



USA Dry Pea & Lentil Council

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webinar presentation



USA Dry Pea & Lentil Council





Presentation Objectives

- Overview: Pulses and pulse-based ingredients
- Dietary protein and consumers
- Proteins in nutrition and health
- Pulse proteins in food and beverage formulation
- Conclusions



REMINDER

Please email Post-WEBINAR questions to mfemreite@pea-lentil.com

Section 1

Overview: Pulse and Pulse-Based Ingredients

- Pulses – definitions and nomenclature
- Nutritional advantages of pulses
- Pulse production in the United States



REMINDER

Please email WEBINAR questions mfemreite@pea-lentil.com

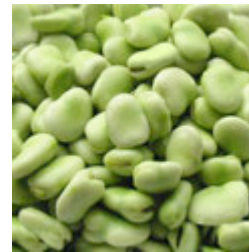
What are Pulses?

1. Pulses are legumes classified separately from oilseeds, such as peanuts and soybeans.
2. There are **10 categories of pulses**, as defined by the U.N. Food & Agriculture Organization (FAO). Of these, seven are of commercial importance as foods and only five are significant in international food trade. The remainder serve primarily as animal feeds.
3. Because they return or “fix” nitrogen in the soil, pulses are **highly sustainable** and often used as rotational crops to restore the quality of farmland. They also require only minimal agricultural chemical treatments.
4. Rich in **protein, protein quality, soluble fiber, insoluble fiber, antioxidants, vitamins, minerals**, and **low in oil content**, pulses are gaining attention as nutritionally superior foods and food ingredients.
5. Pulses are used in many different ways in foods today.
6. Pulses are also **free of gluten and other allergens** that must be declared in FDA allergen declaration labels.

What are Pulses?

Pulses important to human food consumption:

1. Chickpeas (garbanzo beans)
2. Dry beans (*Phaseolus* spp.)
3. Lentils
4. Dry peas (field peas)
5. Broad (fava) beans
6. Pigeon peas
7. Cowpeas



What are Pulses?

Pulses that are important to food formulation

We will focus upon three categories produced in the United States:

- Chickpeas (garbanzo beans)
- Dry peas (field peas)
- Lentils

Chickpeas (Garbanzo)



Split Yellow Peas



Whole Green Peas



Regular Lentils



Pardina Lentils



Red Lentils



Pulses offer Exceptional Nutritional Value

PULSE COMPOSITION

[g/100g]

Food Reference	Protein	Fat	Starch & Sugars	Fiber
Beef ¹	77.5	8.6	0.0	0.0
Whole Soy Flour - Raw	35.0	20.0	25.6	9.6
Dry Peas	23.7	1.3	45.5	16.6
Regular Lentils	26.3	1.1	45.0	13.6
Chickpeas	24.4	5.9	41.1	8.7
Whole Wheat	13.2	2.5	61.3	10.0
Whole Rice Flour	5.6	1.4	77.7	2.4
Tapioca Flour	0.2 [†]	0.0	87.8	0.9

¹ Whole Chuck, 10% moisture basis

Sources: Canadian Grain Commission; U.S. Dept. of Agriculture-ARS; Cho, S., Prosky, L. and Dreher, M.
Complex Carbohydrates in Foods, 1999, Marcel Dekker, Inc., New York, NY.

Plus...

- Superior amino acid profiles
- Vitamins
- Minerals
- Low-Glycemic Index
- Non-GMO

Where are Pulses Grown?

The United States is one of the premier pulse-producing regions in the world.

U.S. Pulse Production		
	Metric Tons	Global Rank
2011		
Dry Peas	255,150	9th
Lentils	214,640	5th
Chickpeas	97,205	16th

Source: United Nations FAOSTAT

The United States also provides...

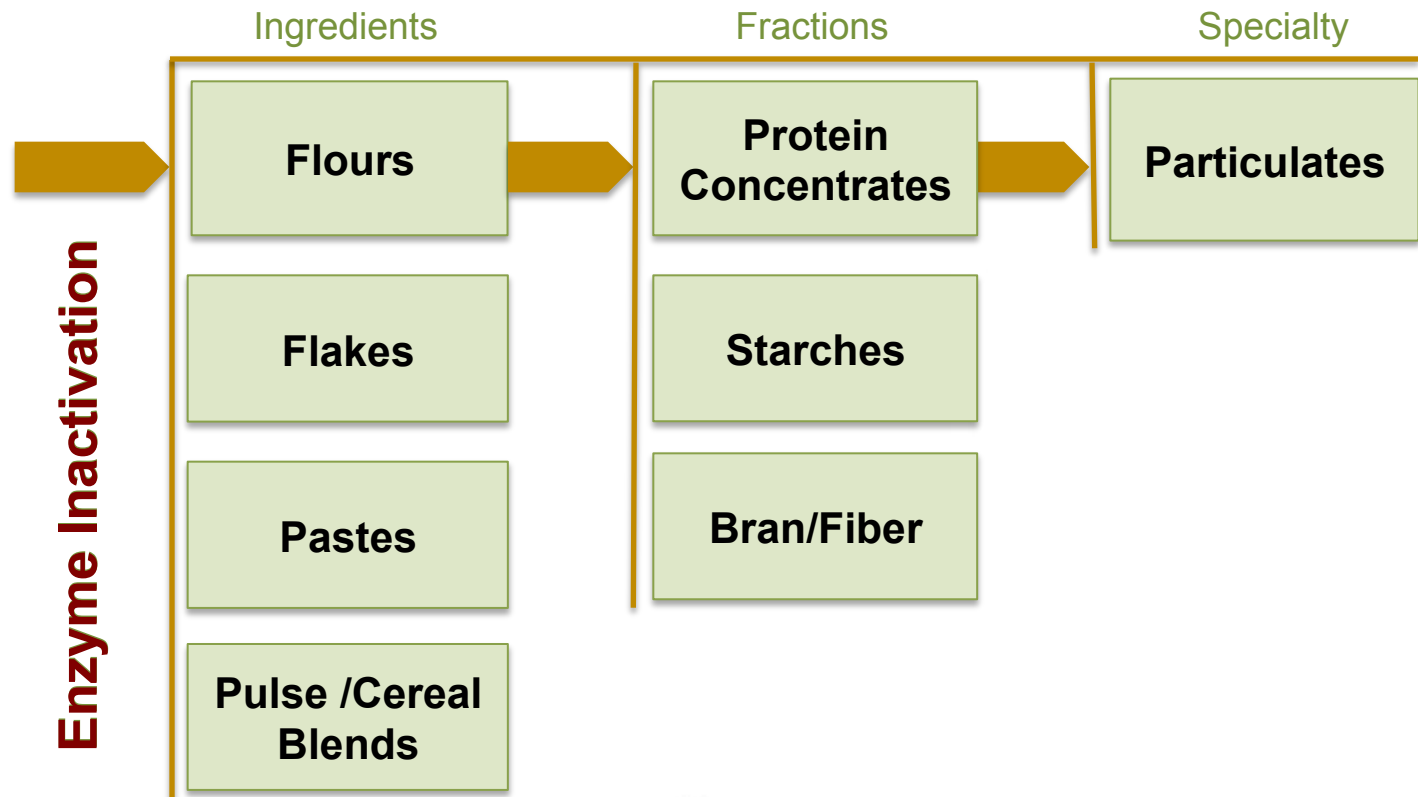
- A superior production, manufacturing and distribution infrastructure.
- Multiple university and technical centers to provide technical support and innovation.

Because of the U.S.'s highly developed quality grading, handling and production control systems, U.S. pulse producers receive top dollar for their pulses in world export markets.

Pulses as Food Ingredients

Pulses can be processed into a variety of food ingredients.

- Dry peas
- Chickpeas
- Lentils





Section 2

Dietary Protein and Consumers

- How consumers view proteins in foods
- Pulses – no longer just center plate
- Pulse protein ingredients
- Pulse protein economics



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How consumers view proteins in foods

2012 Food & Health Survey Consumer Attitudes Toward Food Safety, Nutrition & Health

Survey conducted by the International Food Information Council (IFIC)

Study Demographics

- ❑ 1,057 Americans, age 18 - 80
- ❑ Weighted by age, education, gender, race/ethnicity, and region.

