

pro<sup>TM</sup>  
myc

Mycoprotein  
Health & Nutrition



MYCORENA

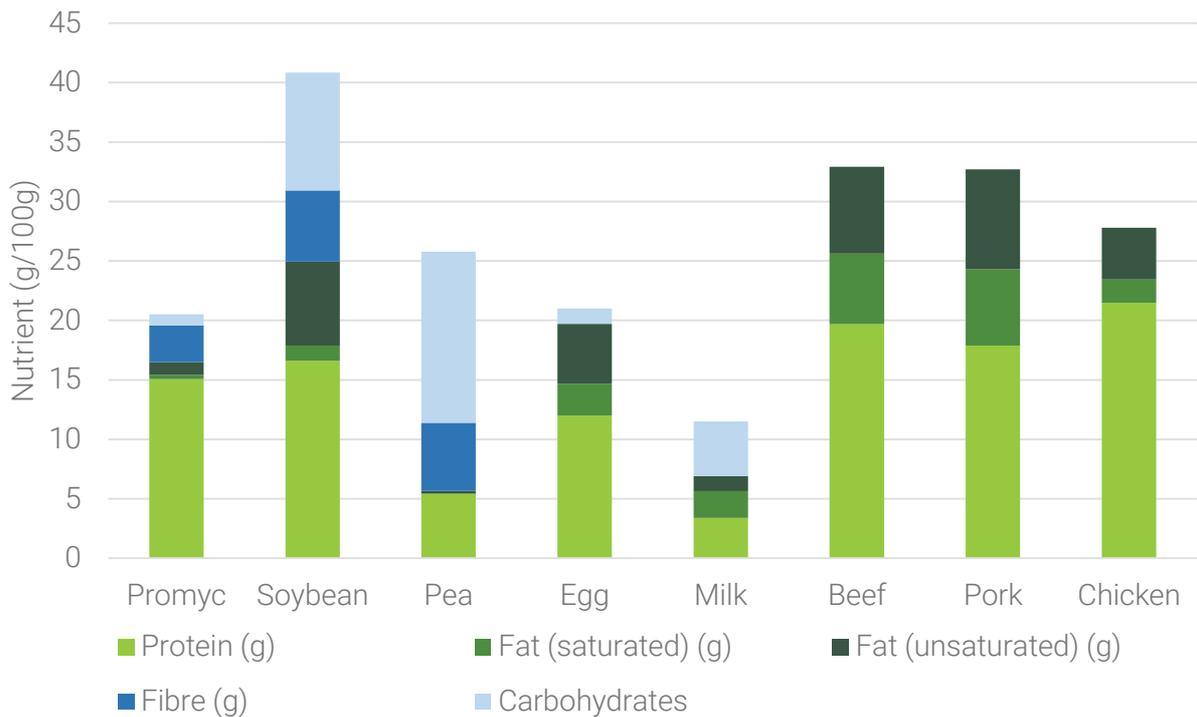
## Promyc Mycoprotein

# Nutritional Overview

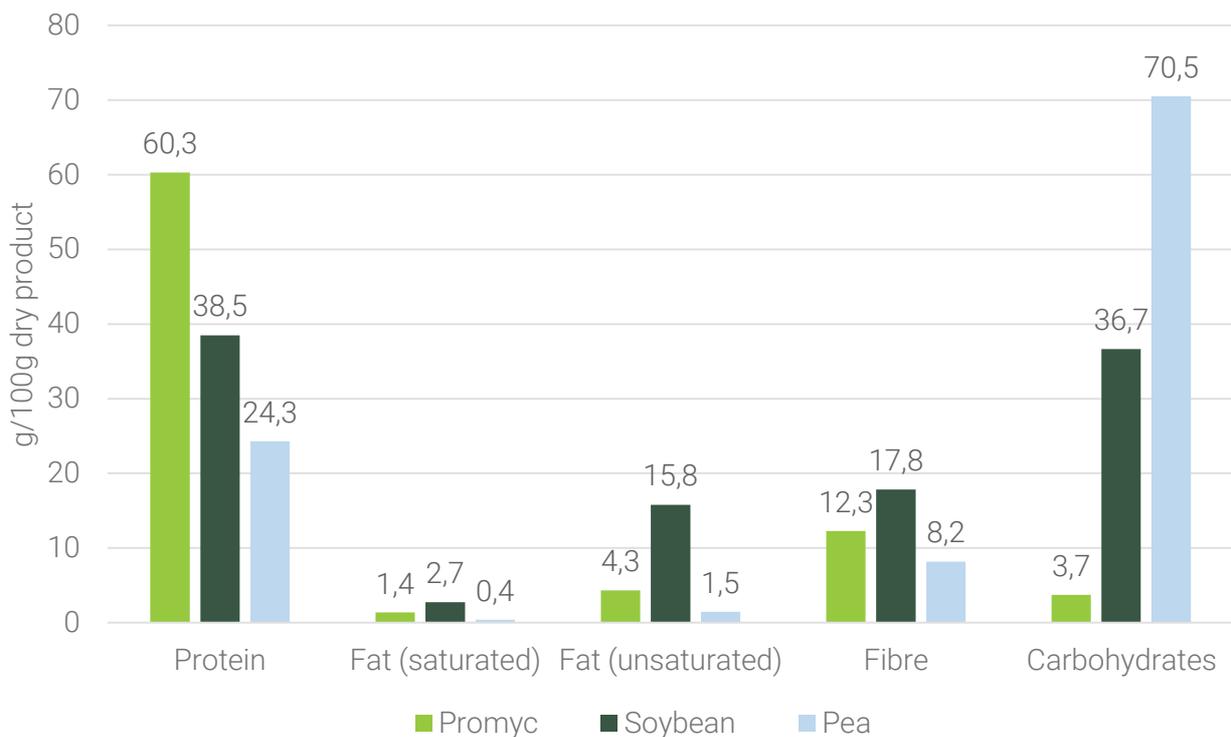
Promyc mycoprotein is a fungi-based natural product. Fungi are naturally-occurring organisms that are composed by a balance of nutrients that enable its own survival and growth. According to our nutritional table below, we can see that Promyc is mostly composed of protein, about 60g of protein for 100g of total dry product. It also contains a good amount of Fiber (12g per 100g of dry product), a low amount of fat (6g per 100g) and carbohydrates (3.7g per 100g). Promyc is a balanced ingredient and can be closely compared with other protein sources, both animal and plant-based. On the following graphic we can see also the nutritional composition of macronutrients in different commonly used protein sources.

### Promyc Nutritional Content (per 100g)

	<i>Standard Product</i>	<i>Dry Product</i>
Energy (kJ)	350 kJ	
Energy (kcal)	85 kcal	
Protein	15,07 g	60,28 g
Fiber	3,08 g	12,32 g
Fat	1,49 g	5,96 g
Saturated fat	0,34 g	1,36 g
Monounsaturated fat	0,40 g	1,6 g
Polyunsaturated fat	0,68 g	2,72 g
Carbohydrates	0,94 g	3,76 g
Sugar	<0,30 g	
Salt	0,3 g	1,2 g



Since the water content varies a lot among each type of fresh food, analysis of the dry products allows for an easier comparison of their usage potential as ingredients. Below is the macronutrient composition of Promyc compared to Pea and Soy, the main consumed vegan protein sources to date.



Sources:

USDA, <https://frida.fooddata.dk/food/lists/alphabetical?lang=en>

# Health Features

## Fulfilled health claims recognized by the EU

Promyc™ has been analyzed by an accredited testing laboratory in order to assure a safe and healthy food product. Listed below is the health claims we can claim according to the EU Commission\*:



Low-fat product  
(<3g/100g)



Source of fibre  
(>3g/100g)



Saturated fat-free  
(<0.10g/100g saturated  
fats and trans-fats)



Sugar-free  
(<0.5g/100g)



High protein  
(>20% of the energy  
value of the food is  
provided by proteins)



High on amino  
acids linked to  
repair and  
recovery of  
muscle tissue.



