Soya Protein Products for Institutional Feeding Systems

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ABSTRACT

This paper deals with aspects of the production and use of soybeans in Brazil, and the contribution by the Instituto de Tecnologia de Alimentos, ITAL, to the research and development of popular institutionalized products, based on soybeans. Two programs for food supplementation, one on a national level, and the other on a regional level, are described. All the products utilized contain soybeans as a protein source, and are directed at 6-to-14-yr-olds. The paper also describes products that the food industry has commercialized for the official institutional programs, industrial and hospital restaurants. The report also shows the results of a campaign to increase the use of soybeans by the population.

INTRODUCTION

Of the foods of vegetable origin produced in Brazil, the soybean occupies fifth place with respect to production; although if only the cereals and leguminous plants are considered, it occupies second place, losing only to corn. This fact, although significant, does not reflect the current food choices of the Brazilian population; those choices are mainly rice and common beans (*Phaseolus vulgaris*).

About 9 million tons of soybean were produced in 1979 (1), and the 1980 crop is estimated at 15 million tons. Commercialization of soybeans in Brazil began during the 1950s (2). Most soybeans were destined for export in the form of beans, meal and oil (3) (Table I), with large incentives. This is probably the reason for the steady increase in production of soybeans. Meanwhile, the food industry has been producing soybean oil for a long time, and this has always been sold at a more reasonable price to the Brazilian consumer than other similar oils. During the last few years, there has been a steady increase in the production of dehydrated formulated products, soybean being one of the main raw materials used for these products.

TABLE I

Brazilian Soybean Exports (1,000 tons), 1975-78 (21)

Year	Beans	Meal	Crude oil
1975	3,333	3,119	263
1976	3,639	4,356	453
1977	2,587	5,389	487
1978	659	5,407	438

Since July 1978, Brazilian legislation has permitted the use of soybeans in meat products at a level of 22%, according to Federal Special Governmental Decree No. 115.

Industries that produce institutional food utilize soybean as a source of protein, naturally obeying the specifications that require certain previously determined levels of calories, proteins and other nutrients, and insuring it has a biological value comparable with that of casein. The most utilized forms of soybean are texturized protein and defatted soybean flour.

SOYBEAN PRODUCTS DEVELOPED BY ITAL

Since its foundation, the "Instituto de Tecnologia de Alimentos" (ITAL) has done research into acceptable ways of introducing products of high nutritional value into the Brazilian diet, which is according to the main social objectives of the Institute. Thus, one of the most important research areas has been the development of soybean products with characteristics that make them acceptable to the people in general, and yet with a high nutritional value.

ITAL has already developed the industrial technology for the production of biscuits and bread, using composite flours (defatted soybean flour and wheat flour) as raw material, and for the production of isolated and concentrated soybean protein, fried soybeans, texturized protein and soybean flour. ITAL has also developed GESTAL, a product destined as a food supplement for pregnant and nursing women with low incomes. GESTAL has been distributed free of charge to those women enrolled in the "Programa de Atendimento Integral à Gestante e a Nutriz" (4).

VITAL: Soybean Protein Extract

VITAL, popularly known as soybean milk, was developed at ITAL on a pilot scale, and later produced on an industrial scale by a continuous process, in both pasteurized and sterilized forms. Using this process, it is possible to obtain from each kg of dehulled soybeans 1.7 kg of residues containing 15% total solids, and 9.3 kg of a protein extract with an average composition of 3.5% protein, 2.2% fat and 6.5% total solids. VITAL's nutritional value, evaluated on the basis of protein efficiency ratio (PER) and net protein utilization (NPU), is about 75% that of casein (5). VITAL (in vanilla and chocolate flavors) was tested organoleptically using 1,497 children from 7 to 14 years of age, and showed an acceptance of 77% (6).

Powdered Soybean Protein Extract

It is possible to obtain a powdered protein extract without the characteristic soybean flavor, yet with nutritional characteristics similar to those of powdered cow's milk, and at a lower cost. The process was developed from the VITAL extraction process. The product has good organoleptic, physical, chemical (50% protein), nutritional (PER = 88% of casein) and storage characteristics, and can be produced industrially at a cost that makes it very competitive (7).

