



Alternative Proteins

Pea Protein as Texturant



Q4 | 2019

INDUSTRY PULSE

FutureBridge

QUARTERLY PLAYER ANALYSIS

Oct 2019 - Dec 2019

Product launches

Ingredient developers are increasingly launching ingredients with a view to increasing the range of ingredients available for the alternative protein segment



Investment

Startups involved in varied segments of the alternative protein are receiving investments as alternative protein is trending



Product Expansion

Established player Roquette is expanding its ingredient portfolio to cater to the alternative protein segment



FutureBridge Insights:

- **Pea-protein** is increasingly utilized by **startups** and **established** players to produce **blends** for incorporation in **alternative meat** and **dairy**.
- Players such as **Sophie's Kitchen**, **Dragsbæk**, and **Südzucker** are **patenting pea-blends** containing **alternative meat** products.
- **Research** in the pea-based domain is focused on **resolving challenges** such as **off-taste**, **texturization**, and **stabilization**.
- Ingredient producers such as **DuPont**, **Vestkorn**, **Roquette**, and **Healy Group** are increasingly **diversifying ingredients** available to players involved in the alternative protein domain.

Things to look out for:

- Increased **utilization of pea-blends** for providing **texturing** and **nutritive value** for alternative protein products
- **Resolution** of challenges regarding **off-taste** and **emulsification** of pea protein
- **Increased** production of **non-GMO pea-seeds** containing **lower anti-nutritive factors** and **off-taste genes** as well as **higher protein content**

Key players :



Note: All company logos have been hyperlinked with respective company websites



FutureBridge Insights

- **Texturants** are essential to maintain the **mouthfeel** and **flavor** of the **alternative protein** after **animal-protein components** have been **removed**.
- **Pea protein texturants** are utilized to provide a **fibrous meat-like texture** to products.
- Pea protein is being **increasingly utilized to avoid the genetically modified nature of the soy protein** that is popular in the alternative protein market.
- Pea protein holds advantages such as provided **emulsifying, gelling, and water retaining properties** while also **not** being a **major allergen** worldwide.

Pea protein is majorly utilized in blend format due to its texturizing and nutrient enriching properties

Pea protein in alternative protein segment: Overview

Extraction Process

- Alkaline /isoelectric precipitation
- Dry Fractionation
- Salt extraction or micellization

Drivers

- Increasing **vegan** and **flexitarian population**
- **GMO** nature of widely used **soy** protein
- **Clean manufacturing** process
- **Lower carbon footprint**

Advantages



- **Emulsifying** and **gelling** properties
- **Water and oil retention**
- **Not a major allergen**
- **Non-GMO** (considered a replacement for GMO soy)
- **Lower fat content** allows for **solvent-less extraction** process
- **Extend shelf-life** of product



Application

- Meat Analogue
- Egg Replacers

Segmentation

- Pea Concentrate: ~60% protein
- **Pea Isolate**: ~80-95% protein
- Textured Pea: pea protein texturized by extrusion

Challenges



- **Nutty** flavor
- **Bitter** flavor
- Presence of **anti-nutritional** factors such as pectins, trypsin inhibitors, and phytic acid
- **Lower solubility** (Compared to soy)
- Development of **acceptable texture** as a meat analogue
- **Shorter fibers** than soy
- **Moderate *PDCAAS = 0.72**

Dry pea flour nutrient content:

Parameters	Nutrient (100g)
Calories (kcal)	365
Protein	23.5
Carbohydrates	65
Fibre	25.5
Fat	2.2
Water <u>holding</u> capacity (pea protein isolate)	~4.0g/g

Key: * Protein digestibility-corrected amino acid score

FutureBridge Insights

- Major **ingredient providers** such as **Roquette**, **Ingredion**, and **Hydrosol** of the food and manufacturing segment recognize the **potential** of the **alternative protein** segment and have launched ingredients for the segment.
- Pea protein** ingredients segments include **isolates**, **concentrates**, and **texturants**.
- Pea protein isolates** have the **highest** market amongst the segments as it provides the **highest protein concentration** in lesser gram of pea.
- Pea protein is utilized mainly in **blends** to maintain the **meat-like texture** and **provide meat-comparable nutritional profile**.

