

FOODSERVICE
Guide *to*
Pulses



PULSES



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Put your finger on the pulse of shifting foodservice trends.

Pulses are the versatile, nutrition-packed, low-cost ingredients consumers are looking for now. Pulses, including beans, chickpeas, lentils and dry peas, can help foodservice operators meet growing consumer demand for healthy, sustainable, delicious packaged goods and menu items.



DRY PEAS



BEANS



LENTILS



CHICKPEAS



36%
of AMERICANS

More than one-third (36%) of Americans are interested in eating a more plant-based diet, as of a 2015 Nutrition Business Journal Special Diets report

48%
of MILLENNIALS

48% of Millennials are more likely to visit a restaurant emphasizing produce

68%
of CONSUMERS

Gluten-free and high-protein menuing is on an upward trend, with 68% of consumers interested in high-protein menu items

80%
of CONSUMERS

80% of consumers look for pulses and legume-based items on menus, with 30% of consumers planning to increase their consumption of pulses as of 2015

56%
of FOODSERVICE OPERATORS

With only 56% of foodservice operators featuring pulses in menu items, menuing is not keeping up with consumer interest, leaving a gap in the marketplace

Source: CIA Menus of Change Study, 2015



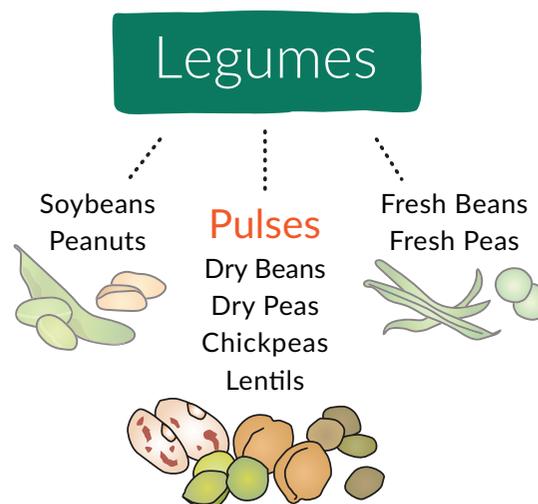


What Are Pulses?

Pulses are versatile and low-cost sources of plant-based protein, fiber and many essential nutrients. Whereas legumes are any plant that grows in a pod, pulses are the edible seeds of legumes, which are generally harvested dry (unlike green beans, snap peas, etc.) and have a lower oil content than legumes like peanuts and soybeans. Additionally, pulses are not one of the top eight food allergens.

All pulses are an excellent source of fiber, a good source of protein, and are rich in other nutrients like potassium, iron, folate and antioxidants. In fact, in the United States, pulses are the only food to fit into two groups on the USDA MyPlate Guidelines, counting as either a vegetable or a protein.

Pulses can be cooked from dry, but also come in canned, shelf-stable pouches, and flash frozen. They can be used in their whole form in appetizers, soups, salads, entrées and even desserts, and pulse flours, flakes and fractions (e.g. pea protein, pea starch) can also be used to increase the nutritional density of a dish.



Pulse Types

Pulses are dry, edible seeds of plants in the legume family, including chickpeas, lentils, dry peas and beans. They are a sub-set of legumes, full of protein and fiber, and low in fat.

DRY BEANS

Beans have been used throughout the world for thousands of years, and come in hundreds of shapes, sizes and colors. Most beans should be soaked before cooking from dry to reduce cooking time and activate enzymes, proteins, minerals and vitamins.



CHICKPEAS

Chickpeas have a nutty, faintly chestnut-like flavor and a firm texture. They are known as the key ingredient in Middle Eastern hummus (the dip made with chickpeas and sesame paste) and falafel (fried chickpea patties), but are also great for adding to salads, stir-fries, or roasted on their own to be enjoyed as a snack. In addition to being a perfect base for many dishes, chickpeas can be roasted and ground into a flour employed in batters for vegetable fritters and other savory foods.

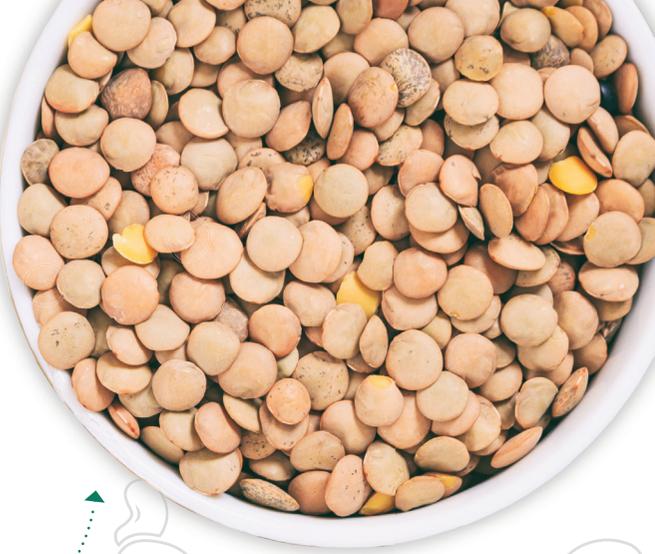
In addition, chickpeas can be used in snacks and desserts, like energy bites or baked goods. Even the leftover cooking liquid (or liquid from canned chickpeas), also known as aquafaba, can be whipped to form a meringue-like consistency, which can be used as an egg replacer or in applications like vegan chocolate mousse.





LENTILS

Lentils do not need to be presoaked and they cook quickly. Lentils that hold their shape after cooking, such as brown or green lentils, are best in salads. Lentils that soften quickly (e.g. red lentils) work well in purées and as a thickening agent for soups and salad dressings (for best results, purée the lentils before adding them to the liquid to be thickened). Lentils sold in the United States as dhal (the word used for lentils in India) have been skinned and split (i.e. decorticated) and are lower in dietary fiber than non-decorticated lentils.



