

The emphatic decrease in mortality after the introduction of soybean in the diet seems to be caused by the increase of the body's resistance to illness, which happens when mortality decreases and morbidity increases, and to a decrease in the contagion of some sicknesses such as tuberculosis in the case of Taxco.

Natality. In Tlapa, Huamuxtillan and Taxco, there was a direct relationship between the introduction of the soybean and an increase in natality; but in Arcelia, which did not receive soybeans, natality, actually decreased slightly. Because of this, the introduction of soybean is followed by family planning programs. Mention should be made that some statistics for 1975 were obtained under abnormal conditions, due to the socio-economic disorders of that time. Besides, when soybeans were introduced one year and not introduced the next, due to the lack of seed, the community produced variable amounts of soybeans, which prevented us from including or excluding it as a soybean producer.

Morbidity. Notwithstanding the fact that morbidity is sub-

ject to various factors that can alter it at any time, in some contagious diseases the addition of soybeans to the food obviously reduced the frequency of contagion. Because of this, it appears that the decrease in mortality that occurs when soybean is added to the diet results in not only better resistance of the body's defenses but also a decrease in the morbidity rate as well. In the case of pulmonary tuberculosis, the results have induced us to include a diet with soybean in the treatment of patients with that disease. The observations made in Taxco are very illustrative. In 1976, the number of cases of tuberculosis in the rural areas more than doubled those in the urban areas. In 1977, with the introduction of soybean to the diet, the frequency of tuberculosis in the rural areas was less than in the urban areas, where such programs were rejected. The next year the promotion of soybean planting in the rural areas was suspended, and the frequency of tuberculosis in the rural areas and in the urban areas increased proportionately. The year after, the programs were again instituted and a definite decrease in the rural areas was observed while the rate in the cities continued increasing.

Utilization of Soya Protein in Highly Nutritious Low-Cost Products in Mexico

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INTRODUCTION

Since 1972 the National Institute of Nutrition (Mexico) has conducted a research program of food technology that is of social interest, sponsored by PRONAL (Programa Nacional de Alimentación). The objective of the program is to develop and promote products and techniques that may help to improve food consumption in those population groups which are presently inadequately fed. The main line of research involves formulation of low-cost, easily preserved, highly nutritive products. Protein content and quality has received special attention. The program uses those materials which are economically more convenient at a given time. In general, soybean protein has been preferred because of its high-protein content and quality, and its supply of energy as oil. Furthermore, it is immediately available (1.5 million tons from production and imports); it has a long tradition as a human food; and it has as low a cost per gram of protein as do beans. Other potential protein resources such as leaf, single cell, fish meal or insects, do not have all the advantages cited, either economically or sensorially.

Efforts to use soybeans in nutritional programs started in Mexico in the 1930s (1-4); it was, however, only in the present decade when research in this field multiplied, and when several companies in Mexico started the production of different soybean products.

From the point of view of nutritional programs, soybeans may be used: (a) to increase the protein content (enrichment) and quality (complementation) of low-protein foods such as cereals; (b) to extend animal products already rich

in protein; (c) as the main ingredient of a product; and (d) as a functional ingredient resulting in enrichment, complementation or extension. PRONAL has sponsored research in all of these lines.

The principal products using soya for enrichment and complementation are summarized in Table I. This procedure using soya is applied fundamentally to cereals. It is based on the technical development of various derivatives of soybeans and on the capacity it has to complement cereals, which are the primary foods for populations that suffer from malnutrition. In essence, these products enriched by soya are mixtures in which the levels of added soybean varies from 8%, in the case of tortillas, to 60% in infant purées (5). These mixtures are processed through diverse technical procedures such as lime treatment, by which corn is processed for the preparation of tortillas. Elimination of the antiphysiological factors of soybeans was achieved with this treatment, consequently increasing its protein quality. Extrusion was used for development of pastas, and thermal treatments in autoclave were used in the case of beverages and infant purées (6-9).

The protein contents and the nutritive values of these products are also shown in Table I. In some cases, such as with tortillas, an increase of 100% in the concentration of utilizable protein was achieved and the protein quality increased by more than 50%. In other products, especially in infant purées, the protein content was increased by three- or four-fold, in comparison with commercial products with a protein quality comparable to that of animal proteins (10-12).

