TABLE XXIII

Effect of Processing Step on Added Antioxidants (45)

Processing step	Recovery (%)	
	BHA	BHT
Crude	100 (added here)	100 (added here)
Refined	96.9	98.0
Bleached	89.1	92.2
Deodorized	None detected	None detected

control laboratories, abused oils cannot be "fixed" to look good.

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Soybean Oil in Brazil and Latin America: Uses, Characteristics and Legislation

W. PREGNOLATTO, Instituto Adolfo Lutz, Av. Dr. Arnaldo, 355, São Paulo, Brazil

ABSTRACT

The soybean was introduced into Brazil in 1882. The oil content of different varieties of soya is ca. 22.5% w/w. Now, soya oil is the most popular oil in Brazil. Food standards legislation has been enacted for soya oil and its hydrogenated products in Brazil and the rest of Latin America.

INTRODUCTION

Soya probably was introduced into Brazil in 1882 in Bahia by the agronomic engineer Gustavo Dutra (1). Ten years later, it was grown by the agronomist Daffert (1) in the Agronomical Institute of Campinas. Soya was unsuccessful in Bahia and the Agronomical Institute until the Agriculture Department of the State of São Paulo became interested in 1921, according to a report by the agronomist Ariosto Rodrigues Peixoto's (1).

Soya culture effectively began in the seed fields of São Simao, the high plateau area of São Paulo, in 1925, when a series of very important experimental work began.

From São Paulo, the soya plantation was moved to the county of Santa Rosa in the state of Rio Grande do Sul, where some 60 varieties were tested. The first oilseed extraction plant was installed in this country.

Soya culture was given little attention in the following 30 years. In 1955, however, 106,000 tons of soya were produced and from that time, there was pronounced and continuous growth: in 1960, 205,000 tons were produced; in 1965, 523,000 tons; in 1970, 1,500,000 tons; and in 1973, production reached 4,800,000 tons. In 1980, the production was a record in Brazil—15,000,000 tons.

Soya is produced mainly in four states which form the southern region of the country: Rio Grande do Sul, Paraná, São Paulo and Santa Catarina. Rio Grande do Sul is the largest producer.

Brazilian production is from seven varieties: IAC-1, IAC-2, Davis, Hardec, Mineira, Santa Rosa and Vicosa. Oil content is relatively constant in the different varieties, ca. 22.5%, w/w. Soya oil is the most widely consumed in the country, far surpassing any other vegetable oil for use in household and industry.

Uses

The main obstacle for soya oil to overcome for approval by the Brazilian consumer was its smell, which has now been eliminated by the high degree of technology achieved in deodorization.

Hydrogenated soya oil is used in fritters and margarines, cakes, soups, biscuits, stuffings, chocolates, caramels and ice creams.

Physicochemical Characteristics

Oil composition in the different varieties does not change significantly, but it is different from North American oil. The average compositions of some fatty acids (wt %) taken from 50 samples of soya oil from 5 refineries in 1973 are: palmitic, 10.76; stearic, 4.27; oleic, 23.59; linoleic, 55.22 and linolenic, 6.09, and very small quantities of arachidic and myristic acids are present, as well. These figures are similar to data taken in 1980: palmitic, 11.2; stearic, 3.7 oleic, 22.9; linoleic, 54.3 and linolenic, 7.9. Physiochemical characteristics required for use are very rigid and they vary, depending on the oil's proposed use (Table I).

Hydrogenated soya fat characteristics are based on the proposed use. Generally, these are 100 hr AOM stability, aldehyde content of 5 (provisional) <3.5 red color and zero peroxide value.

Melting point is one of the most important of these characteristics. Table II shows the melting point of a hydrogenated fat as a function of its use.

Besides Brazil, Latin American producers of soya products are Argentina, Mexico and Paraguay, as well as Colombia and Uruguay in small amounts. The characteristics presented for Brazil also are standards for the other countries in South America.

LEGISLATION

Health standards for these products were established in Brazil by the "Norm and Pattern National Food Committee" (2) which is a department responsible for the development of sanitary norms of food in Brazil. These standards have been official since August 1977. Besides the Brazilian legislation, laws pertaining to soya oil are included in the "Latin American Code of Food" (3) and in the "Sanitary Laws of Food" (4) published by the Pan Amer-

TABLE I

Physicochemical Characteristics of Soya Oil (Brazil)
Maximum and Minimum Values Fixed by Refineries

Characteristic	Indices
Smell and taste	Bland
Color	
Mayonnaises	0 Blue, less than 1 red
Fritters	1 Blue, less than 3 red
Iodine value	130 ± 3
Cloud point	24 hr at -5 C without clouding
Peroxide value	0
Aldehyde number	5 (provisional)
Stability (AOM)	24 hr (minimum)
Acidity	0.05 in oleic acid
Filter test	Maximum 1 point