Startup and established players are involved in the production of pea-based ingredients and products that mimic animal proteins



Key players in pea protein segment

Pea Protein Types	Key Developers
Protein Isolate	    
Protein Concentrates	   
Textured protein	    
F&B Players	     

Pea-based products



Product: Pea M'LK
Company: Oatly (UK)
Ingredient: Pea protein, sunflower lecithin
Features: Product provides 3.2g of protein per 100 ml of serving and is free-from dairy, nuts, soy, gluten and GMO's



Product: Beyond Beef
Company: Beyond Meat (U.S.)
Ingredients: Pea protein isolate, Mung bean protein and rice protein
Features: Product contains 20g of plant protein per serving and is soy-, gluten- and GMO-free



Product: Pea protein chips
Company: Safe+Fair food company
Ingredients: Pea protein, lentil flour, potato starch
Features: Product is made using natural ingredients without addition of any artificial preservatives and provides 10g of plant proteins



Product: Plant-based burger
Company: Lightlife (U.S.)
Ingredients: Pea protein, canola oil, beet powder
Features: Product provides 20g of plant based protein sourced from peas and 0g of cholesterol

FutureBridge Insights

- Pea protein segment has challenges that include **bitter** or **beany taste**, **anti-nutritional** components, and **shorter fibers**.
- The challenges have been overcome by players such as **Kellogg's** and **Givaudan** by developing either utilizing different **processing techniques** or by utilizing **masking solutions**.
- Pea protein is considered as a **replacement for the GMO-soy** hence companies have extensively compared the two proteins functional properties.
- The pea proteins challenges can be mainly overcome by **maintaining pH**, choosing **hybrids with lower anti-nutritional components**, and **extruding the protein at high temperatures**.

Companies are focused on addressing the off-flavor and texture challenges associated with the pea protein



Challenges and Solutions in the pea protein segment

Challenge	Bitter or Off-taste	Anti-nutritional components	Developing texture similar to meat	Shorter fibers than soy	Lower solubility than soy
Solution	<ul style="list-style-type: none"> Changing the pea processing technique to remove the non-volatile components that cause bitter after taste. – Evidence: Kellogg's patented a unique process utilizes steam cooking and drum drying on pea protein flour, concentrates, and isolates. • Developing masking solutions. – Evidence: Givaudan identified universal masking solutions for countering off-flavors in plant-based proteins such as soy, pea, faba, rice, oat and also in alternate proteins such as algae and whey. 	<ul style="list-style-type: none"> • Mutating the genes responsible for producing *anti-nutritional factors. – Evidence: Anti-nutritional factors in pea can be eliminated by missense mutations of trypsin inhibitor protein. 	<ul style="list-style-type: none"> • Pea protein isolates are blended with other components and are extruded to improve texture. – Evidence: The patent describes method for texturizing by cooked-extrusion at pH lower than 12 with starch to provide a meat-like texture. 	<ul style="list-style-type: none"> • Processing techniques can be improved to provide similar strength to fibers as cooked meat. – Evidence: The research paper suggests utilization of pea fibers generated at 120° C. 	<ul style="list-style-type: none"> • Changing processing techniques to increase emulsification. – Evidence: Increasing hydrolysis of pea-protein isolate by hydrolysis, which also reduced its pH dependency for emulsification.

*Key: *Anti-nutritional components: Substances that are generated in natural food substance by normal metabolism that can generate undesirable effects such as reduction in nutrient absorption capabilities e.g., Trypsin inhibitor, phytic acid, cyanogens*



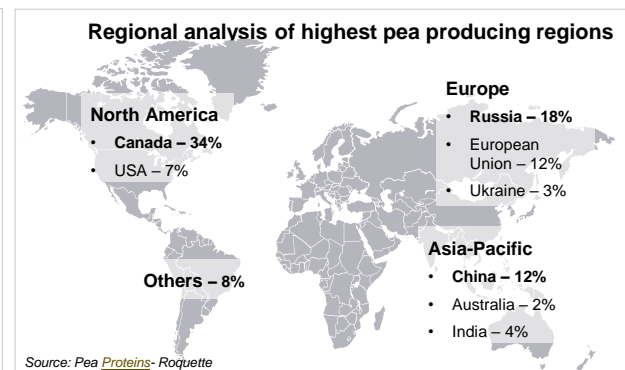
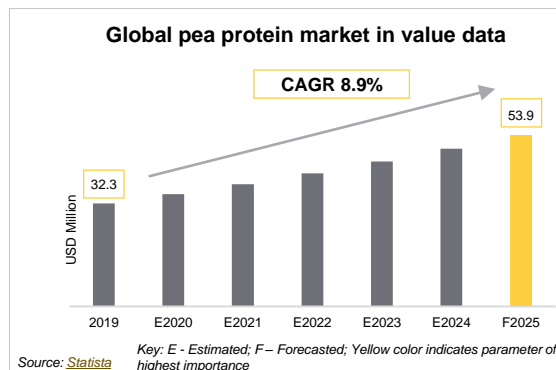
FutureBridge Insights

