

COOKING TIPS

Soaking legumes and cereals before cooking them increases their digestibility and enhances the removal of water-soluble antinutrients (phytates). It also reduces the cooking time and softens the texture of legumes.

=> Put them in water and salt solutions overnight (15 to 20 hours) or for a shorter time (15 to 20 minutes). Distilled or mineral water may be used when tap water is hard or contains excess chlorine or lime.

Dehulling improves water absorption (because seed tegument is waterproof) and palatability of seeds by reducing their bitterness, but it also implies a loss of nutrients contained in the hull.

Germination (or sprouting) of seeds is commonly used prior consumption: it improves protein digestibility by degrading phytate, it reduces the tannin content so increases the mineral bioavailability and nutritional value.



Cooking methods :

. **Boiling legumes** may inactivate protease inhibitors and lectins, even if some other antinutrients remain unaltered (phytic acid, saponins, tannins).

-> if there is no pre-soaking or if legumes are older than 18 months old, add 2 parts of water in weight or volume to 1 part of legumes in the pot.

-> if legumes are soaked in advance, add 1 generous portion of water.

If you cook with an open pot, always make sure that the liquid completely covers the legumes, and add water if needed (hot water if cooking chickpeas, and cold or lukewarm water for other pulses).

Cook at low heat for 40 minutes, then drain and add cold water to start the stewing process. Chickpeas are the only legume that should be cooked – after pre-soaking them for at least 8 hours – by placing them into hot or boiling water instead of placing them into cold water, which is what is done with other legumes.

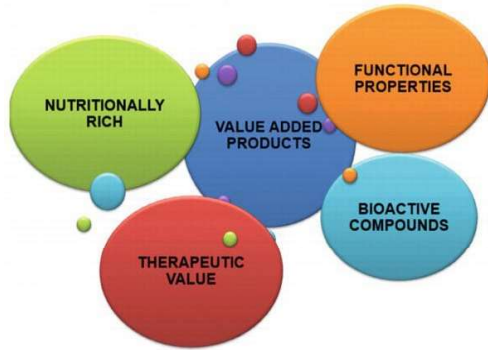
. **Roasting cereals and legumes** with dry heat at 120-250°C can reduce α -galactosides (raffinose), but this technique also impairs some nutrients and trypsin inhibitor activity.



PULSES and CEREALS WHY NOT?

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What about ... ?



LEGUMES and PULSES

“Legume” is derived from the Latin « *Legere* », meaning « to gather », which is an allusion to collecting the seeds by hand.

Legumes belong to the Fabaceae family, the third

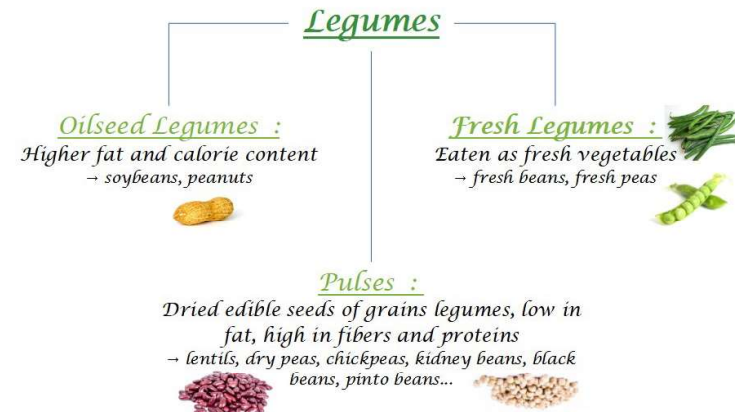
largest family among flowering plants.

Alternatively, legumes are known as pulses (Latin « *puls* » : a pottage made of meal). According to the FAO, pulses are dry grains, thus it excludes green peas, green beans, soybean, peanuts, seeds of clover and alfalfa.

Pulses, 55-65 % total weight is carb (mainly starches)

20-40 % protein, less digestible starch than cereal starches, high content of fibers

(4-19g/cup boiled)



CEREALS

Cereals are the fruit or seed of plants that belong to the Gramineae family of grasses.

This family includes wheat, rye, millet, rice, corn, oats, barley, teff, sorghum, triticale, canary seed, fonio.

Amaranth, buckwheat, quinoa are often considered as cereals but they are not: we call them “pseudo-cereals”.

Pulses and whole grains: is it true that legumes and cereals...

