Potential for yellow pea ingredient utilization in breaded mozzarella stick coatings as determined by functional, sensory and nutritional properties

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Introduction.
- Canada is the global leader in pea production; however, the majority of its peas are sold unprocessed to international markets (1).
- Value can be added to peas by milling them into flour or fractions (starch, fiber, & protein) then incorporating them into popular, prepared foods like breaded mozzarella sticks (MS).
- Peas have a low glycemic index, are gluten-free, environmentally friendly & nutrient dense (↑ fiber, protein & minerals).

Objectives
- To investigate how the addition of pea ingredients affects the functional, sensory & nutritional properties of MS coatings.
- To formulate an optimized MS coating utilizing the benefits of pea ingredients (starch, flour & fiber).

Materials and Methods

Experimental design
- The control included traditional MS ingredients (corn starch/flour, wheat flour/gluten & guar gum).
- 2 pea starches (wet & dry milled), 3 pea flours (whole & split), 3 pea hull fibers (wet & dry milled) from Canada’s three main pea processors were evaluated.
- An optimized pea MS was then formulated by fully replacing traditional MS ingredients (starch, flour, gluten & gum) with pea ingredients.

Sample Preparation
- Breaded mozzarella sticks were prepared based on a commercial formula & process provided by Newly Weds Foods.
- A 6-step coating system was applied (batter, pre-dust, batter, pre-dust, batter & breather).
- 4 replicates of each MS type were prepared on separate days & pooled for sensory testing.
- Samples were par-fried at 380°F for 20 sec, frozen overnight & fully fried in a commercial deep fryer at 350°F for 90 sec.

Methods
- Batter viscosity, coating pick-up & par fry yield were measured.
- A trained sensory panel (n=10) evaluated colour, crispness, beanie flavour & overall quality of fully fried mozzarella sticks using category scales.
- Nutritional composition of par fried mozzarella sticks was determined by SGS Canada Inc. (Figure 2).

Statistical Analysis
- Significant differences were determined by ANOVA using SPSS software.
- Differences were considered significant at p≤0.05.

Table 1. Functional & sensory properties of control & optimized pea MS

<table>
<thead>
<tr>
<th>Property</th>
<th>Control</th>
<th>Optimized Pea</th>
<th>p≤0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batter Viscosity<a href="cP">^</a></td>
<td>199.67[^]</td>
<td>167.50[^]</td>
<td>0.036</td>
</tr>
<tr>
<td>Coating Pick-up[^] (%)</td>
<td>62.87</td>
<td>62.45</td>
<td>0.879</td>
</tr>
<tr>
<td>Par Fry Yield[^] (%)</td>
<td>102.35</td>
<td>102.82</td>
<td>0.290</td>
</tr>
<tr>
<td>Colour[^]</td>
<td>2.00[^]</td>
<td>3.25[^]</td>
<td>0.000</td>
</tr>
<tr>
<td>Crispness[^]</td>
<td>3.50[^]</td>
<td>2.75[^]</td>
<td>0.031</td>
</tr>
<tr>
<td>Beanie Flavour[^]</td>
<td>1.25[^]</td>
<td>2.13[^]</td>
<td>0.008</td>
</tr>
<tr>
<td>Overall Quality[^]</td>
<td>6.00[^]</td>
<td>4.38[^]</td>
<td>0.012</td>
</tr>
</tbody>
</table>

[^] measured with Brookfield viscometer with spindle 3 at 100 RPM for 15 sec
[^] % based on raw batch weight
[^] scale of 1 (light) to 6 (dark) using Newly Weds Flour Brender Fry Colour Chart
[^] scale of 1 (not crispy) to 4 (extremely crispy)
[^] scale of 1 (none) to 4 (extreme)
[^] scale of 1 (extremely low) to 8 (extremely high)
[^] means in the same row with different superscripts are significantly different (p≤0.05)

Results
- Addition of pea ingredients to MS had no significant impact on coating pick-up & par-fry yield despite significantly ↓ batter viscosity compared to the control (Table 1).
- Optimized pea MS was rated significantly ↑ than the control for brown colouring & beanie flavour (Table 1). Some panellists indicated that they preferred the colour & flavour depth of the optimized pea MS (Figure 1).
- Crispness of optimized pea MS was rated significantly ↓ than the control & was the major factor for ↓ overall quality (Table 1).
- Protein, total dietary fiber, & iron content were ↑ while the fat content was slightly ↓ in the optimized pea MS compared to the control (Figure 2).
- Wet milled pea starch & hull fiber & whole pea flour were chosen to incorporate into the optimized pea MS due to ↓ beany flavour vs. dry milled starch, ↓ viscosity vs. dry milled fiber & ↑ fiber vs. split flour, respectively (results not shown).

Conclusions
- Pea ingredients (starch, flour, & fiber) successfully replaced traditional ingredients in MS coatings with limited effects on functional & sensory properties & enhanced nutritional properties.
- Pea ingredients can potentially replace gums, gluten & modified corn starch resulting in a cleaner ingredient list.
- The optimized pea MS contained 3x more total dietary fiber than the control allowing a “source of fiber” nutrient content claim.
- Good potential exists for utilization of pea ingredients in MS coatings as they enhance colour, flavour & nutritional content & create opportunities for gluten-free coatings.

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References