The Evolution of Alternative Protein Ingredients in Baking From the Past to the Future

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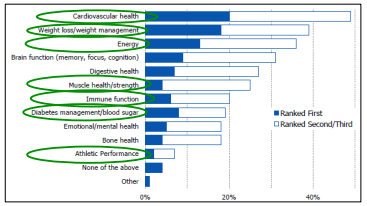
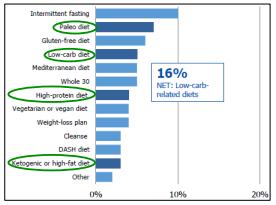
Macro Health Trends

Protein is relevant to majority of the top 12 health benefits consumers are looking for from food

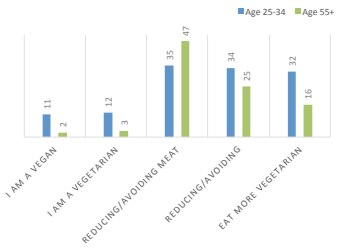




Consumers follow a specific eating pattern of which the leading trend is high protein.

2018 Food and Health Survey – International Food Information Council Foundation

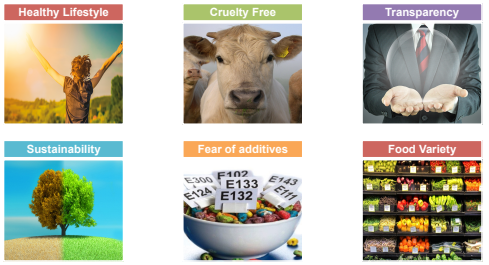
Flexitarian is the protein driver



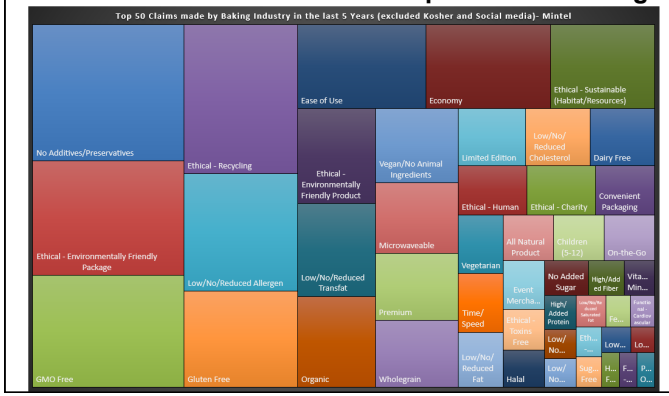
- Merriam Webster Definition of **Flexitarian**: one whose normally meatless diet occasionally includes meat or fish.
- Millennials are the driver

Source: Lightspeed/Mintel

Drivers for flexitarians



Trends- What have we seen in proteins in baking?



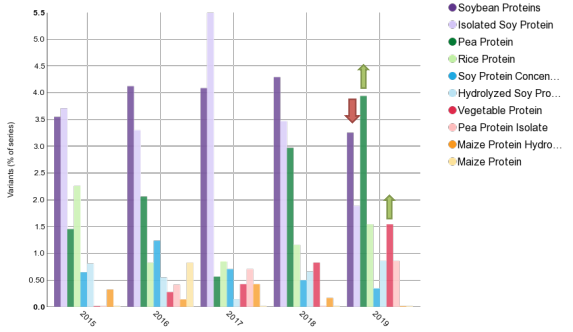
Most common protein source for baking application

Responsible overall for structure, texture, flavors. Responsible for dough strength, elasticity and viscosity.

Help form overall structures, emulsifies, whip ability, coagulation, browning, flavor, texture, and nutrition

Contribute to flavor, color, texture and nutrition

Alternative Protein Ingredients in Baking Industry



Source: Mintel GNPD, Jan 24, 2020

Alternative proteins for baking

Functional

Wheat replacement
Egg replacement
Milk replacement

Nutritional

Protein quantity
Complete Protein

Algae Protein

Seed Protein

Yeast Protein

Legume Protein

Corn Rice
Barley Protein

Working with plant protein

Plant proteins is diverse- molecular structure and structural properties differs due to the sources.

Plant proteins and animal proteins are different

- Animal protein is highly soluble
- Plant protein have storage role and globular structure

Functional properties are influenced by:

- Molecular structure- shape, amino acid composition, surface properties
- Environment- pH, salts, temperature, presence of other ingredients
- Processing: Heat, pressure, shear, enzymes, or chemical processing.

BSM Market Research on Pulse & Hemp: Which ones are the best?

