Gluten-Free Battered French Fries

Peas offer a Novel Approach

L. Sawyer (Jan 2011)

Pulses are gaining momentum as healthy, popular food choices because they are low in fat and high in protein and fibre. Recent research reports conclude that pulses play a role in weight management, and may be helpful in the control and prevention of diseases like diabetes and heart disease.

Pulses and pulse flours are also gluten free making them an ideal fit for the rapidly growing "functional" and "gluten-free" food markets. According to a recent report from Packaged Facts, the health and natural foods market in North American exceeds $22 billion USD annually (2004) and the gluten-free market has grown at an average rate of 28 per cent annual since 2004.

Traditionally peas have been marketed for human consumption as bulk products and for animal feed. Their popularity has been limited in the food sector because they are hard-cooking and time consuming. According to Sheri Strydhorst, executive director of the Alberta Pulse Growers Commission, the majority of Canadian peas are exported to two price-sensitive customers, India and China. Market-dependence is a major concern and a driving force to diversify through innovative utilization of peas and pea fractions which appeal to North American and European consumers. Consumers in these markets crave the health and environmental benefits of pulses in culturally acceptable food products.

Several pulse milling technologies are available in Canada and pea flour and pea fractions such as pea protein, pea starch, and pea fiber are now available in addition to whole and split forms. The availability of commercial pea flours and fractions gives rise to unlimited opportunities for peas in many food applications.

Pea protein and fiber have been studied and utilized in bakery, cereal-based, and health food products because consumers demand higher protein and fiber. However, demand for pea starch is low and the starch fraction is often underutilized. Pea starch has excellent gelling, fat limiting, and water binding properties and the potential to be a functional ingredient in food applications.

A research project conducted by the Food Development Centre in Portage la Prairie, MB and sponsored by Alberta Crop Industry Development Fund Ltd, Alberta Pulse Growers, Pulse Canada, Manitoba Pulse Growers, and Parrheim Food is investigating the use of pea fractions (starch, flour, fibre, and protein) in batter and predust coatings of value-added products. Three food applications will be assessed: French fries, mozzarella sticks, and onion rings. The suitability and benefits of using pea starch in combination of other pea fractions to replace traditional corn starch and wheat flour will be evaluated.

Research Insight: Battered French Fries

According to Agriculture and Agri-Food Canada, frozen French fries are the largest export in the frozen food category. Many restaurants today serve battered French fries as a low-cost alternative to natural (un-battered) French fries. Pea fractions offer a Canadian-made, affordable, environmentally friendly way to produce gluten-free battered French fries.

Phase I of the research evaluated the performance of pea starch (wet and dry fractionated) as a replacement for corn starch in French fry batter.

French fries were evaluation by a 10-person trained sensory panel. Results are shown in Table 1. Battered French fries made with pea starch (**Accugel or Starlite**) in the coating were similar ($p>0.05$) to the control made with corn starch for overall quality, exterior bite, and baked potato flavor.

French fries made with **Accugel** pea starch were similar to the control in all attributes except moistness. French fries with Accugel pea starch were more moist ($p<0.05$) after 30 minutes of holding in the food warmer than the control and samples made with Starlite.

French fries made with **Starlite** pea starch were more crispy, had a more golden color, and a slightly rougher surface texture at 5 and 30 minutes ($p\leq0.05$) than the control.