- The global **pea protein** market is steadily **rising** due to its use in the **alternative protein category**.
- Countries such as **Canada, Russia, and China** are the highest **pea producing nations**. Adequate production of pea proteins helps in **maintaining a steady supply** of pea-protein based products.
- **Pea fiber** containing products were the **highest** launched in Q4-2019. Pea fiber allows increasing the **fiber content** of a product.

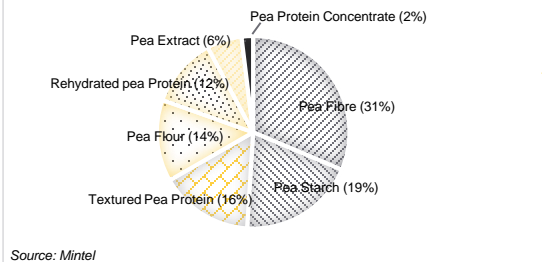


Pea-based protein market is steadily growing with the highest ingredient being pea-fiber that provides texture

Pea protein in alternative protein segment: Market Analysis



Pea-protein containing product launches in Q4-2019



- **Pea Fiber:** Increases fiber without affecting texture and taste. Acts as a bulking agent.
- **Pea Starch:** Used as a binding and thickening agent. Has good shear stability
- **Textured Pea Protein:** Provides texture to product
- **Pea Flour:** Increases protein content
- **Rehydrated Pea Protein:** Contains Pea protein concentrate and water thereby proving high protein content
- **Pea Extract:** Provides anti-oxidative properties to product
- **Pea Concentrate:** Provides high protein content

FutureBridge Insights

- Established players such as **Südzucker** and **Dragsbæk** are increasingly **investing** in the **alternative protein** domain, which is expected to **intensify competition** in the segment.
- Startups such as **Sophie's Kitchen** are utilizing **pea protein blends** to increase their products in the **alternative seafood segment**.
- Patents** in the pea protein segment is focused on development of blends of various **texturants** such as **pea, sunflower seeds, soy, gluten, and wheat** to produce **meat-substitutes**.

Established and Startup players are patenting new pea-based products and improving their processing techniques



Pea protein in alternative protein segment: Market Analysis

Patent's activity for pea protein in alternative protein segment in the year 2019

Patent: [WO2019106072A1](#)

Assignee: Südzucker

Claim: The patent provides description of a co-mixture of plant protein and oilseed to produce a meat analogue. The product may contain either sunflower or linseed or both. The plant protein could be wheat, pea, soy or gluten.



Patent: [WO2019134992A1](#)

Assignee: Dragsbæk

Claim: The patent claims include description of a vegetable meat substitute wheat, pea, chickpea, oat or soy. The product is claimed to mimic minced meat or whole meat. Other ingredients include vegetable fat, gluten, stabilizers, and food coloring.



Patent: [US10477882B1](#)

Assignee: Sophie's Kitchen

Claim: The patent claims provide a product, which is a replacement for fish, beef, and chicken. The composition contains pea, konjac powder, and fenugreek. The patent states the need for utilizing pea protein instead of soy due to the increased presence of GMO soy in the market.



Patent's published by active alternative seafood-based startups in 2019

- [F1128029B](#): Process for producing a plant protein ingredient with method to enzymatically remove anti-nutritional component of phytate
- [WO2019204793A1](#): Method for preparation of flour emulsifiers from plant proteins
- [CN110403058A](#): Preparation method of a steak containing textured soybean, pea, carrageen. The methods allows for preparation of lean meat and fat meat.

Keywords: (Pea OR Pisum sativum) AND (Plant-based Meat OR Alternative meat OR Meat Alternative OR Meat Substitute OR Faux Meat OR Meat Analogue OR Fake meat OR Mock Meat OR vegetarian Meat OR Vegan Meat OR Mock Meat OR imitation meat)

Source: Questal Orbit



FutureBridge Insights

- Research in the pea-protein segment is majorly **focused** on addressing the **current challenges** faced by the industry players while **utilizing pea protein** for alternative protein applications.
- Research focuses on **improving stabilization** properties by a **combination of pea protein** with **polysaccharide** additives for use in **alternative dairy**.
- Focus on preparation of **blends** to increase **meat-like fibrous texture** is increasing. Blends such as **soy** and **gluten** are widely **used** as they increase **nutrition** and provide **chewy** and **fibrous** texture.
- Other **research** is focused on **improving processing techniques** to provide better **sensory** characteristics to pea-based alternative protein products.

