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for WiseTraditions IN FOOD, FARMING AND THE HEALING ARTS
Education • Research • Activism

Comments on the Report of the 2005 Dietary Guidelines Advisory Committee

Submitted by the Weston A. Price Foundation

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EXECUTIVE SUMMARY

- The Foundation recommends guidelines that encourage the inclusion the following four food groups in the daily diet:
  - *Animal foods: meat, poultry, fish, eggs and whole milk products*
  - *Grains and legumes: whole grain baked goods and breakfast porridges, beans*
  - *Fruits and Vegetables: preferably fresh or frozen*
  - *Beneficial Fats and Oils: unrefined saturated and monounsaturated fats including butter and other animal fats, palm oil and coconut oil, olive oil and peanut oil*
- The emphasis of the guidelines should be on food quality, not on contrived macronutrient ratios.
- The guidelines should include warnings to avoid refined foods such as sugar, high fructose corn syrup, white flour, industrially processed vegetable oils, *trans* fats and artificial flavorings.
- The Food Pyramid concept should be scraped.
- The Foundation recommends that the 2005 Dietary Guidelines Advisory Committee discontinue its unscientific opposition to animal fats.
- The Report lists a number of incorrect statements about saturated fatty acids and sources of stearic acid.
- Children especially require enough of the stable saturated fats; they need enough of the monounsaturated fats or oils; and they need an adequate amount and a proper balance of the essential fatty acids, which come primarily from the omega-3 and omega-6 oils.
- Foods should be chosen so that they supply a mixture of beneficial fats and oils. No one fat or oil can properly suit all purposes, although many of the good quality animal fats come close.
- The only good source of fat-soluble vitamins in the American diet is butterfat.
- Babies and children need cholesterol-rich foods, such as butter and butterfat, throughout their growing years to ensure proper development of the brain and nervous system. Children should not be limited to nonfat or low-fat milks.
- There are a number of nutritional differences between the meat of pasture-raised and feedlot-raised animals: meat from grass-fed cattle, sheep, and bison is lower in total fat.
- Commercial, refined vegetable oils should be limited in their consumption
- Cholesterol is not the cause of heart disease but rather a potent antioxidant weapon against free radicals in the blood, and a repair substance that helps heal arterial damage, although the arterial plaques themselves contain very little cholesterol.
- “Added sugars” should be returned to its prominent place in the Committee’s findings, not buried under “Choose Carbohydrates Wisely for Good Health;” as the consumption of sugar has increased in the United States, so have all the "civilized" diseases.

The Weston A. Price Foundation

The Weston A. Price Foundation is a nonprofit, tax exempt food and nutrition education organization founded in 1999. The Foundation is dedicated to restoring nutrient-dense foods to the American diet through education, research and activism.

One of our goals is to disseminate and update the research of nutrition pioneer Dr. Weston Price, whose studies of isolated non-industrialized peoples established the parameters of human health and determined the optimum characteristics of human diets. Dr. Price's research demonstrated that humans achieve optimal physical form and health generation after generation only when they consume nutrient-dense whole foods and the vital fat-soluble activators, such as vitamins A and D, found exclusively in animal foods.

The Foundation supports a number of movements that contribute to this objective including accurate nutrition instruction, organic and biodynamic farming, pasture feeding of livestock, community-supported farms, honest and informative labeling, prepared parenting and nurturing therapies.

The board and membership of the Weston A. Price Foundation stand united in the belief that modern technology should be harnessed as a servant to the wise and nurturing traditions of our ancestors rather than used as a force destructive to the environment and human health; and that science and knowledge can validate those traditions.

The Foundation's quarterly journal, *Wise Traditions in Food, Farming, and the Healing Arts*, is dedicated to exploring the scientific validation of dietary, agricultural and medical traditions throughout the world. It features illuminating and thought-provoking articles on current scientific research, human diets, non-toxic agriculture, and holistic therapies. The journal also serves as a reference for sources of foods that have been conscientiously grown and processed.

Members of the Weston A. Price Foundation have created a network of more than 225 local chapters throughout the U.S., Canada, Australia, New Zealand, Europe and now Moscow to help find locally grown meat, eggs, dairy products and produce; and work towards the return of nutrient-dense foods to American tables through educational and activist activities.

The Foundation is member-driven and does not receive funding from any industry source.

The Foundation invites you to visit its informative and educational website at www.westonaprice.org.

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INTRODUCTION

The Weston A. Price Foundation wishes to express its gratitude for the enormous undertaking of the 2005 Dietary Guidelines Advisory Committee (DGAC) and its final Report to the Secretaries of Agriculture and Health and Human Services. The Foundation agrees with many of the findings of the Committee, particularly those relating to the consumption of fruits and vegetables and whole grain products, physical activity, keeping foods safe to eat, and alcohol consumption.

We, however, take exception to the findings of the Committee regarding fats and oils, whole milk, solid fats and added sugars.

Based on our experience with fatty acids, particularly that associated with the internationally renown lipid researcher Mary Enig, PhD and F.A.C.N., and vice president and science advisor to the Foundation, we find that much of the findings of the Committee regarding saturated fats, animal fats and cholesterol do not hold up to scientific scrutiny. The scientific evidence, honestly evaluated, does not support the assertion that "artery-clogging" saturated fats cause heart disease. More than 60 percent of all heart attacks occur in people with normal cholesterol levels. The majority of people with high cholesterol never suffer heart attacks and half of all heart attack victims have none of the standard risk factors, i.e., obesity, high cholesterol, smoking or genetics.

Animal foods containing saturated fat and cholesterol provide vital nutrients necessary for growth, energy and protection from degenerative disease. Like sex, animal fats are necessary for reproduction. Humans are drawn to both by powerful instincts. “Whatever is the cause of heart disease,” said the eminent biochemist Michael Gurr, “it is not primarily the consumption of saturated fats.

We also find that the Committee’s recommendation that Americans consume nonfat and low-fat milk and milk products is deleterious to the health of children. Whole milk with butterfat is necessary for the healthy growth of infants and children.

Also, the Report’s discussion of animal fats makes no distinction between grass-fed/pastured animals and poultry verses grain-fed/feedlot animals and poultry. We provide an in-depth review of the scientific literature regarding the efficacy of consuming grass-fed/pastured meats and poultry over feedlot-raised meats.

Lastly, we believe that “added sugars” should not have been removed from the all-important findings section of the Report and relegated to a section under “Choose Carbohydrates Wisely for Good Health.” According to a recent *Wall Street Journal* article, childhood weight gain in America might well be caused in good measure by "the sweetening of America." Added sugars are too important an issue to be buried under carbohydrates in general.

CONSUME A VARIETY OF FOODS WITHIN AND AMONG THE BASIC FOOD GROUPS, WHILE STAYING WITHIN ENERGY NEEDS

The Weston A. Price Foundation is very much in agreement with this statement of the Committee to "consume a variety of foods within and among the basic food groups, while staying within energy needs." However, we make the following caveats. As we testified on September 21, 2004 at the oral presentations on the Report of the 2005 Dietary Guidelines Advisory Committee, we recommend guidelines that encourage the inclusion the following four food groups in the daily diet:

- *Animal foods: meat, poultry, fish, eggs and whole milk products*
- *Grains and legumes: whole grain baked goods and breakfast porridges, beans*
- *Fruits and Vegetables: preferably fresh or frozen*
- *Fats and Oils: unrefined saturated and monounsaturated fats including butter and other animal fats, palm oil and coconut oil, olive oil and peanut oil*

The emphasis should be on food quality, not on contrived macronutrient ratios, with warnings to avoid refined foods such as sugar, high fructose corn syrup, white flour, industrially processed vegetable oils, *trans* fats and artificial flavorings. We also advocate that the Food Pyramid concept be scraped. It artificially depicts food groups as more or less important than others while making recommendations that are deleterious to the American diet.

Fifty years ago, grocery stores stocked about 200 items. Seventy percent of those were grown, produced or processed within a 100-mile radius of the store. Today, the average supermarket carries 50,000 food items or more; most of these foods are highly processed and refined, most of which are transported thousands of miles to their final destination.

Americans spend over 90 percent of their food dollars on these processed foods - foods that contain high levels of refined sugars, high fructose corn syrup, refined polyunsaturated oils and *trans* fatty acids, excitotoxins such as MSG and aspartame, as well as highly processed protein isolates.

Only during the last century has man's diet included a high percentage of refined carbohydrates. Our ancestors ate fruits, vegetables and grains in their whole, unrefined state. In nature, sugars and carbohydrates—the energy providers—are linked together with vitamins, minerals, enzymes, protein, fat and fiber—the bodybuilding and digestion-regulating components of the diet. In whole form,

carbohydrates support life, but refined carbohydrates are inimical to life because they are devoid of bodybuilding elements.

The reduction in nutrients in these foods requires that we eat more to satisfy the body's nutritional requirements; hence, the issue with energy consumption. Since the foods consumed are of lesser nutrient-dense value, our body requires more food intake to supply its nutrient needs. The greater food intake brings forth, in most cases, greater caloric consumption. An interesting Catch-22.