“Legume” Are “old-fashion”?

Yes, there are some cultural prejudices against pulses, which are often seen as “the poor man's meal” (in reference to beans, or “poor man's meat”, during the US Great Depression). This vision is supplied by their packaging, as they are often sold raw or in cans (generally perceived as poor quality food), in comparison with prepared dishes.

But pulses are starting to be put under the spotlight worldwide, with for example the year 2016 which was the International Year of Pulses, or with the help of numerous chefs who regularly re invent new recipes: indeed, from rustic stews to vegan sandwich spreads, Mexican tacos and delicate desserts, our imagination is the limit. With 18,000 varieties to choose from, legumes are a cornerstone of biocultural diversity. From the New World's frijoles charros to North Africa's breakfast staple ful medames and the myriad dal recipes of the Indian subcontinent, legumes transcend borders as a foundation of numerous world cuisines.



Are not a part of our eating habits?

Yes, currently only 41% of grains produced are used for human consumption. Pulse consumption in France has declined from 7.2 kg in 1920 to 1.7 kg per person per year in 2016, although health authorities recommend eating pulses at least twice a week (ANSES, 2017), corresponding to an average of 57g/day.

But from the emergence of agriculture, and as human staple foods, cereals form a major source of dietary proteins, vitamins, minerals and calories (from 40 to 90 % of our energy requirements), wheat being one of the most consumed cereal grains in Occident (over 70% of the total cereal production of the globe, together with maize and rice). Concerning legumes, they have been found in Middle and Upper Paleolithic assemblages from humans in Israel, Iraq, Syria, Jordan, Turkey, Albania, and Spain, in some sites being the dominant type of plant food found: it seems they were an important part of the diet of Paleolithic humans, as well as of other primates like chimpanzees. Today, the ease of storage (in cans, dried, or processed as pasta for example), the long shelf life and the very affordable prices of grains and pulses (beans typically fetch four times the price at market than some cereals!) make them nutritious and practical foods to implement to our daily lives.

Pulses and whole grains: is it true that legumes and cereals...

Suffer from a lack of knowledge about their nutritional value?

Yes, the contribution of whole grains to a healthy diet has often been forgotten the last two decades, carbohydrates being blamed by the media for obesity epidemic, diabetes and cardiovascular disease. Also, many legumes' species are unknown to the general public, because they cannot be easily found in supermarkets. They are also usually associated as plant-based protein

sources for vegetarians, which may be a barrier for non-vegetarian eaters.

However, whole grain-based foods (versus refined ones) are rich in nutrients (B vitamins, iron, magnesium, proteins, dietary fibers and about 25.9% energy per day to the Canadian diet), and the huge variety of pulses and grains easily allows each of us to have a more diverse and tastier diet. Many recipes around the world propose ways to cook legumes, more or less long, more or less convoluted, with or without meat, for sweet or savory palates: there is something for everybody! Finally, most dry legumes (as cereals) can be stored for a long time (even for years) without real loss of nutrients, nor spoiling. As a general rule, pulses will retain excellent nutritional quality for 18 months!



Require long preparation and cooking times?

Yes, time is required for soaking pulses (12 hours or overnight), in order to prevent unwanted digestive effects (e.g. flatulence) and to reduce their cooking time. Furthermore, sprouting legumes enhances both their digestibility and nutritional values.

But this is just a matter of organization, as legumes virtually cook themselves: soak and cook them in a large quantity (same for grains) at once, freeze the excess for other meals and that's done! Additionally, lentils don't necessarily need to be soaked.

Pulses and whole grains: is it true that legumes and cereals...

Cause gastrointestinal problems and gas?

Yes, the abundant presence (2-10g/100g dry weight) of indigestible oligosaccharides (alpha-galactosides: raffinose, stachyose and verbascose) in whole grains and pulses leads them to be quickly fermented by gut bacteria, producing gases (carbon dioxide and hydrogen) naturally eliminated.

But evidence suggests that eating regular whole grains and legumes leads to a "tolerance" by a shift in the microbiota distribution, decreasing the flatulence and other gastrointestinal symptoms associated with their consumption. Furthermore, alpha-galactosides can easily be removed by soaking and pressure cooking (discarding both soaking and cooking liquids). Finally, gas production is a normal physiologic process that aids in digestion by softening and helping to move stools through the colon.