DRY PEAS

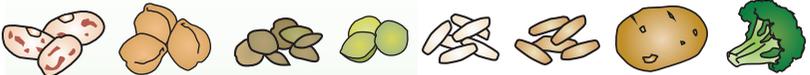
Whereas fresh peas boast a delicate, sweet flavor, dry peas are nutty and robust. Most dry peas in the United States are sold skinned and split, which do not need to be soaked before cooking. Whole dry peas, on the other hand, should be soaked overnight before cooking.

In addition, dry pea ingredients (powders, flours, protein, flakes, crisps and starches) are available for use in foodservice applications and development of products for retail. Pea protein powder is a great plant-based alternative to whey protein, and pea flour and pea starches can be used to make nutrient-fortified baked goods and extruded snacks.

Dry peas are commonly available in green or yellow varieties, in their whole or skinned and split form.



How Do Pulses Compare?



1 SERVING = ½ CUP COOKED

	PINTO BEANS	CHICKPEAS (garbanzo beans)	LENTILS	SPLIT PEAS	WHITE RICE	BROWN RICE	POTATO	BROCCOLI
Kcals	122	134	115	116	121	109	68	27
Fat (g)	0.56	2.12	< 0.5	.38	< 0.5	0.81	0.08	0.32
Protein (g)	7.7	7.27	8.9	8.17	2.21	2.26	1.46	1.86
Carbohydrates (g)	22	22.48	20	20.68	26	23	16	5.6
Fiber (g)	7.7	6.2	7.8	8.1	0.3	1.8	1.4	2.6
Potassium (mg)	373	239	365	355	27	77	296	229
Iron (mg)	1.79	2.37	3.3	1.26	.19	0.52	0.24	0.52
Magnesium (mg)	43	39	36	35	12	43	17	16

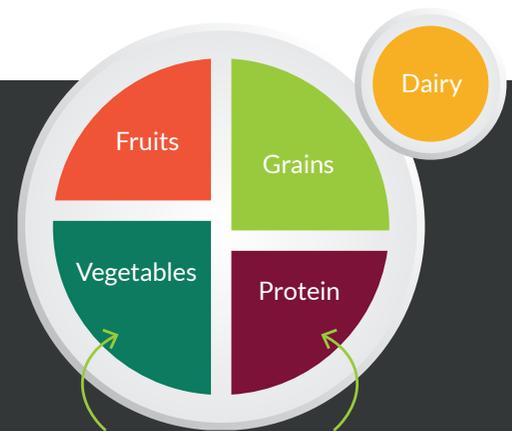
● Highlighted Text ≥ 20% Daily Value
Bold Text ≥ 10% Daily Value

Data from the USDA National Nutrient Database

Nutrition

PULSES ARE:

- ✓ **Good source of protein**
Lentils deliver **double the protein per serving of quinoa**
- ✓ **Excellent source of folate**
Chickpeas contain **3x more folate per serving than kale**
- ✓ **Iron-rich**
One serving of black beans contains **1.5 times as much iron as one 3 ounce serving of flank steak**
- ✓ **High in antioxidants**
Per serving, red kidney beans have **higher antioxidant content than blueberries and pomegranate juice**
- ✓ **Excellent source of fiber**, including soluble fiber, insoluble fiber and resistant starch, contributing to their prebiotic effects. **All pulses have 4x more fiber than brown rice**
- ✓ **Good source of potassium**
One serving of dry peas **contains as much potassium as a banana**
- ✓ **Gluten-free**
- ✓ **Sodium-free**
- ✓ **Cholesterol-free**
- ✓ **Low-glycemic index**



Pulses fit into **MyPlate** eating patterns as both **Vegetables** and **Protein!**

Choose MyPlate.gov



Nutritional information sourced from the USDA Nutrient Database, antioxidant data as published in Journal of Agricultural and Food Chemistry, June 9, 2004; All nutritional figures based on ½ cup serving of cooked pulses

Pulses vs. Meats

Pulses (dry peas, lentils and chickpeas) go head-to-head with common household meats, battling for nutritional value, cost and flavor. Meet your new, healthy meat alternatives that you'll want to eat every day!

	Pulses				Meat		
							
FOOD	Beans	Chickpeas	Lentils	Dry Peas	Chicken	Beef	Pork
CALORIES	122	134	115	116	167	143	189
FAT	0.56g	2.21g	<0.5g	0.38g	1.86g	1.62g	3.81g
CHOLESTEROL	0mg	0mg	0mg	0mg	71mg	68mg	57mg
PROTEIN	7.7g	7.27g	8.9g	8.17g	25.3g	24.7g	20.8g
IRON	1.79mg	2.37mg	3.3mg	1.26mg	0.91mg	2.5mg	0.58mg
FIBER	7.7g	6.2g	7.8g	8.1g	0g	0g	0g
COST	\$TBD Serving	\$0.11/ Serving	\$0.07/ Serving	\$0.07/ Serving	\$0.67/ Serving	\$1.07/ Serving	\$0.71/ Serving

PULSES ARE:

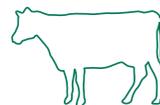
-  An Excellent Source of Fiber
-  A Good Source of Protein

MEAT IS:

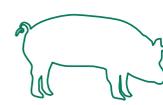
-  High in Cholesterol
-  High in Saturated Fat
-  High in Cost

Cost Savings

Average U.S. cost per serving of pulses is **\$0.10 vs.:**



\$1.49
for beef



\$0.73
for pork



\$0.63
for chicken

In addition to meeting consumer demand for entirely plant-based options, pulses can also be used to extend meat or facilitate meat portion size reduction, helping to cut overall ingredient costs and improve profits.

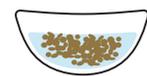


Cooking Basics

Cooking times may vary slightly depending upon the variety of pulse. Find suggested times for specific pulse varieties on the following pages, but note that they are approximations, and you should adjust them to meet your needs. High altitude, hard water and salt added to the cooking water will increase the cooking time.