Cassava Flour Enriched with Soybean

Cassava flour is a basic food for the Brazilian people; however, as a foodstuff, it supplies only carbohydrates. For this reason, it was enriched with the residue from the VITAL extraction. This residue, when dehydrated and ground, is like a good-quality and inexpensive flour with approximately 28% protein. Three different levels of residue were added to the cassava flour, and the results showed that it is possible to add up to 40% of residue without deteriorating its organoleptic characteristics. The cassava flour has about 1.86% protein, and the composite flour (with 40% residue) has about 12.5% protein and a PER value of 94% that of casein value (8).

Corn Flour Enriched with Soybean

Corn is very important in the Brazilian diet, but is unfortunately deficient in certain essential amino acids, so from a nutritional point of view, corn is unimportant, although it is a good source of calories.

In a project carried out at ITAL, corn flour was enriched with the residue from VITAL by two different processes: one by extrusion and the other in a double-drum dryer. Both processes were viable, and a composite flour (70% corn and 30% soybean residue) was obtained. These flours were used as the raw material in such institutional mixtures as soups and corn meal, and showed good acceptance ratings.

The composite flours contain about 14% protein, and nutritional evaluations showed their PER values to be 90% that of casein in both cases, whereas that of corn flour is 24% that of casein (9).

Infant Food Formula Based on Soybean and Cow's Milk

Three mixtures were developed for infant food based on soybean and cow's milk. One contained soybean protein extract; one contained whole soybean flour, and the last contained soybean flour plus cow's milk. Other ingredients were added to the mixtures in order to bring them into line with the recommendations of the American Association of Pediatrics (AAP) Committee on Nutrition (1976).

The best PER values were obtained with the whole soybean flour mixtures, with a PER more than 90% that of casein. The soybean protein extract mixtures had PER values 85% that of casein. The digestibility of all mixtures was higher than 90%.

This project is still underway, and some modifications to the mixtures are being made, in accordance with the AAP recommendations. Acceptance and tolerance tests in children are also being planned (10).

GESTAL

GESTAL is a sweet dehydrated mixture that is easily dissolved in water and is of low cost. It was developed as a food supplement for low-income pregnant and nursing women enrolled in the "Programa Materno-Infantil" of "Secretaria da Saúde do Estado de São Paulo." This program, which started in 1976 (11), reaches an average of 100 thousand women per year.

Following the specifications of the Secretaria da Saúde do Estado de São Paulo, the product has about 380 cal/100 g and 11% protein. The nutritional value of GESTAL evaluated as PER is about 95% that of casein. The raw materials in GESTAL are: precooked corn flour, skimmed milk, soybean protein concentrate, sugar and maltodextrin. It is made in five different flavors: natural, strawberry, coconut, caramel and vanilla. GESTAL is packed into polyethylene bags, each containing 500 g, and its processing cost is about $1.00 per kilo (U.S. dollars), this price being paid by the Secretaria da Saúde to the processing industry. The product is distributed free of charge to the people enrolled in the program.

Bread

The use of composite flours in baked foods is of great interest to the Brazilian people because wheat is imported. The addition of other flours to wheat flour for the making of bread is desirable because bread is a very popular food. Two types of bread were studied, loaf bread and French bread, both using composite flours (wheat flour, cassava flour and defatted soybean flour).

The best results for the loaf bread were obtained with the following composite flour: 80% wheat flour, 13% precooked cassava flour and 7% defatted soybean flour. With the addition of potassium bromate (45 ppm), or ascorbic acid + calcium steroyl-2-lactyl lactate (0.75%), the resulting products were similar to bread made with 100% wheat flour, with respect to their physical and organoleptic characteristics. The chemical composition of the composite flour shows higher levels of protein, mainly of lysine and methionine, than those of wheat flour.

