are removed from their natural habitat. They live in small places so have minimum movement and this also has a negative influence psychologically, for example animals can get frustrated and may result in aggressive behaviour towards other animals (D'Silva, 2006).

3.3 Food choice model

Research indicates that food choices are influenced by taste, convenience, healthiness and price. Eating less meat means changing the composition and products of what is usually eaten. This will take more effort and cooking skills (Tobler, Visschers & Siegrist, 2011). This is a reason that consumers are not so willing to eat less meat. For people to change their eating behaviour it has to take little effort (Tobler, Visschers & Siegrist, 2011). In the food choice model there are five influences to making food decisions. These are: ideals, personal factors, resources, social framework and food context. The most persuasive one is ideals. These are derived from symbolic factors, such as social status and culture, for example what eating 'well' is differs per country. Personal factors also play a role, for example one person can be very food centred while another person just eats because he has to. Another big contributor in making food choices is the resources a person has, for example money, equipment and knowledge. When making food choices people are also influenced by the people around them and the composition of the group of people that they are eating with, for example different priorities that people have. This is called the social framework. And lastly the food context also plays a role in making the choice. This means for example the availability of certain foods and the physical surroundings of where you buy your food (Furst, et al., 1996). In this paper the focus will be on how elements of the food choice model can be used to explain the nutrient intake of plant based eaters. A common reason for not being vegan is that people believe that you will get food deficiencies and this is a consequence of low knowledge on how to replace animal products (Pohjolainen et al., 2015).

3.4 The food pyramid

To know what nutrients are missed when eating a plant based diet, first will be looked what is recommended for a 'general' Dutch diet. The Dutch food centre (Voedingcentrum) has a food pyramid which is called 'De Schijf van Vijf', it can be seen as a pie divided in five pieces. Every piece stands for a group of food products. The five components together form a healthy diet. The size of the piece shows which quantity should be eaten from a certain group of foods per day. This system is invented to give advice to consumers about sustainable, healthy and safe food choices and therefore prevent chronic diseases. These guidelines are based on scientific based knowledge from the Health Council of the Netherlands. One main guideline is to eat more plant based foods and less animal products (Brink, et al. 2016).



Figure 1: De Schijf van Vijf, the dutch food pyramid.

The Dutch food pyramid exists of five product groups. The first is vegetables and fruit. The second is bread, whole grain products and potatoes. The third is hydration like water, tea and coffee. The fourth guideline is dairy, nuts, fish, legumes, meat and eggs. The fifth is fats, in the form of cooking oils. Next to these five product groups they have a few more general recommendations. One recommendation is to eat dairy, fruit, vegetables and unsalted nuts every day. Another recommendation is to eat fish every week. Thereby you should also eat as little as possible food and drinks with added sugar and salt. It is also recommended to choose more often for plant based protein sources (Brink, et al., 2016). The criteria for a main meal are 400 to 700 calories, at least 150 gram vegetables, at most 100 gram meat, fish, egg or meat replacement or 25 gram nuts, at least 60 gram legumes, whole grains or potatoes and at most 15 gram cooking oils (Brink et al., 2016). The food pyramid also gives recommendations to people that are vegetarian, vegan or flexitarian, people who some days do not eat meat. People that eat no meat should eat an extra portion legumes, two extra portions of nuts, an extra egg and no extra dairy (Brink, et al., 2016). The nutrients that are retrieved from eating meat are protein, iron, vitamin B1 and vitamin B12. These nutrients can all be retrieved by eating enough dairy products, vegetables, bread and other grain products. In general vegetarians are recommended to eat eggs, legumes, soy products, nuts and seeds. Vitamin B12 is the only nutrient that you can only retrieve from eating animal products, like milk, cheese and yoghurt. Vegetarians need 20 percent more protein than people that eat meat. This may seem like a lot more, but in practice people (meat eaters) eat too much protein. So when transferring to a vegetarian lifestyle getting in enough protein is not a problem. In vegetarian diets proteins are retrieved from legumes, whole grain products, cheese, milk, yoghurt and quark. It is important to get your proteins from different products. Iron is retrieved from vegetables, especially leafy greens, whole grain products, seitan and potatoes. Iron retrieved from meat is easier to take up than iron retrieved from vegetarian sources. This makes it important to eat vegetables and fruit with every meal. These products contain vitamin C, which helps to absorb the iron better. When eating a meat replacement it has to contain at least 100 gram of iron, B12 and/or B1 and protein has to be at least 12 percent of the calories. When eating dairy replacements it is important that calcium and B12 is at least 100 gram and protein is at least 12 percent of the calories in the product (Brink, et al. 2016).