QUICK TIPS

- Soaking dry pulses before cooking will shorten cooking times, and can improve digestibility. Generally, 12 to 24 hours is a good guideline for soaking time. If time constraints preclude soaking, you can do a “quick soak.”
 - **Quick Soak Method:**
Place dry pulses in water and bring quickly to a boil; then remove the pot from the heat and allow it to rest for about one hour. Then, simmer the pulses until they are tender.
- Pulses can be cooked in a pressure cooker, without soaking ahead of time. As with stovetop method, cooking times vary by pulse type, but generally range from **20–45** minutes.
- Avoid adding salt to pulses until toward the end of the cooking time, as it causes them to harden and therefore they will take longer to cook.
- Although you don’t want to add salt during the cooking process, you can add salt during a long soak to brine the beans and help soften skins. Use three tablespoons of salt for every gallon of soaking water.
- Never throw out the water that pulses have been cooked in! The cooking water can be used as a flavorful stock to enhance the overall taste of the dish, or to create additional dishes.
- Pulses cooked from their dry form will yield between 2 to 3 times their original dry yield. Lentils and split peas yield 2 to 2 ½ times their original dry yield, while beans and chickpeas expand to 3 times their original dry yield.



Suggested Soaking and Cooking Times



Pulse Type	Long Method (Hrs)	Short Method (Hrs)	Cooking Time (Hrs)
ADZUKI BEANS	2-3	1	1-2
BLACK BEANS	12	3	1½-2
BLACK-EYED PEAS	12	2	1-1½
FAVA BEANS	12	4	1½-2
BUTTER BEANS	12	4	1½-2
CHICKPEAS	12	3	1½-2
KIDNEY BEANS RED	12	2-3	1-1½
BORLOTTI BEANS	12	2-3	1-1½
CANNELLINI BEANS	12	2-3	1-1½
DUTCH BROWN BEAN	12	2-3	1½-2
EGYPTIAN BROWN BEANS	12	2-3	1½-2
FAGIOLI BEANS	12	2-3	1-1½
FIELD BEANS	12	2-3	1-1½
FITTLAGEOLETS	12	2-3	1-1½
GREAT NORTHERN BEANS	12	2-3	1½-2
HARICOT BEANS	12	2-3	1½-2
LENTILS	No Soaking Needed		20-30 min
MUNG BEANS	12	4-60 min	45 min
NAVY BEANS	12	2-3	1-1½
PIGEON PEAS	12	2	1
PINK BEANS	12	2-3	1 to 1-½
PINTO BEANS	12	2-3	1 to 1-½
SPLIT PEAS	No Soaking Needed		20-30 min
WHITE BEAN	12	2-3	1-1½





Storing Pulses

Unlike fresh produce, dry and canned pulses can be stored for a long time with minimal nutrient loss, and without costing foodservice providers valuable refrigeration/freezer space. After cooking, pulses can be refrigerated or frozen, and reheated without losing flavor or nutritional value.

DRY STORAGE: When stored in sealed containers in a cool, dry place, dry pulses have an incredibly long shelf-life. After long storage their color may fade slightly and they may require a slightly increased cooking time, but their taste will not be noticeably altered.

PRE-COOKED STORAGE: Precooked pulses can be refrigerated in a tightly covered container for 3–4 days, or can be frozen up to 6 months.

How to Store Pulses

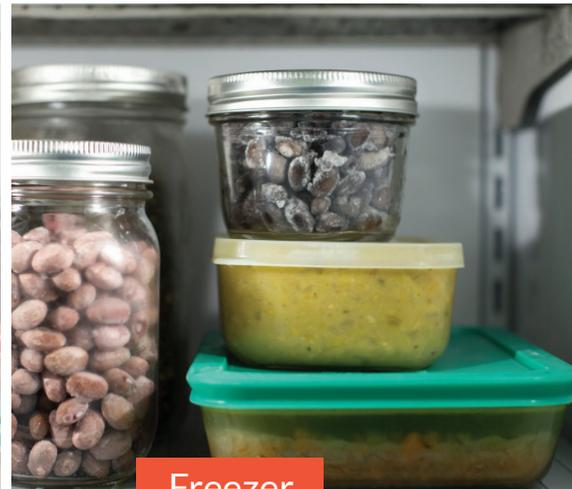
Pulses are one of the world's most nutritious, affordable, shelf-stable food sources!



Pantry



Refrigerator



Freezer

DRY PULSES

Store Time: Up to 1 Year

If stored for longer, pulses may require longer cooking times to soften.

CANNED PULSES (SEALED)

Store Time: Several Years

SALADS

Store Time: Up to 3 Days

Store in sealed, airtight container.

COOKED OR CANNED PULSES (OPENED)

Store Time: Up to 5 Days

Sealed in airtight container in cooking liquid or covered with water.

SOUPS, CHILI AND CURRIES

Store Time: Up to 5 Days

Store in sealed, airtight container.

COOKED PULSES

Store Time: 6 Months

After pulses have cooled completely, drain any excess liquid and store in single-serving portions in sealed, airtight containers or freezer bags.

SOUPS, CHILI AND CURRIES

Store Time: 3–6 Months

Store in sealed, airtight container.



DRY BEANS

Ingredients and Applications

Dry beans come in a variety of colors and sizes. Beans are found around the world, originating in several different locations. The common bean (*Phaseolus*), including kidney, pinto, navy, lima and others, originates in South America, the Andes and central America. Sub-tropical beans such as adzuki, mung and blackeye peas (*Vigna*) originated in Africa, while broad beans such as fava/faba beans (*Vicia faba*) are thought to have originated in the Fertile Crescent region.