Amino acids with  
health benefits:  
Arginine (immune  
system function),  
Tyrosine and Alanine  
(enhanced  
performance),  
Proline (maintenance  
of normal blood  
pressure)

Source: EU Register on nutrition and health claims. Retrieved November, 29, 2019, from [https://ec.europa.eu/food/safety/labelling\\_nutrition/claims/register/public/](https://ec.europa.eu/food/safety/labelling_nutrition/claims/register/public/)

\*Not all health claims are authorised.

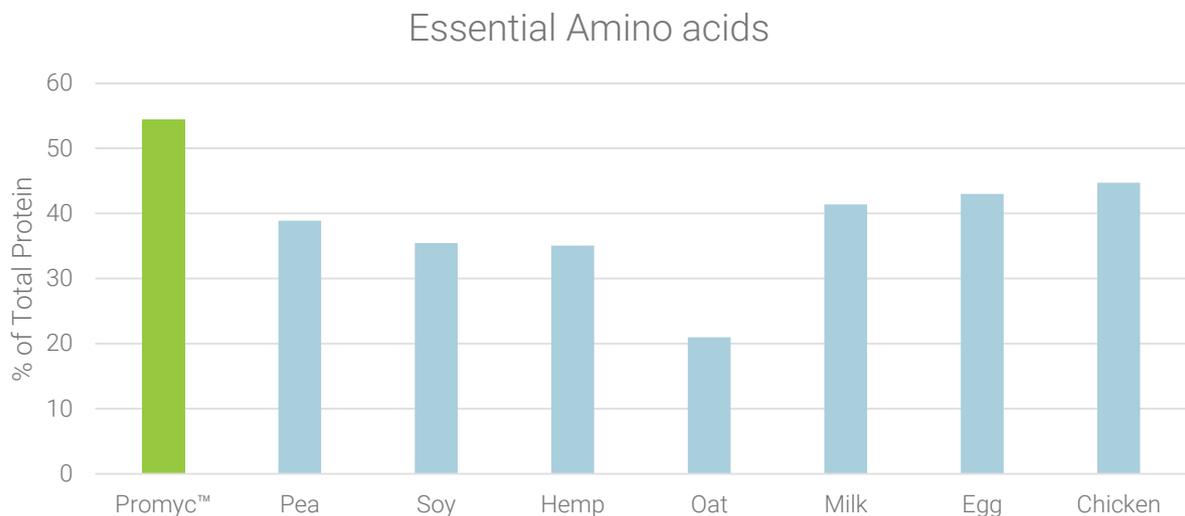
# Protein Quality

The amount of protein present in food is not the only aspect to consider. It is also important that this protein is of high quality. Protein can be broken down into its single building blocks - the amino acids, and it's these amino acids that will be used by the body upon digesting the protein. Good quality protein basically means that the protein fulfills two main criteria: First, the protein is easily digested by the body, therefore being absorbed and used by the organism. Second, the type of amino acids present in the protein is balanced with the type of amino acids required by the body for its functions.

High quality means protein that is digested and used by the body effectively. If the food has protein is of bad quality, it doesn't matter if it has a higher protein content, since part of this protein is not being used and is eliminated from the body without being used.

## High in Essential Amino Acids

For the human body to function properly, 20 amino acids are needed. From these 20 amino acids, the body can produce 11 itself. This means that the other 9 amino acids, called essential amino acids, need to be obtained through food because the human body cannot produce them and these are needed for basic body functions. Promyc mycoprotein is rich in essential amino acids, which make up around 54 % of the total protein content. This means mycoprotein has a higher percentage of essential amino acids than most other plant-based and animal-based protein sources, including Soy (36%), Milk (41%), Poultry (45%) and even whey protein (43%) .