3.5 Replacing nutrients usually retrieved from animal products

Legumes, like beans, soy and lentils are an excellent meat replacement. Just like meat they are a source of iron, protein and B vitamins. Legumes do not contain saturated fat, no salt and a lot of fibre (Voedingcentrum, 2016). Besides that plant based eaters do have to pay special attention to a couple of nutrients that are harder to get in when not eating animal products.

Calcium and vitamin D

The first is calcium, which is important for a good bone health (Craig, 2009). According to Voedingcentrum (2012), for a good intake of calcium vitamin D is important. Products that naturally contain vitamin D are fish and eggs and meat a little bit. Vitamin D is also added in everyday foods, like margarine. Vitamin D can also be obtained naturally from sunlight if you do not cover yourself and are dark skinned (Craig, 2009). Calcium is naturally available in foods, but can also be obtained through supplements or fortified foods. According to Voedingcentrum (2017a) calcium can be retrieved from plant based sources like vegetables, nuts and legumes. To minimize the loss of calcium in a plant based diet, the intake of protein and sodium has to be adapted. The calcium to protein ratio is important to look at. A way to accomplish the right ratio is to increase calcium intake and in this way compensate for the higher intakes of protein (Weaver, Proulx & Heaney, 1999). Another study of people on a vegan diet also shows that a proper calcium intake can be retrieved naturally on a plant based diet. This without any supplementation (Kohlenberg-Mueller & Raschka, 2003).

Vitamin B12

One of the groups of people that is at risk of B12 deficiency are vegan people. Often a vitamin B12 deficiency is due to an inadequate diet or inability of the body to absorb the vitamin (Vitamins in Motion, 2017). An adult is recommended to get in 2.4 micrograms. No plants can synthesis vitamin B12. Only animal products have the right enzymes to synthesise vitamin B12. Not only meat contains B12, also eggs, cheese and fish (World Health Organisation, 2004). Vitamin B12 is also available in fortified foods (National Institutes of Health, 2017). It is recommended for people that eat no animal products to take supplementation, in the form of cyanocobalamin. The forms of B12 used in the human body are methylcobalamin and deoxyadenosylcobalamin. The human body can convert cyanocobalamin in methylcobalamin and deoxyadenosylcobalamin (Linus Pauling Institute, 2017).

Protein

According to Voedingscentrum (2017b) people that follow a plant based diet need 25% more proteins than people who eat meat. Plant based protein contains less essential amino acids than animal based protein. To get in all essential amino acids it is important to eat protein from various sources. Examples of plant based protein sources are vegetables, potatoes and bread (Tieland, et al., 2015).

Vitamin B1

Vitamin B1 is available in plant based foods like bread, grains, potatoes and vegetables. However there is a big difference between the vitamin B1 in meat and in the plant based foods. A piece of multigrain bread of 70 gram contains 0,08 milligram vitamin B1 and 70 gram of meat contains 0,34 milligram (Voedingscentrum, 2017c).

Iron

Plant based foods contain iron. The iron retrieved from animal products, heme iron, is significantly more than iron from plant based foods, non-heme iron. This is because the body absorbs heme iron better. Vitamin C makes the absorption of non-heme iron better. People on a vegan diet often already eat a lot of vitamin C. Many people on a plant based diet get in enough iron to not get a deficiency (Craig, 2009).

Omega-3

There are different sources of omega-3. The most well-known source is fish, but there are also plant sources like chia seeds, flaxseed oil and green leafy vegetables. The plant based sources are sufficient to get in the right amount of omega-3. For special needs people like pregnant or older people supplementation can help. The supplementation to use is made from microalgae (Saunders, Davis & Garg, 2012).

4. Results of the empirical study

Interviews

Four respondents have been interviewed. The respondents were between 21 and 24 years old, three woman and one men. The respondents were recruited on a random basis. Two respondents were acquaintances. The other two were recruited at Wageningen University. All the respondents were students of Wageningen University, three are doing there bachelor and one is doing his master. They all did different studies. One did a social science study and the rest a life science study.

Reason of being vegan

Three of the four respondents became vegan because of environmental reasons and animal welfare reasons. One person specifically went vegan because of health reasons.

Eating a wholesome diet

All the respondents pay attention to what they eat. Every day they make sure to eat beans, nuts and leafy greens. This for an adequate calcium and protein intake. It is very important to eat varied to get in all the adequate nutrients. One respondent who plays an intensive sport, made sure to eat enough calories and protein. He did this by eating more and taking hempseed protein powder. One respondent said it depends on the season what he eats. When he is in university he eats very different than when he is on holiday. For example when he is on a holiday he pays less attention on what to eat.