In addition, the Foundation urges the 2005 Dietary Guidelines Advisory Committee discontinue its unscientific opposition to animal fats. This will be addressed under the following section on "Choose Fats Wisely for Good Health."

CHOOSE FATS WISELY FOR GOOD HEALTH

The Foundation finds that much of the findings of the Committee regarding saturated fats, animal fats and cholesterol do not hold up to scientific scrutiny.

A. Overview

The Report of the 2005 Dietary Guidelines Advisory Committee (DGAC) have been set up to control the "direction for all government nutrition programs including research, education, food assistance, labeling and, and nutrition promotion." Also, the DGAC allows the government to speak with one voice regardless of the accuracy of that speech. This means that for the next five years beginning in 2005, all the incorrect directions for saturated fats will be in control and important research will be impossible to be funded by U.S. agencies.

The Key Findings of the 2005 DGAC contained the recommendation to "Choose fats wisely for good health." In the more detailed part of the report the statements are all in opposition to choosing saturated fats even though there is ample published scientific evidence that saturated fats are quite healthful and, in fact, are even essential under many circumstances. This is especially true for the medium-chain saturates as found in coconut oil, which serve as antimicrobial fats, as anti-obesity sources, anti-inflammatory fats to fight coronary heart disease, and as specific saturated fatty acids needed to cellular signaling.

The DGAC has listed several incorrect statements about saturated fatty acids and sources of stearic acid. For example, the idea that important food sources of stearic acid are partially hydrogenated vegetable oils, when it is totally hydrogenated vegetable oils that are a source of stearic acid is misleading.

In order to understand how inappropriate the 2005 dietary guidelines recommendations regarding saturated fat are, it is essential to understand the history of the guidelines and current recommendations. The history begins in the late 1970s and emanate from the McGovern Committee Dietary Goals. The original recommendations regarding fat were developed by lawyers and journalists who had no science background and industry lobbyists whose agenda was easily obscured by the audience[1]s ignorance.

There has been a long-term interest and involvement on the part of the food industry in the shaping of public policy attitudes to fats and nutrition. This is especially true for the domestic food fats and oils industry in the United States, as represented first by the corn oil interests, then by the soybean oil interests, and finally in the recent decade by the canola rapeseed oil interests. This interest and involvement can be traced in large measure back to the initial involvement of the edible oil industry in shaping directives coming from of the American Heart Association.

In the early 1960s in the U.S., the domestic oil industry reacted to the news from a vocal researcher (Ancel Keyes, 1956) that (partially) hydrogenated fats were the culprits in heart disease in a way that has had long-term ramifications beyond anyone¹s expectations. The industry did this by turning the focus away from the (partially) hydrogenated fats and onto the saturated fats. It did not take too many years before the public had learned to accept the idea that the saturated fats were the bad guys. Gradually this became the clarion cry of the nutrition world. The fact that it was not true seemed to have eluded most people.

The initial attack was directed at coconut oil in an effort to demonize saturated fatty acids in general, and because coconut's fatty acid composition contained about 90% saturates. It therefore was always listed as the highest of saturated fats. The fact is that 65% of the coconut oil saturates are really medium-chain saturates, and there is a difference between the medium-chain saturates, (which made up two-thirds of coconut oil) and the other longer-chain saturates. It was really the longer-chain saturates, which were the competition to the *trans* fatty acids, which the food industry wanted to protect at all costs from legitimate criticism. These longer chain saturates were not a problem, but more importantly they were not the same as *trans* fats.

The attempt to protect the *trans* fatty acids is well-documented in the McGovern Committee papers. The original criticism of the partially hydrogenated fats and oils as a cause of coronary heart disease was challenged by some food industry scientists who claimed that the charge against the partially hydrogenated vegetable fats should be directed instead to the saturated fats in the hydrogenated oils. The members of that first dietary goals committee and every committee since then have not had sufficient scientific understanding or scientific honesty to recognize the singular guilt of the *trans* fatty acids and the total lack of responsibility of the saturated fatty acids.

The following information from a 1999 paper ("Health and Nutritional Benefits from Coconut Oil and its Advantages over Competing Oils," Mary G. Enig, Ph.D., F.A.C.N.) gives facts and historical overview of saturated fats and heart disease. Unless this history is recognized, the food and nutrition community will be stuck for the next 5 years with misinformation about saturated fats that will run the show. (The full paper can be found on the Weston A. Price Foundation website along with the references.)

The literature of epidemiological studies usually attribute an increased risk of coronary heart disease (CHD) to elevated levels of serum cholesterol, which in turn are thought to derive from a dietary intake of saturated fats and cholesterol. But, saturated fats may be considered a major culprit for CHD only if the links between serum cholesterol and CHD, and between saturated fat and serum cholesterol are each firmly established. Decades of large-scale tests and conclusions there from have purported to establish the first link. In fact, this relationship has reached the level of dogma. Through the years metabolic ward

and animal studies have claimed that dietary saturated fats increase serum cholesterol levels, thereby supposedly establishing the second link. But the scientific basis for these relationships has now been challenged as resulting from large-scale misinterpretation and misrepresentation of the data. [1,2,3,4]

Ancel Keys is largely responsible for starting the anti-saturated fat agenda in the United States. From 1953 to 1957 Keys made a series of statements regarding the atherogenicity of fats.[5] These pronouncements were:

> "All fats raise serum cholesterol; Nearly half of total fat comes from vegetable fats and oils; No difference between animal and vegetable fats in effect on CHD" (1953);
>
> "Type of fat makes no difference; Need to reduce margarine and shortening" (1956);
>
> "All fats are comparable; Saturated fats raise and polyunsaturated fats lower serum cholesterol; Hydrogenated vegetable fats are the problem; Animal fats are the problem" (1957-1959).

As can be seen, his findings were inconsistent.

What about the role of edible oil industry in promoting the diet/heart hypothesis? It is important to realize that at this time (1960s) the edible oil industry in the United States seized the opportunity to promote its polyunsaturates. The industry did this by developing a health issue focusing on Key¹s anti-saturated fat bias. With the help of the edible oil industry lobbying in the United States, federal government dietary goals and guidelines were adopted incorporating this mistaken idea that consumption of saturated fat was causing heart disease. This anti-saturated fat issue became the agenda of government and private agencies in the US and to an extent in other parts of the world. This is the agenda that has had such a devastating effect on the coconut industry for the past decade. Throughout the 1960s, the 1970s and the 1980s the anti-saturated fat rhetoric increased in intensity.

More recently an editorial by Harvard's Walter Willett, M.D. acknowledged that even though "the focus of dietary recommendations is usually a reduction of saturated fat intake, no relation between saturated fat intake and risk of CHD was observed in the most informative prospective study to date."[6]

Another editorial, this time by the Framingham Study's William P. Castelli in the Archives of Internal Medicine, declared for the record that "...in Framingham, Mass, the more saturated fat one ate, the more cholesterol one ate, the more calories one ate, the lower the person's serum cholesterol... the opposite of what the equations provided by Hegsted at al (1965)[7] and Keys et al (1957)[8] would predict..." [9]

Castelli further admitted that "...In Framingham, for example, we found that the people who ate the most cholesterol, ate the most saturated fat, ate the most calories, weighed the least, and were the most physically active."[10]

For the past several decades we have heard about animal and human studies feeding coconut oil that purportedly showed increased indices for cardiovascular risk. Blackburn et al have reviewed the published literature of "coconut oil's effect on serum cholesterol and atherogenesis" and have concluded that when "...[coconut oil is] fed physiologically with other fats or adequately supplemented with linoleic acid, coconut oil is a neutral fat in terms of atherogenicity." [11]

The question then is, how did coconut oil get such a negative reputation? The answer quite simply is, initially, the significance of those changes that occurred during animal feeding studies were misunderstood. The wrong interpretation occurred then repeated until ultimately the misinformation and disinformation took on a life of its own.

The problems for coconut oil started four decades ago when researchers fed animals hydrogenated coconut oil that was purposefully altered to make it completely devoid of any essential fatty acids. The hydrogenated coconut oil was selected instead of hydrogenated cottonseed, corn or soybean oil because it was a soft enough fat for blending into diets due to the presence of the lower melting medium chain saturated fatty acids. The same functionality could not be obtained from the cottonseed, corn or soybean oils if they were made totally saturated, since all their fatty acids were long chain and high melting, and could not be easily blended into the diets nor were they as readily digestible.

The animals fed the hydrogenated coconut oil (as the only fat source) naturally became essential fatty acid deficient; their serum cholesterol levels increased. Diets that cause an essential fatty acid deficiency always produce an increase in serum cholesterol levels as well as an increase in the atherosclerotic indices. The same effect has also been seen when other essential fatty acid deficient, highly hydrogenated oils such as cottonseed, soybean, or corn oils have been fed; so it is clearly a function of the hydrogenated product, either because the oil is essential fatty acid (EFA) deficient or because of trans fatty acids (TFA).

B. Comments on …Limit One's Intake of Animal Fats (such as those in cheese, milk, butter, ice cream, and other full-fat products; fatty meat; bacon and sausage; and poultry skin and fat)…

The Foundation recommends that the 2005 Dietary Guidelines Advisory Committee discontinue its unscientific opposition to animal fats.

