PULSE PROTEINS

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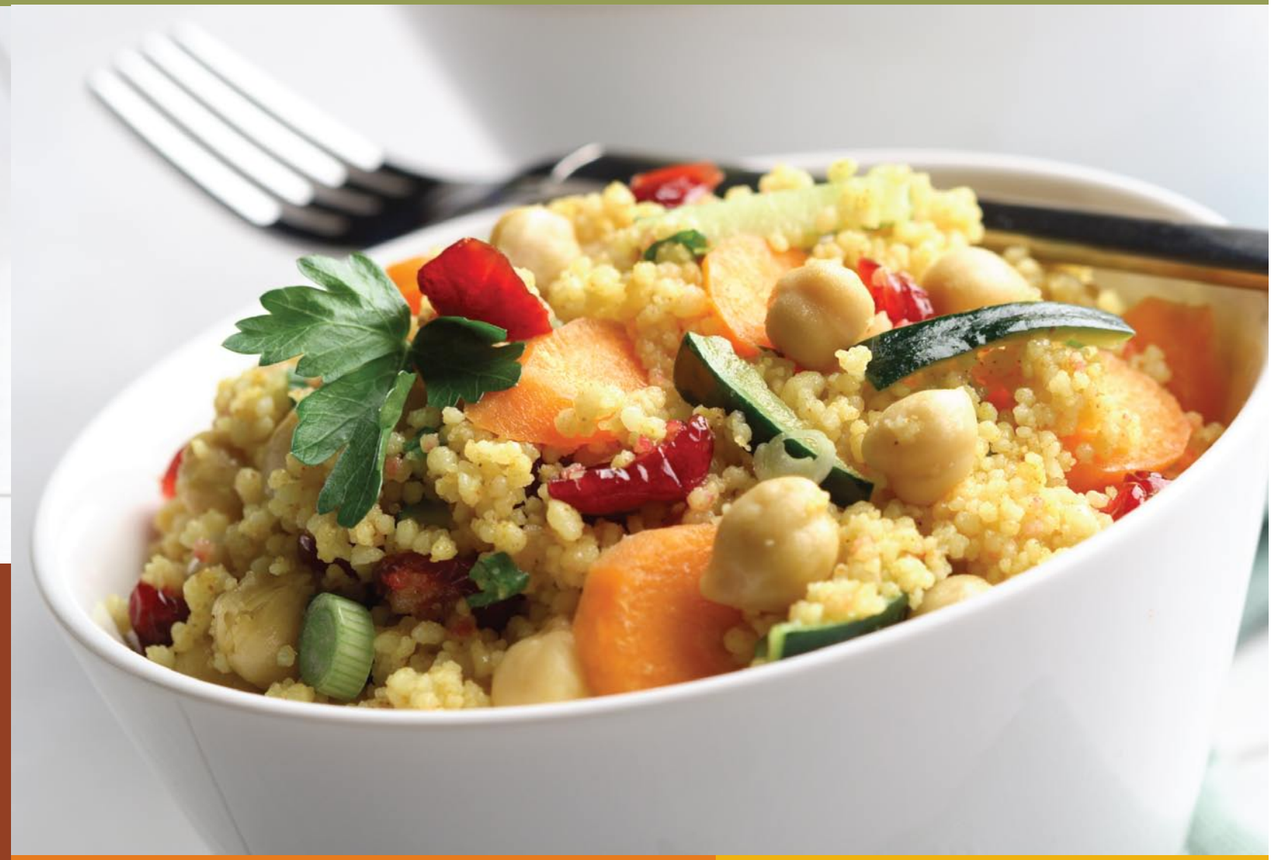

Benefits of Using Pulse Proteins

- Important protein source in human and animal nutrition – can be used to fortify foods
- Ideal for blending with other protein sources or food components
- High quality protein source to complement lysine deficiencies in cereals
- Good source of protein for vegetarians

- No cholesterol
- Low fat
- Non-GM
- Low allergenicity
- Highly digestible
- Gluten free

PULSE PROTEINS

Biochemical Composition of Select Canadian Pulses[1] (g/100g dry matter)

Pulse	Protein (N x 6.25)	Starch	Amylose (% starch)	ADF	NDF	Fat	Ash
Field Pea	20.2–27.4	41.6–49.0	20.7–33.7	5.8–8.7	8.4–11.2	1.0–1.7	2.3–3.4
Chick pea*	17.9–30.8	33.1–43.9	20.5–29.2	3.0–13.5	4.2–13.6	4.4–6.9	2.7–3.8
Beans**	19.7–34.3	31.8–45.3	19.9–29.6	5.5–9.3	7.3–12.8	0.7–2.3	3.2–4.7
Lentil***	21.3–30.2	41.5–48.5	22.5–28.3	4.5–7.4	7.0–9.5	1.0–1.3	2.3–3.5

*Includes Desi and Kabuli types. **Includes red, light red and white kidney beans, navy, black turtle, cranberry, dutch brown, great northern, pinto, small red and pink beans. ***Includes green and red lentils.