How consumers view proteins in foods

2012 Food & Health Survey Consumer Attitudes Toward Food Safety, Nutrition & Health

Survey conducted by the International Food Information Council (IFIC)

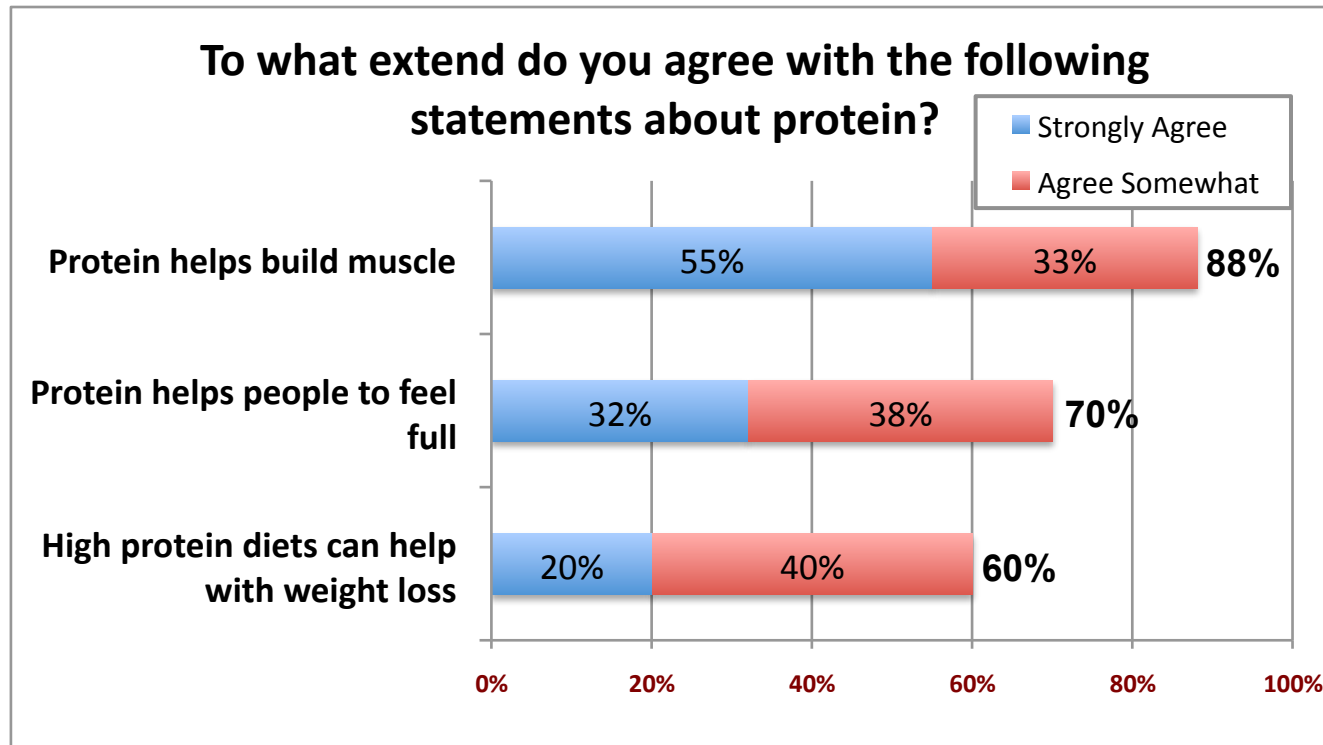
Top-Line Results

- ❑ 48% of those surveyed try to consume products with more protein.
- ❑ 84% of those surveyed agree “strongly” or “somewhat” that it is easy to incorporate protein into their diets.

How consumers view proteins in foods

2012 Food & Health Survey Consumer Attitudes Toward Food Safety, Nutrition & Health

Survey conducted by the International Food Information Council (IFIC)

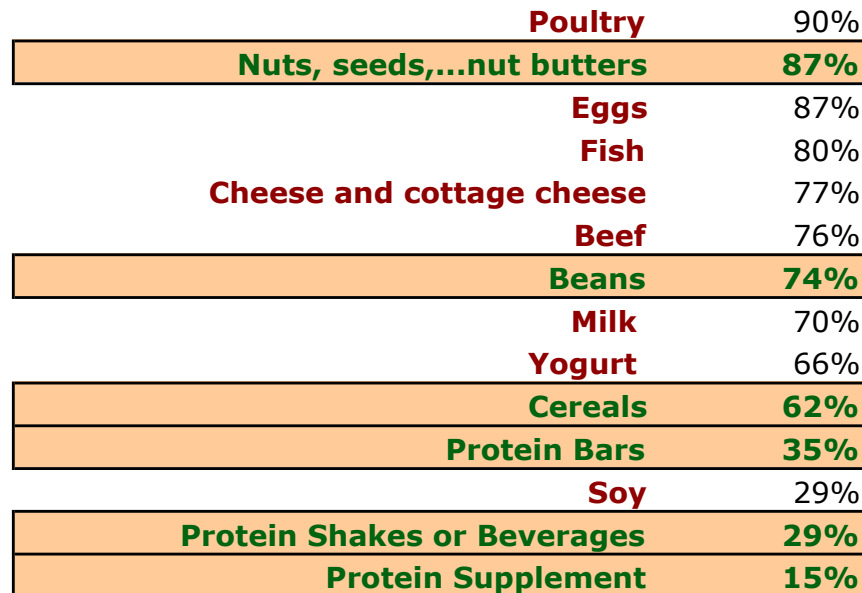


How consumers view proteins in foods

2012 Food & Health Survey Consumer Attitudes Toward Food Safety, Nutrition & Health

Survey conducted by the International Food Information Council (IFIC)

What source of protein are you trying to consume?



Pulse protein ingredients

Suppliers of pea, chickpea and lentil-based ingredients offer a wide range of highly specific protein and starch ingredients for use in food formulations.



Available Pulse Ingredients

- Whole pulses
- Roasted pulses
- Flakes, grits
- Raw flours
- Air-classified flours
- Pre-cooked flours
- Pre-gelled flours
- Protein concentrates
- Protein isolates
- Starches
- Bran meal
- Fiber

List of Pulse Ingredient Suppliers

Best Cooking Pulses, Inc.
Portage La Prairie, MB

Dakota Dry Bean, Inc.
Grand Forks, ND

Fiberich Technologies, Inc.
St. Louis Park, MN

George F. Brocke & Sons
Kendrick, ID

Harvest Innovations
Indianola, IA

Hinrichs Trading Co.
Pullman, WA

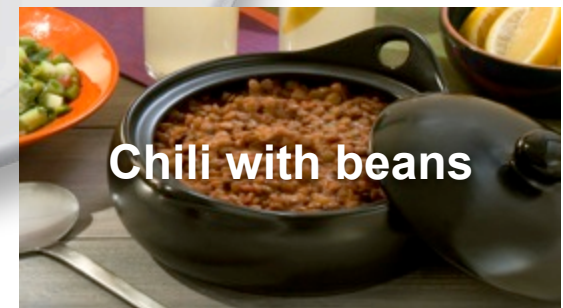
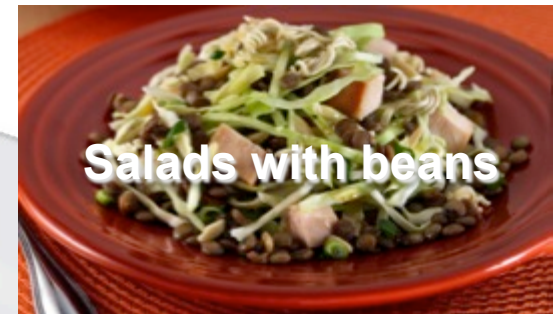
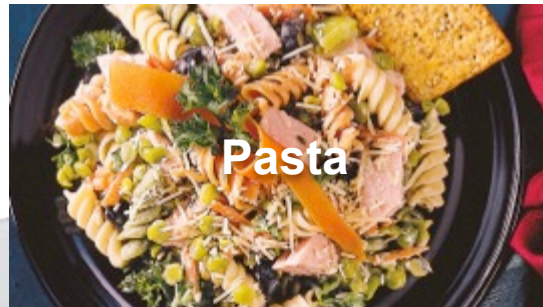
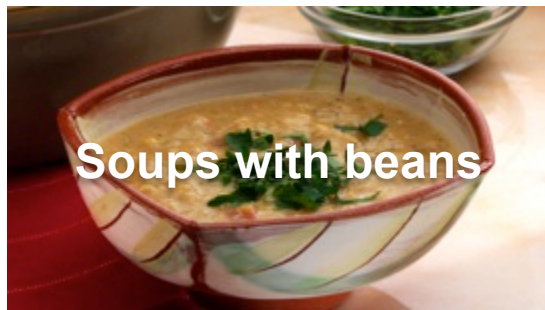
Inland Empire Foods, Inc.
Riverside, CA