## Mycoprotein is a Complete and High-Quality Protein

Protein quality can be quantified to some degree by a value called the Protein Digestibility Corrected Amino Acid Score (PDCAAS), a method recommended by FAO/WHO <sup>1</sup> to analyze this trait. The score evaluates the protein quality according to two factors. First, it compares the amino acid composition of the protein with the amino acid requirements of the human body of a preschool-age child (since in this stage the protein requirement is the highest). Secondly, it accounts for how well this protein source is digested by the body.

On a more technical detail, the PDCAAS is calculated by comparing the concentration of the first limiting essential amino acid (EAA) in the tested product with a reference value (EAA requirements of a preschool-age child) <sup>1</sup>. For mycoprotein, the PDCAAS has been described in scientific literature as 0.996, a lot higher than other alternative protein sources <sup>2</sup>. In comparison, beef has a PDCAAS of 0,92, kidney beans 0,62 and soy protein isolate 0,92 <sup>3</sup> as you can check on the table found in the next page.

$$\frac{\text{mg of limiting amino acid in 1 g of test protein}}{\text{mg of same amino acid in 1 g of reference protein}} \times \text{fecal true digestibility}$$

### **PDCAAS Formula**

[1] Schaafsma G (2000). The protein digestibility-corrected amino acid score. 130(7):1865S-7S  
DOI: 10.1093/jn/130.7.1865S

[2] Edwards, D., & Cummings, J. (2010). The protein quality of mycoprotein. Proceedings of the Nutrition Society, 69(OCE4), E331. doi:10.1017/S0029665110001400

[3] Protein quality evaluation: Report of Joint FAO/WHO Expert Consultation ([link](#))

Another important consideration in protein quality evaluation is the completeness of the protein. A protein source is complete when it contains all nine essential amino acids in adequate amounts. This means an individual could consume a single complete protein source as its only source of protein and receive through this food all the different types of amino acids it needs for a healthy function.

Incomplete proteins are missing one or more of the essential amino acids. This means that you need to balance your protein intake with other protein sources in order to obtain all the necessary amino acids.

Protein Source	PDCAAS	Complete?
Mycoprotein	0,996	Yes
Chicken	1	Yes
Eggs	1	Yes
Milk	1	Yes
Beef	0,92	Yes
Soy	0,91	Yes
Pea	0,89	Yes
Fish	1	Yes
Hemp	0,61	Yes
Beans	0,68	No
Chickpeas	0,78	No
Nuts (cashews)	0,9	No
Wheat	0,42	No
Rice	0,44	No

Sources:

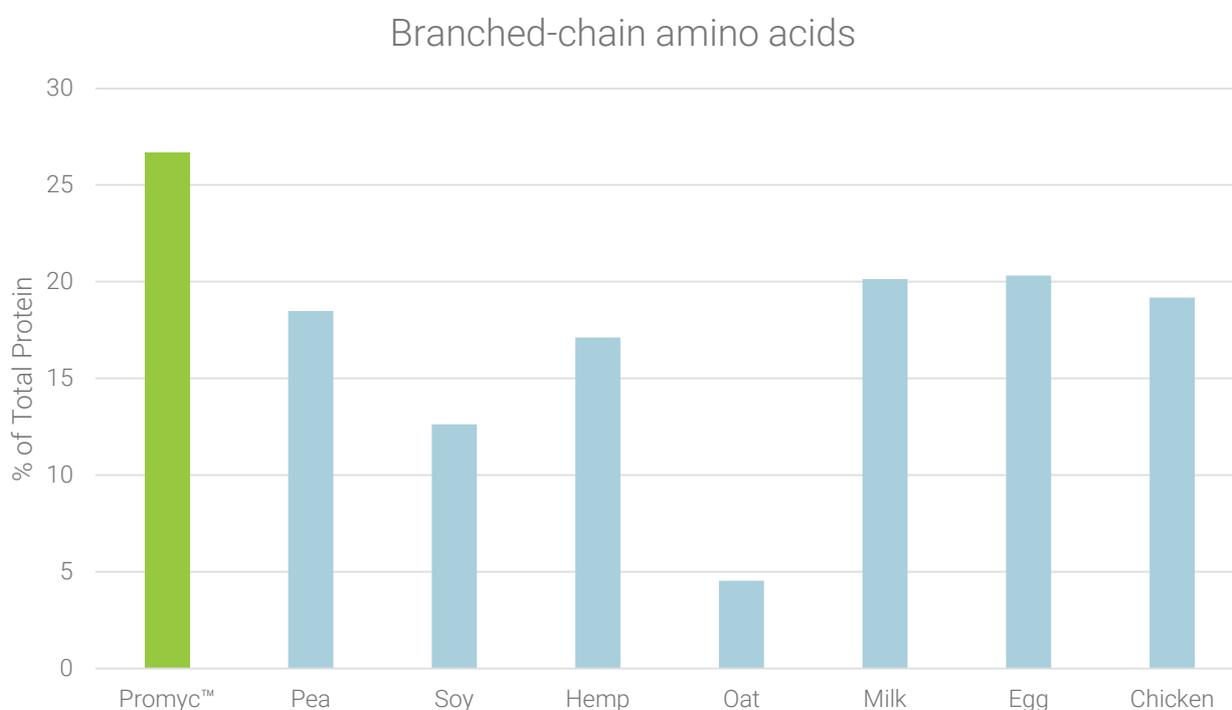
Schaafsma, G (2000) *The Protein Digestibility-Corrected Amino Acid Score. The Journal of Nutrition, Volume 130, Issue 7, Pages 1865S-1867S. DOI: 10.1093/jn/130.7.1865S*

[https://assets.ctfassets.net/2bynbqpgfb2s/5Vdj3dXA9UowGY8WwSqa4m/47c733f6156cd5c7f3d8ae589f1d6c92/health\\_benefits\\_mycoprotein\\_factsheet.pdf](https://assets.ctfassets.net/2bynbqpgfb2s/5Vdj3dXA9UowGY8WwSqa4m/47c733f6156cd5c7f3d8ae589f1d6c92/health_benefits_mycoprotein_factsheet.pdf)

<https://www.accessdata.fda.gov/scripts/InteractiveNutritionFactsLabel/protein.html>

## The Potential of Promyc for Muscle Building

Of the 9 essential amino acids, 3 of them are the branched-chain amino acids (BCAAs): leucine, isoleucine and valine (“branched-chain” refers to the chemical structure of BCAAs). BCAAs are a popular aspect to look for in fitness-related diets, so much that it is frequent to find many BCAA-enriched fitness foods or dietary supplements sold in powder form. BCAA supplements have been shown to build muscle, decrease muscle fatigue and alleviate muscle soreness. For this reason, they are usually sought after for muscle building and repair before and after physical training. In the health sector, they have also successfully been used in a hospital setting to prevent or slow muscle loss and to improve symptoms of liver disease. The protein in Promyc contains 26% of BCAAs, which is the same as the content in whey protein. Whey protein is considered to have the highest concentration of BCAAs of any dietary source of protein. See the graphic below for comparison of BCAA content in Promyc protein vs other common natural sources.



## Bioavailability

Bioavailability is used to describe the proportion of the food we eat that is utilized by the body<sup>1</sup>. According to a recent study, the bioavailability for mycoprotein in a group of healthy young men has been shown to be similar to that of milk protein, and significantly better than plant-based protein sources such as wheat and soy. Also, the ingestion of 60g of mycoprotein was shown to create an optimal response of blood amino acids required for the muscle protein synthetic response. This indicates not only the suitability of mycoprotein as a complete and healthy protein source but also adequate and even optimal for muscle building and muscle repair<sup>2</sup>.



