

Canned native-style concentrates for Puerto Rican-flavored rice dishes¹

Isabel Beauchamp de Caloni² and Teresita Rodríguez³

ABSTRACT

A simple standard method was developed for the preparation of native flavored rice dishes using canned concentrates as a base. Heat penetration studies were conducted at the pilot plant to prepare concentrates with chicken, codfish, pink beans, Vienna and pork sausages. The sterilization process for each concentrate was determined by graphic and numerical methods. Microbiological analyses for low acid canned products proved them to be commercially sterile and thus marketable. A taste panel evaluated the rice dishes prepared with the concentrates at 0, 2 and 4 months storage. Appearance and flavor of the rice dishes were found acceptable up to 4 months of storage.

RESUMEN

Concentrados enlatados para platos a base de arroz con sabor típico puertorriqueño

Se desarrolló un método uniforme y sencillo para preparar platos de arroz con sabor típico a base de concentrados enlatados. Los estudios de penetración de calor se hicieron en la planta piloto de elaboración para el enlatado de concentrados con pollo, bacalao, habichuelas rosadas, salchichas y chorizo. Los procesos para esterilizar los concentrados se determinaron mediante métodos numéricos y gráficos. Los análisis microbiológicos para productos enlatados de baja acidez demostraron la esterilidad comercial del producto. Un grupo de catadores evaluó los platos de arroz confeccionados con los concentrados a los 0, 2 y 4 meses de almacenamiento. Todos los platos fueron aceptables durante todo el estudio en apariencia y sabor.

INTRODUCTION

The two major food cereals, rice and wheat, provide a large proportion of the total nourishment of the world's population (1). However, available information on rice is scattered, in contrast to that of wheat, which has been well researched and published.

Rice is grown in more than 100 countries on every continent of the world (except Antarctica) from north to south latitudes. It is the main staple food for one half to two thirds of the world population. It accounts for one half to one third of the caloric intake (7). Rice protein has one of

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²Food Technologist, Laboratory of Food Technology.

³Research Associate, Laboratory of Food Technology.

the highest nutritive values among cereal proteins. Protein quality of rice can be enhanced with amino acid enrichment. By law, rice is enriched with vitamins and minerals in premix kernels added during processing (7).

Puerto Ricans, as well as people in other Caribbean islands, are great consumers of rice, which is prepared in a variety of stewed dishes mixed with meat, fish, poultry or vegetables. The preparation of such dishes is time consuming work. Pre-cooked rice products requiring minimum effort have been studied in other countries. Processes for the preparation of pre-cooked paella, rice flakes flavored with tropical fruit pulp, and extruded quick-cooking rice-like products are available (4, 8, 9, 10, 13). In the Orient, the manufacture of rice snack foods such as crackers, cake, chocolate and chewing gum is a promising industry (7). Other rice products produced in China and Japan are flours, noodles, bran, wine and rice oil.

This research was done to determine the feasibility of canning native style concentrates to be used as a base for preparing popular Puerto Rican-flavored rice dishes in a simple standard way.

MATERIALS AND METHODS

We developed formulas for the elaboration of five concentrates to be used as a base for preparing native flavored rice dishes. The chicken concentrate had the following formulation per can (454 g) of product:

<i>Ingredient</i>	<i>Weight (g)</i>	<i>%Weight</i>
Onion	73.2	16.1
Pepper	18.3	4.0
Garlic	2.2	0.5
Sweet peppers	3.7	0.8
Coriander	0.7	0.2
Marjoram	0.5	0.1
Vegetable oil	4.1	0.9
Tomato paste	41.7	9.2
Olives and capers	25.6	5.6
Water	95.9	21.2
Salt	5.2	1.1
Chicken pieces	182.9	40.3
Total	454.0	100.0

For chicken concentrate, skins were removed from chicken breasts, which were cut into 1 1/2- 2-inch pieces (36.6 g). Onion, pepper, garlic cloves, sweet peppers and coriander were ground in an electric blender. The vegetables were cooked in hot oil in a steam jacket kettle (8 to 10 PSI) for 8 minutes. Tomato paste and prepared chicken pieces were

added to the kettle along with the salt, marjoram, olives and capers and water. Chicken was cooked in the sauce (8 to 10 PSI) for 20 minutes until chicken pieces reached an internal temperature of 160° F. Water was added to the kettle to compensate for evaporation. The concentrate was heated to 185° to 190° F.

