

Frozen chicken products¹

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ABSTRACT

From 1987 to 1990 Puerto Rico imported an average of 148 million pounds of chicken per year. Even though local poultry production has been steadily increasing, there is still need to replace imports with locally elaborated products. To provide alternatives that can be used to diversify and increase local poultry production, we developed convenience frozen products: fricassee, patties, nuggets, rolls, uncooked and precooked breaded breast fillets and baked chicken in cream sauce. The sensory parameters measured included appearance, flavor, texture and overall acceptability. All samples were evaluated for up to 6-month frozen storage. Results indicated that all products developed were highly rated by the taste panel. This finding suggests that there is a market potential for the developed products. A quality shelf-life of at least 6 months should prove adequate to provide enough room for successful marketing. Since these products were formulated as prime quality foods, ingredient substitution or omission to lower production cost could be considered by whoever produces these products commercially if such cost reduction is desired.

RESUMEN

Productos congelados de pollo

De 1987 a 1990 Puerto Rico importó un promedio de 148 millones de libras de pollo por año. Aunque la producción local de pollos ha estado aumentando constantemente, se hace necesario substituir importaciones con productos elaborados localmente. A manera de proveer alternativas que puedan utilizarse para diversificar y expandir la producción local de pollos, se desarrollaron varios productos congelados. Estos incluyeron fricasé, hamburguesas ("patties"), "nuggets", pastelón enrollado, filetes de pechuga empanados crudos y precocidos y pollo asado en salsa cremosa. Los resultados obtenidos indicaron que todos los productos desarrollados fueron considerados del gusto del panel de catadores. Los parámetros sensoriales evaluados incluyeron apariencia, sabor, textura y aceptabilidad general. Todas las muestras se evaluaron por hasta 6 meses de almacenaje congelado. Estos resultados señalan el buen potencial de mercadeo de estos productos. Una durabilidad en almacenaje de por lo menos 6 meses sin que se pierda calidad debe ser adecuada para proveer suficiente tiempo para un buen mercadeo. Debido a que estos productos fueron formulados como alimentos de alta calidad, quien los vaya a producir comercialmente podría considerar substituir u omitir ingredientes a manera de reducir los costos de producción según las exigencias del mercado.

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INTRODUCTION

The poultry industry in Puerto Rico has a considerable economic impact. During the last 7 years, the net increase in chicken production reached an average of 55.2 million pounds a year, which represents an increase of 95.2%. In 1989-90, 1988-89, 1987-88, 1986-87, 1985-86, 1984-85 and 1983-84, local chicken production totalled 113.2 (preliminary figure), 117.5, 111.5, 93.5, 85.5, 72.8 and 58.0 million pounds, respectively (7, 11). In terms of millions of dollars, the value of the chicken production for the years 1986-87, 1987-88, 1988-89 and 1989-90 was 65.2, 79.7, 80.6 and 77.4 (preliminary figure), respectively (6, 7). From 1986-87 until 1989-90 Puerto Rico imported an average of 148.3 million pounds of chicken (7). This quantity is 36% more than the average local chicken production for the same time period.

On the basis of the above data, part of these chicken imports must be replaced with chicken produced locally if this industry is to continue growing. A feasible way in which local chicken consumption and production may be further stimulated is by diversifying production to offer a variety of processed or partially processed poultry products attractive to present-day time-saving oriented consumers. Because consumers continue to want convenience and nutritious products, the industry must continue its search for different new ways to present them. The marketing thrust of the poultry industry in the 90s will continue to target value-added merchandising and the health-conscious consumer (4).

Frozen chicken products have been one of the most popular lines of new foods developed over the past decade. Among the many frozen chicken products developed are chicken roll, patties, wieners, hogies, breaded breast fillets and strips, nuggets, fried chicken, baked chicken and gourmet entrees, such as chicken kiev, cordon bleu and stuffed boneless breasts (1, 3, 8, 10). The development of chicken products can also be found in Europe and Central and South America (2, 5, 12).

The chicken products that have been, and are being, developed are targeted towards the fast food industry and to retail outlets. If the local poultry industry can satisfy part of this demand, a share of this growing market could be captured. The purpose of this study was to develop quality convenience frozen chicken products that could be produced locally.

MATERIALS AND METHODS

Two general types of frozen chicken products were developed. One type was comprised of comminuted products (patties, nuggets and roll) while the other was comprised of non-comminuted ones (fricassee, uncooked and precooked breaded breast fillets, and baked chicken in cream sauce).

Product development

NON-COMMINUTED TYPES

Fricassee

Chicken breasts and thighs were purchased locally. They were seasoned with 114 g olive oil, 12 garlic cloves, 134 g salt, 158 g vinegar and 2 g oregano per 10 lb (4.55 kg) chicken parts. The seasoned chicken was kept overnight in the refrigerator (7.2°C; 45°F).