Animal and Saturated Fats: All fats and oils, whether of vegetable or animal origin, are some combination of saturated fatty acids, monounsaturated fatty

acids and polyunsaturated omega 6 linoleic acid and omega 3 linolenic acid. In general, animal fats such as butter, lard and tallow contain about 40-60% saturated fat and are solid at room temperature. Vegetable oils from northern climates contain a preponderance of polyunsaturated fatty acids and are liquid at room temperature. But vegetable oils from the tropics are highly saturated. Coconut oil, for example, is 92% saturated. These fats are liquid in the tropics but hard as butter in northern climes. Vegetable oils are more saturated in hot climates because the increased saturation helps maintain stiffness in plant leaves. Olive oil with its preponderance of monounsaturated oleic acid is the product of a temperate climate. It is liquid at warm temperatures but hardens when refrigerated.

During the early 20th century, most of the fatty acids in the diet were either saturated or monounsaturated, primarily from butter, lard, tallows, coconut oil and small amounts of olive oil. Today, most of the fats in our diet are polyunsaturated, primarily from vegetable oils derived from soy, corn, safflower, sunflower, cottonseed and rape seed (canola – primarily monounsaturated) as depicted in Table I.

Table I: Changes in U.S. Dietary Fats During the 20th Century (grams/capita/day)

Year	Total Fat	Saturated Fat	Unsaturated Fat
1909-19	120	50	60
1990-99	159	51	100

Adopted from Cordain, L, Eades, MR, "Hyperinsulinemic Diseases of Civilization: More Than Just Syndrome X," *Comparative Biochemistry and Physiology*, Part A, 136 (2003): 95-112, p. 100.

Table I indicates that total daily per capita fat consumption increased by about 33 percent between 1909 and 1999, saturated fat consumption remained nearly constant. A marked 67 percent rise in intake of unsaturated oils, mostly in the form of vegetable oils, accounted for almost all of the increased dietary fat during this time.

Forty-three percent of the fat produced and stored by the human body is saturated. This fatty acid profile is quite similar to that of the other animal fats, especially lard, which is produced from pigs. Vegetable oil fat profiles are quite different than the human and animal fatty acid profile, much higher in polyunsaturated oils, especially omega 6 essential fatty acid.

Tissues of temperate or northern plants, fish, and other cold-blooded animals typically produce highly unsaturated fats, while warm-blooded animals, including human beings, and tropical plants (coconut and palm oil) produce more saturated fats. This difference is caused by the melting point of the various fats. Animals and plants inhabiting colder climates or having low body temperatures produce

more unsaturated oils because these fats are sufficiently fluid at low temperatures; saturated fats would be too stiff.

In contrast, unsaturated fats would be too fluid for warm-blooded humans and animals and tropical plants to create the needed fatty pads, fat storage deposits, and strong and workable cell membranes. Unsaturated fats are prone to produce carcinogenic peroxides in warm oxygen-rich environments, such as in the human body. Saturated fats are combined with the unsaturated fats in nature to provide necessary antioxidants and protection for the essential fatty acids.[12]

It should be noted that animals store fat mainly as a reservoir of energy for use between meals or when food is scarce. The human body runs on its saturated fat stores between meals and during food scarcity, including fasting. The resting muscles, heart and liver together consume most of the energy used by the body. Their tissues prefer saturated fat for fuel.[13]

The human body makes its own saturated fats because they are essential to our health and well-being. The fatty pads that that protect bony surfaces (sitting bones, palms and soles of the feet) and fat deposits that cushion internal organs are largely made up of saturated fats. Saturated fats are used in the cell membrane to resist the penetration of parasites, viruses and bacteria. In addition, saturated fats play an important role in the nervous system and the brain. The grey matter of the nervous system is composed largely of sphingomyelin, a compound that incorporates one saturated fatty acid, most commonly palmitic or stearic acids.[14] The white matter of the brain is composed largely of phosopholipids, again incorporating palmitic or stearic acids. About one-third of the brain is composed of saturated fats.

Animal fats are stable, do not easily develop free radicals, and contain nutrients that are vital for good health. Children, in particular, require high levels of quality animal fats to achieve optimal physical and neurological development. In addition, animal fats have been highly valued in all traditional cultures.[15]

During the sixty-year period from 1910 to 1970, the proportion of traditional animal fat in the American diet declined from 83% to 62%, and butter consumption plummeted from eighteen pounds per person per year to four. During the past eighty years, dietary cholesterol intake has increased only 1%. During the same period the percentage of dietary vegetable oils in the form of margarine, shortening and refined oils increased about 400% while the consumption of sugar and processed foods increased about 60%.[16]

Foods containing *trans* fat sell because the American public is afraid of the alternative—saturated fats found in tallow, lard, butter, palm and coconut oil, fats traditionally used for frying and baking. Yet the scientific literature delineates a number of vital roles for dietary saturated fats:

- Saturated fatty acids constitute at least 50% of most of the cell membranes. They are what furnish our cells necessary stiffness and integrity.

- They play a vital role in the health of our bones. For calcium to be effectively incorporated into the skeletal structure, at least 50% of the dietary fats should be saturated.[17]

- They lower Lp(a), a substance in the blood that indicates proneness to heart disease.[18]

- They protect the liver from alcohol and other toxins, such as Tylenol.[19]

- They enhance the immune system.[20]

- They are needed for the proper utilization of essential fatty acids. Elongated omega-3 fatty acids are better retained in the tissues when the diet is rich in saturated fats.[21]

- Stearic acid and palmitic acid are the preferred foods for the heart, which is why the fat around the heart muscle is highly saturated.[22] The heart draws on this reserve of fat in times of stress.

- Short- and medium-chain saturated fatty acids have important antimicrobial properties. They protect us against harmful microorganisms in the digestive tract.

The scientific evidence, honestly evaluated, does not support the assertion that "artery-clogging" saturated fats cause heart disease.[23] Actually, evaluation of the fat in artery clogs reveals that only about 26% is saturated. The rest is unsaturated, of which more than half is polyunsaturated.[24] Although consumption of saturated fatty acids in an institutional setting has been shown to temporarily raise serum cholesterol levels, there is no evidence that consumption of saturated fats from animal sources and the tropical oils contributes to heart disease.[25]

See Appendix I “Saturated Fats are Beneficial, Not Harmful” for a more complete list of the benefits of saturated fats.

Animal foods containing saturated fat and cholesterol provide vital nutrients necessary for growth, energy and protection from degenerative disease. Like sex, animal fats are necessary for reproduction. Humans are drawn to both by powerful instincts. “Whatever is the cause of heart disease,” said the eminent biochemist Michael Gurr, “it is not primarily the consumption of saturated fats.”[26]

Butter: Butter is America’s best source of fat soluble vitamins, which include true vitamin A or retinol, vitamin D, vitamin K and vitamin E as well as all their

naturally occurring cofactors needed to obtain maximum effect. In fact, vitamin A is more easily absorbed and utilized from butter than from other sources.[27] Fortunately, these fat-soluble vitamins are relatively stable and survive the pasteurization process.

The Foundation does not endorse the consumption of any type of margarine or any other butter substitute. Margarines and butter substitutes are generally manufactured from partially hydrogenated vegetable oils, which are known to have high levels of *trans* fatty acids. *Trans* fatty acids are sufficiently similar to natural fats that the body readily incorporates them into the cell membrane; once there their altered chemical structure creates havoc with thousands of necessary chemical reactions—everything from energy provision to prostaglandin production.

Most of the *trans* isomers in modern hydrogenated fats are new to the human physiology and by the early 1970's a number of researchers had expressed concern about their presence in the American diet, noting that their increasing use had paralleled the increase in both heart disease and cancer.[28]

Margarine provokes chronic high levels of cholesterol and has been linked to both heart disease and cancer.[29] The new soft margarines or tub spreads, while lower in hydrogenated fats, are still produced from rancid vegetable oils and contain many additives.[30]

Judging from both food data and turn-of-the-century cookbooks, the American diet in 1900 was a rich one—with at least 35 to 40 percent of calories coming from fats, mostly dairy fats in the form of butter, cream, whole milk and eggs. Salad dressing recipes usually called for egg yolks or cream; only occasionally for olive oil. Lard or tallow served for frying; rich dishes like head cheese and scrapple contributed additional saturated fats during an era when cancer and heart disease were rare. Butter substitutes made up only a small portion of the American diet, and these margarines were blended from coconut oil, animal tallow and lard, all rich in natural saturates.

When Dr. Weston A. Price studied isolated traditional peoples around the world in the 1930s[31], he found that butter was a staple in many native diets. (He did not find any isolated peoples who consumed polyunsaturated oils.) The groups he studied particularly valued the deep yellow butter produced by cows feeding on rapidly growing green grass. Their natural intuition told them that its life-giving qualities were especially beneficial for children and expectant mothers. When Dr. Price analyzed this deep yellow butter he found that it was exceptionally high in all fat-soluble vitamins, particularly vitamin A. He called these vitamins "catalysts" or "activators."

Without "catalysts" or "activators," according to Dr. Price, we are not able to utilize the minerals we ingest, no matter how abundant they may be in our diets.