Adzuki



Black



Blackeye Peas



Kidney
DARK RED



Kidney
LIGHT RED



Great
Northern



Navy



Pinto



Fava



Small Red



Mung



Lima



Cranberry

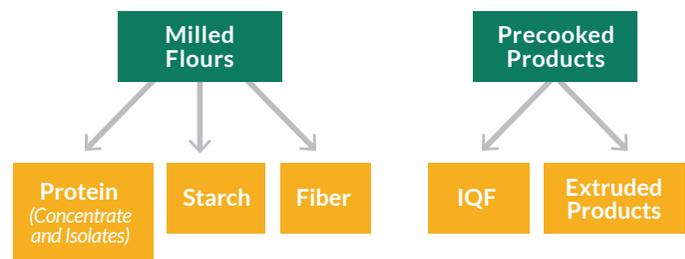


Pink

PROCESSING

Beans are treated similarly to other pulses like peas, lentils and chickpeas. Beans must be soaked prior to cooking. Common methods for cooking beans include canning, pressure cooking, or adding beans to soups. Add any acidic ingredients or those containing calcium or salt after beans have finished cooking, as these can prevent beans from becoming tender while cooking. While adding a small amount of baking soda to cooking water can help beans tenderize more quickly, in excess it negatively affects the flavor of beans and can destroy B-vitamins.

Value Added Bean Products



FLOUR

Dry beans can be milled into flour just like dry peas, lentils and chickpeas. White bean, black bean, and fava bean flours are currently used for gluten-free baking. In a study conducted at Northern Crops Institute, great northern bean flour was used to fortify control bread at 30% and increased the water from 66% in the control to 74% with added bean flour. Differences between raw and pre-gelatinized flours are flavor and functionalities and come from heat processing before milling. Bean flour is mostly available as a whole flour and in pre-gelatinized form.

- **Raw (whole)**

Anti-nutritive factors in bean flour such as polyphenols, phytic acid and trypsin inhibitors, and color and flavor can limit the use of bean flour as an ingredient in bakery products, meat products and snack foods. Legumes can be treated to reduce the content of these anti-nutritive factors, to improve the nutritional value of the protein and remove their bean flavor. Hull of beans are tightly adhered to cotyledons, thus difficult to be removed. Therefore, available bean flour in the market is mostly made from whole beans.

- **Pre-gelatinized (whole)**

Treating raw pulse flour by heating partially gelatinizes the starches, inactivates enzymes, increases shelf life and improves flavor. These attributes make pre-gelatinized pulse flour favorable to raw pulse flour. The differences in gelatinization temperatures among flours from different pulses are attributed to differences in size, form, distribution of starch granules in the flours and to the internal arrangement of starch within the granule. Pregel bean flour serves as an effective flavor carrier and flavor improver, ideal for making more nutritious flatbreads, tortillas, pita breads, crackers, cookies, energy bars and extruded snacks. It also enhances dough yield, firmness and texture.

TIP: Applications determine which flour to use. Know the application!



EXTRUSION

Extrusion is a mechanical process in which materials are forced, under pressure, through a die opening to create products of a desired shape, size and/or texture. Due to its processing flexibility, extrusion cooking produces an incredibly broad range of food products in the cereal, dairy, bakery and confection industries. Pulse flours are often used as the basis for formulations that are extruded in low pressure systems. The flour is often mixed with starchy ingredients, like rice flour, to increase a starch level which enables ideal expansion. Extruded pulse-based products offer a crunchy texture, usually in the form of snacks and breakfast cereals, in a variety of shapes. Extrusion also can be used to produce pre-gelatinized flour by milling the extrusion overs back into flour.



Photo: Northern Pulse Growers Association

BAKING

The majority of the commercially available bean flour is pre-gelatinized, which makes it suitable for baking application. Wide varieties of bean flour enable the manufacturers to experiment with different types of beans for different baked goods. For example, when used in neutral flavored products such as vanilla cakes, white bean or navy bean flour is a good choice. On the other hand, black beans are favorable when used in brownies and chocolate cakes. Apart from the color, the neutral flavor of bean flour provides advantages as an ingredient.

FRACTIONATION

Starch, protein and fiber can be fractionated in the same manner as pea fractionated products. However, because the outer hull of beans is harder to remove than some other pulses (like dry peas and lentils), some fractionations from beans are less common, like fiber, while others are more common, like bean starch, which can be used to make noodles. This affects the commercial applications and products available.

< Red Bean, Black Bean Extruded Products

Photo: Northern Pulse Growers Association

CHICKPEAS

Ingredients and Applications

Chickpeas (i.e. Garbanzo Beans) (*Cicer arietinum*), like all pulses, are members of the subfamily Faboideae of the family Fabaceae. Thought to have been first grown in Mesopotamia up to 7,500 years ago, there are two types of chickpeas: Desi and Kabuli.

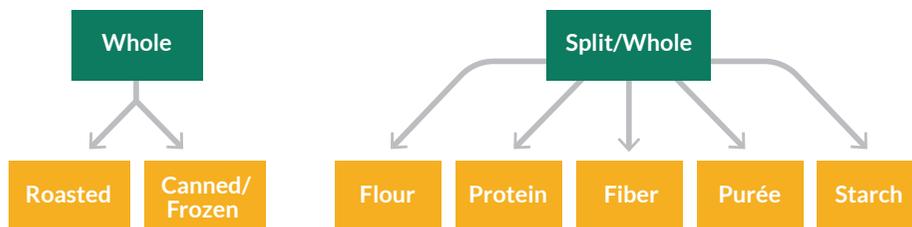
The classification is based on seed size, color and the thickness and shape of the seed coat. Desi types tend to be smaller, angular seeds with thick seed coats that range in color from light tan and speckled to solid black. If intended for human food, they require a specialized seed-coat removal process called decortication. This process requires adjusting the moisture level of the seeds to facilitate the mechanical removal of the thick seed coat, after which the seeds resemble a small yellow pea. Kabuli types, also known as garbanzo beans in the U.S., have larger seeds with paper-thin seed coats that range in color from white to pale cream to tan, which do not need to be removed before consumption.



Desi



Kabuli



FRYING OR ROASTING

Due to their high protein and low fat content, fried or roasted chickpeas are sold worldwide as a healthy alternative to other snack foods. In chickpea snack production, variety selection is key, as size, preparation time and other characteristics range greatly between varieties. The Kabuli offers a less wrinkled surface and generally requires less time to cook than the Desi. It also contains a seed coat that is very thin, but adheres well to the cotyledons. Before frying or roasting, chickpeas should be soaked for 10 hours in water that is held at room temperature. After soaking, the chickpeas are rinsed and drained to remove any excess surface water.