The best results for making French bread were obtained with 90% wheat flour, 7% pre-cooked cassava flour and 3% defatted soybean flour. The French bread made with this composite flour was considered organoleptically better than that made with 100% wheat flour, especially when the following additives were included in the mixture: AA (75 ppm) + CSL (0.75%) + GM-11 (0.2%). The protein level of the composite flour is slightly higher than that of wheat flour (12).

Biscuits

Although the biscuit is not as popular as bread in Brazil, it has some favorable characteristics: long shelf-life, large scale production, easy distribution and high acceptability, mainly by children. The biscuit is a product that can be produced using composite flours, and can be used in institutional programs.

A hard type biscuit was developed at ITAL, using a composite flour consisting of 70% wheat flour, 20% corn flour and 10% defatted soybean flour. Organoleptic evaluations showed the product to be well accepted by adults and children. The protein level of the biscuit was 14%, and it showed a PER value 72% that of casein, whereas the 100% wheat flour biscuit showed a PER value of 24% (13).

Macaroni

Macaroni is well accepted by the people in general; the golden elbow type is the one preferred by children because it is easier to eat. ITAL's staff have developed a macaroni containing 40% semolina, 30% precooked corn flour and 30% defatted soybean flour. The protein level of this product is 20% when biologically evaluated, it showed a PER that was 86.8% that of casein (13).

Fried Soybeans

Different processing methods were studied, with the objective of obtaining a fried soybean product with high acceptability and a shelf-life of at least 90 days. The process chosen is as follows: the soybeans are mechanically dehulled, cooked and drained. Next they are fried for 5 min in edible oil containing a mixture of antioxidants (0.15% BHT + BHA). The excess oil is drained off and salt is added. After cooling, the product is packed in colored polypropylene bags (14).

Micropowdered Whole Soybean Flour

Micropowdered whole soybean flour is obtained from an aqueous suspension of soybeans containing 15% total solids. It is heat treated, homogenized and dried in a spray-dryer. During processing, partially hydrogenated soybean oil, emulsifier and antioxidants are added to the flour to increase its caloric value, solubility and shelf-life. This flour's odor and flavor are similar to that of the cereal, and it contains 42% protein, 28.2% fat, 4.4% moisture, 53% PDI and 3.4 trypsin inhibitor units/mg. Its PER and NPR are 90% that of casein.

Due to its high solubility, long shelf-life and high caloric and protein values, this product can be used mainly on the institutional market for the production of instant caloric-protein beverages (5).

Soybean Flakes

Soybean flakes are obtained from dehulled soybeans that are thermally treated to inactivate the enzymes, and then ground with water and dried in a drum-dryer. The flakes contain 40.8% protein, 21.2% fat, 4.0% ash, 4.0% fiber, 3.7% moisture and 18% PDI. Their biological value evaluated as PER is 80% that of casein.

Due to the physical and organoleptic characteristics of soybean flakes, it is possible to utilize them as a protein and as a raw material of calories in several products such as baking flours, instant foods, baby foods, meat products, dehydrated soups and dessert products (5).

Banana Flakes with Soybean

To obtain banana flakes with soybeans, banana pureé is added to soybean paste (obtained as mentioned above) in the proportion of 70% banana to 30% soybean. This mixture is then drum-dried. The resulting product has a banana flavor, and contains 14.5% protein, 6% fat and 3% moisture. Its PER value is 80% that of casein. This product can be used in instant foods, such as pureés, and in beverages such as milkshakes (14).

INDUSTRIALIZED SOYBEAN PRODUCTS AVAILABLE ON THE INSTITUTIONAL MARKET (BRAZIL, 1980)

Several industries process institutional products in Brazil, and some of them are listed in Table II. These industries provide some information about their products. These products have been used in official programs for food supplementation at the municipal, state and federal levels and also in hospitals, industries and army refectories. These products always have soybean as one of their ingredients, and all of them are enriched with vitamin A, the B complex, calcium and iron, especially when destined for school lunch programs, which require this enrichment.