C-type enameled 33 x 406 cans were filled with five pieces of chicken and enough concentrate to total 454 g (16 oz.).

Table 1 presents formulation per can (454 g) of pink bean, pork sausage, Vienna sausage and codfish concentrates.

Codfish was desalted in boiling water for 3 minutes, after which time the water was discarded. Pink beans were soaked in tap water at room temperature to 100% weight and blanched at 190°F (87.8°C) for 3 minutes before canning. Vienna sausages (salchichas) were cut in pieces 0.5 inch thick and pork sausages (chorizo) in pieces 0.25 inch thick × 1 inch diameter.

For the codfish, bean and sausage concentrates, vegetables were ground and cooked, and spices were added by the same method as for the chicken concentrate. To each 303 × 406 C-enameled can, 150 g of beans, pork or Vienna sausage, or 160 g of codfish was added. Prepared concentrate was added to complete a total weight of 454 g (16 oz) per can.

After canning, concentrates were heat sterilized in a retort at 250° F (121.1° C). Heat penetration was monitored with a Kaye Digi 4 M System

TABLE 1.—Concentrate formulation per can (454 g) of product

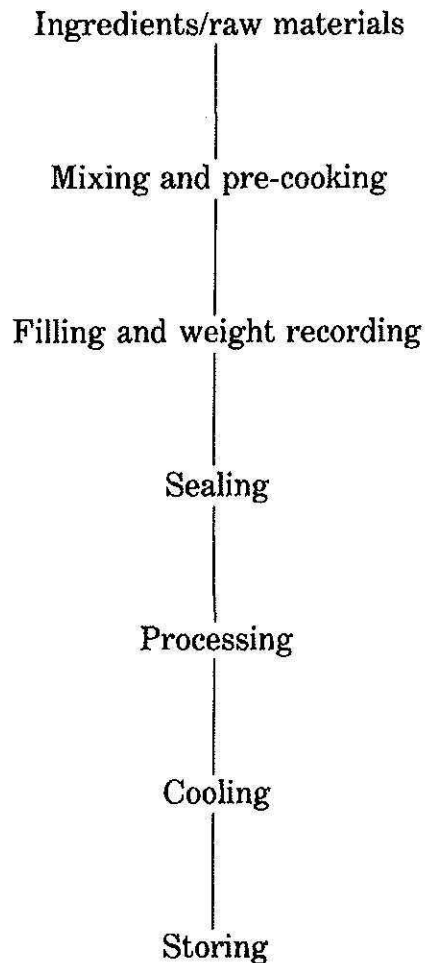
Ingredient	Beans or sausages weight (g)	Codfish	Beans or sausages % weight)	Codfish
Onion	84.5	81.7	18.6	17.9
Peppers	21.1	20.4	4.7	4.5
Garlic	2.5	2.44	0.6	0.5
Sweet peppers	4.2	4.1	0.9	0.9
Coriander	0.8	0.8	0.2	0.2
Marjoram	0.3	0.3	0.1	0.1
Vegetable oil	4.8	4.6	1.0	1.0
Tomato paste	48.1	46.6	10.6	10.3
Olives and capers	21.1	20.4	4.6	4.5
Water	110.6	106.9	24.4	23.6
Salt	6.0	5.8	1.3	1.3
Pink beans or sausages	150.0	----	33.0	----
Codfish	----	160.0	----	35.2
Total	454.0	454.0	100.0	100.0

(Bedford Ma)⁴ to record temperature and time. Cold spot (slowest heating point inside the can) was determined with Ecklund t-type 1 9/16 inch molded plastic thermocouples placed at 3/4 inch, 1 inch, 1 1/2 inch and 2 1/8 inch measured from the bottom of the can.