Replacing nutrients retrieved from animal products

Most respondents rely on good replacements of animal products, like a vegan hamburger or oat milk, to get in the right nutrient intake. These animal product replacements they use are premade and are often fortified with nutrients like B12. Vitamin D is not a problem for the respondents. They believe the intake is sufficient when it is possible to be in the sun. One respondent took a supplement vitamin D when living in Oslo. A supplement taken by two respondents was vitamin B12. The respondents took this supplement because it is not available in plant foods. The other two do not believe this is necessary. They just feel good, so why should they take it. One respondent took it for a while, but it make her skin feel itchy. They say the fortification in foods is enough to get an adequate intake, for example soy milk and tofu. One respondent also eats a piece of cheese once in 6 weeks, this also helps with the vitamin B12 intake.

Difficulties of eating vegan

Most respondents do not believe it is difficult to eat vegan. One respondent in particular said because he is used to eat mostly beans and grains in his country of origin transitioning to a vegan diet was not so difficult. One respondent said that breakfast and lunch is not difficult because there are many vegan substitutes available like soy milk. Dinner is more difficult, especially when you eat with other people. Also there are many cuisines, for example Asian is easily made vegan but Dutch cuisine is less easy to make vegan.

Information sources

The respondents used different sources of information. Two respondent read books, the China Study and Vegan for life. Another respondent uses a list, which she got from the internet, with on it all foods you have to eat for an adequate nutrient intake.

5. Discussion and recommendations for further research

In this research is studied if people that eat plant based can follow this diet without having food deficiencies. To research this question two approaches have been used. A literature study and a field study, consisting of four interviews. The literature study showed that a plant based diet has to be accompanied by supplements. Vitamin B12 is not available in plant based foods and so has to be taken in a supplement. The interviews show that two respondents do not take supplements. They believe that they do not need it and get it in enough by fortified products or eating a piece of cheese once in a while.

It was difficult to find vegans in Wageningen. Short time period was scheduled for this research so a small group of respondents have been interviewed. This makes the results less reliable, but it is still interesting to use for further research. In this research interviewing was also interesting, by comparing what is researched in literature with what vegans do in practice. For example do vegans take supplements or do they rely on fortification.

All the respondents where from Wageningen University which means that they might have more information about the subject . This research can be used as a beginning for further research. Two of the four respondents did not use supplements in this research. It would be interesting to research if this percentage is also so high when looking at a large group of vegans from all over the world. You may compare difference in cultures or gender or age. This may be interesting for product development for vegan products.

Another interesting thing is to study the effect of a plant based diet on the environment further. As seen in the interviews done in this research a common reason for eating vegan was for the environment. In the literature this is confirmed. Further research can look if a plant based diet is good for the environment no matter what you eat and where you live. There may be places where people hunt wild animals and eat them. This could be less damaging to the environment than to import plant based products like nuts and avocado.

Another idea for further research is studying the health benefits with eating a plant based diet. One respondent in this research said she healed her eczema with eating plant based. How is this possible and can maybe more diseases be solved eating this way? Or it could be that it is not eating plant based but an indirect effect of plant based eating, like eating more vegetables and fruit.

The food choice model explains how people make food choices. In the food choice model there are five influences. For the nutrient intake resources is the most important, a lot of people do not want to change their habit of eating meat (Tobler, Visscher & Siegrist, 2011; Pohjolainen et al., 2015). Resources includes knowledge, money and equipment. In this research a part of the interview was focused on how they retrieved their information. Two respondents read books about veganism, the other two did some research online. To research the effect on the kind of information they use and how that has effect on how they eat would be an interesting thing to research further. Another aspect is ideals, for example it differs what 'eating well' means per country. One person said that it was easier for him to eat plant based because he was raised in South-America. There they rely on grains and beans. Interesting would be to research how the country people live in has an influence on the nutrient intake of vegans.

6. Conclusion

In this paper is studied the following research question: *How to follow a plant based diet and getting in all necessary nutrients?*. Through literature and interviews this question is answered.

The Food choice model explains how people make food choices. According to the food choice model there are five influences for making food choices: ideals, personal factors, resources, social framework and food context (Tobler, Visschers & Siegrist, 2011). These influences were seen in the interviews. For example one boy eats differently when he works out a lot, this is an example of personal factors. All the respondents became vegan because of ideals, like animal welfare and environmental reasons.

The recommended daily intake for a healthy diet according to the Dutch pyramid is divided in a pie with five pieces. Each piece represents a product group: vegetables and fruit, whole grain products an potatoes, hydration, dairy, nuts, fish, legumes, meat and eggs and fats in the form of cooking oil. Next to this a recommendation is to eat dairy every day and eat fish every week (Brink et al., 2016). People on a plant based diet do not eat fish, meat, dairy and eggs, but this is not necessarily needed for a healthy diet.