SK Food International
Fargo, ND

United Pulse Trading
Bismarck, ND

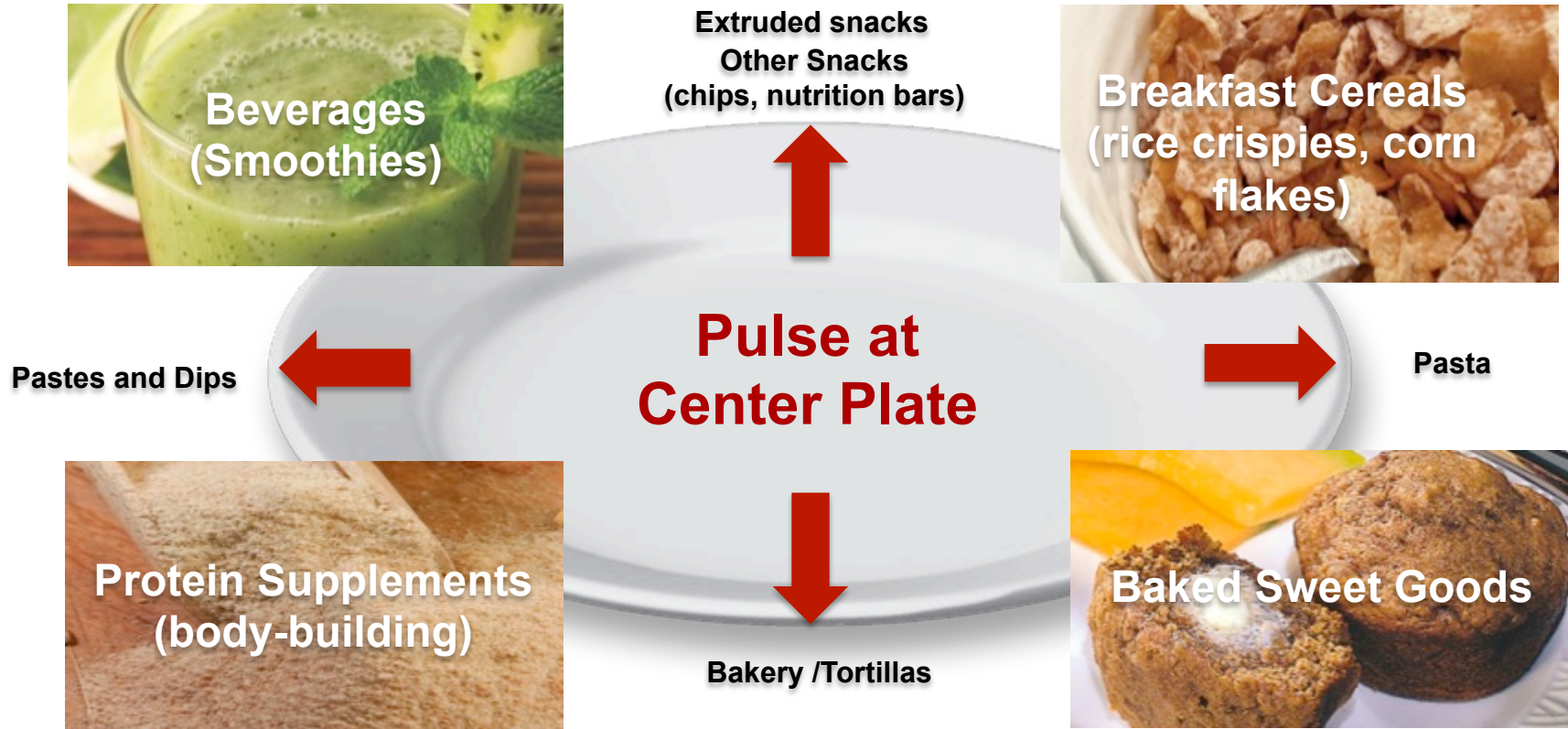
Woodland Foods, Inc.
Gurnee, IL

Proteins at Center Plate



Center Plate

Proteins out from Center Plate



Pulse protein ingredients enable the nutritional, functional and economic enhancement of new food and beverage categories.



Where are pulse proteins being used?

But this is ~~in~~ ~~the~~ ~~ingredient~~ ~~category~~ ~~find~~ ~~ing~~ ~~still~~ ~~they~~ ~~are~~ ~~using~~ ~~a~~ ~~wide~~ ~~variety~~ ~~of~~ ~~consumer~~ ~~products.~~



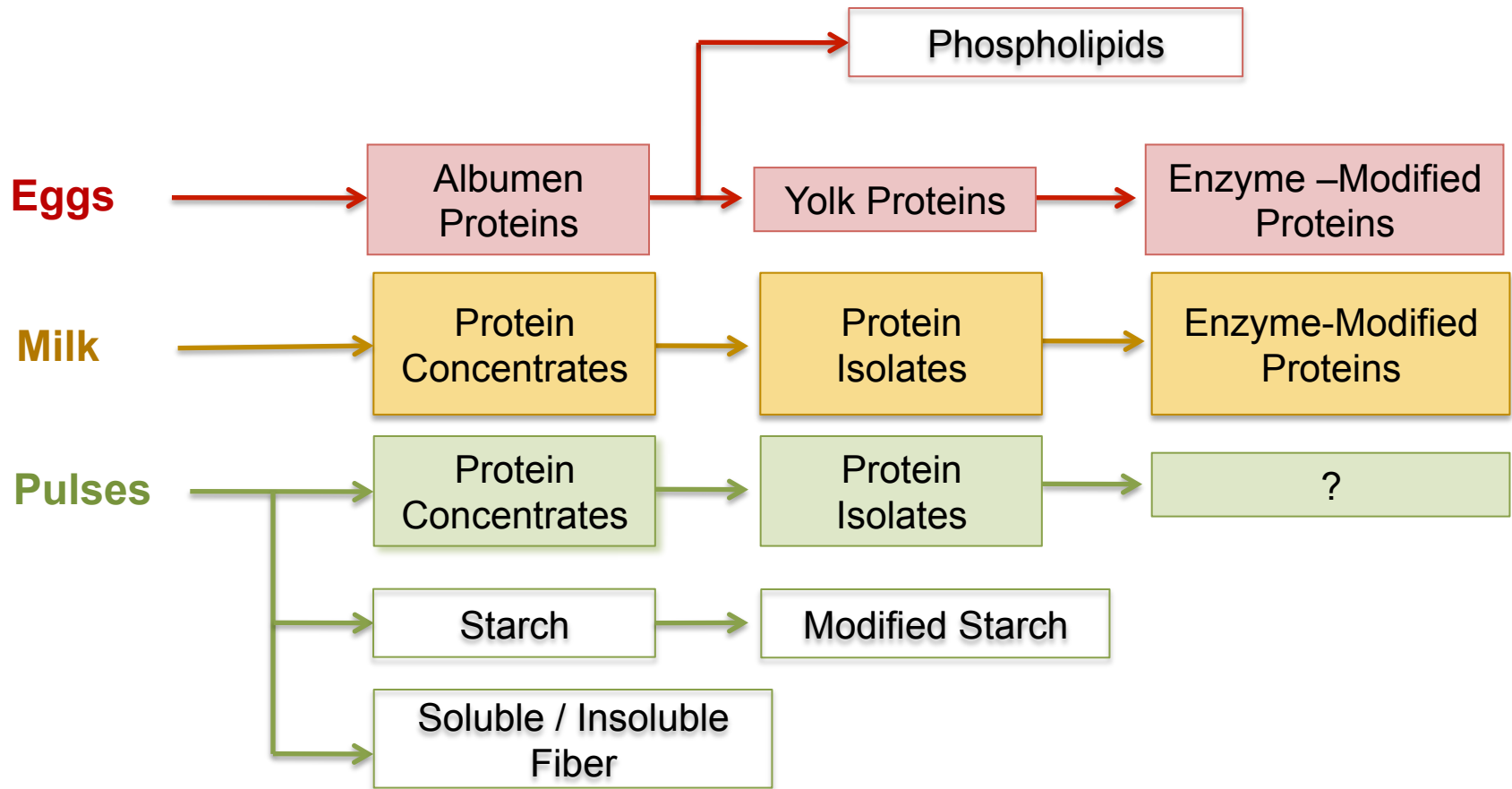
Look out - new flavors coming soon!