TABLE II

Melting Points (Wiley) of Hydrogenated Soya Fat

Use	Melting point (C)
Margarine	38
Cakes	40
Fritters	29-31
Dehydrated soups	42-48
Biscuit	41-43
Stuffings	44
Chocolates	40
Candies	44
Ice cream	38
Creams	42

TABLE III

Physicochemical Legal Characteristics for Soya Oil

Characteristics	Brazil	Latin American Code	Pan American Sanitary Laws
Relative gravities	0.919-0.925 (20 C/20 C)	0.917-0.924 (25 C/ 4 C)	0.917-0.921
Saponification value, mg KOH/g	189-198	188-195	188-198
Iodine value (Wijs)	120-143	125-135	120-140
Refractive index	1.467-1.469 (4 C)	1.472-1.474 (25 C)	1.4645-1.4760
Unsaponifiable material (maximum)	1.5% p/p	1.5% p/p	—
Butyro-refractometric deviation	—	69.5-72.7	—
Bellier modif.	—	19-21	17-21
Thermosulfuric grade (Tortelli)	—	82-95	—

ican Health Organization.

Table III shows the physicochemical standards in Brazilian legislation (from Latin American Code of Food and Pan American Sanitary Laws of Food).

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Relative Nutritional Value of Various Dietary Fats and Oils

L. MASSON, Food Chemistry Laboratory, Department of Food Technology, Faculty of Chemical and Pharmacological Sciences, University of Chile, Santiago, Chile

ABSTRACT

The dietary and nutritional role of fats and oils is quite complex, as evident in the new biological findings about some of their components that are essential to man. Fats and oils must be considered for both their quantitative and qualitative aspects, their fatty acid compositions and relationships with average diets in different countries should be emphasized. Because of some adverse physiological effects ascribed to saturated fatty acids, a tendency to increase the intake of polyunsaturated vegetable oils has occurred to provide a good source of essential fatty acids, mainly linoleic acid. However, saturated fats still are an important part of the diet in developed countries, especially "invisible" fats. Research must continue that is related to modifications fats and oils undergo during industrial processes which affect their nutritional value. Compositions of many fats and oils are provided.

INTRODUCTION

Edible fats and oils have several nutritional roles in the human organism, in addition to being the main source of calories. Fats and oils are normal constituents of cellular structure and membrane function. They are the unique source of essential fatty acids and, for this reason, they are important to prostaglandin synthesis. They regulate the lipid blood level, are vehicles for liposoluble vitamins and transport other important compounds, such as carotenoid pigments and sterols.

In this context, relative nutritional values of the main "visible" and "invisible" fats and oils are presented in relation to their linoleic acid (18:2ω6) content, with a discussion of biological significance.

PRINCIPAL FATTY ACIDS IN EDIBLE FATS AND OILS

Saturated Fatty Acids

The more common saturated fatty acids have straight chains and even carbon numbers, although some odd-carbon-number and branched-chain have been detected in small amounts in several animal and marine edible fats. The chain length is between 4 and 22 carbons in the more common edible fats and oils.

Saturated fatty acids are an important part of solid fats; because of their spatial configuration, they have high melting points (mp). Only the low molecular weight (MW) acids are liquid, i.e., between butyric (4:0) and caprylic acids (8:0), and the others are solid. As an example, the mp of capric acid (10:0) is 31.6 C, and that of stearic acid (18:0) is ca. 70 C. Among the saturated fatty acids, palmitic (16:0) is one of the most widespread in nature. It has been found in practically all fats and oils analyzed.

The presence in the diet of fats with a high content of saturated fatty acids has been related to several physiological disturbances. Among these are the tendencies to increase blood cholesterol level, to favor heart disease, atherosclerosis and arterial thrombosis (1).

Unsaturated Fatty Acids

In unsaturated fatty acids, a double bond is contained in the carbon chain. The molecule becomes more rigid at this point, and has two types of isomers: positional and geometric, *cis,trans*. The presence of a double bond and its spatial configuration has a remarkable influence on the mp. In nature, most fatty acids are *cis*-. For this reason, they are liquid at room temperature. As an example, oleic acid (18:1,9-*cis*) has a mp of 14 C, and its *trans*-isomer, elaidic acid (18:1,9-*trans*) melts at ca. 32 C. This difference is due to the *trans* configuration of the isomer only.

These *trans*-isomers usually are formed during catalytic hydrogenation of liquid fats to form solid fats (2). Also, these compounds are produced in small amounts in the rumen of ruminants.

Unsaturated fatty acids can be monounsaturated with only one double bond in the molecule, or polyunsaturated with two or more double bonds. The more common monounsaturated or monoethenoid fatty acids found in edible fats have chain lengths between 10 and 22 carbons; polyunsaturated or polyethenoid acid chain lengths are between 16 and 22 carbons.

The presence of the double bond creates families of fatty acids. Each family has the same end structure which produces different biological roles and properties.

If the last methyl group of the fatty acid chain is designated omega (ω), and we count the carbons before the first double bond, we have the oleic acid family (18:1ω9), linoleic acid family (18:2ω6), linolenic acid family (18:3-