1 SOAK in room temperature water for 10 hours



2 RINSE and DRAIN



3 FRY at 356°F/180°C or **ROAST** at 212-266°F/100-130°C



NUTRITION FACTS

CHICKPEAS, ¼ CUP DRY

Calories	180
Total Fat	3g
Saturated Fat	0g
Cholesterol	0mg
Sodium	10mg
Potassium	438mg
Total Carbohydrate	30g
Dietary Fiber	9g
Trans Fat	0g
Sugars	5g
Protein	10g

FLOUR

Chickpea flour has a mild, neutral flavor which makes it suitable for baking applications. Both raw and pre-gelatinized flour are available depending on the use.

- **Raw (split/whole)**

Anti-nutritive factors in chickpea flour such as polyphenols, phytic acid and trypsin inhibitors, along with flavor, can limit the use of chickpea flour as an ingredient, especially in applications that go through less extensive heat treatment, like bakery and meat products. Chickpeas and other pulses can be treated to reduce the content of these anti-nutritive factors, and to improve the flavor and nutritional value of the ingredient.

- **Pre-gelatinized (split/whole)**

Treating raw pulse flour by heating partially gelatinizes the starches, inactivates enzymes, increases shelf life and improves flavor. These attributes make pre-gelatinized pulse flour suitable for some applications. The differences in gelatinization temperatures among flours from different pulses are attributed to differences in size, form, distribution of starch granules in the flours and to the internal arrangement of starch within the granule. Low protein and high amylose starches require high inputs of energy to undergo starch gelatinization. Low amylopectin starch has a higher gelatinization temperature, and is more resistant to enzyme and acid digestion compared to other starches. Pre-gelatinized chickpea flour serves as an effective flavor carrier, ideal for making more nutritious flatbreads, tortillas, pita breads, crackers, cookies, energy bars and extruded snacks. It also enhances dough yield, firmness and texture.

In general, pre-gelatinized flour is ideal for baking applications. Similar to flours derived from other pulses, using chickpea flour in baking applications provides nutritional benefits, including increased fiber, protein, micronutrients and better complimentary amino acid profile when used with wheat flour. Furthermore, chickpea flour in baking applications impacts functionality by increasing water absorption, thus increasing dough yield, increasing viscosity and altering the flavor characteristics of finished products.

TIPS:

- Pre-gelatinized flour provides more neutral flavor
- Use of additional ingredients (spices, cocoa, fruits, etc.) complements the flavor
- Addition of chickpea ingredients increases the viscosity of batter or dough
- Add water, as chickpea flour absorbs more water than wheat and other flours

EXTRUDED SNACKS

Chickpeas contain a high amount of fat (~6%) relative to other pulses. For this reason, they are often best-paired with corn, rice and other starch sources in the making of extruded snacks, as too high a proportion of chickpea flour in a formula (70-100%) can cause the dough to slip inside the extrusion barrel and prevent expansion.

Factors affecting extrusion include:

- **Protein, fiber, and fat content** – may lower expansion
- **Particle size** – may affect expansion by changing hydration and gelatinization properties
- **Type of starch** – may affect expansion by changing gelatinization properties, especially amylose and amylopectin content
- **Raw or pre-gelatinized flour** – Pre-gel flour may alter gelatinization properties during cooking

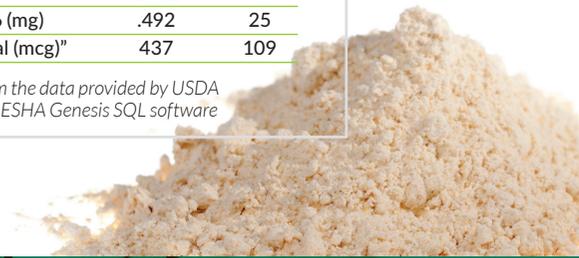
SAMPLE PULSE SNACK BASE FORMULA

Pulse grits (30-60 mesh)	60%
Corn grits	39.5%
Calcium carbonate	0.5%
Final moisture	10-15%
Additional dye and seasoning	

CHICKPEA FLOUR ANALYSIS (Value Per 100 Grams)

NUTRIENTS	CHICKPEA	% DAILY VALUE
Calories (kcal)	387.0	
Calories from Fat (kcal)	60.0	
Fat (g)	6.69	10
Saturated Fat (g)	.693	3
Trans Fatty Acid (g)	0.0	
Cholesterol (mg)	0.0	
Sodium (mg)	64.0	3
Carbohydrates (g)	57.82	19
Dietary Fiber (g)	10.8	43
Total Sugars (g)	10.85	
Protein (g)	22.39	45
Calcium (mg)	45.0	5
Iron (mg)	4.86	27
Potassium (mg)	846.0	24
Zinc (mg)	2.81	19
Vitamin A - IU (IU)	41.0	1
Vitamin C (mg)	0.0	
Thiamin (mg)	.486	32
Riboflavin (mg)	.106	6
Niacin (mg)	1.762	9
Vitamin B-6 (mg)	.492	25
"Folate, total (mcg)"	437	109

Compiled from the data provided by USDA database and ESHA Genesis SQL software

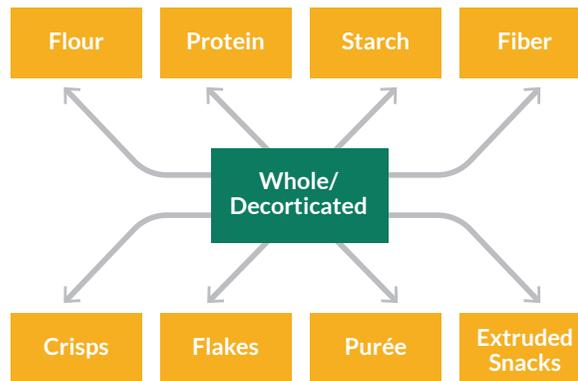


DRY LENTILS

Ingredients and Applications

Lentils (*Lens Culinaris*), named for their characteristic lens shape, are a member of the pulse family that offer a range of nutritional benefits and culinary applications.

