

VEGANISM AND FOOD ALLERGIES – WHEN THE EXCLUSION OF ANIMAL PRODUCTS AND ALLERGENS COINCIDE

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ABSTRACT

Plant-based, vegetarian and vegan diets are becoming increasingly popular. With novel vegan protein sources such as pea, lupin, quinoa and hemp increasingly entering the marketplace, and the increased use of existing vegan protein sources (eg nuts, soya, pulses and wheat protein isolate), it is likely that the rates of allergic reactions to these protein sources may increase. Food allergy and vegan diets both impose dietary restrictions, in this way limiting the sources of important nutrients. Therefore an improved dietary variety is needed. Moreover, factors such as a reduced bioavailability of nutrients in alternative foods need to be taken into consideration. The combination of veganism and food allergy consequently warrants careful consideration and monitoring.

Keywords: veganism, food allergies, dietary restrictions, plant-based proteins

INTRODUCTION

Plant-based, vegetarian and vegan diets are becoming increasingly popular. The vegan diet, the most restrictive of these eating patterns, is defined as the exclusion of all foods of animal origin, including meat, poultry, fish, molluscs and crustaceans, cow's milk, eggs, gelatin and honey, with the exception of breastmilk.¹

Globally, the interest in veganism is growing at a rapid rate: it is now almost twice as popular as it was just five years ago.² According to Google Adwords data, the number of searches for vegan-related information in 2020 is up 47% from those of 2019.²

South Africa is the continent's top consumer of beef, veal, pork, poultry, mutton and lamb, according to data from the Organisation for Economic Co-operation and Development (OECD).³ Despite this, we are seeing a big rise in veganism. South Africa is among the top 30 countries worldwide where veganism was most popular over the past 12 months.⁴ To be more precise, a Google Trends report puts South Africa at 13th around the world in searches for the word 'vegan'. South Africa ranks in 23rd place for veganism and 22nd for vegetarianism. It is the only African country with a sizeable vegan following.⁴ Although there is no official count of the number of vegans there are in South Africa, interest in veganism has led to a sprouting of vegetarian and vegan restaurants in South Africa.⁵

VEGANISM AND ALLERGIES

In recent years, the prevalence of food allergy has also increased, affecting mostly children.⁶ The combination of food allergies and veganism can be challenging and poses risks of

nutritional deficiencies. There are two growing concerns with vegan diets and allergies: the first is an increase in allergies to novel plant-based proteins and vegan-based protein alternatives; the second is a concern about the nutritional adequacy of vegan-based diets, especially when the vegan has concomitant allergies. Both aspects are covered in this article.

ALLERGIES TO NOVEL PLANT-BASED PROTEINS

The protein requirements in vegan diets are met mainly through vegetables, soya, pulses, whole grains, nuts and seeds. When a variety of these foods are eaten during the course of a day, the intake of indispensable (essential) amino acids is sufficient, provided that caloric requirements are met.⁷

With the increase in novel vegan protein sources (eg pea, mycoprotein, quinoa, hemp and lupin) entering the marketplace, together with the increased use of existing vegan protein sources (eg nuts, soya, pulses and wheat protein isolate), it is likely that the rates of allergic reactions to these protein sources may increase.⁸

PEA PROTEIN

Pea protein is commonly used in vegan foodstuffs and is a suitable alternative to soya. Allergic reactions provoked by the ingestion of pea are relatively common, mostly among those with allergies to other legumes. The allergenic potential of this crop is enhanced due to cross-reactivity, particularly with lentil and chickpea.⁹

MYCOPROTEIN (QUORN™)

Mycoprotein, sold as Quorn™ is an alternative, nutritious protein source with a meat-like texture made from *Fusarium venenatum*,

a naturally occurring fungus. Mycoprotein is high in protein and fibre and low in fat, cholesterol, sodium and sugar.⁸ Some Quorn™ products contain a small amount of egg albumin as a binder at the end of processing, therefore they cannot be classed as vegan. However, recent breakthroughs in food technology are now allowing an increasing proportion of the Quorn™ portfolio to be sold without egg and these have received approval from the Vegan Society.⁸ Quorn™ is sold as an ingredient in frozen or refrigerated food products. Unfortunately, Quorn™ Foods has recently pulled out of the South African market.

