GO BEYOND BASIC SUGAR REDUCTION

NUTRAFLORA® prebiotic soluble fiber: an important tool for sugar reduction in yogurts

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From evolving consumer demand for sugar-reduction to government intervention and industry declarations, there is a great deal of interest, and concern, about the amount of sugar that consumers eat. The recently published 2015-2020 Dietary Guidelines for Americans (DGA) recommend that calories from added sugars should not represent more than 10 percent of the total calories consumed daily — this is roughly half of the amount consumed today.1

Consumers view sugar as the major hurdle to leading healthier lives — supplanting fat and sodium — and are trying to stay away from sugar or reduce their consumption of it. In the hope of reaching this goal, consumers are increasingly looking for what is not in a product as much as what is in a product. According to a 2015 Mintel Report titled “2015 Food & Drink Trends,” 50 percent of U.S. consumers look for “low in” claims such as “low sugar,” and 38 percent look for “no sugar” (Figure 1).2

Simultaneously, consumers are increasingly aware of the importance and benefits of dietary fiber and are looking to increase daily consumption, seeking a wider range of products that deliver it.3 The new dietary guidelines further underscore the importance of dietary fiber, indicating that it’s an under-consumed nutrient and recommending that Americans increase their dietary fiber intake to reduce the risk of potential health concerns.3

Consumers in the dairy market also tend to check for negative ingredients before checking for positive ones. According to a recent Natural Marketing Institute (NMI) study, 60 percent of yogurt users check labels for calorie content and 53 percent of them check labels for sugar content (Figure 2).4 Additionally, a study by Health Focus International revealed that 24 percent of consumers believe that lowering the sugar content in a yogurt makes it healthier.3

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**Figure 1:** Food claims sought by U.S. consumers, April 2013

<table>
<thead>
<tr>
<th>Claim</th>
<th>Regular/Drinkable Yogurt Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any nutrition</td>
<td>80%</td>
</tr>
<tr>
<td>Good/Excellent source of (vitamins, fiber, etc.)</td>
<td>62%</td>
</tr>
<tr>
<td>Low sugar/carbs</td>
<td>50%</td>
</tr>
<tr>
<td>Salt/sodium</td>
<td>48%</td>
</tr>
<tr>
<td>Full serving of fruit or vegetables</td>
<td>38%</td>
</tr>
<tr>
<td>No sugar/high-fructose corn syrup, gluten-free, etc.</td>
<td>38%</td>
</tr>
<tr>
<td>All natural</td>
<td>38%</td>
</tr>
<tr>
<td>Local (from a local company farm)</td>
<td>35%</td>
</tr>
</tbody>
</table>

*Source: Mintel*
Similar trends are being seen among shoppers in the healthy beverage segment. These shoppers indicate that lower or reduced sugar is extremely or very important when selecting a healthy beverage, such as milk or dairy-based beverages. In fact, it ranked as the highest factor at 76 percent (Figure 3).\(^5\)

These well-established trends and concerns over added sugar are paving the way for reduced-sugar dairy products that utilize innovative ingredients to help consumers maintain good health and a healthier lifestyle.

**Project objectives**

Two fructan fibers were evaluated to understand their impact on reduced-sugar yogurts. The study, conducted by the applications development group at the Ingredion Idea Labs™ innovation centers, evaluated and quantified the flavor profiles of NUTRAFLORA® P-95 prebiotic fiber short-chain fructooligosaccharides (scFOS\(^\text{®}\)) and oligofructose 95 percent, also known as FOS or fructooligosaccharides.

**Formulations and process**

Full-sugar and reduced-sugar yogurt prototypes were developed for sweetness evaluation, control and negative control, respectively. Two other reduced-sugar yogurts were formulated to contain 5 grams of fiber per 168 gram serving with either NUTRAFLORA® P-95 prebiotic fiber scFOS or oligofructose 95 percent. The full formulas for these prototypes are shown in Figure 4.

The yogurt prototypes were processed following the steps outlined below:

1. Pre-blend of dry ingredients prior to processing
2. Dry pre-blend was added to skim milk and mixed for 20-30 minutes at approximately 500 rpm
3. The mixture was then processed in a pilot scale high temperature short time (HTST) processing system, with an upstream process
   a. Preheated to 149 degrees Fahrenheit and then homogenized at 1740 psi
   b. Pasteurized at 208 degrees Fahrenheit and held for three minutes
   c. Cooled down to approximately 110 degrees Fahrenheit
4. The batches were then inoculated with 0.02 percent yogurt cultures and placed in a fermentation cabinet
5. The samples were fermented until the pH dropped to 4.6
6. Yogurt was cooled down to approximately 45-55 degrees Fahrenheit
7. Samples were smoothed using a 60 mesh screen
8. Yogurt was packaged into 4 ounce cups

All prototypes were characterized through analytical measurements and sensory evaluation was performed focusing on sugar reduction and sweetness replacement. The following analyses were performed on all prototypes: dietary fiber analysis; viscosity and gel strength; microscopy, pre-culturing; shelf life analysis at seven and 49 days; formal sensory descriptive analysis at seven days for sweetness; informal sensory analysis at seven and 24 days for sweetness and texture.
**Results**

**No impact on fermentation time and viscosity**

The inclusion of NUTRAFLORA® P-95 prebiotic fiber or oligofructose 95 percent in the formulations did not have an impact on the fermentation time required to reach a pH of 4.6. Furthermore, as Figure 5 illustrates, the addition of the two fructan fibers did not result in an impact on the viscosity of the yogurt; both of the fiber-enhanced prototypes had comparable viscosities to both the full-sugar control and the reduced-sugar negative control. Similarly, there was no impact on the gel strength of the yogurts when adding the two ingredients.