A condiment seasoning ("sofrito") was prepared with 57 g sweet pepper, 400 g bell pepper, 240 g olives, 18 g capers, 6 bay leaves, four 7-ounce (199 g) cans of sweet red pimentos, 30 g vegetable shortening colored with annatto, 200 g olive oil, eight 7-ounce (199 g) cans of tomato sauce, 1,500 g onions, 5 coriander leaves and 454 g water. The sweet and bell peppers, onions and coriander were ground together in an electric grinder.

The olive oil and the colored vegetable shortening were heated. The ground mixture was added and allowed to saute at low heat for approximately 10 minutes. All the other above ingredients were then added, mixed, and the batch was divided into two portions. To one of these portions we added 10 lb (4.55 kg) of seasoned chicken breasts, and 10 lb (4.55 kg) of seasoned chicken thighs to the second and cooked both portions over medium heat for 10 minutes. To each we added 9 lb (4.1 kg) of cut potatoes. We cooked breasts over medium heat for an additional 35 minutes; the thighs, for 45 to 50 minutes. During this last cooking stage, we added 1 cup (227.2 g) white cooking wine to each portion.

Once the fricassee was ready, either half a split breast or one thigh was placed inside a boilable plastic pouch together with 225 g potato, 1 teaspoon sweet peas and 30 g of the fricassee sauce. The pouches were heat-sealed and frozen.

Uncooked and precooked breaded breast fillets

Twenty-two pounds (10 kg) of boned chicken breasts was sliced into 100 fillets, which were then pounded thin. We prepared a batter consisting of 134 g wheat flour, 608 g water, 4 whole eggs, 0.6 g mixed herb poultry seasoning, 6 g NaCl, 0.4 g ground black pepper, 2.6 g monosodium glutamate, and 2 g commercial "adobo" (powdered seasoning mixture of salt, garlic, monosodium glutamate, oregano and calcium silicate).

All batter ingredients were mixed in an electric blender. Each breast fillet was dipped into the batter and then placed in bread crumbs. Half of the breaded fillets were deep fried in corn oil at 182°C (350°F) for 1.5 minutes. The other half of the breaded fillets were not cooked.

All breaded fillets were individually placed in a plastic pouch, vacuum sealed and frozen.

Baked chicken in cream sauce

Thirteen pounds (5.9 kg) chicken breasts with bone was seasoned with 78 g NaCl, 1.5 g ground black pepper, 7 garlic cloves, 27 g olive oil and 17 g vinegar. The chicken breasts thus seasoned were baked at 204.5°C (400°F) for 50 minutes.

A cream sauce was prepared with 115 g margarine, 1363 g chicken broth prepared with 5 chicken consomé cubes, 28.5 g wheat flour, 511 g milk, 43 g fresh onion and 1 cup (227.2 g) white cooking wine. The onions were sauted at medium heat in the melted margarine and the flour was added to form a paste. The broth and milk were then gradually added with constant stirring. The heat was reduced to low and the mixture allowed to cook for 3 minutes. The wine was then added.

A baked chicken breast was placed inside a boilable plastic pouch together with 85.2 g hot cream sauce. All pouches were heat-sealed and frozen.

COMMINUTED TYPES

Patties, nuggets, roll

Whole chickens were washed and cleaned and their wing tips cut. The entire skin was removed and the chicken was completely boned. All the meat obtained was ground with a 1/4 in. (0.64 cm) plate. Giblets (heart, livers and gizzard) were ground separately.

Necks, wing tips, bones, chassis and giblets were boiled for approximately 1 hour. Adhered meat was removed and, together with the giblet, ground with a 1/4 in. (0.64 cm) plate. Skins were boiled until tender and ground with a 1/8 in (0.32 cm) plate. These ingredients were mixed with equal amounts of the broth produced in the boiling process until a fine emulsion was formed. This emulsion was placed in a tray and chilled at 4.4° - 7.2°C (40-45°F).

Once the emulsion was cold, it was mixed with the raw ground meat previously obtained. Two pounds (0.91 kg) NaCl, 85.2 g monosodium glutamate and 42.6 hydrolized vegetable protein (HVP-AV Powder, Hercules Inc., PFW Division, Wilmington, DE)⁴ was added per 100 lb (45.5 kg) emulsion. The amount of cooked adhered meat and giblet added was

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

equivalent to 5% total weight of emulsion. After thorough mixing for approximately 3 min, we formed 100-g patties.