To calculate the sterilization process, we chose a Z value of 18 (the number of degrees Fahrenheit required for the thermal destruction curve to traverse one logarithmic cycle). The sterilization process in minutes (F value) and processing time were determined by the graphic (General method of Bigelow) and numerical (Patshnik) methods (2, 5, 11, 12).

Within five days of elaboration, we did microbiological analyses to detect organisms capable of growing in low acid canned foods. We used cooked meat medium and bromocresol purple broth tubes incubated at 35° C (95° F) and 55° C (131. F) for 120 and 72 hours, respectively (3).

Flow diagram of processing steps in the canning of the five concentrates:



⁴Trade names in this publication are used only to provide specific information. Mention of trade names does not constitute a warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

For sensory evaluation, rice dishes were prepared with 1 1/2 cups rice and 1 1/2 cup water per can of concentrate. The concentrate was heated for a few minutes. Rice and water were added and mixed well. Rice was cooked on top of stove at medium heat until water was absorbed. Then it was covered and allowed to cook for an additional 20 to 25 minutes. The prepared rice dishes were sensory evaluated as to appearance and flavor by a taste panel using the +2, -2 scale (+2 = very acceptable; -2 = not acceptable) at 0, 2 and 4 months storage (6).

RESULTS AND DISCUSSION

Table 2 shows the heat sterilization data of the five canned products. Net and drain weights, initial temperature, Fo values [number of minutes at 250° F (121° C) necessary to achieve commercial sterility] and total process time were calculated for each product. Cold spot of cans was determined at 2 1/8 inches from the bottom of the can at the geometrical center. The data of the slowest heating can was used as the basis for estimating the Fo value and processing time. The Fo value of the products varied from 15.52 for the concentrate and sausages to 19.63 minutes for the concentrate and beans. Total processing time (minutes) ranged from 74.0 for the concentrate and sausage to 94.5 for the concentrate and codfish.

Sterilization processes suggested in this study are for these particular formulas and for experimental purposes only. Any changes in the formulas, size and shape of cans, fill-in weight or initial temperature of product may alter the thermal processes determined, thus affecting the safety and quality of the product. For any commercial production of these products, a thermal process to assure commercial sterility (a condition achieved by the application of heat necessary to destroy all viable forms of pathogenic microorganisms or of organisms capable of spoiling a product under non refrigerated storage condition) should be calculated

TABLE 2.—Heat sterilization data of five different products in 303 × 406 cans¹

	Net weight	Drain weight	Initial temperature	Fo	Tp ²
	g	g	°F	min.	min.
Chicken	464.60	224.20	174.50	19.41	84.0
Bean	493.87	379.28	153.40	19.63	92.5
Sausage (salchicha)	430.67	227.28	184.20	15.52	74.0
Sausage (chorizo)	460.56	219.94	175.50	18.24	90.0
Codfish	481.88	363.08	134.50	17.30	94.5

¹Retort temperature: 250° F (121.1° C).

²Total process time. A Z value of 18 was assumed.

TABLE 3.—Sensory evaluation of rice dishes prepared from concentrates

Rice dish	Mean values ¹					
	Appearance			Flavor		
	0 ²	2	4	0	2	4
Rice with chicken	1.55	1.42	1.25	1.18	1.25	1.17
Rice with pink beans	1.60	1.40	0.70	1.30	1.20	0.90
Rice with codfish	1.58	1.30	1.13	1.42	0.90	1.00
Rice with sausages (salchicha)	1.00	1.22	1.22	1.00	1.11	1.00
Rice with pork sausage (chorizo)	1.25	1.60	1.33	1.00	1.40	1.67

¹ +2, -2 scale; +2 = very acceptable; -2 = not acceptable.

² 0, 2, 4 = months in storage.

by a processing authority recognized as such by the U.S. Food and Drug Administration.

Microbiological analyses (data not presented) showed that the products were free from organisms. Safety of the thermal processes given to the canned products was thus confirmed.

Table 3 presents the sensory evaluation of rice dishes prepared with the canned concentrates. All rice dishes were rated acceptable in appearance and flavor at 0-, 2- and 4- month evaluation. Rice with sausages (chorizo) and rice with chicken scored the highest in appearance and flavor when evaluated after 4 months storage of the concentrate.

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