Because Quorn™ is of fungal origin, it has the potential to cause allergic reactions in those with a pre-existing mould allergy. Jacobson and DePorter analysed self-reports of adverse reactions via a web-based questionnaire. Quorn™ products were reported to cause 1 752 adverse reactions – allergic and gastrointestinal symptoms – with some people experiencing both. Allergic reactions, including urticaria and anaphylaxis, occurred within four hours of consumption in 312 people and one fatal reaction within one hour of exposure. Of those 312 individuals, 188 (60.3%) reported reproducible reactions after repeated consumption of Quorn™. Gastrointestinal symptoms ranged from mild nausea to emesis severe enough to warrant medical attention.¹⁰ A case report of anaphylaxis to Quorn™ in an adolescent patient with mould-induced allergic rhinitis (AR) was published in South Africa recently.¹¹

QUINOA

Though technically a seed, Quinoa is classified as a gluten-free pseudo-cereal and is a good source of plant protein and fibre. Unlike some plant proteins, quinoa is a complete protein, meaning that it contains all nine essential amino acids.^{12,13} It is therefore a valuable plant protein used in the manufacture of vegan products. Allergic reactions to quinoa are rare; however, sensitisation to quinoa has been associated with apple sensitisation.¹⁴

HEMP

Hemp seeds are seeds of the hemp plant, *Cannabis sativa*. They are from the same species as cannabis (marijuana), but a different variety with negligible amounts of psychoactive compounds.¹⁵ The protein content of whole hemp seeds can vary from 20 to 25%.¹⁵ This amount can increase further in some hemp-seed processed products, such as de-hulled seed and hemp-seed flour. The proteins in hemp seed are mostly located in the inner layer of the seed, therefore the protein content of processed products is higher. This can be explained as being a result of the increased protein concentration after removing some component of the whole seed and the hull.¹⁶ Furthermore, hemp-seed proteins contain all the essential amino acids (EAAs) required by human beings.¹⁶ A case report of anaphylaxis to the ingestion of hemp seed has been reported: a 44-year-old man with a history of seasonal AR, mild asthma and use of marijuana, but no food allergies or prior anaphylaxis.¹⁷ With the legalisation of medical cannabis (marijuana), cross-reactivity with hemp seed may become more of an issue.¹⁸

LUPINE

Lupine belongs to the *Leguminosae* (legume) family, which also comprises soybean, peanut, chickpea and other types of

legume.¹⁹ Lupine is commonly used as an ingredient in a great variety of processed products due to its important technological properties, such as high water-binding capacity and emulsifying abilities. Lupine flours or lupine protein isolates and concentrates have been used to formulate processed foods such as baked goods, processed meat products and pasta.^{9,19} Lupine can be a substitute for soybean and milk proteins as technological agents in the manufacture of processed foods.¹⁹

Lupine is valued because of its nutritional value, having high contents of protein, dietary fibre and being a rich source of antioxidants and vitamins. Lupine does not contain lactose or gluten, therefore is a suitable substitute for individuals with milk allergy, wheat allergy or coeliac disease.¹⁹

Lupine allergy may arise through cross-reactivity in people who are already allergic to another member of the legume family, in particular peanut, or it may also provoke adverse effects by primary sensitisation.⁹ Lentil, chickpea, pea, soybean and, particularly, peanut are reported as cross reactive legume species in lupine sensitisation, but the clinical relevance associated with the ingestion of related legumes is still unclear.¹⁹ The prevalence of lupine allergy is not clear because such studies have not been conducted in the general population. Data on lupine sensitisation ranging from 0.27% to 4.1% have been reported in different European countries, but these values might not reflect the true prevalence of lupine allergy.¹⁹

Lupine is regularly consumed in several countries in the European Union (EU) as well as in Australia.¹⁹ Therefore, in the EU, lupine and its products are considered as allergenic foods, whose presence must be stated and emphasised in the list of labelled ingredients of pre-packaged foods, irrespective of the quantity (Regulation (EU) No 1169/2011).²⁰ Australia has also included lupine as an allergenic food with mandatory labelling in its legislation (FSANZ).¹⁹ Lupine allergy should be considered when a patient with a pre-existing legume or peanut allergy has an unexpected, unexplained reaction to a food which does not overtly contain peanut and/or other legumes.