Research in the pea-based segment is focused on improving processing techniques to provide more stability and meat-like texture to products

Pea protein in alternative protein segment: Research Analysis

Title Of Study: Comparative studies on the stabilization of pea protein dispersions by using various polysaccharides

Abstract: The research paper studies the **stability of pea protein dispersions (PPD)**, which is a challenge faced while utilizing faced while utilizing pea protein for **beverage applications**. The study indicated that the PPD improved on incorporation of **polysaccharides** such as corn fiber gum (CFG), high-methoxy pectin (HMP), carboxymethyl cellulose (CMC), and konjac glucomannan (KGM). The physical stability was also dependent on the type and concentration of the polysaccharide as well as on its pH.

Conclusions: The stability of pea protein incorporated with polysaccharide depends upon:

- **pH**
- **Type of polysaccharide**
- **Concentration of the polysaccharide**

Authors: Yue Wei, Zhixiang Cai, Min Wu et. al.

Universities Associated:



Other research on pea proteins in the year 2019:

- Pea protein isolate-gum Arabic Maillard conjugates improves physical and oxidative stability of oil-in-water emulsions
- Enhancing the Usability of Pea Protein Isolate in Food Applications through Modifying Its Structural and Sensory Properties via Deamidation by Glutaminase

Title Of Study: Comparing structuring potential of pea and soy protein with gluten for meat analogue preparation

Abstract: The research paper indicates **pea and wheat gluten** blend can generate a **fibrous morphology similar** to soy protein isolate and wheat gluten blends. The fibrous morphology was generated when sheared and heated at 120 °C. The study also indicated that the pea-gluten blends and soy-gluten blends have matrix strength similar to chicken meat.

Conclusions: The research paper concludes that

- **Pea-gluten blends** can have **similar** strength to **chicken meat** at **120 °C**
- The **Pea-gluten blends** are **similar** to **soy-gluten blends** at **140 °C**

Authors: Floor K.G. Schreuders, Birgit L. Dekkers, et. al

Universities Associated:



- Recent progress in the utilization of pea protein as an emulsifier for food applications
- Evaluation of gels made with different commercial pea protein isolate: Rheological, structural and functional properties

FutureBridge Insights

- The addition of protein alone cannot provide a product with desired characteristics to mimic meat or dairy.
- Companies are including blends, additives such as polysaccharides, and mainly textured proteins to provide a meat-like bite.
- Ingredients such as apple extracts, coloring agents, and fats as utilized to create a meat-like experience.



Textured Vegetable protein in combination with ingredients such as apple extracts and fats provide an overall meat-like experience



Ingredients utilized in alternative meat products

Textured Vegetable Protein

- Addition of protein alone does not grant texture. Therefore, textured proteins are utilized.
- **Methods:**
- Blending meat with texturized protein with help of meat extenders
- Replacement of meat with texturized protein

Coloring Agents

- **Coloring agents** added to mimic the redness associated with meat.
- **Leghaemoglobin** (popularized by Impossible foods) is a heme containing protein that renders a red tint to the meat analogue
- **Beet Juice Extract** – This provides a **bleeding** effect to the patty

Others

- **Apple Extract:** Provides **browning effect** to the patties on cooking Acts like a plasticizer
- **Fats:** They can **increase juiciness**, and tenderness of the product while also providing a **marbling texture** to the patty.
- **Flavouring agents** – Iron complexes (ferrous chlorophyllin.), savory spicing, savory aromas precursors of reducing sugars and amino acids for Maillard reaction

Key: Yellow border indicates parameter of highest importance

Binding Agents

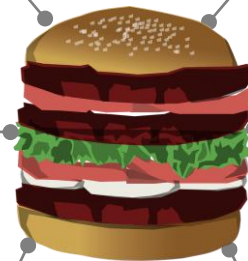
- Added to fine-tune the texture of the meat analogue. Examples include – soy protein isolate, wheat gluten, milk, proteins, carrageenan, xanthan gum etc.
- Non-textured proteins can provide **binding effect** along with **increased nutritional quality**.
- **Carbohydrates: Potato Starch, Methylcellulose** (**plant-fiber** derivative): Provides **gelling effect** to allow binding of the patty

