TABLE I

Proximate Analysis (%) of Almesa's Products Compared to Lime Treatment Corn (Nixtamalización)

Product	Moisture	Protein	Fat	Raw Fiber	Ash	Carbohydrates
Enriched corn flour	8.78	12.31	5.53	2.66	1.42	78.08
Enriched oat meals	6.70	17.34	11.33	2.86	1.74	60.03
Enriched pinole	6.38	11.91	5.19	2.60	2.07	71.83
Lime treatment corn (nixtamalizado)	10.00	7.50	4.50	1.19	1.00	74.80

The Jesuit priests of the same region have schools very similar to those created by the government, and all those children are given tortillas and pinole enriched with soya, too.

The rural population who live in the surroundings of these Tarahumara Indians are peasants who eat mostly corn, chili and beans, and drink coffee. We found that, due to advertising, they eat a lot of atole made from corn starch (maizena) which has a protein content of 1%. Almesa will provide them with an "atole" of corn and oats fortified with soya, the protein values of which are shown in Table I. The Almesa factory is distributing products to 389,219 inhabitants of the 29 counties (4) of the rural areas and mountainous regions of the State of Chihuahua. From February to August of 1980 it has distributed a total of 110 tons of corn enriched with soya, 3 tons of oats enriched with soya, and ½ ton of fortified pinole.

ACKNOWLEDGMENTS

Thanks to the Chihuahua State Government, Native Affairs Agency (Instituto Nacional Indigenista). Proximate analyses were done in Ciatech Laboratory; technical assistance was by CIATECH's staff.

REFERENCES

1. Departamento de Agricultura y Ganadería del Gobierno del Estado, 1979.
2. Elias, L., Enriquecimiento del maíz con proteína de soya, Memorias, Primera Conferencia Latinoamericana sobre la proteína de Soya México, D. F., Nov., 1975.
3. Contrato CIATECH-COPLAMAR-INI Nov. 1979, Chihuahua, Chih., M. B. Aguirre, I. Leon P., A. Camacho G.
4. Departamento de Economía, Gobierno del Estado de Chihuahua, Estadísticas 1970.

Soy Milk Developments in Latin America

R.H. MORETTI, Dept. Food Technology, FEA/UNICAMP, Cxp. 1170, Campinos, São Paulo, Brazil

Soya milk technology was introduced into Latin America by Dr. Miller from the U.S. when he published several papers on soybean products, taken from facts he learned during his stay in the Orient during 1940. From these publications, a Brazilian, Dr. Barretto of Laticinios Mococa, started his first experiments and finally marketed Solein, a mixture of soya milk (30%) and cow's milk (70%), in the year 1967. Solein is produced by cold processing, which results in a milk with beany flavor. Up to now, it has been used in very restricted markets and is being sold mainly in pharmacies. It is powdered and canned.

Almost simultaneously, Dr. Suberbie in Mexico started his experiments which resulted in Sustilac, introduced in 1968. This soya milk is produced by using pregerminated soybeans. The pregermination reduces the amount of oligosaccharides. Compañia Industrial de Alimentos (his company in Mexico) still is producing soya milk. All of its products are in powder form. They also developed Isolac and Soyamalt, which have the following compositions (%):

	Isolac	Soyamalt
Proteins	20.3	24.4
Carbohydrates	47.2	41.8
Fat	25.7	25.7
Fiber	1.7	1.9

Soyamalt is sold in strawberry, vanilla and nut flavors.

In 1968, the Coca-Cola Co. introduced into Brazil the soya milk Saci, which was a sterilized product in liquid form sold in 200-cc bottles. Saci was developed by Coca-Cola to satisfy a United Nations inquiry and had two flavors, chocolate and caramel. The project was a test market, distributed by the same dealers of Coca Cola's soft drinks. Saci reached 8% of total market sales during the years 1968-70. The Saci project was stopped because the company developed another nutritive beverage which could be processed using the same Coca Cola bottling plants and equipment. Saci composition was 3% protein, 1.7% fat and 15% added sucrose. Vitamins A, D, B_1, B_2, B_6 and B_{12} were added to satisfy 25% of MDR in a 200-cc

bottle.

Presently the company is trying to introduce a soya milk beverage in powder form by using soya protein isolate and selling it to school lunch programs. In the 1970 decade, other soya milks were developed and marketed in Latin America. The first was Provesol, which was developed in IIT, Colombia, by Dr. Diaz Delgado. This milk was produced in a powder form by modern techniques and the process was later sold to a Brazilian company, Olvebra, which started producing soya milk in 1975 with the Coca-Cola pilot plant. Presently, they are using a mixed process which combines Coca-Cola and Provesol techniques. The product is sold canned in powder form, under two brand names: Novo Milk and Nova Vida. Novo Milk is sweetened and flavored orange, chocolate, banana and strawberry. Nova Vida has the same Provesol composition of 50% protein, 25% fat, 19% carbohydrates, and 19% fibers.