Add flavours to your plates, Remove odors from your tripe !

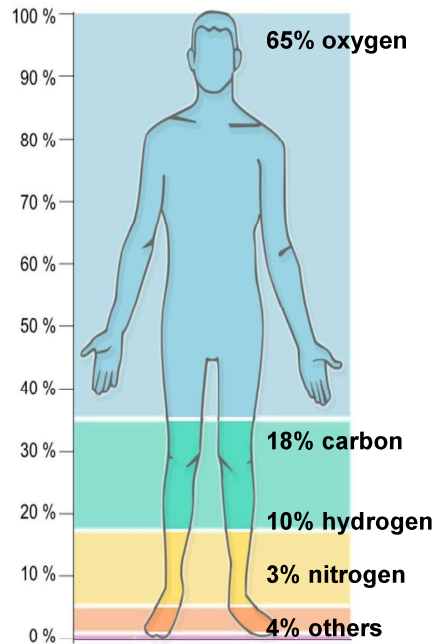
Cumin, caraway, coriander, dill, epazote, licorice, fennel, ginger, lemon grass, mint, nutmeg, basil, marjoram, oregano, anise and rosemary are carminative herbs and spices that neutralize the bacteria in the intestine that create gas while enhancing the taste of legume-based foods. Some simple culinary gestures can also reduce the pleasant gut melodies linked to the consumption of pulses, such as soaking them, eliminating the soaking water, rinsing them and throwing away the first water in which they are boiled (these two waters contain the substances that feed the greed of these bacteria). Finally, we can boil them in new water and really start preparing the dish.

Have many antinutrients?

Yes, cereals and pulses are rich in antinutrients (glycoalkaloid, glucosinolates, protease inhibitors, phytate, saponins, etc.) that inhibit digestive enzymes (trypsin, chymotrypsin, amylase) and reduce the bioavailability of nutrients. Indeed, they are produced by the plants as secondary metabolites to exert a protective effect against the appetite and attacks of microorganisms, insects, animals, and humans.

But antinutrients exert their effect only if legumes and grains are consumed uncooked, because fermentation and heating denature the antinutrients. Finally, in small doses, they are good for human health!

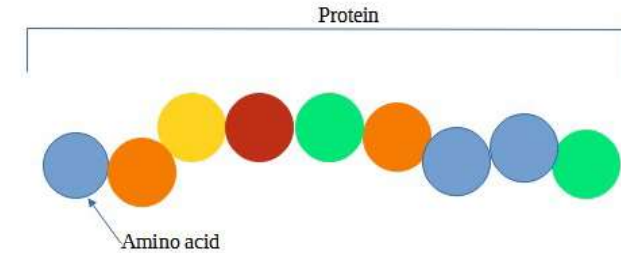
Animal-friendly proteins



As we learned in our biology classes, every living organism is made up of a combination of atoms that organize themselves into molecules. Thus, oxygen, carbon, nitrogen and hydrogen are the atoms that make up the vast majority of our bodies.

Conversely to the other elements, we can only find nitrogen in small components named amino acids, which compose proteins: these molecules are absolutely essential for all living organisms and have to be found in our daily eating.

There is a common belief that we cannot find our protein elsewhere than in animal products, such as meat, fish, eggs or cheese.



However in reality, pulses and grains are quite rich in proteins (8-12 % for cereals -mainly prolamins and gluten, 20-25 % for legumes and even 40-45 % for soya - mainly globulins), even if:

- pulses lack of **sulfur-containing amino acids, methionine, cysteine and tryptophan.**
- cereals are poor in **lysine and threonine.**

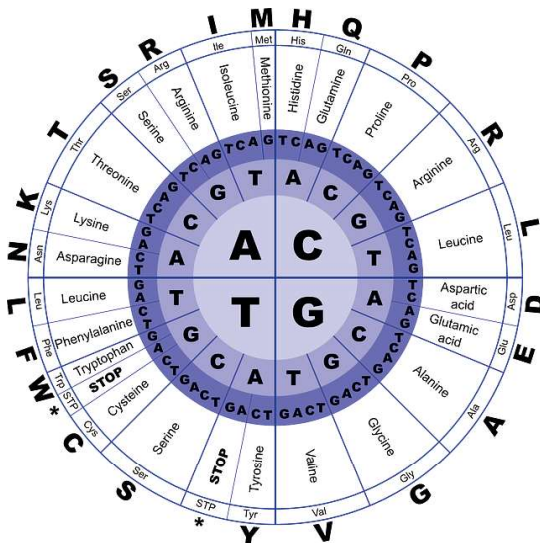
As a result, pulses and cereals can **complement** each other, and provide all of the indispensable amino acids to meet human requirements for growth and health, as any animal product would.