He also believed the fat-soluble vitamins to be necessary for absorption of the water-soluble vitamins. Vitamins A and D are essential for growth, for healthy bones, for proper development of the brain and nervous systems and for normal sexual development.

Many studies have shown the importance of butterfat for reproduction; its absence results in "nutritional castration," the failure to bring out male and female sexual characteristics. As butter consumption in America has declined, sterility rates and problems with sexual development have increased. In calves, butter substitutes are unable to promote growth or sustain reproduction.[32]

Not all the societies Dr. Price studied ate butter; but all the groups he observed went to great lengths to obtain foods high in fat-soluble vitamins—fish, shellfish, fish eggs, organ meats, blubber of sea animals and insects. Without knowing the names of the vitamins contained in these foods, isolated traditional societies recognized their importance in the diet and liberally ate the animal products containing them. They rightly believed such foods to be necessary for fertility and the optimum development of children.

Dr. Price analyzed the nutrient content of native diets and found that they consistently provided about ten times more fat soluble vitamins than the American diet of the 1930's. This ratio is probably more extreme today as Americans have deliberately reduced animal fat consumption. Dr. Price realized that these fat-soluble vitamins promoted the beautiful bone structure, wide palate, flawless uncrowded teeth and handsome, well-proportioned faces that characterized members of isolated traditional groups.

American children in general do not eat fish or organ meats, at least not to any great extent, and blubber and insects are not a part of the western diet; many will not eat eggs. The only good source of fat-soluble vitamins in the American diet, one sure to be eaten, is butterfat. Butter added to vegetables and spread on bread, and cream added to soups and sauces, ensure proper assimilation of the minerals and water-soluble vitamins in vegetables, grains and meat.

Important nutrients found in butter, particularly required for children, include:

> The Price Factor or Activator X: Discovered by Dr. Price, Activator X is a powerful catalyst which, like vitamins A and D, helps the body absorb and utilize minerals. It is found in organ meats from grazing animals and some sea food. Butter can be an especially rich source of Activator X when it comes from cows eating rapidly growing grass in the spring and fall seasons. It disappears in cows fed cottonseed meal or high protein soy-based feeds.[33] Fortunately, Activator X is not destroyed by pasteurization.
>
> Arachidonic Acid: A 20-carbon polyunsaturate containing four double bonds, found in small amounts only in animal fats. Arachidonic acid (AA)

plays a role in the function of the brain, is a vital component of the cell membranes and is a precursor to important prostaglandins.

Short- and Medium-Chain Fatty Acids: Butter contains about 12-15% short- and medium-chain fatty acids. This type of saturated fat does not need to be emulsified by bile salts but is absorbed directly from the small intestine to the liver, where it is converted into quick energy. These fatty acids also have antimicrobial, antitumor and immune-system-supporting properties, especially 12-carbon lauric acid, a medium-chain fatty acid not found in other animal fats. Highly protective lauric acid should be called a conditionally essential fatty acid because it is made only by the mammary gland and not in the liver like other saturated fats.[34] We must obtain it from one of two dietary sources—small amounts in butterfat or large amounts in coconut oil. Four-carbon butyric acid is all but unique to butter. It has antifungal properties as well as antitumor effects.[35]

Omega-6 and Omega-3 Essential Fatty Acids: These occur in butter in small but nearly equal amounts. This excellent balance between linoleic and linolenic acid prevents the kind of problems associated with overconsumption of omega-6 fatty acids found in high amounts in vegetable oils.

Conjugated Linoleic Acid: Butter from pasture-fed cows also contains a form of rearranged linoleic acid called CLA, which has strong anticancer properties. It also encourages the buildup of muscle and prevents weight gain. CLA disappears when cows are fed dry hay or processed feed.[36]

Lecithin: Lecithin is a natural component of butter that assists in the proper assimilation and metabolization of cholesterol and other fat constituents.

Cholesterol: Mother's milk is high in cholesterol because it is essential for growth and development. Cholesterol is also needed to produce a variety of steroids that protect against cancer, heart disease and mental illness.

Glycosphingolipids: This type of fat protects against gastrointestinal infections, especially in the very young and the elderly. For this reason, children who drink skimmed milk have diarrhea at rates three to five times greater than children who drink whole milk.[37]

Trace Minerals: Many trace minerals are incorporated into the fat globule membrane of butterfat, including manganese, zinc, chromium and iodine. In mountainous areas far from the sea, iodine in butter protects against goiter. Butter is extremely rich in selenium, a trace mineral with antioxidant properties, containing more per gram than herring or wheat germ.

> The Wulzen Factor: Called the "anti-stiffness" factor, this compound is present in raw animal fat. Researcher Rosalind Wulzen discovered that this substance protects humans and animals from calcification of the joints—degenerative arthritis. It also protects against hardening of the arteries, cataracts and calcification of the pineal gland.[38] Calves fed pasteurized milk or skim milk develop joint stiffness and do not thrive. Their symptoms are reversed when raw butterfat is added to the diet. Pasteurization destroys the Wulzen factor—it is present only in raw butter, cream and whole milk.

Butter is derived from animal (dairy) fat, and, therefore, is high in saturated fats. Animal fats are stable, do not easily develop free radicals, and contain nutrients that are vital for good health. Children, in particular, require high levels of quality animal fats to achieve optimal physical and neurological development.[39]

Mother's milk is especially rich in cholesterol and contains a special enzyme that helps the baby utilize this nutrient. Babies and children need cholesterol-rich foods, such as butter, throughout their growing years to ensure proper development of the brain and nervous system.

In conclusion, butter is an essential food that supplies children and adults many needed nutrients.

Whole Milk: The milk of all mammals contains high levels of fat. Nature does not make mistakes; mammalian milk contains fat because young animals and young humans need this fat to develop and grow properly. The butterfat in milk contains vital fat-soluble vitamins needed for the utilization of the protein and minerals in the water fraction of the milk. Butterfat in milk works synergistically with the protein and minerals in milk. Butterfat provides glycosphingolipids that aid digestion[40] and CLA that helps prevent cancer and obesity.[41]

Obesity is an ever increasing problem in our young people. Farmers know that the best way to fatten pigs is to give them skim milk--pigs fed whole milk do not get fat. The metabolism of the pig is very similar to the metabolism of the human. Giving whole milk to our children will help prevent obesity.

The rationale for giving children lowfat milk is that this measure will help prevent heart disease in the future. However, there is absolutely no evidence that heart disease can be prevented by denying important fats to growing children. In fact, in a recent study, children on lowfat diets produced the most atherogenic fraction of cholesterol (small, dense LDL-cholesterol). The study indicated that lower-fat diets cause the very problems such diets are supposed to prevent.[42] Children on lowfat diets exhibit growth problems and failure to thrive.[43]

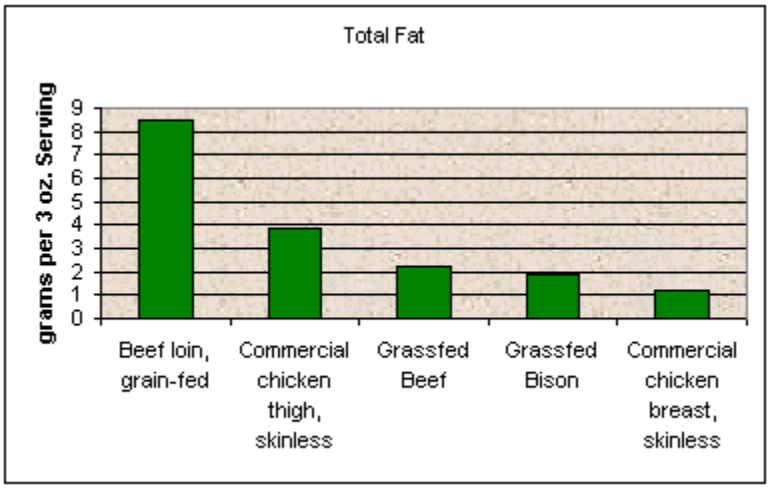
In a recent study, almost 150 girls, ages 8 to 10 years, were put on lowfat diets to reduce their elevated cholesterol levels. After five years, the average estrogen

and progesterone levels were almost one-third lower compared to girls on diets containing normal amounts of fats. Lowfat diets thus inhibit the production of hormones vital for reproduction.[44]

Certain types of special fatty acids in butterfat (EPA, DHA and AA) are vital to the proper development and functioning of the brain and nervous system.[45]

Grass-Fed/Pastured Animals and Poultry vs. Grain-fed/Feedlot Animals and Poultry: Similar to wild game, grass-fed/pasture raised animals and poultry contain the amounts and kinds of nutrients that our bodies "expect" to be fed. Switching to grass-fed meat and poultry may reduce the risk of a number of diseases, including diabetes, obesity, cardiovascular disease, and cancer. The following data on the efficacy of eating grass-fed pastured animals and poultry was developed by Jo Robinson of www.Eatwild.com.