[1] Southon, S, Fairweather-Tait. SJ (2003) BIOAVAILABILITY OF NUTRIENTS. *Encyclopedia of Food Sciences and Nutrition (Second Edition)* pp 478-484. DOI: 10.1016/B0-12-227055-X/00096-1

[2] Dunlop, MV et al. (2017) Mycoprotein represents a bioavailable and insulinotropic non-animal-derived dietary protein source: a dose–response study. *British Journal of Nutrition* 118, 673-685 doi:10.1017/S0007114517002409

## Low and Balanced Fat

Promyc is in itself a low-fat product. It contains only 1.5g per 100g of fresh product (or 6g per 100g of dry product), and this fat is composed of 76% unsaturated fats, and only 24% saturated. Promyc does not contain any trans-fat. As a comparison, fat from animal sources such as meat and milk is usually composed by up to 50% saturated fats, as well as for some “unhealthy” plant oils such as palm oil.

While saturated fats should be consumed in low amounts, unsaturated fats are often regarded as beneficial when consumed in moderation and should be part of a balanced diet. Unsaturated fats (both polyunsaturated and monounsaturated) have been shown to reduce LDL (“bad”) cholesterol in the blood<sup>1</sup>.

## Dietary Fibre

Mycoprotein also possesses a unique fibre, comprising about 12% of its dry weight, composed mainly of polymeric n-acetyl glucosamine (chitin) and beta 1-3 and 1-6 glucans.

Ingestion of this type of fiber has been shown in different studies to have many different potential benefits. Some of these effects include relief of joint pain in osteoarthritis and stimulation of beneficial bacteria in the colon and improvement of the individual's glycemic profile (the reaction of the body after ingesting a meal in terms of blood sugar and insulin release)<sup>2,3</sup>. Mycoprotein fiber is also thought to be largely involved in other observed benefits for mycoprotein described below such as satiety and lowering of cholesterol

[1] Müller, H. et al (2003). *The Serum LDL/HDL Cholesterol Ratio Is Influenced More Favorably by Exchanging Saturated with Unsaturated Fat Than by Reducing Saturated Fat in the Diet of Women*, *The Journal of Nutrition*, 133, 78–83, doi:/10.1093/jn/133.1.78

[2] Bottin, J et al. (2016) *Mycoprotein reduces energy intake and postprandial insulin release without altering glucagon-like peptide-1 and peptide tyrosine-tyrosine concentrations in healthy overweight and obese adults: a randomised-controlled trial* *Br J Nutr* 116, 360-374

[3] Turnbull and Ward (1995) *Mycoprotein reduces glycemia and insulinemia when taken with an oral-glucose-tolerance test;* *Am J Clin Nutr*, 1,1

# Observed Health Benefits

## Satiety

Satiety is the state of a person feeling satisfied, or “full” after a meal. According to different studies, having a mycoprotein meal has been associated with a higher satiety than having the same meal with Chicken. In a test group, individuals who had a mycoprotein lunch were compared to an identical group that had a chicken lunch. At dinner that day and the following day, individuals who had eaten the mycoprotein lunch ingested up to 24% less calories, indicated they felt more satisfied with the mycoprotein meal several hours after having it<sup>1,2</sup>. The reason for this is thought to be a combination of both the protein and fiber present, since both these components have been related to increased satiety in a meal, and meat lacks in its fiber content.

The practical outcome of these observations is that possibly a diet including mycoprotein can be effective in overcoming hunger, reduce total calorie intake and in this way make weight loss easier.