Animal-friendly proteins

Information for curious people

The **PDCAAS** (Protein Digestibility Corrected Amino Acid Score) defines the nutritional quality of protein and its ability to provide nitrogen and indispensable amino acids for human metabolism. The higher it is, the better the protein quality: for cereals and pulses, its value is about **50 %**.

It increases with heating and fermentation through the deactivation of anti-nutritional factors and the changes in molecular structures facilitating access to proteolysis sites.



$$AAS = \frac{\text{First limiting amino acid in test protein [mg/g]}}{\text{Corresponding amino acid of reference protein [mg/g]}}$$

$$TFND [\%] = 100 * \frac{(N \text{ intake} - (\text{faecal } N \text{ loss} - \text{metabolic } N \text{ loss}))}{N \text{ intake}}$$

$$PDCAAS [\%] = AAS * \text{true fecal } N \text{ digestibility } [\%]$$

$$IAA = \frac{\text{Digestible dietary indispensable amino acid in test protein [mg/g]}}{\text{Corresponding amino acid in reference protein [mg/g]}}$$

$$DIAAS [\%] = 100 * \text{Lowest value of } AAS$$

Because of several concerns, the FAO suggested to replace the PDCAAS with the **DIAAS** (Digestible Indispensable Amino Acids Score), which is based on ileal amino acid digestibility, and based on the amino acid requirements of a 0.5–3 years old child. This score must be at least **equal to 100** to be said to be an excellent quality protein. For cereals and pulses, it is usually **under 60**.

Thus, although the proteins are fairly well digested, their retention in the body seems to be quite low for most of the cereals.

When the **DIAAS** of a protein source is **lower than 100**, to reach the protein nutritional recommendations we can:

- increase its consumption until the physiological requirement is reached (ex : 2,8 portions of corn protein or 1,45 portions of pea protein);
- or combine pulses and cereals to complement them.

Potential issues of vegetal proteins

Antinutritional factors (glycoalkaloid, glucosinolates, protease inhibitors, phytate, saponins...) inherent in legumes and cereals decrease their protein digestibility and mineral release.

Lectins can interact with glycoproteins on the surface of the intestinal villi, reducing nutrients absorption.

Saponins, and their bitter taste, are frequent in some legumes and form foam that decreases fat digestibility.

Phytic acid forms complexes with minerals, reducing their bioavailability and absorption. It can also impair protein digestibility.

Phenolic compounds (tannins for example) are responsible for the astringentness of legumes and cereal. They precipitate proteins, by the way reducing their digestibility and availability as well.

The majority of them are reduced by soaking, dehulling, autoclaving, fermentation and enzymatic treatments. Their reminiscent presence is not a problem, as they exhibit antioxidant and prebiotic activity at low concentrations, as well as hypolipidemic and antitumoral properties.

Microbial fermentation improves their nutritive value, availability of nutrients (proteins, amino acids, carbohydrates, some B-vitamins and minerals) and digestibility.

There are several methods of preparation of legumes, ranging from shortened cooking times with the addition of alkaline salts, to long heating for periods up to 24 hours.

Heat treatments can induce molecular alterations making the protein either more resistant to the action of digestive proteases, or on the contrary **more accessible**.

Severe heat damages the **sulfur amino-acids** (cystine is the most sensitive), which are limited in legumes but highly present in cereals: combining them compensate for this loss.

Lysine reacts a lot during heating (giving Maillard molecules), leading to a 30 to 40 % decreased reactive lysine in soybean meal and rapeseed meal. It is of nutritional importance in the case of diets based on plant-based proteins.

Fibers would increase the ileal amino acids endogenous losses by hindering the access of proteases.

Several cereals and legumes have **beta-sheet conformations** that are associated with a particular resistance towards protein breakdown in the gastrointestinal tract, leading to a lower digestibility of proteins.

Health Benefits

Do you know that

Plant-based diets are cost-effective, low-risk interventions that may lower body mass index, blood pressure, and cholesterol levels.