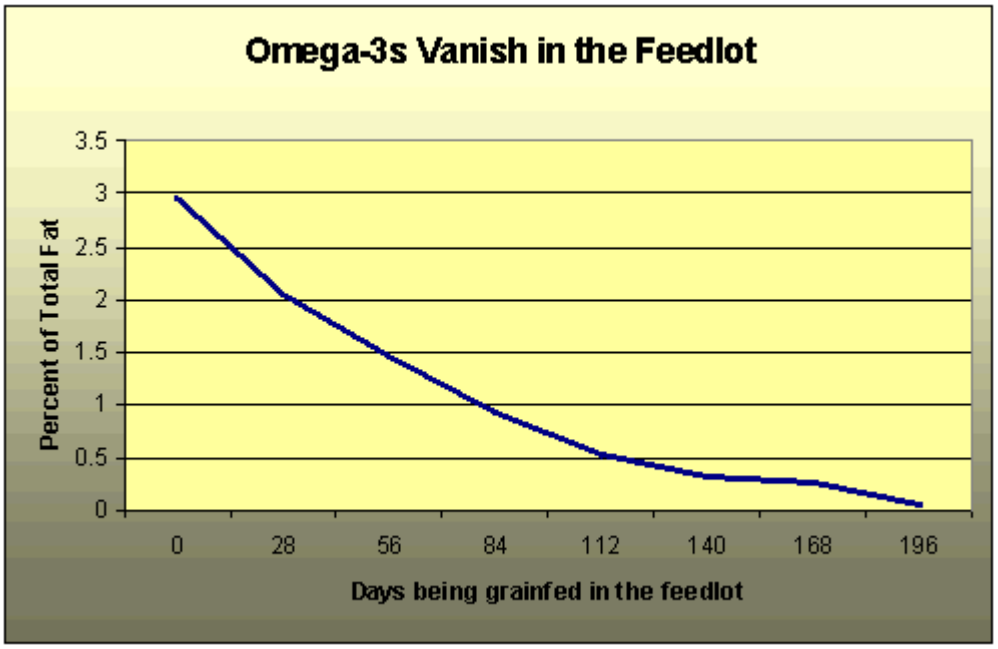
There are a number of nutritional differences between the meat of pasture-raised and feedlot-raised animals. To begin with, meat from grass-fed cattle, sheep, and bison is lower in total fat. If the meat is very lean, it can have one third as much fat as a similar cut from a grain-fed animal. In fact, grass-fed beef can have the same amount of fat as skinless chicken breast, wild deer, or elk, as shown in the graph below. [46] Research shows that lean beef cab lower LDL cholesterol levels.[47]



Data from J. Animal Sci 80(5):1202-11.

Because meat from grass-fed animals is lower in fat than meat from grain-fed animals, it is also lower in calories. As an example, a 6-ounce steak from a grass-finished steer can have 100 fewer calories than a 6-ounce steak from a grain-fed steer. If you eat a typical amount of beef (66.5 pounds a year), switching to lean grassfed beef will save you 17,733 calories a year—without requiring any willpower or change in your eating habits. If everything else in your diet remains constant, you'll lose about six pounds a year.

Omega 3 EFA: Meat from grass-fed animals has two to four times more omega-3 fatty acids than meat from grain- fed animals. Omega-3s are most abundant in seafood and certain nuts and seeds such as flaxseeds and walnuts, but they are also found in animals raised on pasture. The reason is simple. Omega-3s are formed in the chloroplasts of green leaves and algae. Sixty percent of the fatty acids in grass are omega-3s. When cattle are taken off omega-3 rich grass and shipped to a feedlot to be fattened on omega-3 poor grain, they begin losing their store of this beneficial fat. Each day that an animal spends in the feedlot, its supply of omega-3s is diminished.[48] The graph below illustrates this steady decline.



Data from: J Animal Sci (1993) 71(8):2079-88.

When chickens are housed indoors and deprived of greens, their meat and eggs also become artificially low in omega-3s. Eggs from pastured hens can contain as much as 10 times more omega-3s than eggs from factory hens.[49]

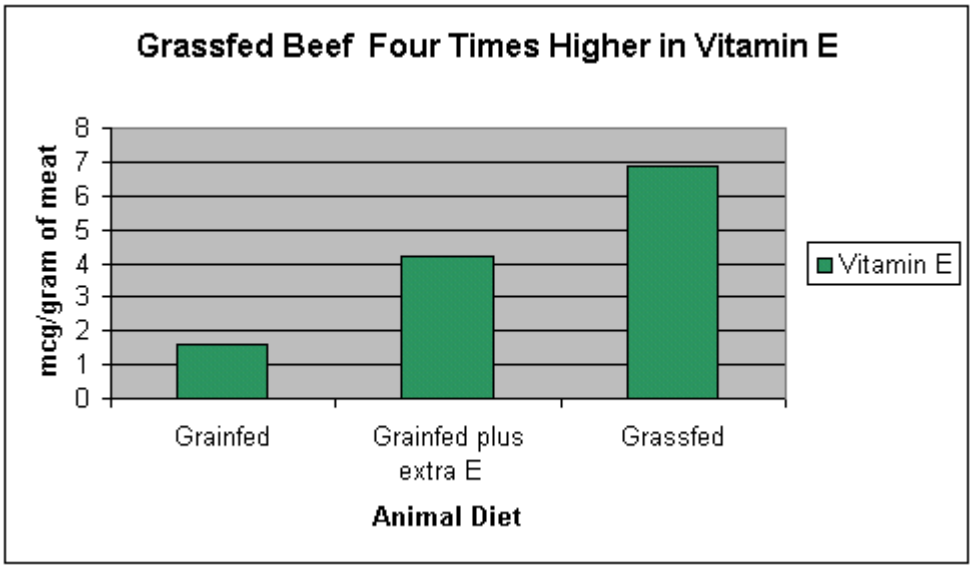
It has been estimated that only 40 percent of Americans consume an adequate supply of omega-3 fatty acids. Twenty percent have blood levels so low that they cannot be detected.[50] Switching to the meat, milk, and dairy products of grass-fed animals is one way to restore this vital nutrient to our diets.

Conjugated Linoleic Acid (CLA): Meat and dairy products from grass-fed ruminants are the richest known source of another type of beneficial fat conjugated linoleic acid or CLA. When ruminants are raised on fresh pasture alone, their products contain from three to five times more CLA than products

from animals fed conventional diets.[51] CLA may be one of the most potent defenses against cancer. In laboratory animals, a very small percentage of CLA --- a mere 0.1 percent of total calories ---greatly reduced tumor growth.[52] There is new evidence that CLA may also reduce cancer risk in humans. In a Finnish study, women who had the highest levels of CLA in their diet had a 60 percent lower risk of breast cancer than those with the lowest levels. Switching from grain-fed to grassfed meat and dairy products places women in this lowest risk category.[53]

Researcher Tilak Dhiman from Utah State University estimates that we may be able to lower the risk of cancer simply by eating the following grassfed products each day: one glass of whole milk, one ounce of cheese, and one serving of meat. You would have to eat five times that amount of grain-fed meat and dairy products to get the same level of protection.

Vitamin E: In addition to being higher in omega-3s and CLA, meat from grass-fed animals is also higher in vitamin E. The graph below shows vitamin E levels in meat from: 1) feedlot cattle, 2) feedlot cattle given high doses of synthetic vitamin E (1,000 IU per day), and 3) cattle raised on fresh pasture with no added supplements. The meat from the pastured cattle is four times higher in vitamin E than the meat from the feedlot cattle and, interestingly, almost twice as high as the meat from the feedlot cattle given vitamin E supplements.[54] In humans, vitamin E is linked with a lower risk of heart disease and cancer. This potent antioxidant may also have anti-aging properties. Most Americans are deficient in vitamin E.



Data from: Smith, G.C. "Dietary supplementation of vitamin E to cattle to improve shelf life and case life of beef for domestic and international markets." Colorado State University, Fort Collins, Colorado 80523-1171.

Polyunsaturated Fats and Vegetable Oils: Lastly, we wish to address the popular misconceptions as to the benefits of commercial vegetable oils (polyunsaturated oils), in general. Polyunsaturated fatty acids occur in small amounts in all foods. Polyunsaturated oils contain large amounts of polyunsaturated fatty acids. Commercial polyunsaturated oils made from corn, soy, safflower and sunflower seeds are new to human diets. The use of these industrially processed oils is four fold higher today than it is was in 1900.[55]

Since the early part of the 20th century, when the Department of Agriculture (USDA) had begun to keep track of food "disappearance" data—the amount of various foods going into the food supply—a number of researchers had noticed a change in the kind of fats Americans were eating. Butter consumption was declining while the use of vegetable oils, especially oils that had been hardened to resemble butter by a process called hydrogenation, was increasing. By 1950 butter consumption had dropped from eighteen pounds per person per year to just over ten. Margarine filled in the gap, rising from about two pounds per person at the turn of the 20th century to about eight. Consumption of vegetable shortening—used in crackers and baked goods—remained relatively steady at about twelve pounds per person per year but vegetable oil consumption had more than tripled—from just under three pounds per person per year to more than ten.[56]

Polyunsaturated fatty acids are very fragile. When exposed to heat and oxygen, as during commercial processing, they form free radicals and other harmful breakdown products that damage the body in many ways.[57] Modern processing destroys the vitamins and antioxidants in vegetable oils, but the pesticides used on the seeds are retained.[58] Seed oils are highly sprayed. Because polyunsaturates are highly subject to rancidity, they increase the body's need for vitamin E and other antioxidants.