Many nutrients are naturally available in plant based foods like calcium, protein, B1, iron and omega-3. So no dairy, meat, fish or eggs have to be eaten like the Dutch pyramid says. Calcium is retrieved from the sun, so when living in a country without a lot of sunlight you should take vitamin D in supplement form or fortification (Craig, 2009). Iron is naturally available but the plant based iron is not as good absorbed as the animal based iron. Vitamin C makes the absorption of plant based iron better (Craig, 2009). Vitamin B12 is the only nutrient that is not naturally available in plant based products (World Health Organisation, 2004). This is why a plant based eater should take B12 supplementation in the form of cyanocobalamin (Linus Pauling Institute, 2017).

All the respondents consciously think about what they eat. They eat a lot of beans and nuts and vegetables. Two of the four respondents read books about a vegan diet. But all the respondents have in mind what they miss as a vegan and need as a vegan. Two of the four respondents do not take B12 supplementation, this is a conscious decision. They know that B12 is not naturally available in plant foods, they believe that when you feel fine it is good. They are aware of fortification in products and eat a piece of cheese once in a while and believe that is enough. It can be said that the knowledge of the respondents on a vegan diet is complete. The respondents have different ways getting in all nutrients.

There is not much difference between the information from literature and the information from the interviews. All respondents were aware of the nutrients they have to get in. The only difference is in getting in B12. Some respondents just felt good so did not feel the need of B12 supplementation and other respondents took supplementation, because it is just not possible to get it in other wise.

So it is possible to follow a plant based diet and get in all necessary nutrients through B12 supplementation, making proper food combinations and eating a varied diet. It is also important to have knowledge about the nutrients. Some nutrients are less easy to take in and some foods need to be eaten more or in many different forms to get in enough of it.

7. References

- Azjen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes* vol. 50(2), p. 179-211.
- Brink, L., Postma-Smeets, A., Stafleu, A. & Wolvers, D. (2016). *Richtlijnen schijf van vijf*. Het voedingscentrum.
- Craig, W.J. (2009). Health effect of vegan diets. *The American journal of clinical nutrition*, vol. 89(5), p. 1627S-1633S.
- Crawford, E.J.L. & Worsley, A. (2006). Consumers' readiness to eat a plant-based diet. *European Journal of clinical nutrition*, vol. 60, p. 828-837.
- Delgado, C.L. (2003). Rising Consumption of Meat and Milk in Developing Countries Has created a New Food Revolution. *Journal of Nutrition*, vol. 133(11), p. 3907S-3910S.
- D'Silva, J. (2006). Adverse impact of industrial animal agriculture on the health and welfare of farmed animals. *Integrative Zoology*, vol. 1(1), p. 53-58.
- Dyett, P.A., Sabaté, J., Haddad, E., Rajaram, S. & Shavlik, D. (2013). Vegan lifestyle behaviors. An exploration of congruence with health-related beliefs and assessed health indices. *Appetite*, vol. 67(1), p. 119-124.
- Furst, T., Connors M., Bisogni, C.A., Sobal, J. & Winter Falk, L. (1996). Food choices: a conceptual model of the process. *Appetite*, 26(3), p. 247-266.
- Graça, J., Oliveira, A. & Calheiros, M.M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, vol. 90, p. 80-90.
- Henchion, M., McCarthy, M., Resconi, V.C. & Troy, D. (2014). Meat consumption: Trends and quality matters. *Meat Science*, vol. 98(3), p. 561-568.
- Honey, L. (2016). Food production and climate change: finding the right balance. *Veterinary Record*, vol. 178(1), p. 9-10.
- Johnson, W.G., Bluestein B.B., Dasilva, F., Moubray, N.I., Orton, M.L., Balagaye, H., Franco Paredes, K. & Kim, M. (2015). Perceptions of overweight in US and global cultures. *Eating behaviors*, vol. 17, p. 125-129.
- Kohlenberg-Mueller, K. & Raschka, L. (2003). Calcium balance in young adults on a vegan and lactovegetarian diet. *Journal of Bone and Mineral Metabolism*, vol. 21(1), p. 28-33.
- Le, L.T. & Sabaté, J. (2014). Beyond Meatless, the Health Effects of Vegan Diets: Findings from the Adventist Cohorts. *Nutrients*, vol. 6(6), p. 2131-2147.
- Lea, E.J., Crawford, D. & Worsley, A. (2006a). Consumers' readiness to eat a plant-based diet. *European Journal of Clinical Nutrition*, vol. 60(3), p. 342-351.
- Lea, E.J., Crawford, D. & Worsley, A. (2006b). Public views of the benefits and barriers to the consumption of a plant based diet. *European Journal of Clinical Nutrition*, vol. 60(7), p. 828-837.
- Linus Pauling Institute (2017). Vitamin B12. Retrieved 27 januari, 2017, from Oregon State university website: <http://lpi.oregonstate.edu/mic/vitamins/vitamin-B12>

Marlow, H.J., Hayes, W.K., Soret, S., Carter, R.L., Schwab, E.R. & Sabaté, J. (2009). Diet and the environment: does what you eat matter? *The American journal of clinical nutrition*, vol. 89(5), p. 1699S-1703S.