There are a wide variety of lentils, in colors including yellow, red-orange, green, brown and black. Red, white and yellow lentils have their skins removed in a process called decortication. Many lentil types come in large and small varieties and are sold in many forms, with or without the skins, whole or split.



Green



Red



Small Brown



French Green



Black

COOKING

Cooking lentils is relatively easy compared to other pulses. Soaking is not necessary and cooking takes a shorter time than many other pulses, ranging from 5 to 40 minutes. Cooked lentils can be stored in the refrigerator or freezer for later use.

Canning

Canning processes vary according to variety, size and period of maturation of pulses. Canned lentils can be found in most grocery stores, which can be a convenient option for meal preparation and baking use.

Frying or Roasting

Lentils are soaked for three hours in water that is held at room temperature. Lentils are then rinsed and drained to remove excess water. When fried, lentils perform differently than dry peas or chickpeas. Because lentils are not as susceptible to thermal shock, a single temperature zone may be used. A temperature of 356 degrees F (180 degrees C) is used to quickly decrease the moisture content in the lentils. The required frying time tends to be very short. Final moisture after frying should be 1–2%.

1 SOAK in room temperature water for 3 hours



2 RINSE and DRAIN



3 FRY at 356°F/180°C or **ROAST** at 257°F/125°C



FLOUR

Lentil flour available in the market includes raw and pre-gelatinized. Lentil flour has very neutral flavor, thus raw flour may be used in most applications. Pre-gelatinized lentil flour serves as an effective flavor carrier, ideal for making more nutritious flatbreads, tortillas, pita breads, crackers, cookies, energy bars and extruded snacks. It also enhances dough yield, firmness and texture.

- **Raw (split/whole)**

Anti-nutritive factors in lentil flour such as polyphenols, phytic acid, and trypsin inhibitors, and color and flavor can limit the use of lentil flour as an ingredient in applications, especially those that go through less extensive heat treatment. Pulses can be treated to reduce the content of these anti-nutritive factors, to improve the nutritional value of the protein and remove strong flavors.

- **Pre-gelatinized (split/whole)**

Treating raw pulse flour by heating partially gelatinizes the starches, inactivates enzymes, increases shelf life and improves flavor. These attributes make pre-gelatinized pulse flour suitable for some applications. The differences in gelatinization temperatures among flours from different pulses are attributed to differences in size, form, distribution of starch granules in the flours and to the internal arrangement of starch within the granule.

TIP: Applications determine which flour to use. Know the application!

FRACTIONATION

Lentils can be fractionated into starch, protein and fiber in the same manner as pea fractionated products. However, fractionation from lentils is less common compared to pea sources, and there are few commercial products available.

SAMPLE PULSE SNACK BASE FORMULA

Pulse grits (30-60 mesh)	60%
Corn grits	39.5%
Calcium carbonate	0.5%
Final moisture	10-15%
Additional dye and seasoning	

EXTRUDED SNACKS

Extrusion is a mechanical process in which materials are forced, under pressure, through a die opening to create products of a desired shape, size and/or texture, creating many products in the cereal, dairy, bakery and confection industries, like chips and puffs. Lentils can be extruded at formula rates up to 100%; however, high formula rates result in a dense product. Addition of corn, rice and other starch sources can aid in the expansion of the pulse snacks.

Factors affecting extrusion are:

- **Protein, fiber and fat content** – may lower expansion
- **Particle size** – may affect expansion by changing hydration and gelatinization properties
- **Type of starch** – may affect expansion by changing gelatinization properties, especially amylose and amylopectin content
- **Raw or pre-gelatinization flour** – Pre-gelatinized flour may alter gelatinization properties during cooking

LENTIL FLOUR ANALYSIS (Value Per 100 Grams)

NUTRIENTS	LENTILS	% DAILY VALUE
Calories (kcal)	353.0	
Calories from Fat (kcal)	10.0	
Fat (g)	1.06	2
Saturated Fat (g)	.156	1
Trans Fatty Acid (g)	0.0	
Cholesterol (mg)	0.0	
Sodium (mg)	6.0	0
Carbohydrates (g)	60.08	20
Dietary Fiber (g)	30.5	122
Total Sugars (g)	2.03	
Protein (g)	25.8	52
Calcium (mg)	56.0	6
Iron (mg)	7.54	42
Potassium (mg)	955.0	27
Zinc (mg)	4.78	32
Vitamin A - IU (IU)	39.0	1
Vitamin C (mg)	4.4	7
Thiamin (mg)	0.873	58
Riboflavin (mg)	0.211	12
Niacin (mg)	2.605	13
Vitamin B-6 (mg)	0.54	27
"Folate, total (mcg)"	479.0	120

Compiled from the data provided by USDA database and ESHA Genesis SQL software



DRY PEAS

Ingredients and Applications

Cultivated peas are classified into two types: garden peas (*Pisum sativum* ssp. *hortense*), which are identified by the wrinkled nature of their seed and cotyledon, and field peas (*Pisum sativum* ssp. *arvense*), also known as dry peas. This second type is distinguished by its smooth seed surface. The two types are genetically different and produce starches with different granular morphologies and characteristics.

The two most common varieties of dry peas are green and yellow peas. Split peas are simply dry peas (green, yellow or red) that have been split. Green split peas have a stronger flavor than yellow split peas, which have a milder, slightly sweet flavor.



Split Green



Split Yellow



Whole Green

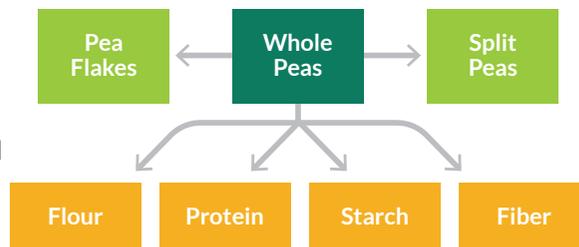


Whole Yellow

APPLICATIONS

Dry peas can be hydrated by soaking, and then either cooked, canned or frozen. Applications for canned or frozen peas include soups, stir-fry dishes, pot pies, salads and casseroles. Most dry peas are put through the splitting process and the split peas are then used in the popular North American dish, split pea soup. In many Asian countries, peas are roasted, salted and consumed as snacks. In parts of the Mediterranean, they are added to meat and potatoes to make a hearty stew.

