concerned about the possible significance of such dietary factors as cholesterol and saturated fats owe it to themselves to understand how controversial these issues still remain among health professionals and scientists.

"The fat contained in beef is not all saturated fat, as some people may think. In fact, only 48% of the fat in beef is saturated; the remaining 52% is monounsaturated and polyunsaturated."

Noting "it's a difficult time for the animal fats industry," Matern said the baked goods industry doesn't want to disclose on ingredient labels that they contain animal fats "as they're worried people won't buy the products."

He and others said the anti-meat/cholesterol issue has not been presented accurately to the public. "Consumers are not receiving good information, but we don't have the money to retaliate," Matern said. "The anti-cholesterol or pro-vegetable people have made a lot of statements, with no answer from our people."

The Washington, D.C.-based American Meat Institute (AMI), meanwhile, has been surprised at findings from its survey measuring consumer awareness of frying fats used in fast foods, according to AMI's Mary Burnette. Survey results showed consumers generally thought french fries sold at fast food chains were fried in vegetable oil. The reason for this perception, she said, may be because people frying french fries at home use vegetable oil.

Rustco's Payne, meanwhile, understands the consumer's dilemma because the information presented to the public is not objective. "Everyone seems to have a bias on this issue," he said.

Oil use in the food service industry

The following article was written by AOCS member Frank T. Orthoefer based on his presentation at the 36th annual Mississippi Valley Vegetable Oil Processor's Oilseed Processing Clinic in March in New Orleans. Orthoefer, currently director of chemical sciences for Nabisco Brands Inc., East Hanover, New Jersey, was director of technical services for Lou Ana Foods Inc. at the time of the presentation.

The food service industry, which uses approximately 20% of U.S. edible fats and oils production, represents a major market for processed vegetable oils. The oils are used primarily as frying oils, bakers' shortenings, margarines, and cooking and salad oils. Growth has been greater in this industry than in other oil uses, due in part to a shift in usage from animal fats to vegetable oils.

Food service markets

The food service market consists of restaurants, hospitals, nursing homes, colleges, motels, hotels and other institutions. This market totaled nearly $200 billion in sales in 1986 (1). Growth in dollar sales was approximately 6.6% over 1985 sales, compared to a 4.8% increase in consumer spending for food and beverages. This represented 2.4% growth when adjusted for inflation. Through 1979, restaurant sales increased at a 6.8% compound annual growth rate. Growth has since slowed as a result of two recessions. However, a 7.2% increase in food service sales has been projected for 1987.

Continued growth in food service is predicted due to:

- an anticipated increase in disposable incomes;
- favorable consumer buying trends;
- an increase in the 35-55 age group; and
- continued low commodity prices.

Restaurant annual growth is projected at 3-5%, while higher projections are made for the fast food segment. New markets, representing additional growth potential, are developing as well, including supermarket delis and convenience stores that, alone or in conjunction with franchises, offer fast foods. For example, test units of 7-Eleven stores that include a Hardee's operation have opened.

Food service consumption of edible fats and oils is over two billion pounds a year. The oils are utilized as oils and shortenings, margarine and butter, and mayonnaise and salad dressings. Oils and shortenings made up about 60% of the total usage in 1979. Mayonnaise and salad dressings accounted for about 22%, while table fats (margarine and butter) represented about 18%.

The makeup of fats and oils consumed depends on the type of food service market. Fast food establishments consume a larger portion of the frying oils produced because of convenience, rapidity and consumer preference for fried foods. Hospitals and nursing homes often use margarine over butter because of perceived health benefits as well as economics. Restaurants likely will use butter because of its image as a better-tasting, higher-priced spread, although both butter and margarine often are provided to meet consumer demands. Restaurants account for

Frying seminar

An all-day international seminar on "Frying: A New Paradigm" was presented by Michael M. Blumenthal, research director of Libra Laboratories Inc., Piscataway, New Jersey, in Amsterdam, The Netherlands, on April 7, 1987.

Thirty-five key executives and senior scientists from industry, government and academia attended the seminar and participated in the round table discussion that explored regulatory implications, research methodologies and the use of quick screening tests to measure important factors at point of food preparation and oil use.

The objective of the seminar was to emphasize the interaction of frying oil with food. This viewpoint, based on physical chemistry and chemical engineering, provides a simple model to explain changes that occur in food as a result of frying in oil of varying "age," according to Blumenthal. Also, it offers an understanding that has major ramifications for the construction of frying equipment and the stability of processed foods, particularly in the fast food, snack food and industrially processed food areas.

