Dietary lipids raise complex questions

"It would be hard to imagine a life without dietary lipids—it would be dull," F.M. Clydesdale of the University of Massachusetts' Department of Food Science told attendees at the opening of the Northeast AOCS Section's Symposium on Dietary Lipids, held in April at that university's Amherst, Massachusetts, campus. As the day's program unfolded, it was evident that current issues concerning dietary lipids are far from dull.

Generating the most interest was a discussion of the possible implications fat substitutes could pose in the American diet if they are approved by the U.S. Food and Drug Administration (FDA). Ron Jandacek of Procter & Gamble Co. (P&G) reviewed the information available on olestra—P&G's fat substitute now under review by FDA. FDA's John Vanderveen, meanwhile, made it clear FDA will move with extreme caution before approving such substances for human consumption.

Jandacek explained that olestra biologically is resistant to pancreatic fat-splitting enzymes, and cited numerous studies that verified olestra is not absorbed in the body. Physically, olestra is stable in the alpha-phase and is completely miscible with vegetable oil containing similar triglycerides, thus allowing blending. Also, heating does not affect its nonabsorbability or its stability. Jandacek said studies show olestra does not affect amino acid or essential fatty acid absorption.

In high doses in animals, however, olestra does affect fat-soluble vitamin absorption. "The level of olestra is what determines whether there is an alteration," Jandacek said, adding, "Low levels of olestra or increased levels of vitamins can take care of this problem." Findings from clinical trials have led to the recommendation to supplement 1 mg of vitamin E per gram of olestra; studies did not show the need for supplementing vitamins A, D or K for the proposed uses of olestra.

Jandacek stressed that olestra is not being considered as a total dietary fat replacement. In its petition to FDA, P&G has asked that olestra be permitted to replace up to 35% of fats in shortenings and oils for home cooking use and up to 75% of the fats in commercial deep-fat frying and snacks. Jandacek projected six grams of olestra per day as the average amount that will be consumed by individuals. Symposium attendees, however, questioned whether some fried-food aficionados would regularly consume more than that.

Speaking on regulatory issues related to fat, FDA's Vanderveen noted that the dietary dilemma for Americans may be more of an energy problem—overconsumption leading to obesity—rather than a problem with fat as such. He noted that the latest dietary guidelines for Americans give only a qualitative statement and no quantification. "This is now being resolved," he said, citing the Surgeon General's recent report and the National Research Council's latest report, "Diet & Health Implications for Reducing Chronic Disease Risk."

Saturated fat intake is recognized as an important factor related to serum cholesterol, but it is premature to make recommendations concerning dietary fiber, Vanderveen said. Increased polyunsaturated fatty acid consumption has raised another concern. "Polyunsaturated fatty acids (PUFA) do enhance the amount of tumors found when a known carcinogen is introduced," he said.

Vanderveen said FDA is pondering a recommendation by S.M. Grundy that stearic acid should be removed from consideration as a saturated fat because it converts to 18:1 when absorbed. FDA regulations, however, define saturated fat as C-12, C-14, C-16 and C-18. "If we change this to eliminate C-18, that would be a major step," Vanderveen said.

In other saturated fat-related issues, FDA opposes singling out tropical oils as "bad guys" in the American diet, particularly since they constitute only a minute share. Noting that tropical oils have functional characteristics that make them unique for some formulations, Vanderveen said, "If a company gets rid of palm oil because it is a saturated fat and then uses winterization to make oils function like palm oil, it is misleading the public." Citing attacks on hydrogenated fatty acids, he said, "I personally feel *trans* fatty acids do not present a health problem for the general population. However, the *trans* fatty acid issue never seems to die." FDA is conducting studies on *trans* fatty acids which hopefully will "put to rest" such concerns, he said.

Health claims concerning omega-3 fatty acids have become another issue for food regulators, with FDA suggesting companies not make health claims for fish oil products. "The science is not in yet. More research is needed before such health claims can be made," Vanderveen said.

"From a regulatory point of view, labeling is the way to go," he stressed. Ingredient statements are important and will require more action by FDA. "Consumers and U.S. Congress are very unhappy with 'and/or' labeling for fats and oils," he said, predicting that FDA will have to take measures "very soon" to deal with this issue. He also predicted a final regulation on cholesterol labeling in the near future, perhaps during 1989.

Meanwhile, fat substitutes have created new issues, including how to label them and whether such foods are drugs. Even substances such as Simplesse—which uses protein as a fat—has raised concerns at FDA. "Is it safe? What is the long-range impact? Is it going to be effective? Indeed, this is a complicated area. On one hand, if a

product will be metabolized, will it alter the properties in the regular diet? If it isn't metabolized, safety is an issue."

He noted that Simplesse and olestra aren't the only substances to watch. "We already have polydextrose. What is the impact on the food supply? We have to do a careful estimate of the public's exposure to all of these substances and their impact on nutrition. This whole issue raises the question: Can someone harm himself by only eating these types of substances?"

He predicted FDA likely will conduct exposure assessments and postmarket surveillance for such substances. A main problem, he said, "is perhaps we'll not have enough data to make a decision, but we'll have to make the decision anyway."

National nutrition surveys

Kenneth Samonds, associate professor at the University of Massachusetts, said it is difficult to assess how much fat is actually consumed by Americans: fat content varies between products in the same category; other foods not thought of as "fat," such as breakfast cereals, are sources of fat; cooking methods can affect fat absorption; and the amount of fat added to foods is up to the consumer's discretion.