TABLE II

Some Institutional Soybean Products Produced in Brazil (1980)

Product	Principal raw material and ingredients	Biological value NPR/Casein (%)	Use	Average price (U.S. %/kg)[a]	Products
Sopa de Feijao com massas Bean soup with with macaroni	Texturized soybean precooked bean, hydrogenated fat, macaroni, malto-dextrin, seasonings, corn starch	88	Soup	1.90	Bhering-Productos Alimenticios S.A.
Mistura Lactea	Powdered milk, powdered soybean milk, corn starch, texturized soybean, sugar, hydrogenated fat, maltodextrin, precooked corn flour	91-97	Beverages flavors: coconut and caramel	1.90	
Mistura para "milk-shake"	Powdered milk, texturized soybean, precooked corn flour, wheat flour, sugar	92-94	Beverage flavors: caramel, coconut, banana (with liofilized banana)	1.90	
Mistura para sopa carioca vitaminada	Precooked corn, precooked rice, texturized soybean, granulated soybean powdered milk, malto-dextrin, hydrogenated fat, dehydrated legumes, vitamins and minerals, seasonings	96	Soup	1.90	
Misutra para sopa creme de aveia vitaminada	Oat flakes, texturized soybean, powdered milk, malto-dextrin hydrogenated fat, dehydrated vegetables vitamins, minerals, seasonings	93	Soup	1.90	
SACI-Chocolate	Soybean protein, powdered milk, hydrogenated fat, sugar, carbohydrate, cocoa powder	90	Beverage	1.76	Coca-Cola Industrias LTDA

Continued.

Precooked soybean flour and flakes	Soybean	84	As raw material for baking and other preparations	1.02	Noval Productos Alimenticios LTDA
Choquente 300	Powdered milk, malto-dextrin, sugar, soybean, cocoa powder	98	Warm beverages	1.89	Nutricia S.A. Produtos Dieteticos e Nutricionais
Millac 300	Powdered milk, sugar, malto-dextrin, cocoa powder, soybean flour, hydrogenated fat	106	Cold beverages	–	
Creme de Chocolate 300	Powdered milk, cocoa powder, sugar, malto-dextrin, soybean flour, hydrogenated fat	99	Pudding	1.88	
Nutricreme 300	Powdered milk, rice flour, sugar, malto-dextrin, soybean flour, hydrogenated fat	135	Pudding	1.84	
Mistura lactea Nutricia-milho	Powdered milk, corn flour, sugar, malto-dextrin, soybean flour, hydrogenated fat	133	Pudding	1.81	
Media 300	Powdered milk, sugar, malto-dextrin, soluble coffee, soybean flour	98	Warm beverages	2.07	
Pacoca 300	Ground peanut, sugar, cassava flour, soybean flour	115	Tablet	1.47	
Canjicreme 300	Powdered milk, corn flour, sugar, malto-dextrin, soybean flour, hydrogenated fat	120	Pudding	1.48	
Sopa Primavera	Dehydrated legumes, corn flour, soybean flour, malto-dextrin, hydrogenated fat, seasonings	110	Soup		
Arrozito-Sabor Amendoim	Dehydrated rice, powdered milk, sugar, hydrogenated fat, texturized soybean, peanut flour, ground coconut	102	Sweet preparation	2.14	Nutrimental, S.A., Ind. Com. de Alimentos
Canjical de coco, mistura para preparo de mingau	Corn snack, powdered milk, sugar, hydrogenated fat, texturized soybean, precooked rice flour, ground coconut	123	Pudding	1.72	
Nutrilac LD-350	Powdered milk, sugar, soybean extract, hydrogenated fat, malto-dextrin	108	Beverage flavors: coconut, strawberry, chocolate, caramel, peach	2.76	
Sopa creme de cereais com legumes LD-250	Macaroni, precooked corn flour, precooked rice flour, hydrogenated fat, texturized soybean, powdered milk, dehydrated vegetables, seasonings	99	Soup	1.40	
Mingau LD-300 (pudding powder)	Sugar, corn starch, powdered milk, soybean extract, hydrogenated fat	90	Pudding	1.74	
Sopa creme de milhe com PTS (corn soup)	Precooked corn flour, texturized soybean, hydrogenated fat, powdered milk, seasonings	84	Soup	1.44	
Creme de feijão com necarrão (bean soup with macaroni)	Dehydrated bean, macaroni, hydrogenated fat, powdered milk, corn starch, texturized soybean, seasonings	108	Soup	1.58	
Risoto com PTS (Risotto)	Dehydrated rice texturized soybean, hydrogenated fat, tomato powder and seasonings	98	Risotto (salt preparation)	2.40	