Pulse proteins are:

- Highly functional**
- Cost-effective**
- Cost-reliable**

Common protein ingredients



Functional Protein Ingredients

Raw Material Sources	<u>%-Protein</u>	Protein Concentrates	<u>%-Protein</u>	Protein Isolates
• Soy	35.0 %	• SPC (dry)	40-90%	SPI 90 + %
• Pulses	26.0 %	• PPC (dry)	40-90%	PPI 90 + %
• Milk (wet)	3.5 %	• MPC (dry)	40-90%	MPI 90 + %
• Whey (wet)	0.8 %	• WPC (dry)	40-90%	WPI 90 + %
• Eggs (wet)	10.9%	• Yolk (wet /dry)	15.8% protein	34.0% protein
		• Albumen (wet /dry)	8.0% protein	82.4% protein

Functionality Benefits of Pulses

The functional properties of pulses replicate many of the functional properties of egg and dairy proteins.

Egg and Dairy Protein Functionality

- Structure
- Strength
- Texture /mouthfeel
- Coloration
- Emulsification
- Gelation
- Film-forming
- Foaming
- Water control
- Viscosity
- Flavor
- Opacity / turbidity
- Particle suspension
- Adhesion
- Agglomeration

Pulse Ingredient Functionality

- Structure
- Strength
- Texture /mouthfeel
- Emulsification
- Gelation
- Film-forming
- Foaming
- Water control
- Viscosity
- Opacity / turbidity
- Particle suspension
- Adhesion
- Agglomeration





Pulse Ingredient Functionality

Pea Protein



Aeration, foaming

Binding, adhesion

Emulsification

Humectancy

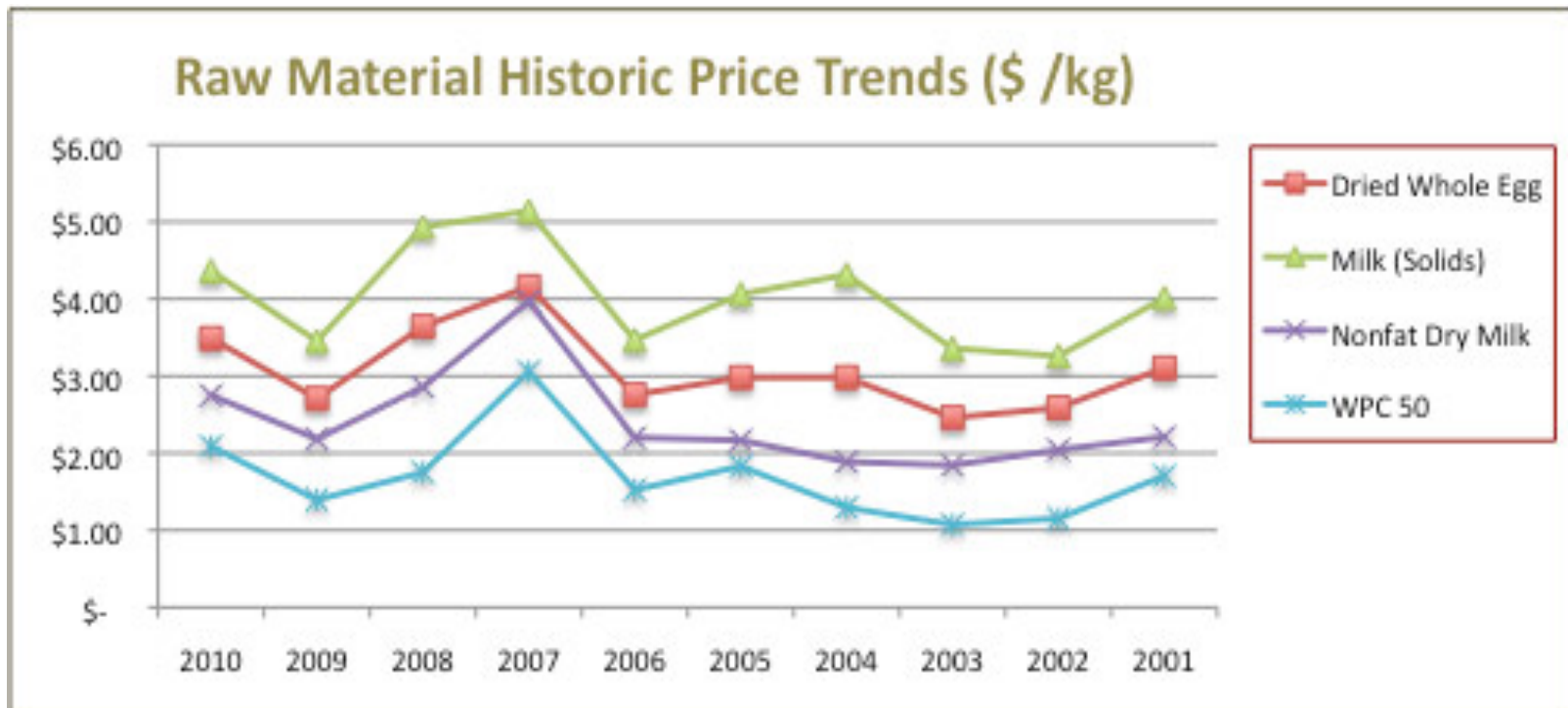
Crispness, strength

Thickening, mouthfeel



Protein Ingredient Economics

Ten-year price trends for dried whole egg, dairy and pea ingredients.



Protein Ingredient Cost Considerations

Ingredient Price on Unit-Protein Basis (2010)

	%-Protein	\$/ kg -2010	\$/kg Protein
Dried Whole Egg Powder	47%	\$ 3.49	\$ 7.42
Nonfat Dry Milk	34%	\$ 2.75	\$ 8.09
Whole Milk Solids	27%	\$ 4.36	\$16.16
WPC 50	50%	\$ 2.09	\$ 4.18
Peas (field)	24%	\$ 0.19	\$ 0.80

Sources: FAOSTAT, University of Wisconsin Dept. of Agricultural Economic; USDA-ERS

Protein Ingredient Cost Considerations

Ingredient Price Volatility (2001–2010)

	%-Protein	Avg. Price (\$/kg)
Dried Whole Egg Powder	47%	\$ 3.09
Nonfat Dry Milk	34%	\$ 2.41
Whole Milk Solids	27%	\$ 4.04
WPC 50	50%	\$ 1.69
Peas (field)	24%	\$ 0.16

Sources: FAOSTAT, University of Wisconsin Dept. of Agricultural Economic; USDA-ERS

Section 3

Proteins in Nutrition and Health

- Nutritional and nutraceutical values of pulse proteins
- Measures of protein value
- Protein requirements
- U.S. nutrient content claims
- Allergenicity



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Nutritional and Nutraceutical Value of Proteins

Nutritional Benefits

- Nutrition
- Weight management
- Satiety

Nutraceutical Benefits

- Tissue repair
- Cholesterol reduction
- Cancer prevention
- Psychological and behavioral

Branch Chain A.A. by Protein Source:			
	Amino Acid as % of Total Protein		
	Pea	Lentil	Chickpea
Leucine	7.5	7.9	7.3
Isoleucine	4.3	4.7	4.3
Valine	4.9	5.4	4.3
Total:	16.7%	18.0%	15.9%

Measures of Protein Value

Pulses contain all the essential amino acids

Amino Acids	Split Peas	Lentil	Chickpea	Navy Bean	Pinto Bean	Soybean	Whole wheat	Brown Rice
Alanine	4.4	4.2	4.3	4.1	4.1	5.2	3.7	5.8
Arginine	8.9	7.7	9.4	5.4	5.1	8.6	4.9	7.6
Aspartic acid	11.8	11.1	11.8	13.0	10.6	14.0	5.5	9.4
Cystine	1.5	1.3	1.3	1.1	0.9	1.8	2.1	1.2
Glutamic acid	17.1	15.5	17.5	12.2	14.1	21.6	32.8	20.4
Glycine	4.4	4.1	4.2	3.4	3.7	5.2	4.3	4.9
Histidine	2.4	2.8	2.8	2.8	2.6	3.0	2.7	2.5
Isoleucine	4.1	4.3	4.3	4.4	4.1	5.4	3.4	4.2
Leucine	7.2	7.3	7.1	7.2	7.3	9.1	6.8	8.3
Lysine	7.2	7.0	6.7	5.7	6.3	7.4	2.7	3.8
Methionine	1.0	0.9	1.3	1.0	1.2	1.5	1.7	2.3
Phenylalanin	4.6	4.9	5.4	5.0	5.1	5.8	5.2	5.2
Proline	4.1	4.2	4.1	4.0	5.0	6.5	15.7	4.7
Serine	4.4	4.6	5.0	5.3	5.5	6.5	4.7	5.2
Threonine	3.6	3.6	3.7	4.2	3.8	4.8	2.8	3.7
Tryptophan	1.1	0.9	1.0	1.0	1.1	1.6	1.3	1.3
Tyrosine	2.9	2.7	2.5	3.4	2.0	4.2	2.1	3.8
Valine	4.7	5.0	4.2	5.1	4.7	5.6	4.3	5.9

* Amino Acids highlighted in "yellow" are essential for infants only.