They may also reduce the number of medications needed to treat chronic diseases and lower ischemic heart disease (IHD) mortality rates.



It's proven that diets high in cereals and pulses are associated with **good heart health and lower systolic and diastolic blood pressure.**

Dietary fibers and resistant starch and phenolic compounds support the growth of healthy gut bacteria.

Consumption of pulses and cereals give more magnesium, potassium, iron, thiamin, riboflavin, foliate, and vitamins and less total fat.

Many diets around the world rely on **pulses as a source of protein.**

The **Mediterranean Diet** is known for its beneficial health-effects. It is rich in fruits, vegetables, whole grains, plant-protein, and low in meat & meat products. This diet is associated with reduced risks of developing heart disease, hypertension, type 2 diabetes, cancer, Parkinson's disease, and Alzheimer's disease.

Pulses have a low glycemic index and the more in combination between them or with cereals, the more health benefits for people who already suffer from chronic illness and people who are health conscious.

Soybean and products can be an excellent source of good proteins and which helps to lower the levels of **low density lipoprotein in blood.**

Cereals and pulses are rich in magnesium : positive effects on **insulin sensitivity.**

Pulses and cereals are richer sources of phytochemicals, saponins and tannins which have **antioxidants** and **anti-cancerogenic effects** and help in prevention of cancer.

Health Benefits

Protein complementation

As the knowledge it is very essential to have micronutrients in our daily diet, which is hard for some diets, but a certain amount of additions and cooking patterns to the regular meals can help in retaining these micronutrients.

- If we combine sugar beans (7.1g) and chickpeas (8.6g) we can meet the protein value upto 15g following with good amount of magnesium (32+49 mg), iron(368+291 mg) and potassium(55+48 mg)
- If we combine lentils 8.6g) with sugar beans (7.1g) we may get proteins upto 16g and magnesium (27+31mg), iron(270+368mg) potassium (55+27mg)
- The most used combination as a high source of protein in many countries is soy beans (16.6g) and chickpeas (8.6g) following higher amount of iron (368+515mg), magnesium(32+102mg) and potassium(55+68mg)

Essential amino acids can also be obtained by eating certain combinations of plant-based foods like brown rice with beans or hummus with whole wheat pita.

Lentil consumption also improves serum lipid profiles and positively affects several other cardiovascular disease risk factors like platelet activity and inflammation.

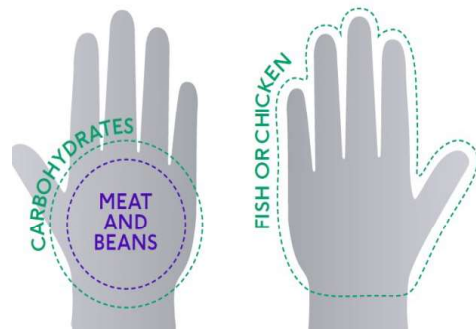
Lentils are low in the essential amino acids methionine and tryptophan, which are found in grain-based products.

They are a good source of selenium, and are very high in thiamin, niacin, folate, riboflavin, and pyridoxine Pulses contain vitamin E and A, and while dried pulses do not contain vitamin C, their sprouted forms do.

As seen in Pulses, cereals provide a major advantage in prevention and cure of many chronic illnesses, it has a good effect on the daily well being and avoids weight gain, early aging.



HOW MANY PULSES AND CEREALS SHOULD WE EAT?



<https://www.bhf.org>

Legumes can be both considered as a protein source or as a carbohydrates source. Indeed, it is good to know that legume starch is more slowly digested than starch from cereals and tubers, and produces less abrupt changes in plasma glucose and insulin upon ingestion. Replacing your portion of white rice by one portion of lentils at lunch is a good option for your health, as well as for your satiety feeling!

The “**Programme National Nutrition Santé**” (PNNS 4) is a french public health program designed to improve the health status of the population by acting on diet, because it is the main factor in the prevention and protection of a large number of diet-related diseases (overweight, obesity, diabetes, cardiovascular diseases, certain cancers, etc). Thus, one **objective** of the PNNS-4 is that 100% of the population eat at least **one serving of legumes a week** by the 2023.

Do you know that ...?

You can use either your plate or your hands as a portion guide.

Replacing meat by pulses will not impair the nutritional quality of your diet, and even would probably slightly improve it thanks to their fibers and nutrients contents: it seems to be the most relevant change for improving diet sustainability compared to replacing starches with pulses. However, the central place of meat in some cultures may be a real barrier for consumers.