Water

- High water content increases juiciness of product
- Acts like a plasticizer
- Increases emulsification

Ingredients

- Water (50%-80%)
- Textured Vegetable proteins (10%-25%)
- Non-textured proteins (4%-20%)
- Flavorings (3%-10%)
- Fat: (05-15%)
- Binding agents: (1%-5%)
- Coloring agents: (0%-0.5%)



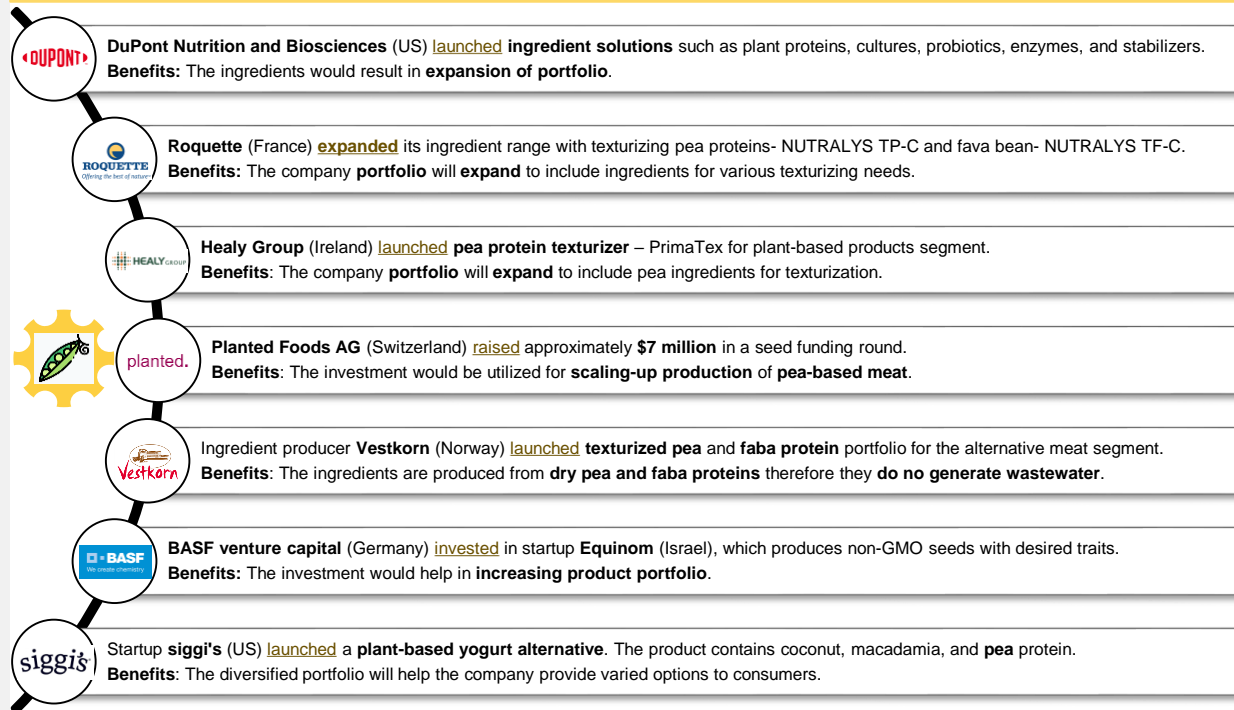


FutureBridge Insights

- The **pea protein segment** in the alternative protein domain is highly **active** in **Q4-2019**.
- **Ingredient producers** are increasingly launching **pea-based ingredients** to capitalize on the **alternative protein segment**.
- **Pea-based products** are **increasing** in the **alternative meat** segment with **startups** receiving **investments** to expand their portfolios
- **Pea-protein** is being utilized in **blend-format** in the alternative protein segment to reduce the **off-taste** and increase **protein concentration** of product.

Established ingredient producers are launching ingredient solutions to address its need in the growing alternative protein market

Pea protein in alternative protein segment: Industry Developments





FutureBridge Insights

- Startup **Equinom** has received funding from industry giants such as **BASF** and **Roquette**.
- The company provides **non-engineered proteins** with **desirable characteristics** such as **high protein content**.
- The company accomplishes production of **non-GMO seeds** by utilizing **hybridization techniques**. The techniques are carried out on seeds that have been chosen for their desirable characteristics using **DNA sequencing** and **algorithms**.

Equinom received a total of \$7.6 million investment with investors such as BASF and Roquette



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