McMichael, A.J., Powles, J.W., Butler, C.D. & Uauy, R. (2007). Food, livestock production, energy, climate change, and health. *The Lancet*, vol. 370(9694), p. 1253-1263.

Mendes, E. (2013). An Application of the Transtheoretical Model to Becoming Vegan. *Social Work in Public Health*, vol. 28(2), p. 142-149.

National Institutes of Health (2017). Vitamin B12, fact sheet for consumers. Retrieved 27 januari, 2017, from national Institutes of health website: <https://ods.od.nih.gov/factsheets/VitaminB12-Consumer/#h4>

Pohjolainen, P., Vinnari, M. & Jokinen, P. (2015). Consumers' perceived barriers to following a plant-based diet. *British Food Journal*, vol. 117(3), p. 1150-1167.

Radnitz, C., Beezhold, B. & Dimatteo, J. (2015). Investigation of lifestyle choices of individuals following a vegan diet for health and ethical reasons. *Appetite*, vol. 90, p. 31-36.

Ronald, P. & Adamchak, Raoul (2010). The future of sustainable food production. *Annals of the New York Academy of Sciences*, vol. 11901(1), p. 184-185.

Rossi, J. & Garner, S.A. (2014). Industrial Farm Animal Production: a comprehensive moral critique. *Journal of Agriculture and Environmental Ethics*, vol. 27(3), p. 479-522.

Sabaté, J. & Soret, S. (2014). Sustainability of plant-based diets: back to the future. *The American Journal of Clinical Nutrition*, vol. 100(1), p. 476S-82S.

Saunders, A.V., Davis, B.C., & Garg, M.L. (2012). Omega-3 polyunsaturated fatty acids and vegetarian diets. *Medical Journal of Australia*, vol. 9(22).

Tieland, M., Borgonjen-Van den Berg, K.J., Van Loon, L.J. & de Groot, L.C. (2015). Dietary protein intake in dutch elderly people: A focus on protein sources. *Nutrients*, vol. 7(12), p. 9697-9706.

Tilman, D. & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, vol. 515, p. 518-522.

Tobler, C., Visschers, V.H.M & Siegrist, M. (2011). Eating green. Consumers' willingness to adopt ecological food consumption behaviors. *Appetite*, vol. 57(3), p. 674-682.

Vitamins in Motion (2017). Vitamin B12. Retrieved 27 januari, 2017, from vitamins in Motion website: http://www.vitaminsinmotion.com/fileadmin/data/pdf/VitaminsinMotion_VitaminB12.pdf

Voedingscentrum (2012). Voedingsnormen en suppletieadviezen vitamine D. Retrieved 3 july, 2016, from voedingscentrum website: <http://www.voedingscentrum.nl/encyclopedie/vitamine-d.aspx>.

Voedingscentrum (2016a). Hoe eet ik minder vlees of vegetarisch? Retrieved 5 july, 2016, from voedingscentrum website: <http://www.voedingscentrum.nl/nl/service/vraag-en-antwoord/gezonde-voeding-en-voedingsstoffen/ho-eet-ik-minder-vlees-of-vegetarisch-.aspx>.

Voedingscentrum (2016b). Zijn peulvruchten een goede vleesvervanger? Retrieved 5 july, 2016, from voedingscentrum website:

<http://www.voedingscentrum.nl/nl/service/vraag-en-antwoord/gezonde-voeding-en-voedingsstoffen/zijn-peulvruchten-een-goede-vleesvervanger.aspx>.

Voedingscentrum (2017a). Calcium. Retrieved 5 maart, 2017, from voedingscentrum website: <http://www.voedingscentrum.nl/encyclopedie/calcium.aspx>.

Voedingcentrum (2017b). Eiwitten. Retrieved 10 maart, 2017, from voedingscentrum website: <http://www.voedingscentrum.nl/encyclopedie/eiwitten.aspx>.

Voedingscentrum (2017c). Vitamine B1. Retrieved 16 maart, 2017, from voedingscentrum website: <http://www.voedingscentrum.nl/encyclopedie/vitamine-b1.aspx>

Weaver, C.M., Proulx, W.R. & Heaney, R. (1999). Choices for achieving dietary calcium with a vegetarian diet. *The American Journal of clinical nutrition*, vol. 70(3), p. 543s-548s.

