FOOD PRODUCT DESIGN

[Fats/Oils] Vol. 19 No. 2 February 2010

Heart Health and Fats

By Marie Spano, M.S., R.D., C.S.C.S., Contributing Editor

Dietary-fat recommendations for heart health are more specific now then ever, breaking down different types of polyunsaturated and saturated fats, and recommending whole foods that confer benefits above and beyond their fatty-acid profile. For a period of time, all fats were demonized as the cause of obesity and heart disease. But times have changed, according to Karen Lapsley, Ph.D., chief scientific officer, Almond Board of California, Modesto. “Research and public-policy opinions related to fat in the diet have changed incredibly in the past years,” she says. “There is an increased interest in the quality of dietary lipids as a major determinant of long-term health and well-being. With evolving nutrition science, we now talk about healthy food with a high fat quality—which must be differentiated from talking simply about foods of high or low fat quantity.”

In the 1950s, people were advised to decrease their total fat intake. For approximately 40 years thereafter, the recommendations were to decrease consumption of total fat, saturated fat and cholesterol, while increasing intake of foods rich in monounsaturated and polyunsaturated fats.

In the past 15 years, however, the focus has shifted from total fat to “good fats” and “bad fats.” By the mid-1990s, mounting scientific evidence of the negative health effects from consumption of manmade *trans* fatty acids parlayed into an onslaught of public-health messages, labeling requirements and changes in food manufacturing. On the “good fat” side, the omega 3s eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) reign (*Journal of Nutrition*, 1998; 128:449S-452S).

Harmful fats

For several years, health authorities were so busy demonizing all foods high in saturated fat that they overlooked the negative health effects of manmade *trans* fatty acids hiding in seemingly healthy vegetable-oil products. However, more-recent research indicates that not all saturated fatty acids are harmful for the heart.

There are several factors that can influence the atherogenic potential of specific saturated fatty acids, including chain length, fats eaten concurrently, overall diet, carbohydrate intake, and the person’s state of health. Studies show that stearic acid has a neutral effect on HDL and lowers LDL in comparison to unsaturated fatty acids (*American Journal of Clinical Nutrition,* 2010; 91:46-63). In addition, replacing carbohydrate with fat (including saturated fat) will decrease triglycerides and increase HDL cholesterol (*American Journal of Clinical Nutrition*, 1995; 61:1,368S-1,373S). And, making matters somewhat more complex, the importance of total blood cholesterol, and therefore factors that alter blood cholesterol, as a risk factor for heart disease has been questioned following the discovery that statin drugs work, in part, independently of cholesterol reduction (*Alternative Medicine Reviews*, 2007; 12:228-45). Consequently, some scientists have diverging opinions on saturated fat and heart health, especially considering the specific population consuming the fat (*Archives of Internal Medicine*, 2009; 169:659-669).

Although research is still examining relationships between saturated-fatty-acid intake and cardiovascular-disease risk factors (especially in those on low- or very-low-carbohydrate diets), the consensus is in on manmade *trans* fatty acids from partially hydrogenated oils: They decrease HDL and increase LDL, triglycerides, insulin resistance and risk of cardiovascular disease (*Circulation*, 2007; 115:1,858-1,865; *American Journal of Public Health*, 1995; 85:411–412; *New England Journal of Medicine*, 2006; 354:1,601-1,613). Despite the fact that manmade *trans* fatty acids are bad for the heart, studies indicate that the naturally

occurring *trans* fatty acid vaccenic acid, found in ruminant fats and converted into conjugated linoleic acid (CLA) in the body, has no affect on cardiovascular disease and may in fact have some health benefits (*Applied Physiology, Nutrition and Metabolism,* 2009; 34(5):979-991).

Manmade *trans* fatty acids are the worst fats for heart health, and some saturated fatty acids are also atherogenic, depending on concurrent dietary intake (*Nutrition and Metabolism,* 2005; 2:21).

Questionable Fats

Interesterified fats have been used for decades in margarines, cooking oils and infant formulas (*Annals of Nutrition & Metabolism,* 2009; 54:15-24) but their use in food has accelerated since the onslaught of pressure to remove *trans* fatty acids from foods. Interesterification involves enzymatic or chemical fatty-acid rearrangement along the glycerin molecule. By altering the chemical structure of a fat and inserting a saturated fatty acid (typically stearic acid), interesterification changes the physical properties of the fat, hardening the oil and making it ideal for various food preparations. Compared to the research on manmade *trans* fats, there is relatively little research in humans regarding how interesterified fats may affect human health. However, by altering the natural position of fatty acids along a 3-carbon glycerol backbone, some studies suggest this could affect both lipoprotein metabolism and atherogenesis (*Current Opinions in Lipidology*, 2001; 12:55-60; *Lipids*, 2000; 35:621-625).

