

# And the PDC Winner Is: KSU's Sweet-Tasting and Gluten-Free Waffle Cones!

*Winner of the 2009 AACC International Student Division Product Development Competition*

- The winning team from Kansas State University created the sweet-tasting, colorful waffle cones—a gluten-free alternative for consumers made with brown rice flour and available in a variety of flavors.
- With celiac disease on the rise, consumers continue to look for gluten-free products that supply a flavorful eating experience while still meeting their nutritional needs.
- When Gluten-Free Fun Flavored Waffle Cones were subjected to a consumer test, overall acceptance, appearance, flavor, and texture in hand scored above 7.0 on a 9.0 hedonic scale.

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A team comprised of two graduate students from the Department of Animal Sciences and Industry at Kansas State University (KSU) took top honors at the 2009 AACC International Student Division Product Development Competition. Their product, Gluten-Free Fun Flavored Waffle Cones, targets consumers with celiac disease, as well as individuals looking for more variety in ice-cream cone flavors. This article highlights the innovation process involved in developing this award-winning product.

Gluten-Free Fun Flavored Waffle Cones are made with brown rice flour as an alternative to wheat flour and are available in vanilla, cinnamon, strawberry, and chocolate flavors. Both the ready-made cones and a dry mix to be baked at home or at ice-creams shops were developed in order to reach a larger consumer base. These cones meet the dietary needs of celiacs and offer flavor variety to individuals who may be bored with typical ice-cream cones.

## Gluten Free on the Rise

More than 3 million Americans suffer from celiac disease, and it is estimated that there will be 500,000 new diagnoses by 2012 (1). Because an increased number of

individuals suffer from this disease and cannot eat gluten, the gluten-free food industry is quickly growing. From 2004 to 2005, sales of gluten-free foods increased by 77.8 million dollars and the U.S. Department of Agriculture projects that the gluten-free revenues will reach \$1.7 billion by 2010 (1). Many people around the world have enjoyed eating ice-cream cones since its invention in 1904. However, individuals with celiac disease cannot eat ice-cream cones because they are made with gluten-containing cake flour. The Gluten-Free Fun Flavored Waffle Cone developed for this competition helps meet the needs of consumers who want or need to eliminate gluten from their diet.

## Focus Group

A focus group comprised of 10 adults (seven females and three males) ages 19 to 53 years old was conducted in the early stages of the development process. During this moderator-led discussion, waffle cone prototypes were evaluated by participants. The following results were revealed:

- Many consumers do not purchase ice-cream cones from grocery stores, but do consume waffle cones at ice-cream shops. Therefore, marketing bulk boxes of ice-cream cones or a dry mix to ice-cream shops would add additional profits.
- Consumers tend to be unconcerned with the nutritional value of ice-cream cones and other dessert items. Thus, focusing on creating a low-fat or enriched product was unnecessary.
- The concept of a gluten-free, flavored waffle cone was well perceived by both individuals with and without celiac disease. Individuals who have celiac disease were excited about being able to eat ice cream from a cone rather than a cup. Individuals without celiac disease liked the idea of having flavored options.
- The amount of flavoring in gluten-free waffle cones needs to be strong



enough to overcome any off-flavors associated with brown rice flour, but weak enough to not distract from the ice cream flavor. Additional flavors suggested were peanut butter and blueberry.

- A crisp, nongrainy waffle cone texture is essential to consumer satisfaction. Waffle cones made with brown rice flour and other liquid ingredients had very little graininess.
- Because the waffle cones do fall in the niche market of gluten free, consumers would be willing to pay an elevated price for the product.

### Formulation and Processing

After trying several different gluten-free flours, it was determined that cones made with brown rice flour had a more desirable texture and less off-flavors. Early in the product development process, the formulation contained liquid butter, eggs, and flavoring. When converting the formulation to dry ingredients, texture in the finished product became undesirable. To reduce the graininess, baker's sugar was used along with warm water to help dissolve the ingredients (Table I). In addition, moisture migration was a major concern in the finished cones. The addition of xanthan gum helped to bind up more water and reduce the water activity of the cone. Silicon dioxide was added as an anticaking agent in the dry mix formulation (Table II). To make these cones more unique, four flavors were developed. A large variety of

ice-cream flavors are available on the market, but few flavor options exist in ice-cream cones. For the product development competition, vanilla and cinnamon flavors were presented. However, there has also been work conducted on chocolate and strawberry flavors.