For the nuggets, we used an additional 6 beaten whole eggs, 150 g wheat flour and 225 g bread crumbs per 1,250 g emulsion. The chicken emulsion was shaped into 25-g pieces, each of which was enveloped in successive covering of flour, egg and bread crumbs, in that order.

For the roll, 1 beaten whole egg, 1 teaspoon ground garlic, 70 g bread crumbs and 3 hard-boiled eggs were additionally used per 750 g emulsion. The chicken emulsion was mixed well with the beaten egg, garlic and bread crumbs and extended to form a rectangle. The 3 hard-boiled eggs were lined on one side of the rectangle and the whole mass was formed into a roll. The roll was covered first with wax paper and then with aluminum foil.

All patties, nuggets and rolls were subsequently frozen.

Freezing procedure

All products here described were frozen in a plate freezer (-40°C; -40°F); and stored frozen at -23.3°C (-10°F).

Sensory evaluation and statistical analysis

After 1, 4 and 6 months of frozen storage, samples were sensory evaluated. A panel of 10 untrained persons independently judged aspects as appearance, flavor, texture and overall acceptability. Results were submitted to analysis of variance using the Duncan's Multiple Range Test (9).

RESULTS AND DISCUSSION

Table 1 summarizes the results obtained in the sensory evaluation and shelf-life of all frozen chicken products developed. All products were found acceptable during the 6-month frozen storage period covered in the study.

The chicken fricassee received ratings of over 5.0 (like) in all aspects considered along the entire length of the study. The high quality of the finished product, together with its convenience (product is reheated by placing pouch in boiling water), makes this frozen fricassee a promising food item.

Both the chicken patties and nuggets were also highly rated (overall acceptability over 5.0). The utilization of giblet and bone-adhered meat in the formulation of these products represents a viable alternative for this material, from which it would otherwise be difficult to benefit.

The precooked breaded chicken fillets were rated higher than the uncooked ones. This observation, however, was based only on a single

TABLE 1.—Sensory evaluation and shelf-life of various chicken products.

Days in Frozen Storage	Mean Values ¹			
	Appearance	Flavor	Texture	Overall acceptability
Chicken fricassee				
0	5.48	5.37	5.84 ab ²	5.44
30	5.41	5.32	5.02 b	5.15
120	5.19	5.38	5.57 a	5.42
180	5.61	5.22	5.22 ab	5.15
Chicken patties				
0	5.09	5.40	5.30	5.40
30	5.22	5.22	5.44	5.33
120	5.00	5.60	5.40	5.60
180	4.90	5.40	5.20	5.30
Chicken nuggets				
0	5.05	5.23 cd	5.06	5.24
30	5.17	4.88 d	4.98	5.09
120	5.24	5.17 cd	5.16	5.26
180	5.54	5.41 c	5.40	5.42
Breaded chicken fillets - uncooked				
0	4.83 e	5.08	4.92	5.08
30	---	---	---	---
120	---	---	---	---
180	---	---	---	---
Breaded chicken fillets - pre-cooked				
0	5.50 f	5.25	5.16	5.33
30	---	---	---	---
120	5.20	5.41	5.29	5.31
180	5.34	5.06	5.05	5.25
Chicken roll				
0	5.23 g	5.13	5.18	5.30
180	4.57 h	4.68	5.02	4.80
Baked chicken in cream sauce				
0	4.55	5.55 l	5.18	5.09
180	4.09	4.73 j	4.73	4.82

¹6-point hedonic scale; 6 = like very much; 5 = like, 4 = like moderately, 3 = indifferent, 2 = dislike moderately, 1 = dislike. Mean values above 4.00 are considered acceptable. These values represent an average of 10 samples.

²Means within a column in a given chicken product that are followed by a common letter or by no letter at all are not significantly different ($P \leq 0.05$).

initial evaluation of the uncooked fillets. It would appear that the pre-cooked product has a better possibility of success than the uncooked one.

The chicken roll and the baked chicken in cream sauce tied for the lowest ratings in overall acceptability after 6-month frozen storage, 4.80 for the former and 4.82 for the latter. These values, however, make the products perfectly acceptable since they lie between 4 (like moderately) and 5 (like), and much closer to this second value than to the first.

The ratings received along the entire length of the study by all the frozen chicken products developed indicate the market potential these products possess. A quality shelf-life of at least 6 months seems adequate for these frozen foods and it should provide enough room for successful marketing.

Because all products were formulated with high quality natural ingredients, and thus are all prime quality items, they would command a relatively high price. Ingredients, however, can be replaced with lower-priced ones or omitted to lower costs, but it must be understood that this would be at the expense of the quality of these foods. Our purpose was to develop prime quality foods that could be used as some sort of standard, which could then be modified to suit the specific objectives or requirements of whoever produces them commercially.

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