ALLERGY AND NUTRITIONAL ASPECTS TO BE CONSIDERED WHEN USING PLANT-BASED MILK-FREE ALTERNATIVE BEVERAGES

Recently, the increased awareness of cow's milk protein allergy (CMPA) and intolerance, and a higher prevalence of vegan dietary habits, has led to an increased need for plant-based milk beverages. These beverages are liquid-based extracts of nuts, soya, hemp, coconut and cereals such as rice or oats, that simulate cow's milk in appearance and consistency.^{21,22} Plant-based milk alternatives, including soya, coconut, almond and oat milk and rice milk, can cause allergic reactions. This should be considered and tested for in a patient with pre-existing allergies wishing to embark on vegan alternatives.

Moreover, many of these milk alternatives do not necessarily meet the nutritional requirements of infants and children.²² Owing to low protein, vitamins (B12, B2, D and E) and mineral content (especially calcium) in most of the plant-based drinks, they need to be fortified. Nevertheless, fortified plant-based beverages and cow's milk differ remarkably in nutritional properties, as some

TABLE I: COMPARISON OF NUTRITIONAL COMPOSITION OF COW'S MILK AND PLANT-BASED BEVERAGES AVAILABLE IN SOUTH AFRICA

NUTRITION CONTENT/100 ML	COW'S MILK (FULL CREAM)	SOYA (ALPRO SWEETENED)	ALMOND (ALPRO SWEETENED)	OAT (OATLY)	RICE (WOOLWORTHS UNSWEETENED)	COCONUT (MILK LAB)
Energy (kcal)	61	39	24	46	66	34
Protein (g)	3.3	3.0	0.5	1.0	0.1	0.6
Carbohydrate (g)	4.7 lactose	2.7	3.0	6.7	14.0	3.0
of which simple sugars (g)*	0.0	2.5 Added fructose	3.0 Added sucrose	4.1	9.5	2.6 Added sucrose
Fat (g)	3.3	1.8	1.1	1.5	1.2	3.7
Calcium (mg)	119	120	120	120	0.4	–
Vitamin B12 (ug)	0.4	0.4	0.4	0.38	132	–

Note: Information on the nutritional composition taken from manufacturers' labels.

Cow's milk nutritional data from MRC Food Composition Tables (1991).²⁵

* This includes added sugars and the natural sugars found in fruit or grains – including glucose, sucrose and fructose. Total carbohydrates comprise complex carbohydrates, dietary fibre and simple sugars (both added and naturally present).

nutrient bioavailability may considerably vary.²¹ No plant-based drinks should be used as a substitute for cow's milk in children < 24 months old; however, they can be used in cooking.²³

Rice-based beverages are rich in simple sugars, so energy is readily available; however, these contain fewer lipids (especially polyunsaturated fatty acids) and proteins than cow's milk.¹⁹ Furthermore, high levels of arsenic have been detected in rice drinks used by children, as recently pointed out by the European Society for Paediatric Gastroenterology Hepatology and Nutrition's (ESPGHAN) Nutrition Committee. It is recommended, therefore, that the consumption of rice-based drinks be avoided in babies and younger children.²⁴ Oat drink has a lower amount of fats, proteins and calcium than cow's milk; however, this has a better micronutrient profile than other plant-based beverages. But it contains phytic acid, which interferes with some nutrients' absorption.²² Table I compares the nutritional composition of cow's milk and some plant-based beverages available in South Africa.