SOYA PROTEIN-PRODUCTS-Round table

TABLE I

Soybean Enrichment of Cereals

Product	Description	Protein content (%)	NPU of casein
Tortilla (5)	Lime treatment of corn and soybean mixes, with 8 and 16% soybean added	12.4	65
Atoles (6)	Wheat, rice, sesame and corn mix beverages with whole soybean flour added at a level of 10% and toasted soybean flour added at a level of 30%	28	73
Pasta (noodles) (8)	Wheat bean (<i>Pphaseolus vulgaris</i>) and corn mixes with 25% soybean defatted flour added and 40% total protein added	17	73
Instant soups (9)	Mixes based on enzymatic fish protein hydrolyzate, wheat flour and rice; enriched with 5% defatted soybean flour	35	79
Instant beverages (10)	Dry whole and defatted soybean flour (added at 10% and 50%) with whey, vitamin C, and artificial flour and color	—	92
Infant purees (12)	Intermediate moisture mixes of wheat flour and skim milk with whole and defatted soybean flour at 20% and 60% protein	4.6	92

TABLE II

Soybean Extension of Milk and Meat Products

Product	Description	Crude protein	Fat ^{a,b}	Carbohydrates ^b	Ash ^b	Crude fiber ^b
Soyacit	Beverage mixes with 18% malted soybean flour, 18% skim milk and 48% sucrose	23.4	8.2	61.2	3.8	0.8
Nutrimpi-Lactodif (13)	Compressed wafer with skim milk and whey extended with 10% defatted soybean flour	15.4	8.9	68.3	—	—
Chorizo I	Heavily spiced pork sausage extended with 45% and 86% texturized soya protein	47.6	24.6	21.0	4.6	2.2
Chorizo II		47.8	7.0	34.0	7.0	4.3
Proteida (14)	Lean beef extended with 30% texturized soya protein, 20% beef and 16% wheat flour	20.4	7.5	20.6	10.3	—
Molida	Ground beef extended with 20% texturized soya protein	—	—	—	—	—

^aEther extract.

^b% dry basis.

TABLE III

Products with Soybean as the Main Ingredient

Product	Description	PER % of casein	NPU % of casein
Soybeverage I	Alkaline soya treated with 8 hr extraction	—	—
Soybeverage II (15)	Soybean extracted, thermically treated at 80 C	55.7	69.3
Soybeverage III	Beverage II with 40% dry whey	85.5	91.2

TABLE IV

Sausages Extended with Textured Soya

Product	Crude protein ^b	Fat ^{a,b}	Moisture ^b	Ash ^b	Crude fiber ^b
Sausage, 100% meat	10.5	6.6	63.2	3.5	—
Sausage; 70% soybean-meat, 30% wheat flour	12.2	18.5	59.5	3.3	4.5
Sausage; 70% soybean-meat, 30% dry egg	13.8	19.4	59.3	3.1	3.0

^aEther extract.

^b% of product.

As for utilization of soybeans as "extenders," the most important studies are shown in Table II. The concept of extension, whose original purpose was commercial, can also be used to improve the nutritional value of diets of population groups with low economic resources, because of the lowered prices of containing products of high-quality protein (such as milk, meat and eggs). Extending milk and meat has received special attention as a result of the development of products such as Soyacit and Nutrimpi-Lactodif. Nutrimpi is a compressed "wafer" of 22 g of which 600,000 units are produced; "chorizo," a typical sausage-like product, flavored with hot peppers and several spices, and with about 20% moisture, enjoys wide acceptance in Mexico but is expensive. Two types of low cost "chorizo" were developed using texturized soya to extend the meat (4).

Proteida and Molida mixtures of beef and textured soybeans have been commercialized through ambulant government stores and markets, achieving sales of up to 10 and 20 tons/day, respectively.

Mexico is one of the first countries in which the extension of products of animal origin has been utilized in nutrition programs; extension is now a part of national food programs.

The products in which soybean is the main ingredient, i.e., greater than 60%, are summarized in Table III. The nutritional value of soybean beverages significantly improved (15) when they received thermal treatment and when dry whey was added. In the case of the sausages (16) (Table IV), a good emulsification of fats was achieved and there was adequate retention of water, resulting in a texture similar to regular sausages.

Several products take advantage of the functional properties of soya. In the protein mixture of anchovy chorizo, soybean contributes 35% of the total protein (17) resulting in higher protein quality because anchovies are deficient in tryptophane; an NPU of 85%, in comparison to that of casein, was achieved. On the other hand, during the development of sardine patties (18), soybean was used to improve the cohesiveness of the product. The sardine pattie contains 36 g of protein/100 g with an NPU of 80% in relation to that of casein. Studies on the acceptance of the product at the community level indicated that these sardine patties are sensorially attractive and easily incorporated into traditional dishes.

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