Proteina texturizada de soja (PTS) (texturized soybean (TVP) protein)	Defatted soybean flour	90	Raw material for other institutional products	1.00	
Extrato hidrossoluvel de soja integral (soybean milk)	Soybean	89	Beverage	1.50	Olvebra, S.A., 11D, E Comércio de Óleos Vegetais
Novo Milke (soybean milk)	Powdered soybean milk and sugar, plus banana pureé, orange juice or cocoa powder	Orange: 88 Banana: 94 Chocolate: 87 Strawberry: 91	Beverages	1.60	
Mistura a base de extrato de soja e leite integral	Soybean milk and whole cow's milk	96	Beverage	—	
Mistura em pó para o preparo de milk-shake (milkshake powder)	Powdered milk, malto-dextrin, sugar, precooked rice flour and precooked cassava starch	118	Beverage	2.00	Pratika-Ind. Prod. Alimentícios Instantaneos LTDA
Produto para preparo de canjica de milho	Corn "canjica," sugar, powdered milk, soybean protein isolate, soybean oil	110	Pudding	2.00	
Mistura para o preparo de macarrão com molho de tomate e soja texturizada	Macaroni, texturized soybean, soybean protein isolate, dehydrated legumes and seasonings	80	Macaroni with sauce	2.00	
Sopa canja com gelinha (chicken soup)	Precooked rice, powdered milk, texturized soybean, soybean oil, malto-dextrin, dehydrated chicken meat, seasonings, minerals, vitamins	103	Soup	2.00	
Sopa com arroz Dona Xepa (rice soup)	Rice, precooked corn flour, soybean flour, malto-dextrin, powdered milk, soybean oil, soybean protein isolate, seasonings	142	Soup	2.00	
Mistura tipo Risoto (Risotto)	Precooked rice, texturized soybean, dehydrated chicken, soybean oil, powdered milk, dehydrated legumes and seasonings	129	Salt preparation	2.00	
Mistura Lactea	Sugar, powdered milk, precooked corn flour, soybean flour, malto-dextrin	121	Beverage	2.00	
Macarrão com frango (macaroni with chicken)	Macaroni, texturized soybean, seasonings	80	Macaroni	1.26	S.L. Alves S/A-Ind. e Comércio
Macarronada Aurora (macaroni)	Macaroni, texturized soybean, dehydrated tomato, seasonings	95	Macaroni	1.40	
Biscoito cream cracker (biscuits)	Wheat flour, defatted soybean flour, hydrogenated fat, sodium bicarbonate, salt	96	Biscuits	1.23	
Biscoito Amanteigado Carinhoso (biscuits)	Wheat flour, soybean flour calcium caseinate, hydrogenated fat, sugar, malt, flavoring	81	Biscuits	1.32	
Sopa de aveia com cenoura (oat soup with carrots)	Oat flour, texturized soybean, hydrogenated fat, wheat flour, corn flour, dehydrated carrot, seasonings	92	Soup	1.90	Toddy-Suconasa Brasil S.A.
Sopa de milho (corn soup)	Corn flour, texturized soybean, hydrogenated fat, wheat flour, corn flour, seasonings	103	Soup	1.40	
Composto Alimentar Vitaminado para o preparo de Milkshake (milkshake powder)	Sugar, milk, soybean protein isolate	Vanilla: 92 Coconut: 78 Chocolate: 99	Milkshake	2.00	
Composto Alimentar vitaminado em pó para preparo de mingau (pudding powder)	Sugar, rice flour, soybean protein isolate, powdered milk	380	Pudding	2.00	
Sopa de macarrão com legumes (macaroni soup with legumes)	Macaroni, texturized soybean, hydrogenated fat, wheat flour, corn flour, dehydrated vegetables, seasonings	81	Soup	2.00	