Westbroek, H., Lesschen J.P., Rood, T., Wagner, S., De Marco, A., Murphy-Bokern, D., Leip, A., van Grinsven, H., Sutton M.A. & Oenema, O. (2014). Food choices, health and environment: effects of cutting Europe's meat and dairy intake. *Global environmental change*.

World Health Organization (2004). Vitamin and mineral requirements in human nutrition. *Food and Agriculture Organization of the United Nations*, vol. 2.

Wu, G., Fanzo, J., Miller, D.D., Pingali, P., Post, M., Steiner, J.L. & Thalacker-Mercer, A.E. (2014). Production and supply of high-quality food protein for human consumption: sustainability, challenges, and innovations. *Annals of The New York Academy of Sciences*, p. 1-19.

Wyker, B.A. & Davison, K.K. (2010). Behavioral Change Theories Can Inform the Prediction of Young Adults' Adoption of a Plant-based diet. *Journal of Nutrition Education and Behavior*, vol. 42(3), p. 168-177.

Appendix 1: Interview questions

Name:

Gender:

Age:

Study:

Vegan since:

- What is the reason you eat plant based?
- What is for you a wholesome healthy diet?
- What is for you characteristic for a plant based diet?
- In what does it differs from a regular diet?
- What is necessary to get in all the nutrients when eating a plant based diet?
- How do you do this in practice?

(If the question/s below are already answered in the previous questions, the upcoming question/s can be skipped, these are to make sure all the information is retrieved)

- Typical what you eat in a day
- Do you think about getting in all nutrients? Why?
- Do you think that by not eating animal products you miss crucial nutrients? Why?
- Do you eat certain things to not miss crucial nutrients? Why?
- Do you think about this when composing a meal? Why?
- Do you take supplements? Which ones? Why? Why not?

Appendix 2: Interviews

Respondent 1

Leeftijd: 22

Studie: Bodem, water atmosfeer

Waarom ben je veganist geworden?

Cowspiracy. Toen besepte ik dat vegetarisch wel goed was voor het milieu, maar vooral kaas en melk enzo. Dus vooral uit milieuoverwegingen en daarbij dat het beter is voor de dieren en gezonder, als je het goed doet.

Wat is voor jou een volwaardig dieet?

Vooral veel eiwitten en vetten. Dus veel noten, bonen en veel groente. Vooral weinig suikers en koolhydraten.

Hoezo weinig suikers en koolhydraten?

Ik heb ook de documentaire fed up gekeken. Dat ik me eigenlijk besepte suikers zijn eigenlijk wel heel slecht en koolhydraten vind ik gewoon minder lekker.

Wat is voor jou kenmerkend voor een veganistisch dieet?

Ik was een keer ergens naar toe met iemand en die moest heel erg lachen toen ik iets mee had, dadels, hummus, bananen en pindakaas had ik mee. En dat zijn wel typische dingen.

Hoe verschilt een veganistisch met een regulier dieet?

Vooral avondeten. Lunch en ontbijt kan je makkelijk veganistisch eten, zoals havermout en smoothie bowls. Je kan heel veel dingen vegan maken met bijvoorbeeld soya melk. Ik neig voor avondeten meer naar oosters en Indische maaltijden een avgtje is toch moeilijk om veganistisch te maken.

Hoe zorg jij dat je de nutrienten van dierlijke producten binnenkrijgt?

B12 daar slik ik een supplement voor. Dat komt trouwens uit zand. Ik neem ook supplementen voor calcium, vitamine D en magnesium.

Waarom?

Magnesium, want ik slaap daar lekker door. Calcium omdat ik al wist dat ik daar een tekort van had. Ik doe dit niet speciaal omdat ik vegan ben. Ik zou dit ook slikken als ik wel dierlijke producten at. Net zoals met vitamine D, dit ben ik gaan slikken toen ik naar Oslo ging.

Moest je ergens aan wennen?

Ik eet heel veel bonen. Daar moest ik eerst heel erg aan wennen.

En waarom eet je die bonen?

Voor eiwitten vooral!

Dus waar let je vooral op?

Ik zorg voor genoeg eiwitten en vetten.

Waarom vetten?

Ik merkte het vooral toen ik meer vetten ging eten en toen voelde ik me gewoon beter. Dit staat los van vegan dieet.

Je hebt niet het idee dat je verder iets mist?

Ik heb naar calcium wat research gedaan en dierlijke eiwitten stimuleren heel erg de calcium uitscheiding, dus ik geloof dat ik er nu beter aan toe ben. Maar ik probeer wel veel dingen met calcium te eten zoals vijgen.