Dry pea flour also has many uses worldwide. It is valued not only as a vegetable protein source, but also, in part, for its unique functional properties.



DRY PEA FLOUR ANALYSIS (Value Per 100 Grams)

NUTRIENTS	DRY PEA	% DAILY VALUE
Calories (kcal)	356.0	
Calories from Fat (kcal)	20.0	
Fat (g)	2.2	3
Saturated Fat (g)	0.0	
Trans Fatty Acid (g)	0.0	
Cholesterol (mg)	0.0	
Sodium (mg)	15.0	1
Carbohydrates (g)	65.0	22
Dietary Fiber (g)	25.5	102
Total Sugars (g)	8.0	
Protein (g)	23.5	47
Calcium (mg)	55.0	6
Iron (mg)	4.4	25
Potassium (mg)	981.0	28
Zinc (mg)	3.0	20
Vitamin A - IU (IU)	149.0	3
Vitamin C (mg)	1.8	3
Thiamin (mg)	0.7	48
Riboflavin (mg)	0.2	13
Niacin (mg)	2.9	14
Vitamin B-6 (mg)	0.2	9
"Folate, total (mcg)"	274.0	69

Compiled from the data provided by USDA database and ESHA Genesis SQL software

FLOUR

Raw, pre-gelatinized flour, and flour made from peas that were heat processed before milling offer differences in flavor and functionalities.

- **Raw (split/whole)**

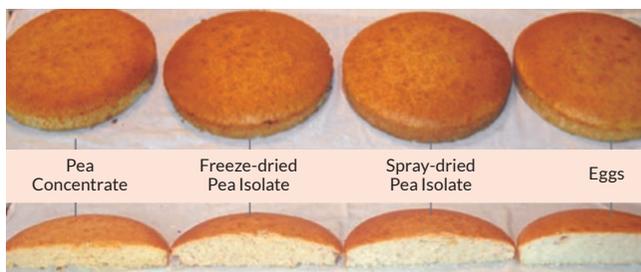
Anti-nutritive factors in pea flour such as polyphenols, phytic acid and trypsin inhibitors, along with color and flavor, can limit the use of raw pea flour as an ingredient. Raw pea flour is less common for applications that undergo less extensive heat treatment, such as bakery and meat products. Dry peas and other pulses can be treated to reduce the content of these anti-nutritive factors and to improve the flavor and nutritional value.

TIP: Application determines the type of flour used. Know your application!

- **Pre-gelatinized (split/whole)**

Treating raw pulse flour by heating partially gelatinizes the starches, inactivates enzymes, increases shelf-life, and improves flavor. These attributes make pre-gelatinized pulse flour suitable for some applications. Differences in size, form, and distribution of starch granules in the flours and to the internal arrangement of starch within the granules causes the gelatinization temperatures to be different among different types of pulses. Low protein and high amylose starches require high inputs of energy to undergo starch gelatinization. Low amylopectin starch has a higher gelatinization temperature, and is more resistant to enzyme and acid digestion compared to other starches. Pre-gelatinized pea flour serves as an effective flavor carrier, ideal for making more nutritious flatbreads, tortillas, pita breads, crackers, cookies, energy bars and extruded snacks. It also enhances dough yield, firmness and texture.

Dry peas offer twice the protein of cereal grains, delivering 8 grams of high quality, low-fat, and all-vegetable protein per ¼ cup. Rich in lysine, dry peas and pea flour provide an amino acid profile that complements cereal grain proteins. Pea flour is also rich in slowly digestible starch and resistant starch, which contributes to its low glycemic index.



White cakes prepared from pea concentrate, pea isolates and eggs. The bottom row represents the cross-section of the corresponding cakes.

Northern Pulse Growers Association

PROTEIN

Pea protein (concentrate or isolate) has found its way into healthy, protein-fortified or gluten-free baked goods, snacks, cereals, pastas, energy bars and beverages. Pea protein is recognized as high quality protein with an amino acid balance that complements other common ingredients such as wheat, soy or rice protein.



STARCH

Pea starch is a great alternative to chemically modified starch, due to its high amylose content. Gels can be prepared from pea starch with about 50 % less starch in comparison to corn starch. Pea starch can be used to modify the texture of frozen foods, extruded snacks, pasta, noodles, cookies, crackers, sauces and soups. A starch-based texturizing agent has been produced from high-amylose pulse starch. The aim of texturing agents is to create fat-like attributes like structure, viscosity, smoothness and opacity. This can reduce and/or replace the actual fat content in foods, including pourable salad dressings, yogurt, cottage cheese, sour cream, cream cheese, peanut butter, frosting, cheesecake, mousse and sauces.

FIBER

Pea fiber fractions offer bakers a natural, more economical and nutritious alternative to gums. While enhancing dough yield, pea fiber fortification can also modify texture, create a full-bodied mouth feel, improve uniformity and consistency and reduce breakage in bars and cookies. Traditionally derived from the hull portion of the seed, pea fiber is 85% soluble and 15% insoluble fiber. Its high (20:1) water binding capacity, fat absorption and dough conditioning properties make pea fiber great for granola bars, pasta and many baked products.



