

ANNUAL REPORT
COMPREHENSIVE RESEARCH ON RICE
January 1, 2003 - December 31, 2003

PROJECT TITLE: Rice Utilization and Product Development

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OBJECTIVES AND EXPERIMENTS CONDUCTED BY LOCATION TO ACCOMPLISH OBJECTIVES:

1. Rice bran and phytase treated rice bran to prevent colon cancer. Phytate, a component of rice bran, that binds minerals can be removed by treatment with an enzyme, phytase. Phytase treated rice bran will be evaluated in a rat colon cancer model and compared to untreated bran.

SUMMARY OF 2003 RESEARCH (MAJOR ACCOMPLISHMENTS) BY OBJECTIVE:

1. Prevention of Colon Cancer by Rice Bran and Dephytinized Rice Bran:

We used a rat model to evaluate rice bran and phytase treated rice bran for their ability to reduce colon cancer. In a preliminary study a few years ago we showed that full fat rice bran was comparable to wheat bran and cellulose in reducing the risk of colon cancer in a rat model (Fig. 1). In this model rats are treated with a chemical that induces an early stage of colon carcinogenesis called aberrant crypt foci (ACF). The number of ACF are related to the risk of colon cancer. We fed rats diets containing cellulose, wheat bran and rice bran. These fiber sources contain almost all insoluble fiber. We have also shown that MC, a soluble fiber, increases cancer risk when it is the only source of fiber. Both wheat bran and rice bran contain about 50% cellulose and 50% hemicellulose. Cellulose passes through the digestive system mainly undigested. Some hemicellulose is digested and provides nutrient to the colon as well as antioxidants that make up part of the hemicellulose. Rice bran contains some of the highest concentration of phytate in plant foods (Table 1). Phytate or inositol hexaphosphate is high in phosphate. This compound is often considered an antinutrient because it binds and decreases the bioavailability of zinc and iron. Phytate can cause decreased weight gain in animals if not compensated for by sufficient zinc and other minerals. The enzyme phytase can convert phytate to derivatives that do not bind minerals as strongly.

Stabilized full fat rice bran was defatted by solvent extraction with hexane (Fig. 2). Rats were fed stabilized full fat rice bran, defatted rice bran, and phytase treated full fat rice bran for about 3 months. Compared to the control cellulose diet the rats on full fat rice bran had higher body weight. The rats on the defatted and phytase treated full fat rice bran were similar in weight to the control. Colon and other tissues were removed for histological examination. Colon ACF counts are in progress.

2. Conversion of Phytate to Cell Signalling Agents

An international research project with Dr. Abdulla Abdel-Gawad, Assuit University, Egypt to identify and isolate microbial phytases that can convert phytate or phytic acid into derivatives that are thought to be beneficial cell signaling agents in humans. The Egyptian laboratory will test phytases from soil micro-organisms and the U.S. laboratory will provide analytical support to identify the derivatives from the microbial fermentation.

Table 1.

	Phosphorus, g/100 g DM	% as Phytate P	Phytic acid, g/100 g DM
Rice Bran	1.34	76.9	3.65
Wheat Bran	1.15	49.6	2.02
Soy Bean Meal	0.63	60.3	1.35
Brown Rice	0.38	73.7	0.99
Polished Rice	0.31	54.8	0.60

Fig. 1.