Sopa de macarrão (macaroni soup)	Macaroni, texturized soybean, hydrogenated fat, wheat flour, corn flour, seasonings	85	Soup	1.60
Composto para mingau vitaminado (pudding powder)	Sugar, powdered milk, soybean flour, rice flour, corn flour and cocoa powder, coconut flavoring	Chocolate: 353 Coconut: 361	Pudding Pudding	2.00 2.00

[a]One U.S. dollar = Cr 50.00.

INSTITUTIONAL PROGRAMS IN BRAZIL

Campanha Nacional de Alimentação Escolar

The Campanha Nacional de Alimentação Escolar (CNAE) maintains the biggest food supplementation program in Brazil. It was created in 1955 and is subordinated to the Ministério da Educação e Cultura. Its purpose is to promote nutritional assistance and education among Brazilian school children.

The programs developed by CNAE are in accordance with the objectives of the "Programa Nacional de Alimentação e Nutrição," which are: (a) improvement of the nutritional condition and learning ability of children, and consequent reduction in absenteeism, repetition of the school year and school evasion; (b) increase in the resistance of school children to disease; (c) improvement of the food habits of school children; and (d) increase in the level of school enrollment and conditions of those enrolled, by protection of preschool children.

The CNAE acts in all states through the "Coordenações Regionais" (Regional Coordinators) who develop the program.

Table III shows the number of 7- to 14-year-old children assisted during the last 5 years (15). Assistance consisted of supplementation with at least 250-300 cal and 10 g of protein per day (16). Table IV shows the amount of food utilized in the CNAE supplementation program during the last 5 years in each of Brazil's regions.

Operação Escola Assistência Nutricional

The Departamento de Assistência ao Escolar (DAE) of the Secretaria do Estado de Educação is the state organization that is responsible for school assistance, its objective being caring for the welfare of school children, providing them with better physical, mental and social development, and helping in their adaptation and learning processes.

The priorities of the DAE's program in 1979 were to assist the newly enrolled school child on entering either preschool or first grade, and to assist schoolchildren during their first 5 years of school. The DAE's program also included the following two projects: "Promoção da Assistência a Escolares e Pré-escolares," and "Operação Escola Assistência Nutricional."

As a result of the project "Operação Escola Assistência Nutricional," about 347 million school lunches were distributed, and the children in the more needy areas received special attention. In Table V we can see the development of this program since 1976, as well as the cost per capita of the school lunches, and their protein and caloric contents. Training courses realized during this period are also included in the figure (17).

According to DAE information, all products distributed by this program in the second semester of 1979 contained soybeans, and all were easy to prepare. There were 13 different products, and with prices ranging from $0.69 ($1.00 U.S. = $50.00 Brazilian Cruzeiro [Cr]) to $2.28 (U.S. dollars), and an average price of $1.40 per kg (18).

Campaign for the Utilization of Soybeans for Human Consumption

The Secretaria de Agriculture e Abastecimento do Estado de São Paulo is currently campaigning for the use of soy-

TABLE III

Development of the PNAE from 1975-1979 in the Different Regions

Regions	Beneficiary school population				
	1975	1976	1977	1978	1979
North	473,953	554,304	627,456	649,926	789,089
Northeast	2,380,689	2,530,275	2,958,902	3,064,250	3,594,642
Central-West	748,671	856,716	892,387	968,470	1,102,832
Southeast	5,504,091	5,671,893	6,136,923	6,920,406	5,998,965
South	2,030,577	2,156,293	2,361,009	2,469,396	2,518,234
All Brazil	11,137,981	11,769,481	12,976,677	14,072,448	14,003,762