79% of the total food service salad dressing consumption as a result of salad bar offerings.

Food service requirements

Various factors affect the amount and type of fat used in food service. For example, the weight-reducing diets of American consumers have shown a marked effect on the type of salad dressing produced. While there has been a 10% growth in the production of pourable salad dressing, a sizable reduction in total fat usage has occurred due to the production of low-calorie dressings. A similar effect, driven primarily by nutritional concerns, is being seen for animal versus vegetable fat usage.

The major factors involved in the selection of a particular fat or oil in food service are price and supply, functionality, image and nutrition.

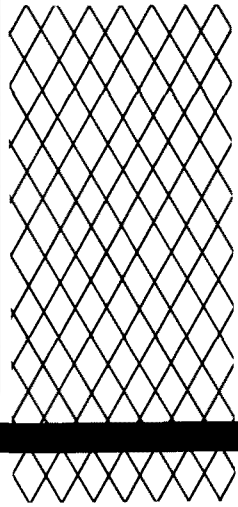
Price and supply. The three major vegetable oils produced in the U.S. are co-products of other industries (2). Cottonseed oil was once the major U.S. oil, with its supply dependent on the market for cotton fiber. Synthetic fiber reduced the demand for cotton and, subsequently, the supply of oil. Cottonseed oil is now in third place. Nearly 80% of the domestic oil production is soybean oil; corn oil is second, with about 7% of the production. The supply of corn oil has grown as a result of the strong demand for corn starch, corn sweeteners and fuel alcohol. Other vegetable oils that compete in the food service market include sunflowerseed, canola (rapeseed) and peanut. Animal-based fats are used both as frying shortenings and butter.

Neither the supply nor demand for fats and oils is very price sensitive (2). Demand, once satisfied, is not affected by price. The relative demand for a particular vegetable oil relates directly to the interchangeability of fats and oils. A small change in price, therefore, can greatly affect an oil's usage in any particular product. Processing capabilities allow the substitution among oil types. Substitution is often made based on the price of the oil.

Functionality. Most domestic vegetable oils have limited flavor stability. They may be used in salad dressings and sauces where less stress is placed on the oil than in frying or baking. Animal fats, because of their saturation, are naturally stable and are used without modification where solid shortenings may be used (3). Combinations of animal fats softened with vegetable oil are prepared for use as frying fats.

Stressed vegetable oils produce characteristic flavors. Soybean oil develops a fishy, painty, or "beany" odor and flavor. Corn oil develops a slight burnt or "corny" flavor, and cottonseed oil develops a nonobjectionable nutty flavor. Peanut oil possesses a natural nutty flavor and aroma. Both corn and cottonseed oils can be used to mask the

Photo courtesy of Lou Ana Foods Test Kitchen, Opelousas, Louisiana, directed by Leo Gingras, research and development manager.



The food service industry has been moving toward greater use of liquid shortenings and fluid margarines mainly due to convenience in pouring and measuring.

undesirable flavors that oils develop, particularly those from soybean oil. Oil blends are prepared for use in fast food deep frying as well as commercial snack frying. Blends produced include cottonseed/soybean, corn/soybean and peanut/soybean.

Hydogenated vegetable oils possess improved stability for frying (4). Partially hydrogenated soybean and corn oils are most frequently used. Brush or lightly hydrogenated soybean oil (100–110 I.V.) is generally processed into a liquid shortening form with the solids held in suspension by a fully hydrogenated component, generally a 0–8 I.V. soybean oil. Clear, liquid oils are also produced from lightly hydrogenated oil (80–110 I.V.) that has been winterized to remove the solids fraction.

More heavily hydrogenated oils in the 65–85 I.V. range constitute the plastic cube forms available. These are marketed as heavy duty frying shortenings for bakery applications. Fried chicken, fish, pies and other fried products prepared with the heavy duty frying shortenings are sold in fast food restaurants. Both single component and blended shortenings are marketed.

Various vegetable oils after partial hydrogenation may be used in preparing bakery shortening basestocks. Soybean oil is normally used because of price. To obtain the desired plasticity, a B′ crystalline fat, such as 0–8 I.V. cottonseed oil, is added to the base fat at 10–15%. Hydrogenated palm oil is also used.

The food service industry has been moving toward greater use of liquid shortenings and fluid margarines. This trend is driven mainly by convenience in pouring and measuring a liquid product, coupled with greater emphasis on health and nutrition. Proposed food service labeling requirements may also enforce the use of liquid products.