Older studies indicate that interesterified fats have no effect on blood lipids, but also state that health effects may depend on the type of fatty acid inserted and where it is inserted (*Nutrition Research Reviews*, 2009; 22(1):3-17; *Lipids*, 2001; 36(7):655-68; *American Journal of Clinical Nutrition*, 1998; 68:242-247; *European Journal of Clinical Nutrition*, 1997; 51:527-534). In addition, other factors, such as the type of interesterification, chemical or enzymatic, and whether the person consuming it is obese or of normal weight may determine if and how the modified fat affects metabolic risk factors. In a randomized, crossover study in 11 obese and 10 non-obese men, with each subject serving as his own control, several measures were taken 6 hours following consumption of 50 grams of carbohydrate from white bread in addition to 1 gram of fat per kilogram of body mass of non-interesterified, chemically interesterified or enzymatically interesterified stearic-acid-rich fat spread or no fat. Interesterification had no affect on postprandial glucose, insulin, free fatty acids or cholesterol in either group. However, obese subjects showed an 85% increase in triglycerides after consuming the fat that was modified through chemical interesterification versus non-interesterification. Non-obese subjects' triglycerides were not affected by either fat treatment. (*Lipids*, 2009; 44(1):17-26). It is worth noting, however, that in this study, the total load of fat and altered fat was extreme for one meal (91 grams of fat for a 200 lb. adult).

In a four-week study comparing different fats, a manmade *trans*-fatty-acid-rich partially hydrogenated soybean oil (containing 3.2% *trans* fatty acids and 6.5% palmitic acid), palm olein (containing 12% palmitic acid) and an interesterified fat (providing 12.5% stearic acid) were given to 30 subjects fed a controlled, whole-food diet that differed only in the composition of the fat. A crossover design was used so each subject served as their own control during the three different test periods. Both partially hydrogenated soybean oil and the interesterified fat elevated the LDL:HDL ratio and fasting blood glucose (almost 20% in the interesterified group). In addition, the interesterified fat meal led to a significant rise in postprandial blood glucose. This study found that interesterified fat, in addition to the partially hydrogenated soybean oil, unfavorably altered lipoprotein and glucose metabolism in comparison to an unmodified highly saturated fat (*Nutrition & Metabolism*, 2007; 4:3).

Adding small amounts of interesterified fats to margarines can decrease the saturated fat content and cut out manmade *trans* fatty acids. Any potential untoward health effects associated with the consumption of

interesterified fats likely depend on the quantity consumed, the type of interesterification and the health of the person consuming it. As of this writing, interesterified fat is not required on food labels or in the ingredients list.

Heart-healthy fats

Heart-healthy fats include polyunsaturated and monounsaturated fatty acids (*Archives of Internal Medicine*, 2009; 169(7):659-669). And, while specific fatty acids stand out, others may be healthy merely because the person consuming them has replaced an unhealthy fat with a healthier fat (i.e., replacing shortening with oil).

Several clinical trials using fats high in monounsaturated fatty acids, as well as epidemiological studies examining heart-health benefits from a Mediterranean diet, indicate that monounsaturated-fat-rich diets may help lower LDL cholesterol while raising HDL (*Molecular Nutrition & Food Research*, 2007; 51:1,225-1,234; *Public Health Nutrition*, 2006; 9:105-110).

Among the polyunsaturated fats, omega-3 fatty acids stand out. Despite the widespread recommendation to consume omega-3 fats, the majority of studies on omega-3s have focused on EPA and DHA, both of which are considered cardioprotective. EPA plus DHA intake is inversely related to risk of fatal (and possibly nonfatal) CHD (*Journal of Nutrition*, 2009; 139(4):804S-819S). In addition, fish-oil intake can reduce blood pressure, especially in older, hypertensive populations, and decrease triglycerides in a dose-dependent manner (*Agency for Healthcare Research and Quality*, Publication Number 04-E010-1). It remains unclear if one or the other, EPA or DHA, is superior for heart health, although studies have found heart-health benefits from taking them together or independently of one another (*Lancet*, 2007; 369:1,090-1,098; *Prostaglandins, Leukotrienes, and Essential Fatty Acids*, 2009; 81:199-204).

