

ANNUAL REPORT
WESTERN REGIONAL RESEARCH CENTER, ARS, USDA
COMPREHENSIVE RESEARCH ON RICE
January 1, 1992 - December 31, 1992

PROJECT TITLE: Rice Utilization and Product Development

PROJECT LEADER: R. N. Sayre
Research Leader
Cereal Product Utilization Research Unit
Western Regional Research Center, ARS, USDA
Albany, California 94710
(510) 559-5664 FAX (510) 559-5626

WRRC INVESTIGATORS: M. M. Bean
R. Becker
R. H. Edwards
T. S. Kahlon
W. Yokoyama
M. M. Chiu
F. I. Chow
C. A. Hudson
R. E. Miller
A. P. Mossman
C. Nihaniv
L. Zaragoza

LEVEL OF 1992 FUNDING: \$25,000

PROPOSAL OBJECTIVES: To carry out research on California rices that ultimately will lead to new products for domestic and foreign markets.

RESEARCH OBJECTIVES:

1. Stabilized Rice Bran
2. Rice Technology
3. Extrusion Technology
4. Rice Quality Assessment

SUMMARY OF 1991 RESEARCH (MAJOR ACCOMPLISHMENTS) BY OBJECTIVE:

1. Stabilized Rice Bran: Starch and protein have been enzymatically removed from stabilized rice bran to obtain rice fiber which was used in feeding studies to determine its effect on cholesterol metabolism. Experimental procedures which more realistically simulate the manner by which hypercholesterolemia is induced in humans are being evaluated using the hamster model. A micro-chromatographic method has been developed to measure the plasma cholesterol status in a drop of hamster blood. This allows repeated use of animals and screening of various components from rice bran for influence on blood lipid and cholesterol status. An experiment is now in progress to evaluate and quantitate the LDL receptor mediated clearance by the liver of serum cholesterol. The objective of this research is to understand the mechanism by which rice bran components affect cholesterol absorption, synthesis, and clearance.

The unsaponifiable lipid fraction was isolated from rice bran and added to a cellulose based diet at 1X and 2X the level found in rice bran. These diets were compared to rice bran based diets containing similar levels of unsaponifiable lipids. A dose response was noted in the amount of cholesterol lowering, and rice bran diets lowered cholesterol twice as much as cellulose diets with comparable amounts of unsaponifiable matter indicating cholesterol lowering activity in both unsaponifiable matter and in other components of rice bran.

A preliminary study on the influence of storage temperature on the flavor of stabilized rice bran in baked products indicated a significant improvement when the bran was stored at refrigerated temperatures prior to use in baking. A more detailed study is planned for the immediate future.

2. Rice Technology: Long grain and short grain rice were cooked and repeatedly freeze-thawed then evaluated with the differential scanning calorimeter (DSC). The long grain but not the short grain rice contained an endotherm in the DSC thermogram at about 160°C. This endotherm is expected to be the amylose retrogradation endotherm. Amylose retrogradation is undesirable in rice but desirable in baking applications. Physical characterization of this endotherm is important to the textural understanding of rice based products.
 3. Extrusion Technology: Work is progressing on the production of a high quality rice pasta product. Short and medium grain flour fed directly to the twin screw extruder resulted in a product with excessive disintegration during cooking. Use of long grain flour produced only a partial improvement. Preconditioning the flour by increasing the moisture content to 20-35% and tempering overnight significantly improved the processing and cooking characteristics of the extruded pasta with retention of shape and a desirable cooked taste and texture. Recent installation of an on-line steam preconditioner at the extruder resulted in similar product characteristics without the extended holding period. Higher temperature preconditioning resulted in pasta with shorter cooking time but with similar firmness and cooked physical integrity. Cooked characteristics were measured using an Instron Universal Testing Machine. New snack food products were prepared using novel extruder modifications of preconditioning and precooling.
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4. Rice Quality Assessment: A collaborative study was developed with the USDA Instrumentation and Sensing Laboratory at Beltsville, MD and the Grain Research Laboratory in Winnipeg, Manitoba, Canada to predict amylose content in rice cultivars and commercial rices. Rice samples from the 1988, 1989, and 1990 crops were ground at Albany and then scanned at all three near-infrared reflectance (NIR) laboratories to determine if the instruments were measuring the same attributes at all three locations. The 1992 crop rices are being sent as milled whole kernel rices to each laboratory for grinding and scanning to determine the extent of laboratory variation in the entire testing process. Kent McKenzie of the California Rice Research Foundation organized breeders to obtain samples which have expanded to a set of 50 varieties from each of five rice-producing states. WRRC scientists have been working with NIRSystems, a major NIR instrument manufacturer, who is interested in developing an instrument specifically for rice analysis.

PUBLICATIONS AND REPORTS:

Kahlon, T. S., Chow, F. I., Knuckles, B. E., and Chiu, M. M. 1992. Cholesterol-lowering in hamsters by barley fractions, rice bran and oat bran, and their combinations. *FASEB J.* 6:A1080 #835.

Kahlon, T. S., Chow, F.I., Chiu, M. M., and Hudson, C. A. 1992. Cholesterol-lowering in hamsters by unsaponifiable matter from rice bran. *Cereal Foods World* 37:568.

Kahlon, T. S., F. I. Chow, R. N. Sayre, and A. A. Betschart. 1992. Cholesterol-lowering in Hamsters fed rice bran at various levels, defatted rice bran and rice bran oil. *J. Nutr.* 122:513-519.

Kahlon, T. S., Saunders, R. M., Sayre, R. N., Chow, F. I., Chiu, M. M., and Betschart, A. A. 1992. Cholesterol-lowering effects of rice bran and rice bran oil fractions in hypercholesterolemic hamsters. *Cereal Chem.* 69:485-489.

Kahlon, T. S., Chow, F. I., and Sayre, R. N. 1992. Cholesterol-lowering with rice bran and rice bran oil fractions. *Rice Field Day, Biggs, CA (Abstract)*

CONCISE GENERAL SUMMARY OF CURRENT YEAR'S RESULTS:

1. Micro methods have been developed to allow the reuse of experimental animals in nutritional studies. This will allow the screening of components from rice bran to test their effect on lipid and cholesterol status of the blood and to monitor the formation or remission of atherosclerotic lesions in the aorta. Unsaponifiable lipids have been shown to lower serum cholesterol on a dose response basis, but whole rice bran is about twice as effective as the unsaponifiable matter alone. A preliminary storage study had been conducted to try to determine conditions for reducing oxidative flavor deterioration in rice bran as a food ingredient.
2. The effects of cooking and repeated freeze-thaw cycles on long and short grain rice were tested with the differential scanning calorimeter (DSC). Endotherms associated with retrogradation of the starch were evaluated in order to develop and understanding of textural changes in rice containing baked products.

3. Preconditioning rice flour by increasing the moisture content to 20-35% and tempering overnight prior to extrusion prevented excessive disintegration of rice pasta during cooking and significantly improved the processing characteristics of extruded rice products. Recent installation of an on-line steam preconditioner at the extruder has made rice pasta production a continuous process.
4. Prediction of amylose content in rice cultivars by NIR technology is being jointly evaluated at WRRC, the USDA Instrumentation and Sensing Laboratory, Beltsville and the Grain Research Laboratory, Winnipeg. Samples prepared at Albany are being scanned at all three locations to test instrument variation. Whole grain samples from the 1992 crop will be sent to the three locations to test the extent of laboratory variation in the entire testing process.