Researchers have found that commercial vegetable oils (polyunsaturated oils) contain free radicals and dangerous breakdown products that can cause heart disease, cancer, inflammation and aging, as well as increased obesity. In the young, diets based on vegetable oils depress learning and cause growth problems. Furthermore, these oils are often partially hydrogenated and contain dangerous *trans* fatty acids.[59]

Research has determined that:

- Polyunsaturated oils cause the formation of black-brown ceroid pigment deposits, a sign of aging.[60]

- In animal studies, polyunsaturated oil shortens life span and increases the possibility of atherosclerosis, cancer and other disease.[61]

- Polyunsaturated oils increase the levels of uric acid in the body, a sign of the destruction of protein. An elevated level of uric acid is a heart disease risk factor.[62]

- In animals, consumption of excessive polyunsaturates causes cirrhosis of the liver, similar to that caused by excessive alcohol.[63]

- Many studies have shown that polyunsaturated oils cause cancer.[64]

- Polyunsaturated oils are particularly damaging to the reproductive organs and the lungs.[65]

- Polyunsaturated oils depress learning ability, especially under conditions of stress.[66]

- Polyunsaturated oils given to young animals impair growth.[67]

- When heated, as in cooking, polyunsaturated oils bond to each other forming polymers, leading to digestive problems (varnish and shellac are polymers).[68]

Excess use of commercial vegetable oils interferes with the production of prostaglandins leading to an array of complaints ranging from autoimmune disease to PMS. Disruption of prostaglandin production leads to an increased tendency to form blood clots, and hence myocardial infarction.[69]

See Appendix II “Adverse Effects of Excess Polyunsaturated Oils” for detailed list of the health impact of these oils.

Beneficial Fats and Oils: Beneficial fats and oils can be an inherent part of the food children and adults eat such as the fat in meat and fish and fat in the vegetables, nuts, and grains; or they can be added to foods through cooking and as dressings and sauces. A spoonful of a particular fat or oil can be easily added to soups, stews, mixed dishes or hot cereals.

Beneficial fats are quality dairy fats from grass-fed cows, such as butter, cream and whole milk. Beneficial fats are natural fats from properly fed animals, poultry, and fish. These animal fats supply true vitamin A, vitamin D and the proper cholesterol needed for brain and vision development. The animal fats also supply other fat soluble nutrients that support the immune system such as glycosphingolipids. Fish oils such as cod liver oil also supply important elongated omega-3 fatty acids as well as vitamins A and D.

Beneficial oils are those readily extracted from fruits such as olive oil, palm oil, coconut oil, and they are traditionally unrefined. Beneficial oils are also those that are unrefined and extracted from many nuts and seeds. Some of these oils are

omega-3 oils, omega-6 oils, and some are omega-9 oils. Oils with plenty of omega-3 include flaxseed oil and perilla oil; those with moderate amounts of omega-3 fatty acids include unrefined canola, soybean, and walnut oils. However, for various reasons, most canola and soybean oil should be avoided. Many oils such as unrefined corn oil, safflower oil, and sunflower oil do not have omega-3 but are typically high in omega-6 fatty acids and they should be used only in very small amounts.

Foods should be chosen so that they supply a mixture of these different fats and oils. No one fat or oil can properly suit all purposes, although many of the good quality animal fats come close. Children especially require enough of the stable saturated fats, they need enough of the monounsaturated fats or oils, and they need an adequate amount and a proper balance of the essential fatty acids, which come primarily from the omega-3 and omega-6 oils.

C. Comments on Cholesterol

Our blood vessels can become damaged in a number of ways—through irritations caused by free radicals or viruses, or because they are structurally weak—and when this happens, the body's natural healing substance steps in to repair the damage. That substance is cholesterol. Cholesterol is a high-molecular-weight alcohol that is manufactured in the liver and in most human cells. Like saturated fats, the cholesterol we make and consume plays many vital roles.

Cholesterol is not the cause of heart disease but rather a potent antioxidant weapon against free radicals in the blood, and a repair substance that helps heal arterial damage, although the arterial plaques themselves contain very little cholesterol. The cholesterol in your diet (dietary cholesterol) has very little effect on the cholesterol in your blood (serum cholesterol). You could completely eliminate all cholesterol from your diet and your liver would just produce more of it, because your body needs cholesterol. On the other hand, eating more cholesterol would cause your liver to reduce production to maintain consistent levels.

More than 60 percent of all heart attacks occur in people with normal cholesterol levels. The majority of people with high cholesterol never suffer heart attacks and half of all heart attack victims have none of the standard risk factors, i.e., obesity, high cholesterol, smoking or genetics.

Like fats, however, cholesterol may be damaged by exposure to heat and oxygen. This damaged or oxidized cholesterol seems to promote both injury to the arterial cells (endothelium – the layer of tissue that lines all of our arteries and veins) as well as a pathological buildup of plaque in the arteries.[70] Damaged cholesterol is found in powdered eggs, in powdered milk (added to reduced-fat

milks to give them body) and in meats and fats that have been heated to high temperatures in frying and other high-temperature processes.

See Appendix III for a more complete list of the benefits of cholesterol.

High serum cholesterol levels often indicate that the body needs cholesterol to protect itself from high levels of altered, free-radical-containing fats. Just as a large police force is needed in a locality where crime occurs frequently, so cholesterol is needed in a poorly nourished body to protect the individual from a tendency to heart disease and cancer. Dietary cholesterol plays an important role in maintaining the health of the intestinal wall,[71] which is why low-cholesterol vegetarian diets can lead to leaky gut syndrome and other intestinal disorders.[72]

Poor thyroid function (hypothyroidism) will often result in high cholesterol levels. When thyroid function is poor, usually due to a diet high in sugar and low in usable iodine, fat-soluble vitamins and other nutrients, the body floods the blood with cholesterol as an adaptive and protective mechanism, providing a superabundance of materials needed to heal tissues and produce protective steroids. Hypothyroid individuals are particularly susceptible to infections, heart disease and cancer.[73]

CHOOSE CARBOHYDRATES WISELY FOR GOOD HEALTH

We fail to understand why the 2005 Dietary Guidelines Advisory Committee decided to exclude a warning about “added sugars” in its list of Findings (page 2 of the Executive Summary). We believe this is a grievous error and should be rectified when the official dietary guidelines are published in 2005. While your rationale is sound for limiting one’s intake of added sugars, it should not be buried under “Choose Carbohydrates Wisely for Good Health.” Added sugars should be returned to its prominent place in the Committee’s findings.

In addition, the Foundation takes strong exception with your statement that milk should preferably be consumed in the form of nonfat or law-fat milk and milk products. Whole milk is essential for the proper growth of children. (See section on Whole Milk in “Choose Fats Wisely for Good Health”).

A. Comments on Added Sugars and High Fructose Corn Syrup

As the consumption of sugar has increased in the United States, so have all the "civilized" diseases. In 1821, the average sugar intake in America was 10 pounds per person per year; today it is 170 pounds per person, representing over one-fourth the average caloric intake.[74]

Another large portion of total calories comes from white flour and refined vegetable oils.[75] This means that less than half the diet must provide all the nutrients to a body that is under constant stress from its intake of sugar, white flour and rancid and hydrogenated vegetable oils. Herein lies one of the root causes of the vast increase in degenerative diseases that plague modern America.

Sweetness in fruits, grains and vegetables is an indication that they are ripe and have reached maximum vitamin and mineral content. The naturally sweet foods from which sugar is extracted—sugar beet, sugar cane and corn—are particularly high in nutrients such as B vitamins, magnesium and chromium. All of these seem to play an important role in the blood sugar regulation mechanism. These nutrients are discarded—or made into animal feed—when the raw product is refined into sugar. Refining strips foods of vital nutrients while concentrating sugars, thus allowing us to fulfill our body’s energy requirements without obtaining the nutrients needed for bodybuilding, digestion and repair.

Scientific evidence against sugar has been mounting for decades. As early as 1933, research showed that increased consumption of sugar caused an increase in various disease conditions in school children.[76] Sugar, especially fructose, has been shown to shorten life in numerous animal experiments.[77] Sugar consumption has recently been cited as the root cause of anorexia and eating disorders.[78] In the 1950s, British researcher Yudkin published persuasive findings that excessive use of sugar was associated with the following conditions:

release of free fatty acids at the aorta; rise in blood cholesterol; rise in triglycerides; increase in adhesiveness of the blood platelets; increase in blood insulin levels; increase in blood corticosteroid levels; increase in gastric acidity; shrinkage of the pancreas and enlargement of the liver and adrenal glands.[79]

Numerous subsequent studies have positively correlated sugar consumption with heart disease.[80] These results are far more unequivocal than the presumed association of heart disease with saturated fats. Researchers Lopez in the 1960s and Ahrens in the 1970s have repeatedly pointed out the role of sugar as a cause of coronary heart disease, but their work has not received recognition by government agencies or by the press.