Some studies suggest that alpha-linolenic acid (ALA) is also heart healthy, whereas others have found no benefit from ALA. However, these studies vary considerably in study population and design, and the epidemiological studies relied on dietary questionnaires, which can result in major reporting errors, to assess ALA intake (*Lipids in Health and Disease*, 2009; 8:33). ALA may be associated with a decreased rate of fatal and nonfatal coronary events. In addition, ALA intake may reduce arrhythmia and inhibit the omega-6 metabolic pathway—helping prevent platelet aggregation and decrease vascular pressure (*Alternative Therapies in Health and Medicine*, 2005; 11:24-30; *Minerva Cardioangiologica*, 2006; 54:431-432).

Through genetic modification, the Monsanto Company, St. Louis, produced SDA, a new soybean oil rich in omega-3 fatty acids. Developed by inserting one gene from a different plant and one from a fungus into soybeans, the soybeans contain approximately 20% stearidonic acid, an omega-3 fatty acid that is produced in the body from the enzymatic desaturation of ALA (although this conversion process is inefficient). In 2009, SDA omega-3 soybean oil received GRAS status for intended use.

To date, one published study has examined how consumption of SDA omega-3 soybean oil affects tissue levels of EPA and DHA. In this study, 45 healthy, overweight adults consumed SDA oil providing 3.7 grams of SDA. SDA consumption increased risk-based concentrations of EPA levels with about 17% efficiency. DHA levels remained unchanged (*Lipids*, 2008; 43(9):805-811). Consuming a diet containing more SDA may increase tissue EPA levels, but studies to date have failed to show that consuming normal doses of SDA will result in significant increases in tissue DHA levels (*Lipids*, 2008; 43(9):805-811; *American Journal of Clinical Nutrition*, 2003; 77(5):1,140-1,145). In addition, no studies to date have examined SDA oil intake and established its relationship to risk factors of cardiovascular disease.

Best bets for fat

In the United States, the main recommendations for fat intake come from the Dietary Guidelines for Americans, the Institute of Medicine's Dietary Reference Intakes and the American Heart Association (AHA), Dallas.

The 2005 Dietary Guidelines for Americans recommend:

• Less than 10% of calories from saturated fatty acids;

• Less than 300 mg per day of cholesterol;

• Keep *trans*-fatty-acid consumption as low as possible;

• Total fat intake of 20% to 35% of calories, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts and vegetable oils;

• When selecting and preparing meat, poultry, dry beans, and milk or milk products, make choices that are lean, low-fat or fat-free;

• Limit intake of fats and oils high in saturated and/or *trans* fatty acids, and choose products low in such fats and oils.

The guidelines do not distinguish between *trans* fatty acids from synthetic oils and those that are naturally occurring, but instead identify the most-prevalent sources of *trans*-fat intake from all foods, including animal products. The seventh edition of the Dietary Guidelines for Americans will be published in fall 2010.

The Food and Nutrition Board of the Institute of Medicine set the following acceptable macronutrient distribution ranges for fat in the "Dietary Reference Intakes (DRI) for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids":

• N-6 polyunsaturated fatty acids (linoleic acid): 5% to 10% of energy intake;

• N-3 polyunsaturated fatty acids (α-linolenic acid): 0.6% to 1.2% of energy intake.

There is no DRI for EPA or DHA. In the body, approximately 8% to 21% (men are at the low end of this range and women at the higher end) of ALA is converted to EPA and just 4% to 9% of ALA makes its way to DHA (*Current Opinions in Clinical Nutrition & Metabolism*, 2004; 7:137-144).

AHA recommends that people without documented coronary heart disease (CHD) eat 3.5 oz. cooked (or ¾ cup flaked) fish (particularly fatty fish) at least two times per week and consume oils rich in ALA (flaxseed, canola and soybean oils; flaxseeds and walnuts). AHA recommends patients with documented CHD consume 1 gram of EPA plus DHA per day, preferably from fatty fish, and that patients who need to lower their triglycerides consume 2 to 4 grams of EPA plus DHA per day under a physician's care.

As science advances, the recommendations on fat and heart health will continue to evolve. Recent studies show differences in how certain fatty acids affect heart health risk factors in obese and non-obese individuals, as well as those with no known cardiovascular risk factors in comparison to those with established cardiovascular disease risk factors. These potential effects on overall heart health vary, depending not only on the person's state of health, but also their overall diet. At this time, it is clear that manmade *trans* fatty acids are bad for the heart, whereas the omega-3 fatty acids DHA and EPA are heart-healthy. Epidemiology studies also

show that diets rich in monounsaturated fatty acids from foods such as olive oil, nuts and seeds are associated with a decrease in cardiovascular-disease incidence.

Marie Spano, M.S., R.D., C.S.C.S., is a nutrition communications expert whose work has appeared in popular-press magazines, e-zines and nutrition-industry trade publications. She has been an expert guest on NBC, ABC and CBS affiliates on the East Coast. For more information, visit mariespano.com.