Measures of Protein Value

Peas, chickpeas and lentils have similar amino acid profiles

Amino Acids	Split Peas	Lentil	Chickpea	Navy Bean	Pinto Bean	Soybean	Whole wheat	Brown Rice
Alanine	4.4	4.2	4.3	4.1	4.1	5.2	3.7	5.8
Arginine	8.9	7.7	9.4	5.4	5.1	8.6	4.9	7.6
Aspartic acid	11.8	11.1	11.8	13.0	10.6	14.0	5.5	9.4
Cystine	1.5	1.3	1.3	1.1	0.9	1.8	2.1	1.2
Glutamic acid	17.1	15.5	17.5	12.2	14.1	21.6	32.8	20.4
Glycine	4.4	4.1	4.2	3.4	3.7	5.2	4.3	4.9
Histidine	2.4	2.8	2.8	2.8	2.6	3.0	2.7	2.5
Isoleucine	4.1	4.3	4.3	4.4	4.1	5.4	3.4	4.2
Leucine	7.2	7.3	7.1	7.2	7.3	9.1	6.8	8.3
Lysine	7.2	7.0	6.7	5.7	6.3	7.4	2.7	3.8
Methionine	1.0	0.9	1.3	1.0	1.2	1.5	1.7	2.3
Phenylalanine	4.6	4.9	5.4	5.0	5.1	5.8	5.2	5.2
Proline	4.1	4.2	4.1	4.0	5.0	6.5	15.7	4.7
Serine	4.4	4.6	5.0	5.3	5.5	6.5	4.7	5.2
Threonine	3.6	3.6	3.7	4.2	3.8	4.8	2.8	3.7
Tryptophan	1.1	0.9	1.0	1.0	1.1	1.6	1.3	1.3
Tyrosine	2.9	2.7	2.5	3.4	2.0	4.2	2.1	3.8
Valine	4.7	5.0	4.2	5.1	4.7	5.6	4.3	5.9

Measures of Protein Value

The high-lysine content of pulses complements the low lysine of cereals

Amino Acids	Split Peas	Lentil	Chickpea	Navy Bean	Pinto Bean	Soybean	Whole wheat	Brown Rice
Alanine	4.4	4.2	4.3	4.1	4.1	5.2	3.7	5.8
Arginine	8.9	7.7	9.4	5.4	5.1	8.6	4.9	7.6
Aspartic acid	11.8	11.1	11.8	13.0	10.6	14.0	5.5	9.4
Cystine	1.5	1.3	1.3	1.1	0.9	1.8	2.1	1.2
Glutamic acid	17.1	15.5	17.5	12.2	14.1	21.6	32.8	20.4
Glycine	4.4	4.1	4.2	3.4	3.7	5.2	4.3	4.9
Histidine	2.4	2.8	2.8	2.8	2.6	3.0	2.7	2.5
Isoleucine	4.1	4.3	4.3	4.4	4.1	5.4	3.4	4.2
Leucine	7.2	7.3	7.1	7.2	7.3	9.1	6.8	8.3
Lysine	7.2	7.0	6.7	5.7	6.3	7.4	2.7	3.8
Methionine	1.0	0.9	1.3	1.0	1.2	1.5	1.7	2.3
Phenylalanine	4.6	4.9	5.4	5.0	5.1	5.8	5.2	5.2
Proline	4.1	4.2	4.1	4.0	5.0	6.5	15.7	4.7
Serine	4.4	4.6	5.0	5.3	5.5	6.5	4.7	5.2
Threonine	3.6	3.6	3.7	4.2	3.8	4.8	2.8	3.7
Tryptophan	1.1	0.9	1.0	1.0	1.1	1.6	1.3	1.3
Tyrosine	2.9	2.7	2.5	3.4	2.0	4.2	2.1	3.8
Valine	4.7	5.0	4.2	5.1	4.7	5.6	4.3	5.9

Measures of Protein Value

Protein Digestibility Score

“A measure of the efficiency of the protein in a foodstuff for the maintenance and growth of the bodily tissues of an individual, computed as the percentage of protein intake actually utilized in the body”

– *Merriam Webster*

Dry peas = 72

Corn = 40

Gelatin = 0

Source: N. Jeradechachai, Northern Crops Institute

Measures of Protein Value

Protein Digestibility Corrected Amino Acid Score “PDCAAS”

A measurement of protein quality found by multiplying the

	Pea* Protein	FAO Req. Children(2-5)	FAO Req. Adults
Cysteine + Methionine	2.1	<2.5	>1.7
Histidine	2.5	>1.9	>1.6
Isoleucine	4.5	>2.8	>1.3
Leucine	8.4	>6.6	>1.9
Lysine	7.2	>5.8	>1.6
Phenylalanine + Tyrosine	9.3	>6.3	>1.9
Threonine	3.9	>3.4	>0.9
Tryptophan	1.0	>1.1	>0.5
Valine	5.0	>3.5	>1.3

Source: Calculations based on Roquette Nutralys® Protein

Measures of Protein Value

Protein Digestibility Corrected Amino Acid Score “PDCAAS”

Comparative PDCAAS Values for Pea Protein

Eggs	1.00
Pea Protein (75%) + Wheat Gluten (25%)	0.87
Pea Protein Isolate	0.82
Pea (yellow, split)	0.64
Wheat Flour	0.43

Sources: Pulse Canada; Roquette

How much protein do people need?

	Recommended Dietary Allowance (RDA)	Daily Reference Value (DRV)
Infants:	10g /day	50g /day
Teenage Males	52g /day	
Teenage Females	46g /day	
Adult Males	56g /day	
Adult Females	46g /day	
Pregnant or Lactating Females	71g /day	

- 7.7% of females consume less-than minimum requirement
- 8.0% of older adult women consume less-than minimum requirement
- Median intake of children is 13.4% below minimum.

Source: National Health and Nutrition Examination Survey

What about protein content claims?

U.S. Nutrient Content Claims (21CFR 101.54)

A food or beverage product may claim the following:

- “Added Protein”
- “Extra Protein”
- “Fortified with Protein”
- “Enriched in Protein”
- “More Protein”

...if it contains more-than 10% of the protein DRV value than the reference serving size of that food (RACC) normally contains.

A food or beverage product may claim the following:

- “Good Source of Protein”
- “Contains Protein”
- “Provides Protein”

...if it contains more-than 10% of the DRV for protein (> 5g) per reference serving size (RACC).

A food or beverage product may claim the following:

- “Excellent Source” of Protein”
- “Rich Source of Protein”
- “High Source of Protein”

...if it contains more-than 20% of the DRV for protein (> 10g) per reference serving size (RACC).

“Reference amounts customarily consumed per eating occasion” (RACCs) for food and beverage products can be found in 21CFR101.12 of the Code of Federal Regulations.