[1] *Bottin, J et al. (2016) Mycoprotein reduces energy intake and postprandial insulin release without altering glucagon-like peptide-1 and peptide tyrosine-tyrosine concentrations in healthy overweight and obese adults: a randomised-controlled trial Br J Nutr 116, 360-374*

[2] *Turnbull, WH (1993) Acute effects of mycoprotein on subsequent energy intake and appetite variables The American Journal of Clinical Nutrition, 58 (4) 507–512, doi: /10.1093/ajcn/58.4.507*

## Controlled Blood Sugar

It is shown that mycoprotein can control blood sugar levels, more specifically bring beneficial effects on glycemia (levels of glucose in the blood) and insulinemia (levels of insulin in the blood). In this sense, a reduced glyceemic response is a desirable trait to avoid development of type-2 diabetes and heart disease. The mechanisms for this action is thought to be related to mycoprotein's fibre content, since fibre has been shown to slow down the passage of food to the small intestine, creating a slower sugar uptake in general<sup>1</sup>.

Mycoprotein is therefore a suitable food for fighting obesity and type 2 diabetes. A high fiber and protein intake is good for a reduced energy intake, which is needed in the western world where obesity and type 2 diabetes is increasing<sup>2</sup>.

## Mycoprotein Lowers Cholesterol

Previous studies with mycoprotein in controlled groups has shown significant decreases in the blood cholesterol levels of individuals consuming mycoprotein. For the experiment, the group consumed for three weeks different two meals a day where meat was replaced by mycoprotein. The group consuming mycoprotein showed a decrease of 14.3% in blood cholesterol compared to the group consuming meat.

Mycoprotein does not contain any amount of cholesterol, as opposed to meat. Besides, it contains a healthy amount of unsaturated fats which contribute to lowering of LDL cholesterol ("bad" cholesterol). These facts combined with a high fiber content are all positive contributors to lowering blood cholesterol levels and therefore improve health and decrease the risk of heart-related problems.

[1] Turnbull WH et al. *Effect of Mycoprotein on blood lipids*, *Am J Clin Nutr* 1990;52:646-50

[2] Turnbull WH et al. *Mycoprotein reduces blood lipids in free-living subjects*, *Am J Clin Nutr* 1992; 55:415-9

# Safety

Promyc is a product from a safe and edible species of filamentous fungi. Our fungi are naturally present in existing food products and have been consumed for many decades in large quantities without adverse effects. Still, product safety is of major importance to us and we have tested our product for the existence of toxins that can potentially arise in certain species of filamentous fungi - mycotoxins. We have confirmed through third-party accredited laboratory analysis that our fungi does not contain mycotoxins and its consumption as a food product is safe. The fungi species we use has also been classified Generally Regarded as Safe (GRAS) by the US Food and Drug Administration (FDA).

## Allergies

Allergic reactions are possible for virtually every existing source of protein. Different sources of protein can contain allergens that affect the population with different severity, but can never be completely excluded. In fact, according to the Asthma and Allergy Foundation of America, the 8 most common food allergies are: Milk, Egg, Peanuts, Tree Nuts, Soy, Wheat, Fish and Shellfish. Most of the items in this list like milk, eggs and soy are widely popular protein sources. Pea protein has also been reported for some possible allergic reactions, often as a cross-reaction from peanut allergies.

It is possible for an individual to have an allergic reaction to mycoprotein if they react to mold due to potential similarity of allergens. However, previous studies have shown that allergic reactions to mycoprotein are drastically less than for other protein sources. Consumption of mycoprotein has shown that on average one potential allergic reaction was observed for each 1.85 million servings consumed<sup>1</sup>. That's an incident rate about 600 times lower than for soy protein, in which statistics indicate that 1 in every 300 people is allergic to soy.

[1] Finnigan TJ et al. (2019) Mycoprotein: The Future of Nutritious Nonmeat Protein, a Symposium Review , *Current Developments in Nutrition* 3;6:nzz021 doi: /10.1093/cdn/nzz021

# Disclaimer

Mycoprotein is a general term describing protein derived from filamentous fungi, a term that covers many different fungal species with different characteristics among them. In this sense, Mycorena only assumes responsibility from the sample data labelled under the “Promyc” name, as opposed to when “mycoprotein” is referred to in the text as data from the literature, in which the species used might be different from the species used for production of Promyc.



*Copyright © 2019 Mycorena AB. All rights reserved.*