Beans		Peas	Hemp
Adzuki	Kidney	Green	Hulled Hemp
Black	Lupin	Yellow	
Chickpea	Mung		
Cowpea	Otebo	**Lentils**	
Cranberry	Pinto	Green	
Fava	Small Red	Red	
Great Northern	Navy	Yellow	

Functionality Testing Summary

Test	Purpose	Method	Results
Bake Testing	Determine how protein ingredient inclusion influences processing and cookie spread.	AACCI cookie bake at 50% replacement of the pastry flour.	Cookie flow was reduced due to higher absorption. Some doughs were harder to process. No ingredients were rejected due to poor bake performance.
Viscosity and Gelatinization	Viscosity and gelatinization profile influences processing (dough cohesiveness, viscosity, expansion) and finished product characteristics (firmness, cohesiveness).	Rapid ViscoAnalyzer	All ingredients showed acceptable RVA curves suitable for extrusion (pasta and snacks) except hemp.
Water Holding Capacity (WHC)	WHC influences processing (dough cohesiveness, viscosity) and finished product characteristics (firmness, cohesiveness, shelf life).	Water uptake under gravimetric conditions	WHC ranged from holding two to five times an ingredient's weight of water, except for mung bean which was very low in absorption and highly soluble. All could be acceptable depending on application.
Color	Determine how protein ingredient inclusion could influence color of finished product.	Sensory team analysis. Blind tasting.	Colors were deemed unacceptable for the following: Black bean, Cow pea, Cranberry, Fava, Kidney Bean Dark + Light + Pink, Mung, Small Red Bean, Hemp 50% Protein Powder
Flavor	Determine how protein ingredient inclusion could influence color of finished product.	Sensory team analysis. Blind tasting.	Flavor notes on the following pulses were deemed too strong and unacceptable: Azuki, Kidney, Lupin, Mung, Pinto, Black Bean, Hemp 50% Protein Powder

Front runners from Functionality Research: Chickpea, Great Northern Bean, Otebo Bean, Pinto Bean, Navy Bean, Lentils, Peas

Nutritional Quality Summary

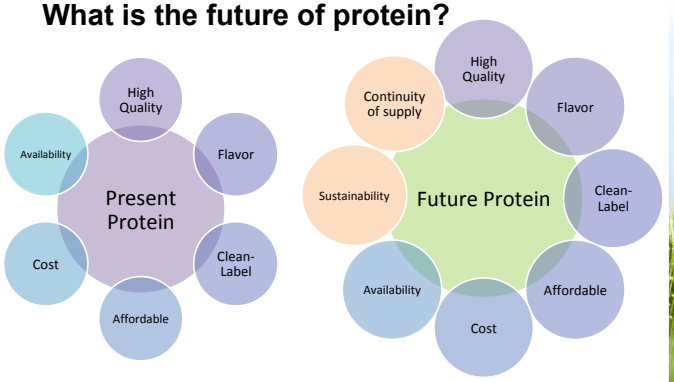
Nutritional Parameter	Purpose	Results
Protein Quantity	Market research proves this is an important factor when selecting protein ingredients.	Highest Protein Quantity Ingredients: Lupin Bean & Hemp with >30gPRO/100g Fava Bean, Red Lentils, Peas >24gPRO/100g
Protein Quality ("Complete Protein")	This is an up and coming trend with some relevance in the marketplace now for protein claims.	Highest Protein Quality Ingredients (PDCAAS ≥ 0.60): Lupin bean (0.71), Hemp, Green Lentils, Yellow Peas, Navy Beans, Desi Chickpeas
Fiber	Whole food protein sources contain natural fibers and protein.	Highest Fiber Ingredients (TDF≥25%): Red Lentils, Yellow Peas W&S, S Green Peas, Fava Bean, Great Northern Bean, Cranberry Bean
Nutrients of Concern	Calcium, Iron, Potassium, Magnesium are grossly under-consumed.	All ingredients tested had good or excellent sources of the above, with some standouts.

Front runners from Nutrition Research: Hemp, Lupin Bean, Lentils, Peas

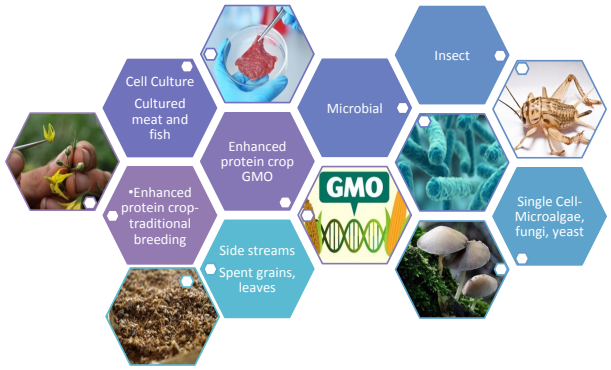
Tallying the Results

	Research	and Sensory			protein	
Green Lentil	✓	✓	✓	✓	✓	5
Red Lentil	✓	✓	✓	✓	✓	5
Green split Pea	✓	✓	✓	✓	✓	5
Yellow Split Pea	✓	✓	✓	✓	✓	5
Chickpea Pea	✓	✓		✓		3
Great Northern Bean		✓		✓		2
Otebo bean Bean		✓		✓		2
Pinto bean		✓		✓		2
Navy Bean		✓		✓		2
Hemp Bean			✓	✓		2
Azuki bean				✓		1
Black turtle Bean				✓		1
Cranberry Bean				✓		1
Kidney dark, light, pink				✓		1
White Kidney Bean				✓		1
Lupin Bean			✓			1
Small red Bean				✓		1
Cow pea Bean						0
Fava Bean						0
Mung Bean						0

What is the future of protein?



Novel protein sources



Opportunities and Challenges

Thank you!

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