Image/perception. Animal-based shortenings have the image of being nonhealthful, possess saturated fatty acids and contain cholesterol, yet the characteristic tallow flavor developed with fried foods, particularly french fries, is preferred. Corn oil is perceived as a good quality, high purity, polyunsaturated, no-cholesterol cooking and salad oil (5). Users of corn oil have been able to capitalize on this image. Currently, some major fast food chains have adopted hydrogenated corn oil in a blend with cottonseed oil to take advantage of this image; margarine producers also have used corn oil.

Corn oil was probably in the right place at the right time for studies on the effect of polyunsaturated fatty acids and on saturates, monounsaturates and polyunsaturates. The favorable results of various investigators have been used by trade associations and large producers to build the image of corn oil. However, the fatty acid compositions of the major vegetable oils are not that different (Table 1).

Peanut oil, at least in the southern U.S., is preferred for fish frying and general frying. Blends of soybean oil liquid shortening or cottonseed oil

TABLE 1

Fatty Acid Composition (by %) of Major U.S. Vegetable Oils

	Cottonseed oil	Corn oil	Soybean oil
Saturated	26.2	13.8	15
Monounsaturated	18.0	25.4	24
Polyunsaturated	55.1	60.8	61

with peanut oil are produced to capture the preference for peanut oil and the economy of the lower-priced oils.

Nutrition. The importance of nutrition to today's consumer has been highlighted in various surveys (5). A 1986 Gallup survey conducted by the National Restaurant Association revealed that six out of ten consumers have altered their eating habits in accord with U.S. dietary guidelines. Four out of ten report altering their restaurant eating habits as well. Ninety-three percent of consumers are "very" or "somewhat" concerned about nutrition and health. A food attitude survey revealed that the most popular types of salad dressings are "light" or low calorie. Many restaurants are offering "lite" (diet) menu items. As previously noted, others have changed from tallow to vegetable oil to avoid the animal fat designation.

The American Heart Association (AHA) has given its approval to vegetable oils in the diet for a healthier heart. Also, the National Institutes of Health and the AHA have issued guidelines recommending a reduction in overall consumption of dietary fat to 30% of daily calories and reduction of saturated fat intake to 10%, with the remainder being 10% polyunsaturated and 10% monounsaturated fatty acids. Overall, downward pressure on oil consumption is occurring.

Fats and oils in food service

Food service use of fats and oils is primarily for deep frying, griddle and pan frying, salad and cooking oils, and baking. Nearly half of all lunch and dinner food orders in restaurants include deep-fried items, a fact which reflects the importance of this method of food preparation (3). Deep frying is rapid and economical, and meets the needs of the food service operator. Consumer flavor preference and demands for efficiency make deep frying the method of choice for food service preparation. Oils used in deep frying include refined cottonseed, corn, peanut, tallow and various hydrogenated oils. The major changes that occur with frying fats are color formation, oxidation, polymerization and hydrolysis. The operator may assess performance by color of the fried food, flavor of the oil, foaming or gum tendency, or decrease in smoke point. Rapid assessment of fryer performance may be performed by color kits or free fatty acid techniques. The major factors involved in oil life are fryer temperatures, turnover rate of the oil, the food being fried, and care of the fryer, such as daily filtration. Oils used in pan and griddle frying are usually butter-flavored and colored, with lecithin added to prevent sticking and spattering. Partially hydrogenated, winterized soybean oil and partially hydrogenated soybean oil processed in a liquid shortening form are the most widely prepared products. Often, these are used to replace butter or margarine for bun coating or in vegetables, sauces and dip preparations.

Salad oil requirements are the same for food service as for industrial salad oils. Chill-proofing is the major requirement. Soybean oil is naturally chill-proof, whereas cottonseed requires winterization and corn oil must be dewaxed. The desirability of any particular oil depends on the preference of the food service operator.

Bakery shortening requirements are also the same for food service as the industrial bakery.

Conclusions

Food service is a major market for processed oils. Continued growth is anticipated. Trends have shown a move away from animal fats to partially hydrogenated vegetable oil-based products as well as movement toward liquid oils. The preference for a particular oil may be a function of price, functionality, image or nutrition. To counter the downward pressure on oil consumption, the benefits of any particular oil will have to be expressed to maintain usage levels. Information on an oil's nutritional characteristics, how it may be used and how to functionally meet the needs of the food service operator has to be developed. Producers must keep abreast of these changes in order to find their position in the current market.

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