The main use of Nova Vida is in the school lunch program in Brazil. It is well accepted by school children.

In 1975-76, two new projects were started, again in Brazil. ITAL, the Institute of Food Technology, developed a soya milk with brand name Vital which was first processed by dehulling soybeans, and later, by hot grinding and extraction. The centrifuged and formulated soya milk was sterilized by UHT and asceptically packed in Tetrapak. Several flavors were developed and tested by school children and industry workers. It is well accepted, but is limited by the high cost. Later, in 1977, Vital was also packed in polyethylene bags, but at that time, only in pasteurized form. Vital can be kept refrigerated for 2-3 days. The same soya milk was also developed in powder form.

In 1976, a new concept of soya milk processing was developed in Brazil. This technique consists of producing on a small scale, the soya milk at the market spot. The project was called "mechanical cow" and produces 200 ℓ/hr of sterilized soya milk, with 3.0% protein, 1.9% fat, 1.2% carbohydrates, 0.5% ash, 8.0% added sugar and at pH 7.0.

This project was introduced in 1977 and, presently, there are 80-90 "mechanical cows" in Brazil. The idea already is being exported to Paraguay, the Seychelles Islands and Ecuador.

The process uses the most modern techniques of soya milk processing. Soybeans are soaked for 6 hr in running tap water or 3 hr in 60 C water. Soaked soybeans are ground with 98 C water to render a finely divided suspension of 1 part dry soybeans to 10 parts water, and a final grinding temperature of 80-85 C is reached. Insoluble residue is separated with a basket centrifuge and soya milk is pumped to a sterilizer-cooler after formulation with sugar, flavor and optional vitamin and mineral pre-mix. Sterilization is done at 135 C for 2 min, and the mixture is immediately cooled to room temperature. The cooling water, which is heated by the soya milk, is used for grinding the soaked soybeans, thus saving heat energy.

The main advantages of this project are: (a) small and simple equipment can operate in small towns, giving employment to workers; (b) water is not transported, as it is used at the moment of usage or sale of final milk; (c) only soybeans are transported, facilitating storage and reducing working capital to a minimum; (d) by being very cheap, the equipment can be bought by very small entrepreneurs, or by the government to implement school lunch programs or health programs; (e) the equipment uses only water and electricity and does not need a steam generator.

Presently, the Brazilian federal government gives tax exemptions for this equipment when it is bought in a full package: Mechanical Cow, polyethylene bag filler and residue dryer, which shows Brazil's interest in the project and also the success of the product all over the country.

With one kilo of soybeans, 8 ℓ of 3% soya protein milk is produced which has the antitrypsin factor correctly inactivated. Packed soya milk can stand for two days at room temperature and 10 days under refrigeration (5 C). The production cost of 1 ℓ of this formulated soya milk is US $1.10.

Soybeans As an Extender of Common Beans

V.C. SGARBIERI, R. GARRUTI and **E.C. GUZMAN,** Departamento de Planejamento Alimentar e Nutrição, Faculdade de Engenharia de Alimentos, Universidade Estadual de Campinas, Caixa Postal 1170, Campinas, São Paulo, Brazil

ABSTRACT

Soybeans were used as extenders of common beans in the form of whole beans and precooked, powdered form. Mixtures containing 20, 25, 30, 35, 40, 45 and 50% soybeans were studied. Sensory evaluations (preference tests) showed no preference for mixtures containing up to 50% soybeans over 100% common beans. On the other hand, nutritional differences were detected between common beans and mixtures with more than 20% soybean. The mixture with 50% common beans and 50% soybeans contained 27.9% crude protein, 13.2% lipids and 47.2% carbohydrate. The amino acid composition was improved particularly by increasing cystine from 0.6 to 1.2% of the protein and methionine from 0.7 to 1.2%. The protein efficiency ration (PER) values fo the 50:50 mixture for rats was 1.6 compared to 1.0 for the common bean. Acceptability of the 50:50 mixture in different institutional trials did not differ in consumption from that of common beans and no sign of physiological disturbance was observed. When the mixture was precooked, dried and ground to a powder, it served as an excellent base for an instant soup. The formulation containing 80% of the 50:50 mixture, 10% corn starch and seasonings had (%) 21.3 protein, 10.8 lipid, 5.3 crude fiber and 51.9 carbohydrate with total metabolizable energy of 390 Kcal/100 g and an NDP Cal% = 12. The hydration capacity of the 50:50 mixture was 162 g water/100 g mixture whereas that of the soup with all ingredients added was 205 g water/100 g soup. The acceptability as well as the storage stability of the soup was good.

INTRODUCTION

Legume seeds constitute a very important source of protein and energy for human populations of many countries (1). The common bean is the main legume consumed directly in human diets. Although it contains a good source of protein (20–25%) in most cultivars, its protein quality is low, primarily because of a limiting concentration of sulfur-containing amino acids (methionine plus cystine), in addition to the low biological availability of these amino acids from bean proteins (2, 3).

The strategy to improve bean protein quality is (a) genetic