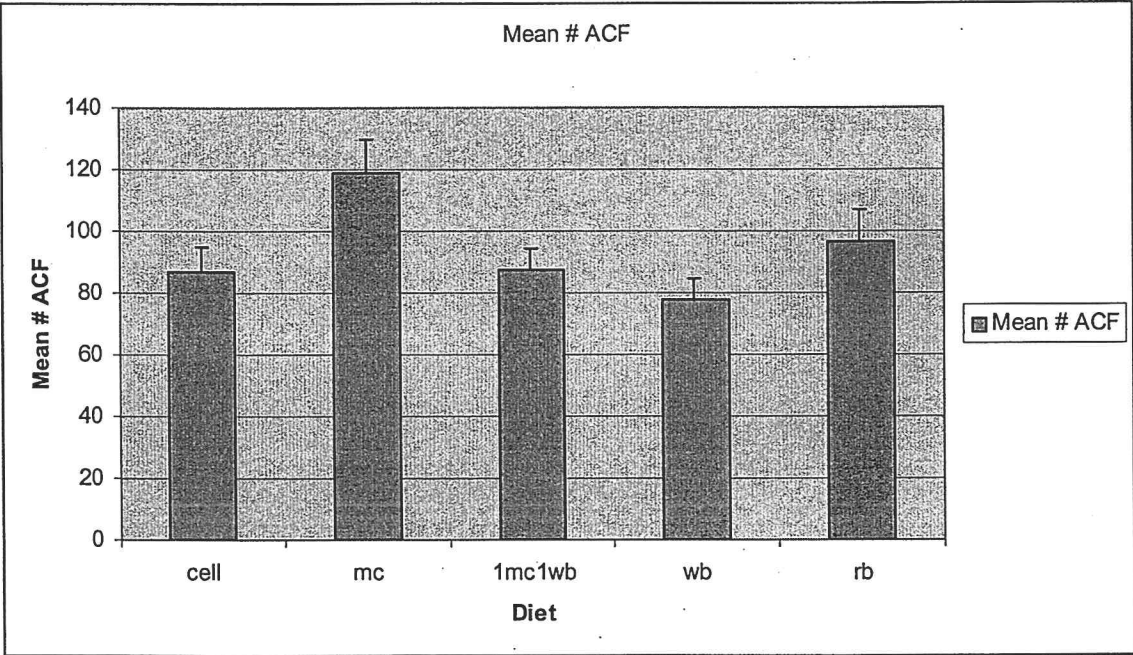
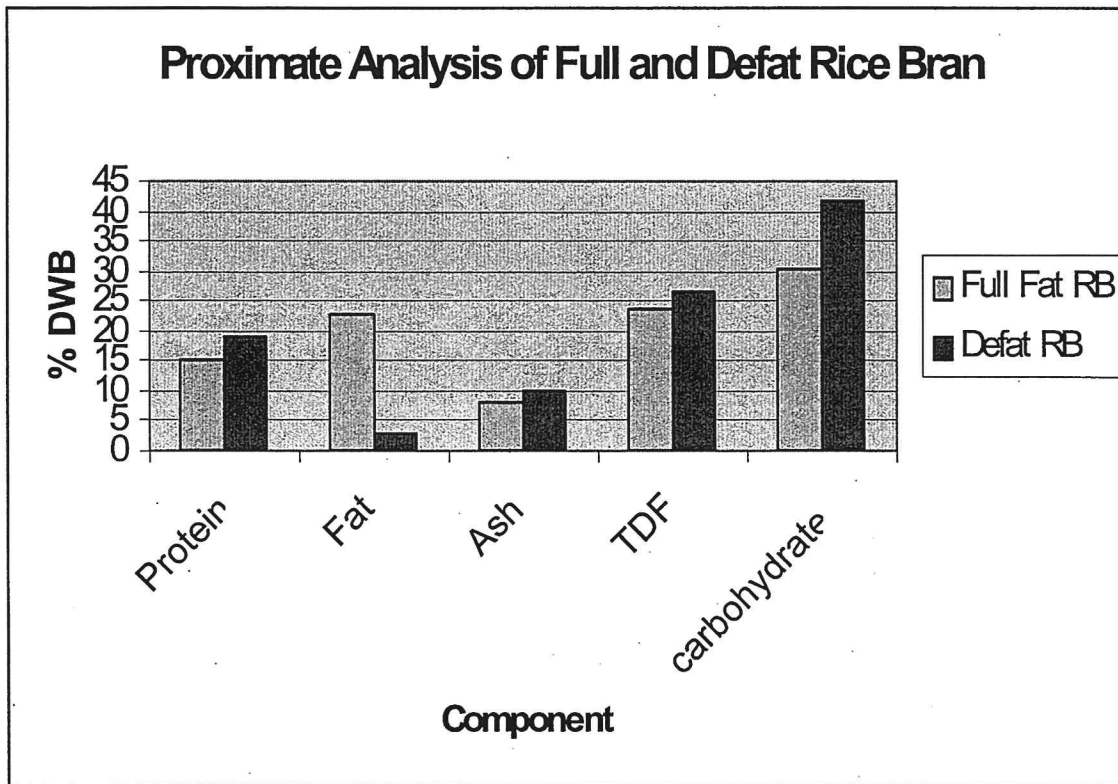


Figure 2.



PUBLICATIONS OR REPORTS:

Yokoyama, W. H. Rice Nutrition. Book Chapter. Rice: Chemistry and Technology, 3rd Edition. Ed. By E. Champagne, AACC Press. St. Paul, MN. In press.

Kahlon, T. S. and Woodruff, C. L. 2003. *In Vitro* Binding of Bile Acids by Various Ready to Eat Breakfast Cereals. Cereal Foods World 48:73-75.

Kahlon, T. S. and Keagy, P.M. 2003. Benefits and Sources Funtional Foods. Cereal Foods World. 48:112-115.

Kahlon, T. S. Cholesterol Lowering with Grain Fractions. Getreide Mehl Und Brot. (Accepted 9/30/2003).

CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

Rice bran was treated with phytase an enzyme that degrades phytic acid. The phytase treated rice bran as well as full fat rice bran and defatted rice bran were evaluated for their colon cancer preventing properties in a rat model. The tissues are still under examination.