TABLE IV

Quantities of Food Provided from 1975-1979 in All Regions

Regions	Amount of provided foods (ton)				
	1975	1976	1977	1978	1979
North	2,501.5	2,875.2	2,899.9	3,858.0	6,177.6
Northeast	15,992.0	21,097.2	20,001.6	15,874.2	25,067.4
Central-West	4,750.6	8,780.0	7,371.3	8,398.0	8,799.0
Southeast	35,949.1	77,127.9	80,788.3	83,196.0	52,204.8
South	7,727.6	18,785.3	22,098.8	25,279.3	20,564.3
All Brazil	66,920.8	128,665.6	133,159.9	136,605.5	112,813.1

TABLE V

Evolution of the Nutritional Assistance Subprogram, 1976-1979

Specifications	1976	1977	1978	1979
Assisted school children:				
São Paulo and Vale do Ribeira	436,953	393,309	448,432	420,670
Other municipalities	921,294	1,325,891	1,365,611	2,570,000
Total	1,358,247	1,719,200	1,814,043	2,990,670
Lunches distributed	145,163,069	179,923,920	159,915,684	346,733,800
Lunch cost per capita[a]				
São Paulo and Vale do Ribeira	Cr $0.76	Cr $2.05	Cr $1.28	Cr $22.33
Other states municipalities	Cr $0.34	Cr $1.28	Cr $1.28	Cr $ 1.36
Annual distribution				
São Paulo and Vale do Ribeira	150 days/yr	150 days/yr	150 days/yr	140 days/yr
Other states and municipalities	84 days/yr	112 days/yr	104 days/yr	112 days/yr
Protein and calorie contents of lunches				
São Paulo and Vale do Ribeira	9.00 g protein/320 cal	9.00 g protein/320 cal	9.00 g protein/320 cal	9.81 g protein/291.59 cal
Other municipalities	5.20 protein/96 cal	6.20 g protein/126 cal	6.00 g protein/120 cal	6.36 g protein/126.62 cal
Trainings	10	9	56	25

[a]One U.S. dollar = Cr 50.00.

beans for human consumption (19). The objective of this campaign is to introduce the soybean into the daily diet of the population, because of its high nutritive value and its extensive production in São Paulo.

To realize these objectives, information about soybean utilization is being spread via radio, television, newspapers, and posters; and practical demonstrations are being given about the use of the soybean to formal and informal groups, along with the distribution of recipes for the preparation of traditional dishes—thus offering new options without changing eating habits.

The campaign is counting on collaboration of other government bodies, soybean cooperatives and the "Associaçao Paulista Supermercados." The soybean cooperatives supply the supermarkets which belong to the "Associacão Paulista de Supermercados." Thus one can evaluate the success of the campaign by observing the amount of sales to the consumers.

During the 14 days of the campaign, the cooperatives supplied the supermarkets with 512 tons of soybeans, which were bought by the consumers. This represented 25% of the consumption of the common bean (*Phaseolus vulgaris*) in the capital of São Paulo, and 12% of the consumption in the remaining towns and cities of São Paulo state.

According to the "Associacão Paulista de Supermercados," the initial experimental phase, based on curiosity, has passed, and several supermarkets (650 in São Paulo and 256 in other regions of the state) have already put in one or more new orders.

DISCUSSION

Brazil has frequently been cited as potentially the biggest agricultural country in the world. Nevertheless, Brazil has become a large-scale importer of basic foods, due to factors such as the energy crisis that started in 1973 and the introduction of sophisticated eating habits as a result of the various communication systems. All this was worsened by an inadequate food supply policy and the unfavorable weather conditions which have prevailed during the last few years.

For many years Brazil imported wheat at low prices from the U.S., to be repaid on a long-term basis. As a result, Brazilians started consuming more of the other kinds of cereals, such as corn, which are easily grown in this country. Since domestic wheat production is not sufficient to supply Brazilian demand, it has become necessary to import larger quantities of that cereal.

Today, Brazil needs the courage to take measures to increase the production of basic foods and offer them to consumers at reasonable prices, especially to those segments of the population that need better nutrition.