Finally, replacing meat by pulses only requires **monitoring of iron and zinc status** among individuals at risk of deficiency.



What does a Healthy Diet Look Like?



one quarter:
foods rich in protein*
various beans, pulses,
nuts, seeds, fish
yoghurt, tofu
poultry, egg
& meat

*in reality all the other foods on this 'plate' contain protein too, including the whole grains below ...

one quarter:
a range of whole grain foods
brown rice
wholemeal bread & pasta
other examples include:
oats, corn, rye, barley
buckwheat, and millet



one half:
all kinds of vegetables and fruits
like broccoli,
carrots, blueberries
strawberries,
peppers, apples,
red cabbage,
spinach, squash,
potatoes, tomatoes
and peas.
mushrooms too.

The more different kinds of plants we eat the healthier our gut. The bright colours and strong flavours that occur naturally in edible plants are beneficial.

Source: Health Canada 'Welcome to Canada's Food Guide', 2018 https://food_guide.canada.ca/en
This is a 'national' level food guide which was created with no influence from the food industry

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ENVIRONMENT

How can pulses help to a SUSTAINABLE DIET?

Environmentally pulses fix atmospheric nitrogen and have low water requirements, and their use has been shown to reduce the need for summer fallow, and enhance the yield, water use efficiency, and fertilizer use efficiency of cereal crops grown in rotation with them.

Animal feed consumes 3/4 of the biomass produced worldwide.

The production of animal proteins consumes 20 times more **water** than plant proteins and generates much more greenhouse gases.

Help to fertilize the soil

Legumes increase **soil fertility** and crop production by enriching soil with nitrogen. Legumes fix atmospheric nitrogen (300kg of nitrogen per hectare) using specialized root nodules that contain symbiotic bacteria, or rhizobia.

Although legumes are often used in crop rotation systems or intercropping with cereal crops, their use has declined because of increased use of nitrogen-rich fertilizers. The symbiotic relationship between legumes and rhizobia in major legume crops is estimated to fix 21 Mt of nitrogen per year, save US \$8–12 billion.

Pulses also release hydrogen gas into the soil, up to 5000 litres per hectare per day.



SUSTAINABLE DIETS defined by the Food and Agriculture Organization of the United Nations (FAO)

"Diets with low environmental impact that contribute to food and nutrition security and a healthy life for present and future generations. Sustainable diets protect and respect biodiversity and ecosystems."

"Are culturally acceptable, accessible, economically fair and affordable. And also are nutritionally adequate, safe and healthy, and optimize natural and human resources"

**"1kg of animal protein requires
4.9kg of vegetable protein"**



How much do you know about Pulses & Cereals?

1. From which country does the couscous originate?

- A) Japan B) Morocco C) India D) France

2. What are chickpeas called in India ?

- A) Chana B) Pois chiches C) Garbanzo D) Guasanas

3. Which of these pulses has the highest amount of iron?

- A) Sugar beans B) Chickpeas C) Moth beans D) Soy beans

4. In what year was breakfast cereal discovered?

- A) 1995 B) 1854 C) 1932 D) 2000

5. Which of these foods is not a grain?

- A) Wheat B) Rye C) Sorghum D) Fava

6. In which country is rice mostly consumed?

- A) India B) Brazil C) China D) France

7. Arrowroot is free from ?

- A) B12 B) Amino acids C) Iron D) Gluten

8. What amino acid do cereals generally lack?

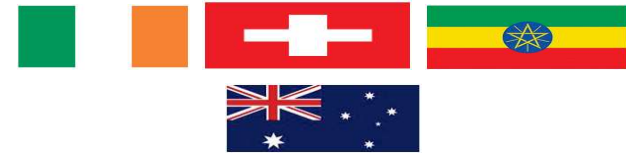
- A) Lysine B) Valin C) Leucine D) Histidine

9. What is the second largest consumer of legumes?

- A) Pakistan B) Egypt C) Nigeria D) India

10. What is the first producer and exporter of pulses in the world after the United States of America?

- A) Australia B) Syria C) Vietnam D) Canada



B) MOROCCO, A) CHANA, D) SOY BEANS,

B) 1854, D) FAVA, C) CHINA, D) GLUTEN, A) LYSINE

C) NIGERIA, D) CANADA

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