The following processing steps reflect a commercial-type setting to ensure technical feasibility for mass production. Dry ingredients would be scaled and blended prior to the addition of water. After the addition of water, the batter would be mixed for approximately 5 min and then extruded onto a waffle-cone oven/press and cooked at 400°F for approximately 4 min. Cones would then be rolled into a cone shape and allowed to cool on a conveyor belt for 5 min prior to packaging. Cones would then be placed in biodegradable styrofoam for protection against breakage and packaged in polypropylene bags that have been flushed with N<sub>2</sub> to eliminate O<sub>2</sub> in the package. Packages would be placed in laminated paperboard boxes. Processing for the dry mix would only involve scaling and blending dry ingredients. The mix would be packaged in a polypropylene bag and a laminated paperboard box (Fig. 1).

### Product Specifications

The estimated shelf life of both ready-made Gluten-Free Fun Flavored Waffle Cones and the dry mix is 6 months. The product specifications that would need to be monitored in a plant setting can be found in Table III. It is especially important for the water activity of finished cones to be less than 0.450 to ensure inhibition of microbial growth and also texture attributes.

### Distribution Channels

Ready-made Gluten-Free Fun Flavored Waffle Cones would be marketed in grocery stores at the end of ice-cream cone aisles and also sold in bulk boxes to ice-cream shops. The dry mix would be marketed in grocery stores so that consumers could make fresh cones at home. However, a larger market for the dry mix would be ice-cream shops that make their cones fresh in the store. The suggested retail price for a box of six ready-made cones

would be \$4.99 and the estimated retail cost of a 1-lb dry mix bag would be \$3.99. These cones would be more expensive than traditional waffle cones currently available on the market. However, research has found that products labeled gluten free cost 242% more than similar products that contain gluten (2).

Table I. Ready-made cone formulation

Ingredient	Percent Flour Basis (%)
Brown rice flour	100
Baker's sugar	81.1
Powdered whole egg yolk	27
Powdered egg whites	11.7
Flaked fat	11.7
Powdered vanilla/cinnamon flavoring	7.2/1.5
Salt	2.0
Xanthan gum	0.2
Water	155.0

Table II. Dry mix formulation

Ingredient	Percent Flour Basis (%)
Brown rice flour	100
Baker's sugar	81.1
Powdered whole egg yolk	27
Powdered egg whites	11.7
Flaked fat	11.7
Powdered vanilla/cinnamon flavoring	7.2/1.5
Silicon dioxide	1.8
Salt	2.0
Xanthan gum	0.2

Table III. Product specifications

Item	Specification
<b>Batter attribute</b>	
Weight	72 ± 3 g
a <sub>w</sub>	0.950 ± 0.01
°Brix	48 ± 2°
<b>Cone attribute</b>	
a <sub>w</sub>	≤0.450
Texture force	3,727 g Force ± 12%
Fracturability	1.56 g Force ± 19%
Cone color	L* 54.0 ± 5 a* 4.5 ± 0.5 b* 30.0 ± 5
Yeast and mold, total plate count, and coliforms	Less than 10 CFU/g
<b>Dry mix attribute</b>	
Weight	1 lb

Table IV. Consumer test results

Product Attribute	Mean Score <sup>a</sup> ± Standard Deviation	Top 3 Box (%) <sup>b</sup>
Overall acceptability	7.19 ± 1.05	81.1
Appearance	7.22 ± 1.18	78.4
Flavor	7.30 ± 1.40	76.0
Texture in hand	6.32 ± 1.45	70.3
Texture in mouth	6.32 ± 1.75	48.6

<sup>a</sup> Scale: 1 = dislike extremely, 9 = like extremely.

<sup>b</sup> "Top 3 Box" indicates the percent of those who scored a 7 or better.



Fig. 1. Gluten-Free Fun Flavored Waffle Cones offer consumers and industry leaders a new spin on an old product.

## Sensory Analysis

Panelists, representative of a university population, were asked to conduct sensory analysis on Gluten-Free Fun Flavored Waffle Cones (Table IV). Panelists signed a consent form, and panelists with allergies (other than gluten) were eliminated. Thirty-seven consumers ranging in age from 18 to 70 years old assessed the product.

The ballot was based on a nine-point hedonic scale with one being “dislikes extremely” and nine being “likes extremely.” Participants were asked to evaluate overall acceptability, appearance, flavor, texture in hand, and texture in mouth. Space was also allowed for panelists to add additional comments.