Sugar consumption is a cause of bone loss and dental decay. Tooth decay and bone loss occur when the precise ratio of calcium to phosphorus in the blood varies from the normal ratio of four parts phosphorus to ten parts calcium. At this ratio, all blood calcium can be properly utilized. Dr. Melvin Page, a Florida dentist, demonstrated in numerous studies that sugar consumption causes phosphorus levels to drop and calcium to rise.[81] Calcium rises because it is pulled from the teeth and the bones. The drop in phosphorus hinders the absorption of this calcium, making it unusable and therefore toxic. Thus, sugar consumption causes tooth decay not because it promotes bacterial growth in the mouth, as most dentists believe, but because it alters the internal body chemistry.

More health issues than heart disease and dental decay can be laid at sugar's door. A survey of medical journals in the 1970s produced findings implicating sugar as a causative factor in kidney disease, liver disease, shortened life span, increased desire for coffee and tobacco, atherosclerosis and coronary heart disease.[82] Sugar consumption is associated with hyperactivity, behavior problems, lack of concentration and violent tendencies.[83] Sugar consumption encourages the overgrowth of *candida albicans*, a systemic fungus in the digestive tract, causing it to spread to the respiratory system, tissues and internal organs. Sugar consumption is positively associated with cancer in humans and test animals.[84] Tumors are known to be enormous sugar absorbers.

Moderate use of natural sweeteners is found in many traditional societies. Thus it is perfectly acceptable to satisfy your sweet tooth by eating fully ripened fruit in season and limited amounts of certain natural sweeteners high in vitamins and minerals, such as raw honey, date sugar, dehydrated cane sugar juice and maple syrup. Avoid all refined sugars including table sugar, so-called raw sugar or brown sugar (both composed of about 96 percent refined sugar), corn syrup, fructose and large amounts of fruit juice.

Research indicates that it is the fructose, not the glucose, moiety of sugar that is the most harmful, especially for growing children.[85] Yet the greatest increase in

sugar consumption during the last two decades is from high fructose corn syrup used in soft drinks, ketchup and many other fabricated foods aimed at children.

For many years, Dr. Meira Fields and her coworkers at the U.S. Department of Agriculture investigated the harmful effects of dietary sugar on rats. They discovered that when male rats are fed a diet deficient in copper, with sucrose as the carbohydrate, they develop severe pathologies of vital organs. Liver, heart and testes exhibit extreme swelling, while the pancreas atrophies, invariably leading to death of the rats before maturity. [86]

Sucrose is a disaccharide composed of 50 percent glucose and 50 percent fructose. Dr. Fields repeated her experiments to determine whether it was the glucose or fructose moiety that caused the harmful effects. Starch breaks down into glucose when digested. On a copper-deficient diet, the male rats showed some signs of copper deficiency, but not the gross abnormalities of vital organs that occur in rats on the sucrose diet. When the rats were fed fructose, the fatal organ abnormalities occurred.

Lysl oxidase is a copper-dependent enzyme that participates in the formation of collagen and elastin. Fructose seems to interfere with copper metabolism to such an extent that collagen and elastin cannot form in growing animals—hence the hypertrophy of the heart and liver in young males. The females did not develop these abnormalities, but they were reabsorbed into their litters.

These experiments should give us pause when we consider the great increase in the use of high fructose corn syrup during the past 30 years, particularly in soft drinks, fruit juices and other beverages aimed at growing children, children increasingly likely to be copper deficient as modern parents no longer serve liver to their families. (Liver is by far the best source of copper in human diets.)

“The bodies of the children I see today are mush,” observed a concerned chiropractor recently. The culprit is the modern diet, high in fructose and low in copper-containing foods, resulting in inadequate formation of elastin and collagen—the sinews that hold the body together.

Until the 1970s most of the sugar we ate came from sucrose derived from sugar beets or sugar cane. Then sugar from corn—corn syrup, fructose, dextrose, dextrine and especially high fructose corn syrup (HFCS)—began to gain popularity as a sweetener because it was much less expensive to produce. High fructose corn syrup can be manipulated to contain equal amounts of fructose and glucose, or up to 80 percent fructose and 20 percent glucose.[87] Thus, with almost twice the fructose, HFCS delivers a double danger compared to sugar.

(With regards to fruit, the ratio is usually 50 percent glucose and 50 percent fructose, but most commercial fruit juices have HFCS added. Fruit contains fiber, which slows down the metabolism of fructose and other sugars, but the fructose in HGCS is absorbed very quickly.)

In 1980 the average person ate 39 pounds of fructose and 84 pounds of sucrose. In 1994 the average person ate 66 pounds of sucrose and 83 pounds of fructose, providing 19 percent of total caloric energy.[88] Today approximately 25 percent of our average caloric intake comes from sugars, with the larger fraction as fructose.[89]

High fructose corn syrup is extremely soluble and mixes well in many foods. It is cheap to produce, sweet and easy to store. It's used in everything from bread to pasta sauces to bacon to beer as well as in "health products" like protein bars and "natural" sodas.

In the past, fructose was considered beneficial to diabetics because it is absorbed only 40 percent as quickly as glucose and causes only a modest rise in blood sugar.[90] However, research on other hormonal factors suggests that fructose actually promotes disease more readily than glucose. Glucose is metabolized in every cell in the body but all fructose must be metabolized in the liver.[91] The livers of test animals fed large amounts of fructose develop fatty deposits and cirrhosis, similar to problems that develop in the livers of alcoholics.

Pure fructose contains no enzymes, vitamins or minerals and robs the body of its micronutrient treasures in order to assimilate itself for physiological use.[92] While naturally occurring sugars, as well as sucrose, contain fructose bound to other sugars, high fructose corn syrup contains a good deal of "free" or unbound fructose. Research indicates that this free fructose interferes with the heart's use of key minerals like magnesium, copper and chromium. Among other consequences, HFCS has been implicated in elevated blood cholesterol levels and the creation of blood clots. It has been found to inhibit the action of white blood cells so that they are unable to defend the body against harmful foreign invaders.[93]

Studies on the Maillard reaction indicate that fructose may contribute to diabetic complications more readily than glucose. The Maillard reaction is a browning reaction that occurs when compounds are exposed to various sugars. Fructose browns food seven times faster than glucose, resulting in a decrease in protein quality and a toxicity of protein in the body.[94] This is due to the loss of amino acid residues and decreased protein digestibility. Maillard products can inhibit the uptake and metabolism of free amino acids and other nutrients such as zinc, and some advanced Maillard products have mutagenic and/or carcinogenic properties. The Maillard reactions between proteins and fructose, glucose, and other sugars may play a role in aging and in some clinical complications of diabetes.[95]

Fructose reduces the affinity of insulin for its receptor, which is the hallmark of type-2 diabetes. This is the first step for glucose to enter a cell and be

metabolized. As a result, the body needs to pump out more insulin to handle the same amount of glucose.[96]

Nancy Appleton, PhD, clinical nutritionist, has compiled a list of the harmful effects of fructose in her books *Lick the Sugar Habit, Healthy Bones, Heal Yourself With Natural Foods, The Curse Of Louis Pasteur* and *Lick the Sugar Habit Sugar Counter.* She points out that consumption of fructose causes a significant increase in the concentration of uric acid; after ingestion of glucose, no significant change occurs. An increase in uric acid can be an indicator of heart disease.[97] Furthermore, fructose ingestion in humans results in increases in blood lactic acid, especially in patients with preexisting acidotic conditions such as diabetes, postoperative stress or uremia. Extreme elevations cause metabolic acidosis and can result in death.[98]

Fructose is absorbed primarily in the jejunum before metabolism in the liver. Fructose is converted to fatty acids by the liver at a greater rate than is glucose.[99] When consumed in excess of dietary glucose, the liver cannot convert all of the excess fructose in the system and it may be malabsorbed. The portion that escapes conversion may be thrown out in the urine. Diarrhea can be a consequence.[100] A study of 25 patients with functional bowel disease showed that pronounced gastrointestinal distress may be provoked by malabsorption of small amounts of fructose.[101]

Fructose interacts with oral contraceptives and elevates insulin levels in women on “the pill.[102]

In studies with rats, fructose consistently produces higher kidney calcium concentrations than glucose. Fructose generally induces greater urinary concentrations of phosphorus and magnesium and lowered urinary pH compared with glucose.[103]

In humans, fructose feeding leads to mineral losses, especially higher fecal excretions of iron and magnesium, than did subjects fed sucrose. Iron, magnesium, calcium, and zinc balances tended to be more negative during the fructose-feeding period as compared to balances during the sucrose-feeding period.[104]

There is significant evidence that high sucrose diets may alter intracellular metabolism, which in turn facilitates accelerated aging through oxidative damage. Scientists found that the rats given fructose had more undesirable cross-linking changes in the collagen of their skin than in the other groups. These changes are also thought to be markers for aging. The scientists say that it is the fructose molecule in the sucrose, not the glucose, that plays the larger part.[105]

Because it is metabolized by the liver, fructose does not cause the pancreas to release insulin the way it normally does. Fructose converts to fat more than any other sugar. This may be one of the reasons Americans continue to get fatter.