Gluten and Other Allergen Concerns

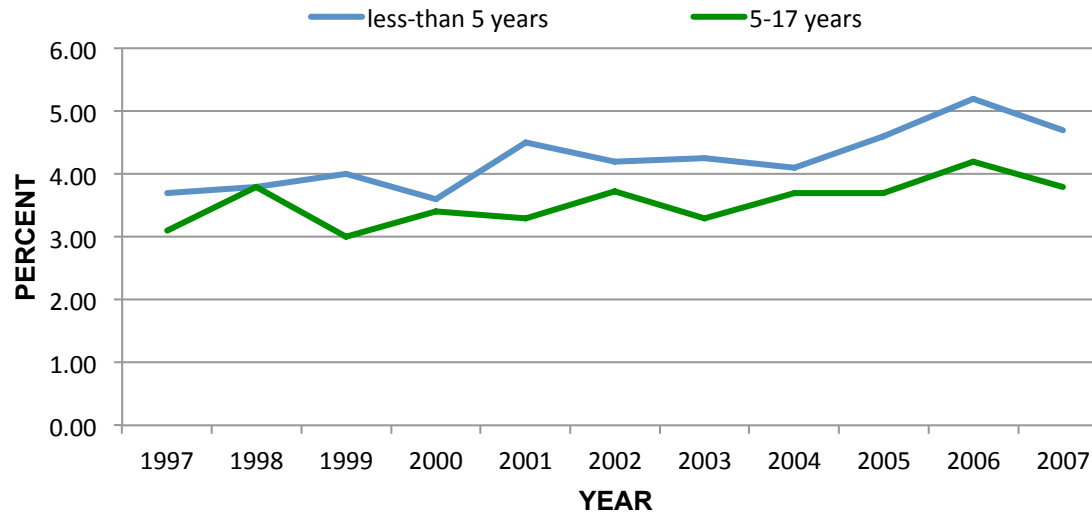
U.S. Food Allergen Labeling and Consumer Protection Act of 2004

FALCPA passage was based on estimates that eight major food allergens account for 90% of all food allergies:

- Milk
 - Eggs
 - Fish
 - Crustacean shellfish
 - Tree nuts
 - Peanuts
 - Wheat
 - Soybeans
- FALCPA required all foods to clearly identify all ingredients that contained one or more of the identified allergens.
 - Pulses can play important roles as ingredient alternatives for those food allergens highlighted in **red**.

Why Food Allergens are of Concern?

Percent of children with a reported food or digestive allergy in 12-month period



The incidence of food allergies in children has been trending upwards.

How Big is the Allergen Averse Market Opportunity?

When we include the following categories that are not included in the often-quoted **Packaged Facts** or **SPINS /Mintel** gluten-free market surveys:

- Walmart (about 15% of all retail food and foodservice sales)
- Trade Joe's
- Restaurant /food service
- Store brands
- PLU (coded-entry sales)
- Multilevel marketers
- Internet Sales



(Oct., 2012) **Packaged Facts** - **\$4.2b in 2012**

(Sept., 2011) **SPINS /Mintel** – **\$6.0b \$12.4b in 2012** (revised to incl. Walmart)

BEST VANTAGE Inc. estimates the current gluten- and allergen-free market size at \$10 - 15 billion with a potential to reach **\$70** billion by 2020.

Section 4

Pulse Proteins in Food and Beverage Formulation

- Bakery goods: cakes
- Bakery goods: cookies
- Battered and fried products
- Pasta
- Beverages & Smoothies



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How to use pulses as egg and dairy alternatives and extenders

Resources:

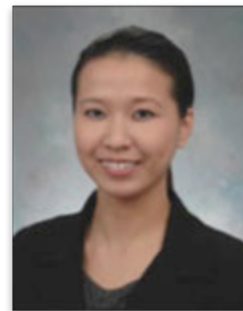


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Prof. Cliff Hall III



**Thunyaporn (“Naggie”)
Jeradechachai**



Pulse Flour Properties

Pea Flour



Aeration, foaming

Binding, adhesion

Emulsification

Humectancy

Crispiness, strength

Thickening, mouthfeel



Pulse Protein Properties

Pea Protein



Aeration, foaming

Binding, adhesion

Emulsification

Humectancy

Crispiness, strength

Thickening, mouthfeel



Sweet bakery goods

Pulse proteins can substitute for egg and dairy proteins

Cakes and Cookies



- Aeration, foaming
- Binding, adhesion
- Emulsification
- Gelation, coagulation

- Pulse flour
- Cooked pulse flour
- Pregel pulse flour
- PPC
- PPI
- Pulse starch
- Pulse bran

Degree of Egg or Dairy Substitution: **100%**



Sweet bakery goods

Layer cakes

White Cake Formula weight (g)

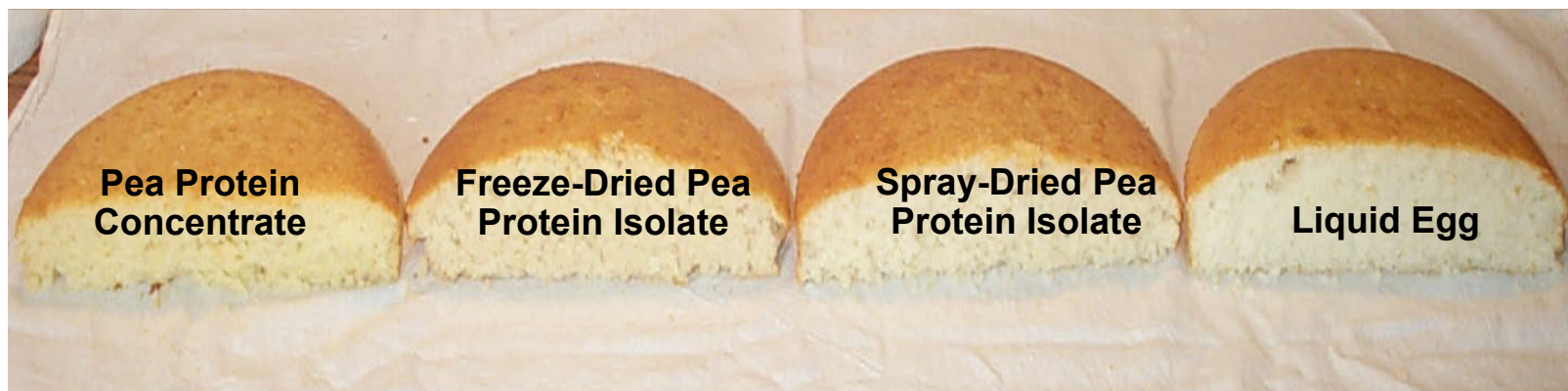
	w/Egg	w/ PPI
Cake flour	130	130
Baking powder	7	7
Shortening	50	50
Pea Protein	-	6
Water	45	115
Fresh Whole Egg	69	-
Sugar	100	100
Salt	3	3
Vanilla Powder	3	3
	407	414

Source: "Sensory Qualities of Cakes and Cookies Made with Pea Proteins as an Egg Replacer.", 2012: Mary Niehaus, Clifford Hall III and Hieu Hoang; School of Food Systems, North Dakota State University, Fargo, ND

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Sweet bakery goods

Layer cakes



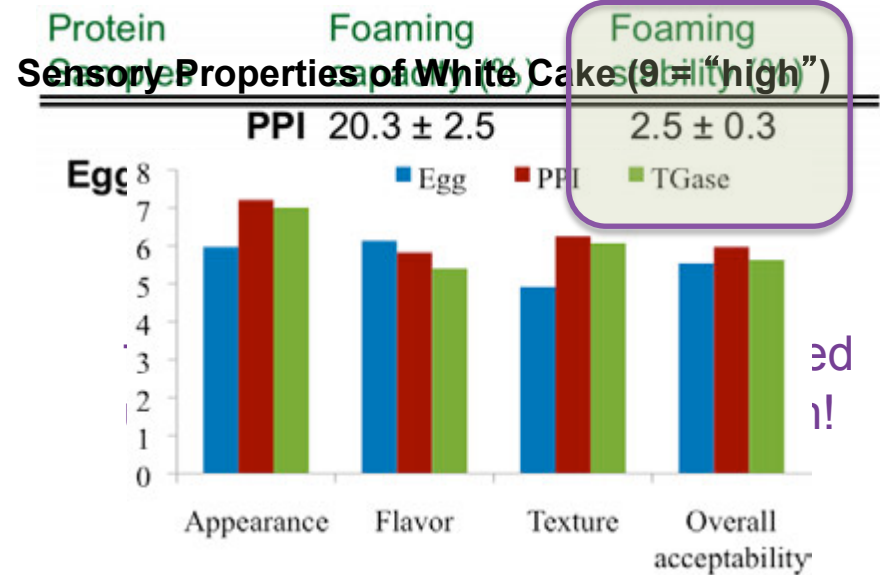
White cakes prepared from pea concentrate, peas isolates, and eggs. Surface and cross-sectional views are presented of the cakes.