**Improved sweet taste profile using NUTRAFLORA® P-95 prebiotic fiber**

Trained sensory panelists at Ingredion Idea Labs™ innovation centers evaluated the different prototypes. Descriptive sensory results for sweetness, shown in Figure 6, indicated that NUTRAFLORA® P-95 prebiotic fiber demonstrated the closest sweetness profile to sucrose of all prototypes tested \((p < 0.05)\). As expected, the control was significantly sweeter than the other samples \((p < 0.05)\). In relation to the negative control, NUTRAFLORA® P-95 prebiotic fiber was able to build back some sweetness in yogurt, as did oligofructose 95 percent. **Regarding sweet aftertaste, NUTRAFLORA® P-95 prebiotic fiber had a higher sweet aftertaste than the oligofructose 95 percent and the negative control. NUTRAFLORA® P-95 prebiotic fiber and oligofructose 95 percent had a longer lasting sweet aftertaste that was not significantly different from the control after one minute \((p > 0.05)\). Regarding bitter aftertaste and astringency aftertaste, there were no significant differences \((p > 0.05)\) between the control and either fiber formulation, indicating that the fibers do not influence bitter or astringent aftertaste.**

Informal sensory results for sweetness evaluation showed that both fiber ingredients produced an improvement over the negative control in sweetness contribution. NUTRAFLORA® P-95 prebiotic fiber was considered to be the closest in sweetness to the full-sugar control, but was not quite as sweet. Yogurt with NUTRAFLORA® P-95 prebiotic fiber had a longer lasting sweet note and a more sugar-like round taste than oligofructose 95 percent. Yogurt with oligofructose 95 percent exhibited some astringent and bitter notes.

**About NUTRAFLORA® P-95 prebiotic soluble fiber**

NUTRAFLORA® short chain fructooligosaccharides (scFOS) is a prebiotic soluble fiber derived from pure sugar cane utilizing a bio-fermentation proprietary process and non-GMO ingredients. NUTRAFLORA® is the purest form of short-chain fructooligosaccharides available on the market, with a fiber content of 95 percent on a dry basis. NUTRAFLORA® prebiotic fiber consists of \(\beta 2 \rightarrow 1\) linked linear chains of fructose bound to a terminal glucose. The chain length, or degree of polymerization (DP), varies from three to five. Short-chain fructooligosaccharides are also found in a variety of fruits, vegetables and grains. A comparison between NUTRAFLORA® scFOS® prebiotic fiber and oligofructose 95 percent is found in Figure 7.

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**FIGURE 5: VISCOITY COMPARISON AFTER 1 AND 7 WEEKS**

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**FIGURE 6: DESCRIPTIVE SENSORY RESULTS FOR SWEET TASTE**

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**FIGURE 7: INGREDIENT DESCRIPTION, COMPOSITION AND DEGREE OF POLYMERIZATION (DP)**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Description</th>
<th>Source</th>
<th>Degree of Polymerization (DP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUTRAFLORA® scFOS® P-95 fiber</td>
<td>Short chain FOS; (\betaeta(2 \rightarrow 1)) linked linear chains of fructose bound to a terminal glucose (GFn); GF2 = 30-42%; GF3 = 45-57%; GF4 = 5-15%; Total scFOS = 95%</td>
<td>Sucrose</td>
<td>3 – 5</td>
</tr>
<tr>
<td>Oligofructose 95%</td>
<td>Mixture of oligosaccharides composed of fructose units linked by (\betaeta(2 \rightarrow 1)) linkages (FFn); part of the molecules are terminated by glucose (GFn). Total FOS = 95%</td>
<td>Chicory inulin</td>
<td>2 – 8</td>
</tr>
</tbody>
</table>
Summary
With increasing consumer interest in clean and simple label yogurts that have reduced or no added sugars, and with a changing regulatory environment, yogurt manufacturers and formulators need to have many tools at their disposal for developing yogurts that meet the requirements of the market. This study demonstrates that NUTRAFLORA® prebiotic soluble fiber can be an important component in the formulator’s tool kit of ingredients for sugar reduction. NUTRAFLORA® prebiotic fiber builds back sweetness and has a sweet taste profile that is similar to sucrose. Additionally, it contributes to a higher and longer lasting sweet aftertaste when compared with oligofructose 95 percent or a negative control. With only 1.5 kcal per gram, NUTRAFLORA® prebiotic fiber can help reduce the calorie content of yogurts, when compared to full-sugar formulations; it is easily dispersible, does not contribute to viscosity and is clear in solution.

References