The mighty bean

Dr Kanak Udani described the results of the incorporation of the Phase 2 fractionated white bean extract in baked goods and its impact on consumers

With the growing consumer demand for low carbohydrate and low glycaemic foods, several methods have been evaluated to lower the effective glycaemic index of existing foods. These include the addition of soluble fibre, psyllium, blackgram fibre, barley or the substitution of simple starches with resistant starches. One novel approach is the addition of a Phase 2 brand of proprietary fractionated white bean extract (FWBE) prepared from the White Kidney Bean (Phaseoulus vulgaris), which has amylase inhibitory properties.

Results of the Phase 2 product development test showed muffins scored a 9 point rating

The proposed mechanism of action for this FWBE is its ability to partially inhibit or delay the breakdown of complex carbohydrates into their more absorbable sub-constituents (mono and disaccharides). The delay in digestion may delay the gut absorption rate of glucose, and may also blunt the subsequent insulin rise.

The White Kidney Bean (Phaseolus vulgaris) inhibits salivary and pancreatic amylase. Phaseolus vulgaris binds to amylase in non-competitive fashion, optimally at a pH of 5.5, forming a 1:1 molar complex. Similar binding can be seen at neutral pH as well. White bean extracts are not expected to have any activity on the brush border enzymes and an invitro study confirmed that it does not inhibit the brush-border enzyme maltose/glucoamylase.

The activity of Phaseolus Vulgaris is dose-dependent and extract-dependent. Threshold levels of greater than 90% inhibition of amylase are required before any carbohydrate malabsorbtion is seen. Below this threshold, incomplete inhibition of amylase may not have any significant effect on carbohydrate malabsorbtion.

Animal toxicity studies (both acute and chronic) were performed on the proprietary fractionated white bean extract (from Pharmachem).

Human clinical trials have yielded mixed results regarding weight loss, but pilot data shows promise for the ability of this ingredient to lower the glycaemic index of foods containing carbohydrates.

FWBE is currently available in tablet, capsule or a powder form and consumers take this product before or with meals. This requires consumers to have easy access to FWBE during their meal time as well as to remember to take it before or with meals, which can become a cumbersome regimen and an inconvenience for the consumers.

Since convenience is one of the most important attributes desired by consumers in their lifestyle in general and in the selection of food products in particular, incorporating FWBE into high-carbohydrate foods would provide consumers with the desired convenience of not having to remember to take FWBE before or with their meals. Therefore high-carbohydrate foods with FWBE would become added-value food products.

Requirements

Incorporating FWBE into food products, particularly baked goods made with yeast-raised dough such as breads and pizzas, without affecting their quality is challenging. When FWBE are to be incorporated in an existing baked goods product, the resulting product must be comparable in key attributes, such as appearance, texture and taste, to the existing product, and liked by consumers as much as the product. The product must also be formulated to take into consideration serving size and allow appropriate amount of FWBE per serving size of the product as consumed. In addition, it should have a comparable shelf life.

A key factor to be taken into consideration in the development of baked goods would be the effect of FWBE on the performance of yeast during the preparation of the dough for the baked goods. FWBE should not be added during dough fermentation as they would reduce the available assailable carbohydrates, and prevents yeast to act on assailable carbohydrates to convert them into carbon dioxide and alcohol.

Another important factor affecting the product performance would be the composition of flours, particularly the amylase enzyme content of the flours as it would affect the FWBE performance in the product. Such as, rye flour contains high levels of amylase and makes it particularly difficult to formulate with FWBE.

A study to find ways to incorporate FWBE in baked goods using the product requirements described above was recently done by the author in a joint effort with the manufacturer of FWBE and the Centre for Human Nutrition at UCLA. Among the products developed were three varieties of breads, cheese pizza, coffee cake and muffins.

Basic formulations for breads and pizza were developed broadly based on information provided.

The wheat bread formulation consisted of wheat flour, flour, water, honey, vegetable oil, gluten, yeast and salt. The multigrain bread formulation consisted of water, wheat flour, flour, multigrain mix, honey, vegetable oil, yeast, gluten and salt. The rye bread formulation consisted of flour, water, rye flour, sugar, yeast, vegetable oil, caraway seeds and salt. The cheese pizza formulation had three parts: crust (flour, water, shortening, yeast, sugar, salt and gluten), pizza sauce and mozzarella cheese. Both pizza sauce and mozzarella cheese used in the experiment were retail products purchased from a local supermarket.

The coffee cake formulation was an adaptation of a basic coffee cake recipe from a retail cake mix product.

The blueberry muffin mix was a commercial product available locally.

Several trials and iterations in the method of preparation and processing conditions were required to develop successful prototypes of control and test products with white bean extract. Key factors in the preparation that influenced the product performance were the order and method of ingredient incorporation, the time and temperature requirements for the dough development, and the baking of the product.

Prototype samples of both control products and test products with white bean extract were then evaluated by an outside consumer research company (Tragon Corp) to assess consumer acceptance of the prototype test products made with white bean extract relative to a control product.

Products were tested using a sequential monadic, balanced block design by qualified consumers (heads of household, 50% female & 50% male, age 25-65, category users) in the San Francisco area.■

Results

Wheat bread:

Number of tasters -34
Hedonistic (9-point liking) Results
Control and Test were liked similarly by consumers.
The two products scored at statistical parity at the 95% and 90% confidence levels for all hedonistic means.
Control and Test scored the same (6.1) for Overall Appearance.
Test was numerically better liked for Overall Texture (6.0 vs. 5.7).
Control was numerically better liked for Overall Taste (6.4 vs. 6.1).
Control (6.0) received a slightly better Overall Opinion score than Test (5.9).

Multigrain bread:

Number of tasters -35
Hedonistic (9-point liking) Results
Control and test were liked similarly by consumers.
The two products scored at statistical parity at the 95% and 90% confidence levels for all hedonistic means.
Test was liked numerically higher than control across all hedonistic means.
Overall Appearance 6.8 vs. 6.5
Overall Texture 6.4 vs. 6.1
Overall Taste 6.5 vs. 6.3
Overall Opinion 6.6 vs. 6.1

Rye Bread:

Number of tasters -34
Hedonistic (9-point liking)
Results
Consumers scored control and test similarly for overall texture, overall taste and overall opinion.
The two products scored at statistical parity at the 95% and 90% confidence levels for all hedonistic means.
Consumers liked control significantly more than test for overall appearance (7.1 vs. 6.1).
Test was liked numerically higher than control for overall taste (6.8 vs. 6.6). ■