Table 1: Effect of Pea Starch on the Sensory Characteristic of Battered French Fries

	Holding*	Control **	Accugel**	Starlite **	Significance
	Minutes	Corn Starch	Pea Starch	Pea Starch	P ≤ .05
Color	5	0.50[a]	0.15[a]	1.10[b]	.000
0=white; 6=brown	30	0.10[a]	0.10[a]	1.25[b]	.000
Surface Texture	5	2.90[a]	3.20[a]	2.10[b]	.005
1=smooth; 4=rough	30	3.10[a]	3.10[a]	2.30[b]	.008
Exterior Bite	5	3.50	3.40	3.90	.380
1=tender; 8=tough	30	4.30	4.78	5.10	.312
Crispiness	5	5.20[a]	4.60[a]	6.30[b]	.000
1=crispy; 8=soggy	30	4.40[a]	4.50[a]	5.50[b]	.005
Moistness	5	4.80	5.70	5.20	.328
1=moist; 8=dry	30	4.40[a]	6.20[b]	4.90[a]	.009
Overall Quality	5	5.60	5.40	6.0	.297
1=high; 8=low	30	4.80	4.70	4.80	.973

* Holding in food warmer (OHC-500 Heat Lamp) equipped with 250W, 120V incandescent bulbs

** Means represent data from a 10-person trained sensory panel

a, b means with differing superscripts are significantly different ($p\leq.05$)

Pea starch did not effect the nutritional composition of batter, parfried French fries. Nutritional facts panels of French fries containing corn starch (control) and pea starch are shown in Figure 1.

Figure 1: Nutritional Facts Panel of French Fries

Control (Corn Starch) Battered French fries

Nutrition Facts

Valeur nutritive

Serving Size (100 g) / Portion (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 160	
Fat / Lipides 6 g	**9** %
Saturated / saturés 0.4 g + Trans / trans 0 g	**2** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 210 mg	**9** %
Carbohydrate / Glucides 25 g	**8** %
Fibre / Fibres 2 g	**8** %
Sugars / Sucres 0 g	
Protein / Protéines 2 g	

Pea Starch Battered French fries

Nutrition Facts

Valeur nutritive

Serving Size (100 g) / Portion (100 g)

Amount / Teneur	% Daily Value / % valeur quotidienne
Calories / Calories 160	
Fat / Lipides 6 g	**9** %
Saturated / saturés 0.4 g + Trans / trans 0 g	**2** %
Cholesterol / Cholestérol 0 mg	
Sodium / Sodium 210 mg	**9** %
Carbohydrate / Glucides 25 g	**8** %
Fibre / Fibres 2 g	**8** %
Sugars / Sucres 0 g	
Protein / Protéines 2 g	

Processing data (Table 2) showed that pea starch thickened batter ($p\leq0.05$) and slightly increased batter pick-up ($p\leq0.05$) compared to the control (corn starch). Pea starch has higher amylose content than corn starch which may have contribute to increased batter viscosity. Moisture loss over time increased with the use of pea starch. The commercial pea starches available are native starches whereas the industry-standard corn starch (control) is a chemically modified starch. It is realistic to expect a modified starch to retain moisture more efficiently than a native starch. No differences were observed between batted French fries containing pea or corn starch in parfrying yield, cooking yield, and residual crumb production in the fryer.

Table 2: Effect of Pea Starch on the Processing Characteristic of Battered French Fries

	Control	Accugel	Starlite	Significance
	Corn Starch	Pea Starch	Pea Starch	P ≤ .05
Batter Viscosity, centipoise	434 [a]	622 [b]	706 [c]	.000
Batter Pick-up, %	15.13 [a]	16.57 [b]	17.68 [b]	.006
Parfrying Yield, %	84.61	84.45	85.46	.410
Crumb Production, %	2.40	2.12	2.54	.577
Cooking Yield, %	72.45	70.71	72.25	.859
Moisture Loss, %	1.30 [a]	2.56 [b]	1.89 [ab]	.039

a, b means with differing superscripts are significantly different (p≤.05)

The most successful pea starch was selected from phase I and utilized in phase II to make gluten free battered French fry prototypes using pea starch, flour, protein and fibre. The most promising French fry prototypes were those with batters containing pea starch and pea flour. Prototypes are under sensory and nutritional evaluation to determine the overall quality.

Research will commence on the mozzarella stick and onion ring upon completion of the French fry research. For additional information contact Laura Sawyer at laura.sawyer@gov.mb.ca.