Research conducted by Dr. Clifford Hall III, Associate Professor, Food and Cereal Science, North Dakota State University

Sweet bakery goods

Layer cakes

	White Cake Formula weight (g)	
	w/Egg	w/ PPI
Cake flour	130	130
Baking powder	7	7
Shortening	50	50
Pea Protein	-	6
Water	45	115
Fresh Whole Egg	69	-
Sugar	100	100
Salt	3	3
Vanilla Powder	3	3
	407	414



Source: "Sensory Qualities of Cakes and Cookies Made with Pea Proteins as an Egg Replacer.", 2012: Mary Niehaus, Clifford Hall III and Hieu Hoang; School of Food Systems, North Dakota State University, Fargo, ND

Impact on Nutritional Labels

Gluten-Free Shortbread

INGREDIENTS: Gluten-Free Flour (tapioca flour, rice flour), Sugar, Butter, Eggs, Salt, Baking Soda, Flavor, Xanthan Gum

Replacement of 30% of a gluten-free blend of tapioca and rice flours with lentil flour resulted in:

- Increased **protein** from 1g to 2g per 30g serving.
- Increased **Total Dietary Fiber** from 0g to 2g per 30g serving.

Nutrition Facts	
Serving Size (30g)	
Servings Per Container	
Amount Per Serving	
Calories 120	Calories from Fat 45
% Daily Value*	
Total Fat 5g	8%
Saturated Fat 3g	15%
Trans Fat 0g	
Cholesterol 25mg	8%
Sodium 55mg	2%
Total Carbohydrate 19g	6%
Dietary Fiber 0g	0%
Sugars 6g	
Protein 1g	
Vitamin A 4% • Vitamin C 0%	
Calcium 0% • Iron 0%	
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
Calories: 2,000 2,500	
Total Fat	Less than 65g 80g
Saturated Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	

Nutrition Facts	
Serving Size (30g)	
Servings Per Container	
Amount Per Serving	
Calories 120	Calories from Fat 45
% Daily Value*	
Total Fat 5g	8%
Saturated Fat 3g	15%
Trans Fat 0g	
Cholesterol 25mg	8%
Sodium 55mg	2%
Total Carbohydrate 18g	6%
Dietary Fiber 2g	8%
Sugars 6g	
Protein 2g	
Vitamin A 4% • Vitamin C 0%	
Calcium 0% • Iron 4%	
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
Calories: 2,000 2,500	
Total Fat	Less than 65g 80g
Saturated Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	

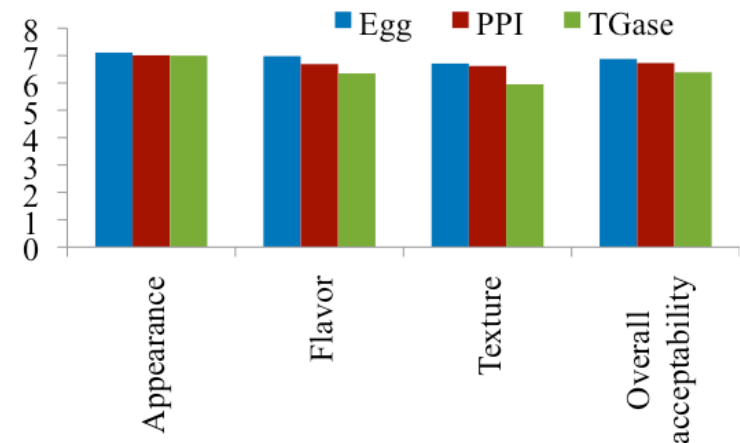
Sweet bakery goods

Sugar Snap Cookies

Sugar Cookie Formula
Formula weight (g)

	w/Egg	w/ PPI
Cake flour	175.0	175.0
Butter	113.0	113.0
Sugar	75.0	75.0
Brown Sugar	56.0	56.0
Fresh Egg	23.0	-
Pea Protein	-	3.0
Water	-	22.0
Salt	1.5	1.5
Baking Soda	2.7	2.7
	446.2	448.2

Sensory Properties of Sugar Cookies (9 = "high")



Source: "Sensory Qualities of Cakes and Cookies Made with Pea Proteins as an Egg Replacer.", 2012: Mary Niehaus, Clifford Hall III and Hieu Hoang; School of Food Systems, North Dakota State University, Fargo, ND

Pasta (Gluten-Free)

Base Formula

100% - pulse flour
32-35% - water



Blend dry ingredients



Add water (40°C / 104°F)
to the blend



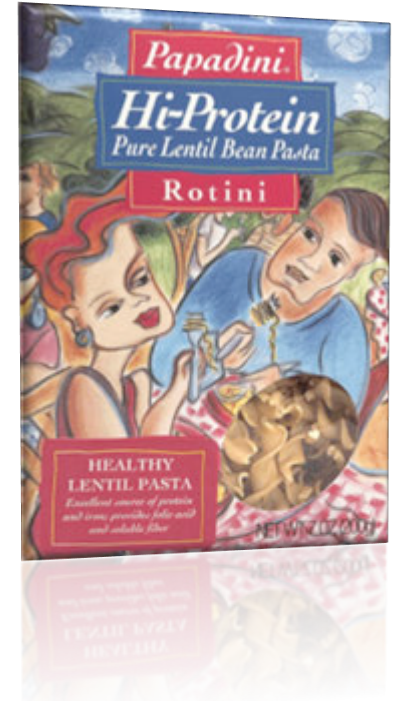
Mix



Extrude



Cut



Pasta

Level of pea flour incorporation

	0%	5%	10%	15%	20%
Cooking Quality (al dente)					
Cooked Wt (g)	75.8	75.3	77.7	77.2	76.3
Cooking Loss (%)	5.9	5.6	5.9	6.1	6.3
Cooked Firmness (g cm)	12.9	12.4	12.5	13.4	14.4
Cooking Quality (overcook 6 min)					
Cooked Wt (g)	87.4	86.7	87.9	88.0	88.0
Cooking Loss (%)	7.2	6.6	7.3	7.2	7.3
Cooked Firmness (g cm)	9.3	9.0	9.1	9.6	10.2

The al dente cooking quality of the pasta is increased with an increase in the pea flour incorporation.

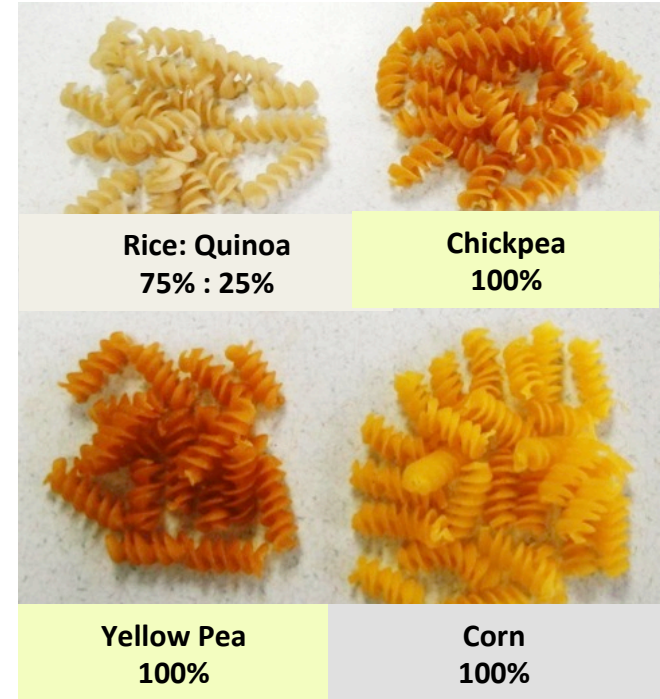
Source: Northern Crops institute



Useful tip: Addition of 0.5-1.0% calcium sulfate will further increase al dente texture and robustness.

* Patent Pending

Pasta



100% Legume Pasta

Useful tip: Addition of 0.5-1.0% calcium sulfate will further increase al dente texture and robustness.