Although the soybean is not a basic food of Brazilians, it is important for the country's economy, because there is a large export market for this commodity. This can contribute to increase Brazil's reserves in foreign currencies. Brazil is the second largest soybean producer in the world, and according to the statistical data available for the year 1978, the soybean is the second largest produced commodity in the country. Zockun (20) says that the expansion of soybean culture during the period 1970 to 1973 resulted in replacement of 88% of the other crops (rice, common bean, cassava, potato and onion), as well as a reduction in the production of milk, swine and cattle. However, in areas where export crops such as coffee, cotton and sugar cane are grown, only 12% of these crops were substituted by soybean.

Only facts of this nature can explain why Brazil must import cereals such as rice and corn, and legumes such as the common bean (*Phaseolus vulgaris*). Domestic consumption of soybeans is small and its use as a bean is practically nil.

The research program being carried out at ITAL has contributed to an increase in the use of soybeans, and Brazilian industry is already using soybeans in various products, mainly in formulated foods for institutional programs. The institutional feeding systems contributed to the increase of soybean consumption, especially due to their requirements of products with sufficient protein, and a biological value similar to that of casein, all at a low cost. The combination of soybeans with other raw materials improves the protein value of the final products, and foods that are predominantly sources of energy can also become good sources of protein, with a desirable balance of amino acids and at a low cost.

The campaign for a better use of soybeans for human consumption does not intend to substitute soybeans for other already highly consumed foods such as the common bean (*Phaseolus vulgaris*), but to compensate for the shortage of that bean, by offering an option that can be used for the same purpose at a 65% price. The basic Brazilian diet depends on the consumption of rice and beans as the main dish. Soybeans, therefore, offer a good option as a substitute for the common bean, allowing the population to consume a more nutritious food at a much lower price.

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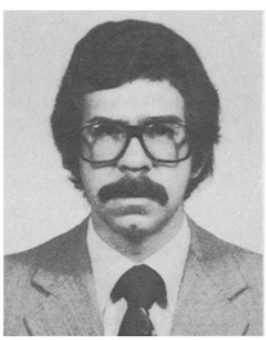

Direct Consumption of the Soybean

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ABSTRACT

Efforts in some Latin American countries directed toward the use of soybeans as a primary source of proteins for human nutrition have especially focused attention on simple home-level procedures such as the soaking and cooking of soybeans and the lime-cooking of corn-soybean mixtures. Data obtained with these two procedures indicate there is great potential in using soybeans directly in human feeding. Soaking soybeans in 0.25% $NaHCO_3$ for 8 hr and cooking for 20 min decreases trypsin inhibitor activity more than 80%, and 40 min of cooking gives chewiness indexes similar to those of common beans with acceptable texture (10-20). The protein efficiency ratio (PER) of a mixture that was 50% soybeans and 50% common beans was 60% higher than that of common beans alone. Considering acceptability and functional characteristics of "masa" (dough) and "tortilla," an optimum soybean level within the lime-cooking procedure was found to be 16%. Green pods of soybean varieties adapted to the tropics, at 65 to 85 days of maturation, have the same nutrient content (dry basis) as mature soybeans, with a good quality protein and a good content of B complex vitamins.

INTRODUCTION

Despite apparently sufficient food resources, the fact is that two-thirds of the world's inhabitants do not receive adequate nourishment. Protein-energy malnutrition is common in children, resulting in high morbidity and mortality. Proteins of animal origin are recommended because of their high quality for human nutrition, especially for children. However, these proteins are scarce, are difficult to preserve and are high priced; therefore, they are becoming useless to feed low income populations.

Legume seeds represent the most abundant source of protein. Their protein quality, especially when combined with cereals, is almost always high enough for adults and for children. Soybean is the most abundant legume, with an estimated world production for 1980 of 97.6 million tons; it is also the cheapest protein source at the consumer level, and has the highest protein quality among legumes.

Soybeans can be considered as sources of intermediate-quality protein, which is better than that of cereals and very much like that of meat, although of lower quality than that of milk and egg proteins, for soybean protein is only deficient in its methionine content (1).

In fact, soybeans have great potential as foods not only because of their high protein content (38% in the raw seed), but also because they are a good source of energy (18% fat), vitamins and minerals. Most of all, soybeans have a low