En als je een maaltijd samenstelt kijk je er dan ook naar dat je alles hebt?

Ja eigenlijk wel!

Wat is dan voor jou een goeie maaltijd?

Nou als ik met me ouders eet is het wel lastiger want dan is het vaak een pasta maar dan zonder de kaas. Maar normaal zorg ik wel dat ik groente, bonen en iets van een goeie vleesvervanger heb.

Wat eet je nou echt om die nutrienten niet te missen?

Tahin, bonen, noten en soyamelk/producten dat is goed voor eiwitten en calcium en tempeh.

Waarom neem je b12 in een supplement?

Dat krijg je anders gewoon niet binnen! Ik heb in een boek gelezen, Vegan For Life, daar staat in dat je b12 echt nodig hebt en zeker als een lange tijd niet een schadelijk maar wel chronisch tekort hebt is dit ook al heel slecht voor je! Ook als je al net tekort hebt is dat ook al heel schadelijk. Dus daar probeer ik heel goed op te letten.

Hoe vaak neem je die?

Ik deed altijd elke dag maar toen hoorde ik van een vriendin dat dat niet hoefde want het gaat echt niet gelijk naar beneden je peil, dus nu neem ik het om de dag ofzo.

Respondent 2

Leeftijd: 21

Studie: gezondheid en maatschappij

Waarom ben je vegan geworden?

In eerste ben ik begonnen uit gezondheidsredenen omdat ik die eczeem had, maar toen ik me er meer in ging verdiepen en erachter kwam waarom veganisten, veganisten zijn toen kon ik me daar wel in vinden echt in het perspectief dat het niet oke is om dieren op die manier te behandelen en het dier te gebruiken voor ons plezier en omdat wij het lekker vinden en niet omdat we het nodig hebben en ook omdat het zo'n slechte invloed heeft op het milieu, maar ook nog steeds gezondheid vind ik heel belangrijk. Dus het is nu gewoon die drie redenen samen.

Wat versta jij onder een volwaardig gezond dieet?

Whole foods plant based. Ik eet voornamelijk, bonen, noten en rijst. Als ik zelf kook gebruik ik geen olie. Maar als het ergens in zit eet ik het wel. Ik doe dit uit gezondheidsredenen. Wetenschappelijke boeken, zoals the china study, gaan allemaal over wholefoods plant based. En daarin zeggen ze ook dat olie geen wholefoods is en dat als je wil afvallen je dit beter niet kan eten. Niet dat ik wil afvallen, maar 1 eetlepel olie is 100 calorieën en als jij je salade met super veel olie gaat doen dan is het niet echt efficiënt.

Met een maaltijd denk je er dus wel bij na dat je iets van bonen of noten erin hebt?

Ja! Dus als het er een dag niet is is het niet erg maar over het algemeen let ik er wel een beetje op dat ik gevarieerd eet en alles binnenkrijg.

Dus daar kijk je wel naar? Dus als je een maaltijd bereid dat je alle nutriënten hebt?

Ja dus dat het een beetje een geheel is. Dat je alles binnenkrijgt.

Denk je dat als je plantaardig eet je bepaalde nutrienten niet binnenkrijgt?

Nou ik denk het niet, maar ik denk wel dat je het op een goede manier moet doen. Ik bedoel je kan ook, als je heel eenzijdig eet dat je sommige nutrienten niet binnenkrijgt. Je moet wel beetje gevarieerd eten, maar dat moeten we allemaal ook als je niet veganistisch eet. Maar als je veganistisch eet moet je daar wel meer op letten en dat is ook wel iets wat een hobbel is voor veganistisch eten dat je er wel even in moet verdiepen voordat je het kan doen. Ik ben er wel van overtuigd dat je B12 moet nemen.

Dat is het enige dat er in jou ogen mist als je geen dierlijke producten eet?

Ja en vitamine D als je niet vaak in de zon komt, of als je ergens in het Noorden leeft ofzo of een hele donkere huidskleur hebt.

Waar zit B12 precies in?

Vitamine B12 is een bacterie dat in de grond zit. En dieren krijgen die binnen omdat ze gras eten en het zit ook in ons en in dieren. Maar de theorie is dat je het wel binnen zou kunnen krijgen door het eten van groente en fruit, maar omdat onze soils are depleted en we wassen alles zo goed dat we de bacteriën niet meer op die manier binnen kunnen krijgen. Dus dan is alleen dierlijke producten om dat binnen te krijgen. Je kan niet zomaar zand eten, want dan is het weer de vraag hoeveel er in de bodem zit. Maar ik hoor ook van sommige dat ze het helemaal niet nemen.

Wat is dan voor jou de reden om het wel te nemen?