** Patent Pending*

Pasta

Gluten-Free Organic Lentil Pasta

RACC serving size (dry) : 55g %-Formula

- 13.5g Protein per serving **24.7%**
- 8.4g Total Dietary Fiber per serving **15.3%**

Percent Daily Value

- Riboflavin 15%
- Calcium 20%
- Vitamin B6 10%
- Iron 40%
- Thiamin 20%
- Niacin 8%
- Folate 30%
- Zinc 25%

**An Excellent
Source of Protein**

**An Excellent
Source of Fiber**

Nutrition Facts	
Serving Size 3 oz (85g)	
Servings Per Container 4	
Amount Per Serving	
Calories 310	Calories from Fat 10
% Daily Value*	
Total Fat 1g	1%
Saturated Fat 0g	0%
<i>Trans Fat</i> 0g	
Cholesterol 0mg	0%
Sodium 10mg	0%
Total Carbohydrate 56g	19%
Dietary Fiber 13g	54%
Sugar 6g	
Protein 21g	
Vitamin A 0%	• Vitamin C 2%
Calcium 20%	• Iron 40%
Vitamin D 0%	• Thiamine 20%
Riboflavin 15%	• Niacin 8%
Vitamin B ₆ 10%	• Folate 30%
Vitamin B ₁₂ 0%	• Zinc 25%

Battered, breaded and fried products

Pulse-based “egg” wash and binder



- Binding, adhesion
- Emulsification
- Oil barrier
- Gelation, coagulation

- Pulse flour
- Cooked pulse flour
- Pregel pulse flour
- PPC
- Pulse starch
- Pulse bran

Degree of Egg or Dairy Substitution: **100%**

Battered, breaded and fried products

Pulse-based “egg” wash and binder



Eggless Tempura Batter

Ingredients	grams	Formula %-percent
All-purpose flour	125.0	29.1%
Sugar	11.0	2.6%
Seasoned Salt Mix	8.0	1.9%
Water	265.0	61.7%
Pregelld Yellow Pea Flour	10.0	2.3%
Guar Gum	7.5	1.7%
Xanthan Gum	2.5	0.6%
Lecithin	0.5	0.1%
	429.5	100.0%

Source: Harvest Innovations

Instructions:

Pre-Dust

1. Mix: 20g **Pregelld Yellow-Pea Flour**
250g All-Purpose Flour
2. Pre-dust meat or vegetable in mixture

Eggless Coating Batter

1. Blend dry ingredients
2. Add water and blend until smooth
3. Dip meat or vegetable into coating batter

Coating

1. Roll battered meat or vegetable in Tempura crumbs
2. Add to oil and fry until done at 350°F / 178°C

Degree of Egg or Dairy Substitution: **100%**

Beverages and Smoothies

The Basics...

1. Pea, chickpea and lentil proteins have similar iso-electric points ($\text{pH} = 4.6$), at which point the proteins precipitate (i.e., the pH of minimum solubility).
2. The solubility characteristics of proteins will depend upon how the proteins were processed.
3. Pulse protein solubility is about 20% at **$\text{pH} < 3.0$** or **$\text{pH} > 5.5$** .
4. Pulse protein solubility is about 50% at **$\text{pH} < 2.5$** or **$\text{pH} > 6.5$** .
5. Use organic acids to adjust (buffer) pH s.



Typical Acidities

	<u>pH</u>
Milk	6.4 - 6.8
Sweet whey	5.6 - 6.5
Coffee	5.0 - 7.0
Vinegar	4.0 - 5.0
Yogurt	4.6 - 4.8
Root beer	4.0 - 4.2
Apple juice	3.4 - 4.0
Orange juice	2.6 - 3.0
Coca Cola	2.0 - 2.2

Beverages and Smoothies

Cinnamon-Vanilla Protein Beverage

	Formula Weight (g)
Water	867.8
Pea Protein Isolate	70.0
Sugar	60.0
Vanilla Powder	1.0
Gellan Gum	1.0
Cinnamon	0.2
	1000.0

1. Blend dry ingredients.
2. Add to hot water (203°F / 95°C) in blender while mixing (low speed).
3. Mix, high speed, for 3-minutes.

Nutrition Facts	
Serving Size 296 g	
Amount Per Serving	
Calories 160	Calories from Fat 10
% Daily Value*	
Total Fat 1g	2%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 40mg	2%
Total Carbohydrate 22g	7%
Dietary Fiber 0g	0%
Sugars 20g	
Protein 16g	

**An excellent
source of protein**



**16 grams Protein
per Serving**

Source: Harvest Innovations

Beverages and Smoothies

Chocolate-Flavored Protein Beverage

	Formula Weight (g)
Water	846.2
Pea Protein Isolate	69.0
Sugar	67.7
Cocoa Powder	14.8
Gellan Gum	1.2
Vanilla Flavor	0.6
Salt	0.5
	1000.0

1. Blend dry ingredients.
2. Add to hot water (203°F / 95°C) in blender while mixing (low speed).
3. Mix, high speed, for 3-minutes.
4. Homogenize (2x @ 10,000 psi).
5. Fill into containers and seal.
6. Keep refrigerated.

Nutrition Facts	
Serving Size 296 g	
Amount Per Serving	
Calories 170	Calories from Fat 15
% Daily Value*	
Total Fat 2g	3%
Saturated Fat 0.5g	3%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 100mg	4%
Total Carbohydrate 24g	8%
Dietary Fiber 2g	8%
Sugars 20g	
Protein 17g	

**An excellent
source of protein**



**17 grams Protein
per Serving**

Source: Harvest Innovations

Section 4

Summary and Conclusions

- Summary & Conclusions
- Resources
- Questions and Answers



REMINDER

Please email Post-WEBINAR questions to mfemreite@pea-lentil.com

Summary and Conclusions

- Pulses represent a very environmentally friendly and sustainable food source.
- Pulses are rich sources of high-quality and cost-effective protein ingredients.
- Consumers actively look for protein in foods.
- Pulse proteins do not require allergen warning labels on food packages.
- Pulse proteins will reproduce most or all of the functional properties of other food protein ingredients, depending upon the application.
- Product applications:
 - Layer cake: pulse proteins can replace 100% of egg or milk ingredients, but need a gelling ingredient (e.g. pea starch) to help stabilize foam.
 - Cookies: pulse proteins can replace 100% of egg or milk ingredients.
 - Pasta: pulse flour and protein can replace 100% of wheat in formula.
 - Fried meats and vegetables: pulse flours and proteins can replace 100% of egg in batters and egg washes.
 - Beverages: pH is critical.

Additional Resources

- **The USA Dry Pea and Lentil Council**

Contact: MacKenzie Femreite
Email: mfemreite@pea-lentil.com
Tel. 1-208-882-3023
Website: www.pea-lentil.com

- **Northern Crops Institute (North Dakota State University)**

Contact: Thunyaporn “Naggie” Jeradechachai
Email: T.jeradechachai@ndsu.edu
Tel. 1-701-231-7736
Website: www.northern-crops.com

- **BEST VANTAGE Inc.**

Contact: Daniel Best
Email: info@bestvantageinc.com
Tel. 1-847-714-9527
Website: www.bestvantageinc.com

Industry Resources

Best Cooking Pulses, Inc.

Portage la Prairie, MB

www.bestcookingpulses.com

Dakota Dry Bean, Inc.

Grand Forks, ND

www.dakotadrybean.com

Fiberich Technologies, Inc.

St. Louis Park, MN

www.fiberichtech.com

George F. Brocke & Sons

Kendrick, ID

gfbrocke.com

Harvest Innovations

Indianola, IA

harvest-innovations.com

Hinrichs Trading Co.

Pullman, WA

www.hinrichstrading.com

Inland Empire Foods, Inc.

Riverside, CA

www.inlandempirefoods.com

SK Food International

Fargo, ND

www.skfood.com

United Pulse Trading

Bismarck, ND

www.alliancegrain.com

Woodland Foods, Inc.

Gurnee, IL

woodlandfoods.com

For Future Reference

A downloadable copy of this Webinar presentation will be posted on the USA Dry Pea & Lentil Council website in the near future @ www.pea-lentil.com/webinars. We will send webinar registrants an email notification when it becomes available.

Upcoming Webinars: Please stay tuned for future 2013 webinar presentations on more specific uses of pulse ingredients in food product development.

QUESTIONS?



REMINDER Please email Post-WEBINAR questions to mfemreite@pea-lentil.com



Thank You
for your participation



REMINDER Please email WEBINAR questions to mfemreite@pea-lentil.com