Globulin proteins in pulses provide functionality[2-4]

In pulses, water-soluble albumins, and salt-soluble globulins predominate[5], with prolamins and glutelins present in smaller concentrations. Globulin proteins contribute most to the functionality in food products. Of all pulses, peas provide the most accessible, highest concentrations of globulins making them a good choice for commercial protein concentrates and isolates.

All pulse globulins are composed of two major proteins – 11S legumin-like and 7S vicilin-like proteins. Both the globulin:albumin ratio and the 11S:7S ratio contribute to differences in the physicochemical properties of pulse flours and protein concentrates and isolates[6]. Vicilin-like globulins have high foaming capacity and legumin-like globulins have high emulsifying capacity. Compared to soy, most pea globulins are always higher in vicilin than legumin.

Protein	Peas	Beans	Chickpeas	Lentils
Crude Protein (dry basis-whole seed)	15–32%	18–25%	~22%	27.9–32.1%
Globulins	65–85%	55–80%	42%	51%
Albumins	20–35%	10–20%	16%	11–16%
Glutelins	12%	10%	9.9	11%
Prolamins	~1%	~1%	0.48%	3.5%

Processing of Protein Concentrates and Isolates

Both dry and wet processing methods can be used to yield protein products with different characteristics and functionalities.

In the dry method, air-classification separates the flour particles to yield an enriched light or fine (protein) fraction containing about 50-60% protein and a heavy or coarse (starch) fraction.

More concentrated protein fractions (70-92%)[7,8] are obtained by wet extraction of pulse flours. Processing parameters can be modified to give protein isolates with different proportions of legumin and vicilin.

Modifying the extraction process produces proteins with desirable functional attributes, preserves biological activity and improves organoleptic qualities[9,10,11,12]

Applications

Pulse flours, protein concentrates and isolates	Protein concentrates and isolates
• Bakery products • Snack foods • Extruded products • Pastas • Meat extenders in processed meats	• Beverages (drinks, smoothies, shakes), • Nutrition bars • Meat products • Texturized proteins in meat replacements products • Edible films • Soup products

Canadian Research Expertise

R. Aluko, Department of Human Nutritional Sciences, University of Manitoba, Winnipeg, MB
- Characterization, structure and function of plant seed proteins

J. Boye, Food Research and Development Centre, Agriculture and Agri-Food Canada, Ste. Hyacinthe PQ
- Characterization, functionality, processing and utilization of pulse proteins

J. Han, Department of Food Science, University of Manitoba, Winnipeg, MB
- Biodegradable and edible protein-based films

R. Tyler, Department of Food and Bioproduct Sciences, University of Saskatchewan, Saskatoon, SK
- Functionality and utilization of pulse proteins

Functionality of Pulse Proteins[13-16]

Pulse	Protein	Water Holding Capacity (WHC) (g or ml H_2O/g protein)	Oil Holding Capacity (OHC) (g or ml oil/g protein)	Foam Capacity (% volume increase)	Emulsion Capacity	Gelation
Cicer arietinum (Chickpea)	Micelle protein conc. (87.8%)	4.9 g/g	2.0 g/g	43.3	63.7%	
	Isoelectric protein conc. (84.8%)	2.4 g/g	1.7 g/g	47.5	72.9%	
	Desi protein isolates (89.9–94.3%)	2.6–3.4 g/g	2.08–3.75 g/g	30.4–44.3%		Least gelation concentration ranges from 14–20%
	Kabuli protein isolate (94.4%)	2.4 g/g	3.96 g/g protein	40.0 % High foam stability		Least gelation concentration ~18%
Lens culinaris (Lentils)	Native protein isolate	1.08 ml/g protein	2.61 ml/g protein	83.8–88 ml	54.2%	
	Acylated (62.5–93%) protein isolates	1.67–2.33 ml/g protein	1.76–2.17 ml/g protein	67–89 ml	52.3–56 %	
Phaseolus vulgaris (Dry beans)	Whole bean flours	1.43–2.03 g/g	1.05–1.32 g/g	115–129	63–88%	Requires 10–20% protein to make "instant gel"
	Dehulled bean flours	1.66–4.36	1.34–1.59 g/g	121–133	64–94%	
	Protein Isolates (75.6–88.7%)	2.63–3.09	3.26–3.48	38.3%	55.12 %	Least gelation concentration ~14%
Pisum sativum (Field pea)	Flour (25% protein)	0.78 g/g	0.41 g/g	300	34.6 ml/100g sample	
	Protein fraction (47.2%)	1.09 g/g	1.59 g/g	565	37.2 ml/100g sample	
	Protein isolate (80.3% protein)	2.52 g/g	0.98	315	36.6 ml/100g sample	
Soybean	Protein isolate (82.3%)	2.65 g/g	1.03 g/g	120 %	45.1 ml/100g sample	

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