NUTRITIONAL CONCERNS ABOUT VEGAN DIETS AND ALLERGIES

A poorly planned vegan diet can increase the risk of stunted growth and micronutrient deficiencies, particularly iron, zinc, calcium, Vitamin B12 and omega 3 fatty acids such as docosahexanoic acid (DHA).²⁶ The combination of veganism and food allergy brings about greater concerns related to adequate micro- and macronutrient intakes that warrant careful consideration and monitoring.

MICRONUTRIENTS TO CONSIDER

IRON

Typical vegan diets often include many iron-rich foods, including lentils, tofu (soya), chickpeas, nuts, seeds and grains. However, unlike iron from animal sources – haem iron, which is readily absorbed – non-haem iron from plants has poor bioavailability and lower absorption, due to high phytate and polyphenol levels.^{26,27} Vitamin C may enhance the absorption of non-haem iron.²⁷ Plant-based sources of iron must also be consumed in

larger portions than animal-based sources in order to meet needs. Moreover, many vegan sources of iron, particularly soy, nuts, sesame seeds and lentils, are also common food allergens.^{6,26}

ZINC

Zinc, like iron, has poor bioavailability, especially in a vegan diet.²⁷ Vegan sources of zinc include soy and other legumes, nuts, seeds and whole grains as well as fortified cereals; therefore, particular attention is warranted when working with vegan children who must avoid these foods due to allergy.²⁶

CALCIUM

Calcium is a vital mineral for bone mineral density (BMD) development, but it is obtained predominantly through dairy products, which are notably absent from the vegan diet.²⁶ Numerous calcium-fortified alternatives to dairy products are available, and calcium is also found in most green leafy vegetables (preferably those with low levels of oxalate as it inhibits absorption), sesame seeds, almonds, tofu and dried figs.²³ However, almonds, soya and sesame are common allergens.⁶

In a Dutch study, adolescents who had followed a vegan-type diet in early life had significantly lower BMD in adolescence. These differences were not explained by current calcium intake, suggesting that early life is a critical window for BMD development.²⁸ Caution is therefore warranted to ensure that young vegans consume adequate levels of calcium to maximise their BMD. This need for caution is emphasised in a recent meta-analysis, which studied the impact of vegetarian and vegan diets on BMD and fracture risk. Compared to omnivores, vegetarians and vegans had a lower BMD, and vegans also had higher rates of fractures.²⁹

VITAMIN B12

Vitamin B12 is perhaps the most common concern for those following a vegan diet, as it is found almost exclusively in food of animal origin; therefore, supplemental Vitamin B12 may be an

option for those following a plant-based diet.³⁰ Many plant-based beverages are fortified with Vitamin B12 and can be readily incorporated into the diet. Notably, most plant-based 'milks' are not intended as a primary beverage until at least two years of age, as they are often low in calories and/or fat and may not be (adequately) fortified to meet infants' needs.²³ Children and adolescents following a vegan diet show significantly lower B12 intake and serum vitamin B12 concentration levels compared to omnivore peers.²⁶

OMEGA-3 FATTY ACIDS

Omega-3 fatty acids demand special attention in the vegan diet, more so during pregnancy, lactation, infancy and childhood. The inclusion of vegan, omega-3-containing foods, such as walnuts, ground flax seeds, ground chia seeds, canola and pumpkin seeds, is advisable.³⁰

CONCLUSION

Plant-based diets are increasing significantly. Novel plant protein sources play a role in improving the quality of the vegan diet; however, the incidence of allergic reactions to these protein sources is increasing and needs to be explored. The combination of veganism and food allergy raises greater concerns related to dietary restrictions, which can lead to inadequate micro- and macronutrient intakes. It therefore warrants careful consideration and monitoring. Allergy testing may be necessary to finding suitable alternatives for allergic vegans, and dietetic input is vital to ensure nutritional adequacy.

DECLARATION OF CONFLICT OF INTEREST

The author declares no conflict of interest.

This article has been peer reviewed.

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