The amount of day-to-day intake of fat varies more than for any other nutrient. "For some people, monitoring intake for three to six days may be adequate; for others, it may require 20 days to accurately predict their average fat intake," Samonds said. Most surveys are based on only one day's worth of information. He noted that fat-containing foods are omitted or under-reported more than any other food in such surveys.

Also, surveys may make different assumptions about such issues as the extent to which meat is trimmed of fat, the size of the serving, and what kind of fat was actually eaten (i.e., margarine, imitation margarine or a spread). Samonds said the U.S. Department of Agriculture now has computerized recipes that are used to calculate what was eaten when a respondent mentions a particular menu item. However, these still are incomplete. Some unanswered questions include: When fat is lost or gained during cooking, are all fatty acids affected proportionately? When fat content changes, what happens to fat-soluble vitamins?

"When you try to estimate the polyunsaturated/saturated consumption, the problem of assessing accurately is magnified," he noted.

(Continued on page 754)

Fate of cholesterol and omega-3 fatty acids

W.W. Nawar of the University of Massachusetts at Amherst, general chairman for the symposium, spoke on the fate of cholesterol and omega-3 fatty acids during deep-fat frying. Nawar said there are many questions still unanswered. For instance, what happens to cholesterol and omega-3 fatty acids during processing, particularly frying? Are they lost or converted to good or bad products?

His conclusions were that both cholesterol and omega-3 fatty acid can oxidize readily and catastrophically—but not always.

Noting there are at least 60 oxidation products, Nawar pointed out cholesterol oxides are more toxic than cholesterol. Complicating any analysis, he said, are the facts that "analytical methods for cholesterol are very bad, and for cholesterol oxides, they are much worse."

"Fractionation of the many oxides is very complicated, and quantitation is nasty. We have spent two years solely on improving the analysis. And, what you can do with cholesterol in a test tube is completely different from cholesterol in food. In food, we have a complex situation. Some factors speed up oxidation, others slow it down. Therefore, we cannot generalize what will happen."

Because omega-3 FA are long-chain, "there are many possibilities where it could break down due to oxygen attack and cause many oxides, some toxic and some not," Nawar said. One product that can be formed is malonaldehyde, which can link with chains of peptides and bind with essential fatty acids.

Medium-chain triglycerides and structured lipids

John Cunningham, also of the University of Massachusetts, spoke on the metabolism of medium-chain triglycerides (MCT) and structured lipids as alternative energy sources for humans.

Despite their high saturation, MCT are liquid at room temperature; they also are highly water-soluble and are neutralized at high pH. Cunningham said MCT "are ideal for certain diseases that result in lipid malabsorption because MCT don't involve pancreatic lipase." Many MCT are commercially available as enteral formulations and as infant formulas for premature infants; the latter include MCT as 40% of the lipid content. Uses for MCT are:

- formulations for premature infants
- formulations for cystic fibrosis patients
- low-fat formulations
- specialized trauma formulations for burn patients

There is a definite advantage to using MCT in such formulations as they are absorbed by the intestinal cells and go directly to the liver, unlike long-chain triglycerides, which go to the tissues. "They act more like carbohydrates than lipids when they get to the liver. They also increase ketonic production, causing an insulin response; fats do not cause such an effect," he said.

However, because they go to the liver preferentially, MCT are not recommended for patients with liver disease. Also, he said, diarrhea and distention result after consuming too many MCT.

Structured lipids are a mixture of MCT and long-chain triglycerides and are used to manipulate calories and prostaglandins. Currently, structured lipids are used for medicinal purposes, particularly offering benefits for cystic fibrosis patients. Also, he said, modified dairy fat can be achieved by using 50% butter oil, 35% MCT and 15% sunflowerseed oil.

ASA requests panel for trade petition

The American Soybean Association (ASA) has asked the European Economic Community (EEC) to permit the establishment of a panel that would rule on the validity of ASA's trade complaints against the EEC.

ASA filed a Section 301 Petition in December 1987, claiming that the EEC's oilseed and protein crop subsidies are unfair to U.S. soybean exporters. The soybean group claimed the EEC "had nullified and impaired its duty-free tariff bindings on soybeans and soybean meal by offering lucrative subsidies to EEC farmers, processors and feed manufacturers." Those subsidies cost U.S. soybean farmers more than $1.4 billion in annual sales, according to ASA.

The U.S. Trade Representative's (USTR) office on Jan. 5, 1988, agreed to act on ASA's petition; however, the office's initial consultations with the EEC failed to resolve the issue. The next stage—the establishment of a General Agreement on Tariffs and Trade panel to investigate the charges—requires the concurrence of the EEC, which still had not given approval as of late April. "The EEC has been unable to agree on the terms of reference (or mandate) and the membership of the panel," according to A. Jane Bradley, associate general counsel in the USTR office.

"GATT consideration of our case could and should have been completed by now were it not for the EEC's foot-dragging. If the EEC does not allow ASA's case to go forward soon, the U.S. will be forced to retaliate against $1.4 billion in EEC exports to the U.S. on July 5, 1989," ASA President James Lee Adams said.

Under a provision of the 1988 Omnibus Trade Act, the USTR will be required to evaluate actions on