Individual results were tabulated to find the mean score, standard deviation, and top 3 percentage box. In all evaluation categories, except “texture in mouth,” consumers ranked the cones above seven points. At this point in the product development process, there was still some concern with the texture of the product. Slight alterations were made to the formulation to increase the acceptability of the cone texture.

## The Future of Gluten-Free Fun Flavored Waffle Cones

With celiac disease on the rise, consumers will continue to look for gluten-free

products that supply a flavorful eating experience while still meeting their nutritional needs. With a unique flavor and nutritional profile, Gluten-Free Fun Flavored Waffle Cones offer consumers and industry leaders a new spin on an old product. While gluten-free waffle cones may be at the forefront of novel foods that are emerging on the market, numerous advancements in innovation and research are bound to take this once illusionary idea and make it an industry standard.

## Acknowledgments

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## 2009 Student Division Product Development Competition Focuses on Healthy Foods



Competition winners Melissa Daniel and Angela Dodd with AACC Intl. past president Mary Ellen Camire.

The AACC International Student Division Product Development Competition, held annually during the AACC Intl. Annual Meeting, invites student members from around the world to create a new product containing at least one major cereal ingredient. In 2009, 13 teams applied, and five were selected to present their products to the judges at the 2009 annual meeting. Each finalist team created a poster describing formulation, shelf life, marketing aspects, processing, packaging, and other relevant information regarding the product. Teams delivered a 10-minute oral presentation for the judges and provided servings of the product at a tasting session.

This year, team “Gluten-Free Fun Flavored Waffle Cones” (featured on page 9) from Kansas State University took the first place prize of \$2,550. Team members Melissa Daniel and Angela Dodd developed waffle cones made with brown rice flour as an alternative to the conventionally used wheat flour. The gluten-free waffle

cones would be available in an assortment of flavors, including chocolate, cinnamon, strawberry, and vanilla.

“Crêpe Ups,” a new pea-based, pancake-like breakfast item, took second place and a prize of \$1,000. The University of Manitoba team, with members Rena Tanaka, Shangleigh Thomson, Huiqin Wang, and Chenxin Zhao, created these pancake-like, filled frozen breakfast rolls which are ready to serve after microwaving.

The high in fiber and protein, low in fat, gluten-free Crêpe Ups were designed to satisfy health-conscious consumers with a busy morning schedule. Two crepe fillings were developed: hearty ham, cheese, and spinach; and homestyle apple delight.

The third place of \$850 went to team “DiFiNoo” for their dietary fiber-fortified instant noodles from South Dakota State University. Julie Darly used phosphorylated cross-linked resistant starch to create a fortified formulation for Asian noodles. Wheat flour was substituted with phosphorylated cross-linked resistant wheat starch and vital gluten. The instant noodles would be oven dried to make a healthier product.

Teams “TruCous—Gluten-Free Couscous” from Texas A&M University and “Burger Bites” from the University of Arkansas also competed in the competition. TruCous, a multigrain, tricolor, gluten-free couscous, consists of 60% yellow maize couscous, 20% blue maize couscous, and 20% millet/sorghum/maize couscous. Burger Bites are two- to three-bite snacks with a healthy “meat” mixture composed of brown rice, vegetables, fat-free cheese, and lean beef and turkey completely encased in a whole-grain bun.

The event was made possible by sponsorships from the Archer Daniels Midland Co., Caravan Ingredients, Cargill, Inc., ConAgra Foods, David Michael & Co., Deb Patterson, Frito-Lay, General Mills Inc., Kellogg Co., Srim Enterprises LLC, Starquest F.O.O.D. Consulting LLC, and TIC Gums. The competition was judged by Tim Christensen, Cargill Bake Lab; Brinda Govindarajan, Kellogg Co.; Elizabeth Knight, McCormick & Co. Inc.; Thomas Luallen, Starquest F.O.O.D. Consulting LLC; John M. Mathew, Frito-Lay Research & Development; Deirdre E. Ortiz, W. K. Kellogg Institute; and Deb Patterson, General Mills Inc. Student member Cynthia Machado, Purdue University, chaired the event.

Information about the 2010 Student Division Product Development Competition will be available in March 2010.

*Team Crêpe Ups stacked up against the healthy competition.*



*Third-place winner DiFiNoo with dietary fiber-fortified noodles.*