Omdat het toch wel echt geadviseerd wordt om het wel te doen. En ik zie er niet echt iets negatiefs in om het niet te doen.

Wat houdt zo'n supplement precies in?

Er staat een of andere scheikundige naam op metha..blablabla. het is gewoon puur B12 en dat is een hele hoge dosis en dat neem ik een keer per week maar. Je lever kan het zelf goed opslaan. Het is ook zo dat B12 is een wateroplosbare vitamine. Het is niet dat het in vet opslaat dus dan heb je niet de kans op vergiftiging.

Respondent 3

Age: 22

Study: International Development Studies

Since when are you vegan?

I became vegan in January after I watched the documentary Cowspiracy.

So what is the reason you became vegan?

I was a vegetarian since the age of fourteen. Then I watched Cowspiracy and it was a logical transition. I do not eat meat for ethical reasons. I don't know. I just do not agree with the food system how it works right now. But I guess for me it is mostly the animal welfare. Like the environment comes second. And then it just feels good. Other than when I am craving.

Yeah do you have cravings a lot? What kind?

Yes cheese. Not once a month anymore like in the beginning but I do cheat. I try when I have been thinking about cheese for like 6 weeks straight. I eat it. It doesn't matter what kind. Just melted.

What is for you a wholesome diet? When do you get in what your body needs?

I looked up a list and if I follow that I feel like I get in everything that I need. With beans and stuff. I checked it the first day I became vegan. So I make sure I for example have something like kale and spinach and chickpeas and beans every day.

So when you became vegan you still want to get in all the nutrients. So how did you manage that?

Well the B12. In the beginning I also took the supplement. But I did not feel good I had like really itchy skin. So I stopped. And then I do eat cheese. Not often but I feel good this way of eating. But I am not taking any supplements. And then like soy milk b12 is added.

How do you make sure you get in everything?

The one thing I always make sure that there is some kind of protein in it. So tofy or beans or nuts. And then like cabbage is high in calcium. So that is it. Next to that I do not pay crazy much attention to what I eat. And then I eat more often. I just find it tastier. I love vegan food. I also now make more stuff myself like bread spreads.

Respondent 4

Age: 24

Study: Food safety master

Since when are you vegan?

Since January!

So what is the reason you became vegan?

I became vegan after I watched Cowspiracy. I was vegetarian for a year. I just thought it was a good transition. Not abruptly. I first cut off chicken and red meat. Then I cut off fish. So then became vegetarian for a year and then became vegan. It was good like smooth transition. But I did not like cheese and milk already. So it was not such a big deal for me.

And do you have a main reason why you became vegan?

Animal welfare and environment in the first place. And also like food technology wise we are living in an age where you do not have to eat animal products anymore.

So when are you eating a wholesome diet?

For me it is seasonal. When I am in uni. During uni terms I usually play basketball. I work out a lot to keep up in shape. So then I am eating really well and monitoring what I eat. But during holidays, no I do not pay attention whatsoever.

How did you manage to still get in all the nutrients when transitioning to a vegan diet?

In January I became vegan. I was working out a lot. It was basketball season. So I did really intensive work outs. So then I took hemp seeds protein, grinded hemp seeds . It was working out really well for me. But also like culturally we rely a lot on grains and beans in our food. So for me it was not like a drastic transition. Also you have like the pre prepared tofu the one really high in protein. So I do not think you miss anything or have a lack of something. Like soy milk and nut milk they are all fortified. And also like the pre prepared tofu it is all fortified with B, C, D and B12 vitamin. So you do not feel the difference. Because one glass of soy milk can give you the 50 percent of B12 supplements.

So you do not think you miss anything when you eat a whole plant based diet?

It is more behavioural thing. You might get used to food that has less protein. But you like that food like carrot soup. And then you might get used to it. So if you don't care. Like I said when I work out I really monitor what I eat, but in the holidays I do not care at all. Just vegan stuff. For example calcium. Like I said you have the fortified foods like soy milk. Also I eat a lot of dark leafy greens for calcium. Recent studies show that cow milk is not improving any absorption for bones. The ones that are fortified are better at doing their job then regular milk.

And do you eat more eating plant based?

Yes! I snack more. Smaller meals but more food. Which is better. Like if you are working out it is always better to have smaller meals. And each of them should be nutritious.

Why is that you think?

I especially eat more when I am playing basketball. I have to re compensate the calories. Because you have to make sure you gain your muscle weight and stuff. Because if you do not take enough of daily protein base then your muscle weight will drop and then it becomes easier for you to intake fat. You have a much more variety of ingredients so you eat more.

Do you also eat less of packaged things?

At the beginning not! But now I am more shifting to beans. Like fava beans and stuff.