Glossary of Common Pulse Types

APPALOOSA	A new pinto hybrid from the Palouse area of the Northwest. Two-toned lavender, tan, and white.
ADZUK	A small, oval, dark-red bean with a white ridge, grown and eaten in China and Japan for centuries. Great for Southwestern dishes or mixed with pasta for salads.
ANASAZI	A red and palomino-colored bean. Named for the Anasazi cliff-dwelling people of the desert Southwest, these beans were found in the ruins by settlers in the early 1900s. A good all-purpose bean.
BACCICIA	Mottled red and white medium-sized bean. Excellent for soups and Italian dishes.
BELUGA LENTILS	Tiny fast-cooking black lentils which hold their shape quite well. These lentils are smaller than other lentil varieties and resemble caviar when cooked. Wonderful for lentil beds, garnishes, soups, and salads.
BLACK TURTLE	A small shiny jet-black bean. It is the basis for many Caribbean and Latin American soups and side dishes.
BLACK VALENTINE	An heirloom black bean which is small and has an elongated round shape. An all-purpose bean that can be eaten fresh or dried.
BORLOTTI	Related to the cranberry bean. It is a medium-sized bean mottled with magenta. Used in Italian dishes.
BROWN	A small oval brown bean also known as Swedish beans because of their popularity in Sweden.
CALYPSO	Has crisp black and white markings. Excellent for baking.
CANNELLINI	Large Italian white kidney bean which originally came from Argentina. It is excellent for minestrone and Mediterranean dishes. It has a smooth texture with a nutty flavor.
CHINA YELLOW	Also known as sulfur beans due to their pale yellow color.
CHANA DAL	Split and polished baby garbanzo beans. Dal refers to split or cooked pulses. It is very sweet tasting, resembles sweet corn. Can be an interesting addition to soups, salads, and rice dishes.
CHRISTMAS LIMA	Large burgundy and white markings. Has a subtle taste of chestnuts and superb in casseroles and salads.
CRANBERRY	Mottled ivory-colored with cranberry red markings. It has a firm texture and is great for baking. New Englanders call them cranberry; Midwesterners, October; Southerners, shellouts; and Italians, borlotto rosecoco.
EUROPEAN SOLDIER	Well-known in early New England. Long, white with a red “toy soldier” profile marking. Great for soups.
FAVA	An ancient bean (dates back to pre-biblical Egyptian antiquity) which was called the broad bean or horse bean. Good in soups and salads. Must blanch 15–20 minutes to remove outer seed coat.
FLAGEOLETS	Originated in the Americas but cultivated and made popular in France and Italy. Pale mint-green color. Classic of French country dishes, particularly good with thyme and in lamb dishes.
FRENCH NAVY	Globular white with green tinge, smaller than marrow. Deliciously tender, excellent with seafood, soups, and salads.
GARBANZO	Also called chickpeas and ceci nuts. These are pale gold and round with a beet-like sprout. Used in African, Asian, Middle Eastern, and Italian dishes such as falafel, hummus, salads, pasta dishes, and soups.
GREAT NORTHERN	A medium-sized white bean grown commercially in Idaho, Colorado, Kansas, Wyoming, and Nebraska.
JACOB'S CATTLE	Named this because they resemble the spotted and speckled cattle raised by Jacob in the bible. A sweet, fat, and fine grained bean.



LIMA	Available in various sizes: Large limas known as butter beans, small limas are also available. The small limas are preferred for their buttery texture
MUNG	Small, round ancient bean commonly used for sprouting by Chinese and Indians. Also used dried, either whole or split.
JACKSON WONDER	Popular in Atlanta in the 1880s. Mottled shades of buff and purplish- brown. Great for soups.
MARROW	Plump white beans with a creamy texture. Larger than French navy. Popular in the United States in the 1850's as a baking bean. Slight bacon or smoky flavor. Purées nicely—great for soups.
PINK	Pale, pinkish red version of a kidney bean. Similar to a pinto bean.
PINQUITO	An heirloom variety of a pink bean.
PAINTED PONY	Brown and white markings, resembles appaloosas. Versatile for “chuck wagon style” cooking, soups, and side dishes.
PETITE CRIMSON LENTILS	About 1/3 the normal size of lentils of which we are accustomed to. Decorticated (outer seed cover removed) and cooks in four to six minutes. Not necessary to soak. Versatile for soups, salads, and garnishes. If cooked longer than twenty minutes becomes a golden- colored purée.
PETITE FRENCH GREEN LENTILS	Previously imported from France and now grown domestically. Hold their shape when cooked, and make a delicious side dish or a bed for meats, fish, or game.
RATTLESNAKE	An attractive new pinto hybrid. Growing pods twist just like snakes. Speckled brown or tan. Superb for Southwestern chili.
RICE	Resemble plump grains of rice. Quick cooking, tender, and slightly sweet. Add to soups, casseroles, or vegetable dishes. Date back to 1860s in Germany.
SCARLET RUNNER	An heirloom bean with deep violet and black markings. A large bean which can be picked young and eaten pod and all. It has a sweet taste and excellent tossed with new potatoes or with a salad.
SNOW CAP	A kidney bean with tomato flavor. It retains its markings when cooked. A snowy cap at one end with warm beige and brown markings. Great in creamy soups or chowders.
SPANISH PARDINA	Also known as Spanish brown lentils or Continental lentils. This is the lentil that Italians, Greeks, and other Mediterraneans are accustomed to cooking with. These small lentils have a nutty flavor and hold their shape when cooked. Slightly larger than petite lentils.
SPANISH TOLOSANAS	Distinctive cinnamon and claret-brown color. Go nicely with clams or other seafood. Creamy texture.
SWEDISH BROWN	The real Swedish bruna conor (baked beans with bacon). Rich mocha color and great for baking.
TONGUES OF FIRE	Italians call these beans borlotto lingua di fuoco. A relative on cranberry beans. Mottled tan-colored with burgundy markings. Firm texture and great for baking. Popular in Italian and Portuguese cooking.
TEPARI	A very old Mexican bean resembling a navy bean. Not common in this country yet, but it is gaining popularity and now grown in Arizona.
WHITE EMERGO	Also known as sweet white runners. White and large, slightly irregular in shape. Creamy and sweet, can be used in soups and salads.
YELLOW EYE	Yellow beans with a dark spot or “eye” on a cream colored bean. Also known as molasses face. Date back to the 1860s in Maine and Vermont. In Boston, commonly used for baked beans because of their flavor. Preferred for hoppin’ John in parts of the South.



PULSES



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