Fructose raises serum triglycerides significantly. As a left-handed sugar, fructose digestion is very low. For complete internal conversion of fructose into glucose and acetates, it must rob ATP energy stores from the liver.[106]

Not only does fructose have more damaging effects in the presence of copper deficiency, fructose also inhibits copper metabolism—another example of the sweeteners double-whammy effect. A deficiency in copper leads to bone fragility, anemia, defects of the connective tissue, arteries, and bone, infertility, heart arrhythmias, high cholesterol levels, heart attacks, and an inability to control blood sugar levels.[107]

Although these studies were not designed to test the effects of fructose on weight gain, the observation of increased body weight associated with fructose ingestion is of interest. One explanation for this observation could be that fructose ingestion did not increase the production of two hormones, insulin and leptin, that have key roles in the long-term regulation of food intake and energy expenditure.[108]

See Appendix IV for a listing of the health effects of fructose.

The magnitude of the deleterious effects of fructose varies depending on such factors as age, sex, baseline glucose, insulin, triglyceride concentrations, the presence of insulin resistance, and the amount of dietary fructose consumed.[109] Some people are more sensitive to fructose. They include hypertensive, hyperinsulinemic, hypertriglyceridemic, non-insulin dependent diabetic people, people with functional bowel disease and postmenopausal women.[110]

According to a recent *Wall Street Journal* article, childhood weight gain in America might be caused in good measure by "the sweetening of America."[111] When sugar is consumed in high quantities as "liquid candy" (high fructose corn syrup in processed drinks and foods), unused amounts are stored as fat cells. The more carbohydrate that is eaten, the more fat the liver and adipose tissue make from any excess carbohydrate. The end product of much of the carbohydrate that is eaten is fat. This fat is stored either for the short term or for long term, depending on the energy requirements of the body. Instead of burning this energy, sedentary children store more and more of the sugar as fat.[112]

High fructose corn syrup is the primary sweetener used in soft drinks, now readily available to children in school vending machines. The soft drink industry increased US production from 22 to 41 gallons of soft drinks per person a year between 1970 and 1997.

Teenagers and children, the industry's main targets, are among the largest consumers. In the past 10 years, soft drink consumption among children has almost doubled in the United States. Teenage boys now drink, on average, three or more cans of soda per day, and 10 percent drink seven or more cans a day. The average for teenage girls is more than two cans a day, and 10 percent drink

more than five cans a day. A typical 20-ounce Coke contains zero fat, zero protein and 27 grams of carbohydrates, usually in the form of high fructose corn syrup.

There are an estimated 20,000 vending machines in schools nationwide, according to the National Automatic Merchandising Association. The USDA collected data on vending machines in schools and reported that 88 percent of high schools, 61 percent of middle schools and 14 percent of elementary schools have food or beverage vending machines for student use. Thirty-four percent of high schools and 15 percent of middle schools permit students to use school vending machines at any time, and 6 percent of elementary schools allow students to use vending machines during lunch.

Everyone should avoid over-exposure to fructose, but especially those listed above. One or two pieces of fruit per day is fine, but commercial fruit juices and any products containing high fructose corn syrup are more dangerous than sugar and should be removed from the diet.

Recently, the World Health Organization (WHO) recommended limiting intake of added sugars found in food and drink to no more than 10 percent of daily calories, a step the WHO said could help stop the worldwide rise in obesity that is fueling the growth of such chronic diseases as type 2 diabetes.[113] On the other hand, the Institute of Medicine of the National Academy of Sciences recently provided guidelines that recommended up to 25 percent of one's daily calories as added sugar.[114] The WHO recommendation is far stricter than the Institute of Medicine added sugar limit of 25 percent of calories, the average level found in today's American food intake.

The Foundation concurs with WHO guidelines, with the particular caveat that consumption of refined sugars and syrup be limited. Most of the carbohydrates consumed should be in the form of whole grains, legumes, fresh or frozen fruits and fresh or frozen vegetables.

B. Comments on Refined Carbohydrates and Grains

Only during the last century has man's diet included a high percentage of refined carbohydrates. Our ancestors ate fruits and grains in their whole, unrefined state. In nature, sugars and carbohydrates—the energy providers—are linked together with vitamins, minerals, enzymes, protein, fat and fiber—the bodybuilding and digestion-regulating components of the diet. In whole form, carbohydrates support life, but refined carbohydrates are inimical to life because they are devoid of bodybuilding elements.

Digestion of refined carbohydrates calls on the body's own store of vitamins, minerals and enzymes for proper metabolization. When B vitamins are absent, for example, the breakdown of carbohydrates cannot take place, yet most B vitamins are removed during the refining process.

The refining process strips grains, vegetables and fruits of both their vitamin and mineral components. Refined carbohydrates have been called "empty" calories. "Negative" calories is a more appropriate term because consumption of refined calories depletes the body's precious reserves.

Whole grains provide vitamin E, B vitamins in abundance, and many important minerals, all of which are essential to life. These are discarded in the refining process. Fiber—indigestible cellulose that plays an important role in digestion and elimination—is also removed. Refined flour is commonly fortified, but this is of little value. Fortification adds a handful of synthetic vitamins and minerals to white flour and polished rice after a host of essential factors have been removed or destroyed. Some of the vitamins added during the fortification process may even be dangerous. Some researchers believe that excess iron from fortified flour can cause tissue damage, and other studies link excess or toxic iron to heart disease.[115] Vitamins B_1 and B_2 added to grains without B_6 lead to imbalances in numerous processes involving B vitamin pathways. The safety of bromating and bleaching agents, almost universally applied to white flour, has never been established.

The Foundation recommends the use of a variety of whole grains but with an important caveat. Phosphorus in the bran of whole grains is tied up in a substance called phytic acid. Phytic acid combines with iron, calcium, magnesium, copper and zinc in the intestinal tract, blocking their absorption.[116] Whole grains also contain enzyme inhibitors that can interfere with digestion. Traditional societies usually soak or ferment their grains before eating them, processes that neutralize phytates and enzyme inhibitors and, in effect, predigest grains so that all their nutrients are more available.[117] Sprouting, overnight soaking and old-fashioned sour leavening can accomplish this important predigestion process in our own kitchens. Many people who are allergic to grains will tolerate them well when they are prepared according to these procedures. Proper preparation techniques also help break down complex sugars in legumes, making them more digestible.

Whole grains that have been processed by high heat and pressure to produce puffed wheat, oats and rice are actually quite toxic and have caused rapid death in test animals.[118] Breakfast cereals that have been slurried and extruded at high temperatures and pressures to make little flakes and shapes should also be avoided. Most, if not all, nutrients are destroyed during processing, and they are very difficult to digest. Studies show that these extruded whole grain preparations can have even more adverse effects on the blood sugar than refined sugar and white flour.[119] The process leaves phytic acid intact but destroys phytase, an enzyme that breaks down some of the phytic acid in the digestive tract.

Consumption of sugar and white flour may be likened to drawing on a savings account. If continued withdrawals are made faster than new funds are put in, the

account will eventually become depleted. Some people may go longer than others without overt suffering, but eventually all will feel the effects of this inexorable law. If you were fortunate enough to be born with an excellent constitution, you may be able to eat unlimited quantities of sugar with relative impunity, but your children's or your grandchildren's inheritance will be one of impoverished reserves.

The all-important level of glucose in the blood is regulated by a finely tuned mechanism involving insulin secretions from the pancreas and hormones from several glands, including the adrenal glands and the thyroid. When sugars and starches are eaten in their natural, unrefined form, as part of a meal containing beneficial and unrefined fats and protein, they are digested slowly and enter the bloodstream at a moderate rate over a period of several hours. If the body goes for a long time without food, this mechanism will call upon reserves stored in the liver. When properly working, this blood sugar regulation process provides our cells with a steady, even supply of glucose. The body is kept on an even keel, so to speak, both physically and emotionally.

But when we consume refined sugars and starches, particularly alone, without fats or protein, they enter the blood stream in a rush, causing a sudden increase in blood sugar. The body's regulation mechanism kicks into high gear, flooding the bloodstream with insulin and other hormones to bring blood sugar levels down to acceptable levels. Repeated onslaughts of sugar will eventually disrupt this finely tuned process, causing some elements to remain in a constant state of activity and others to become worn out and inadequate to do the job. A diet high in refined carbohydrates stimulates an abnormal pancreatic insulin response in order to moderate blood sugar levels, while high sugar intake may also increase adrenal cortisone and cholesterol levels. Constant high intake of simple dietary sugar over-stimulates or "burns out" normal, healthy pancreas and adrenal function.

The situation is exacerbated by the fact that a diet high in refined carbohydrates will also be deficient in vitamins, minerals and enzymes, those bodybuilding elements that keep the glands and organs in good repair. When the endocrine system thus becomes disturbed, numerous other pathological conditions soon manifest—degenerative disease, allergies, obesity, alcoholism, drug addiction, depression, learning disabilities and behavioral problems.

CONCLUSIONS

Again, the Weston A. Price Foundation thanks the 2005 Dietary Guidelines Advisory Committee on its fine work, particularly in the area of fruits and vegetables, fiber, whole grains, *trans* fats and vitamins.

As noted throughout our comments, we take exception to the Committee's conclusions regarding saturated and animal fats and cholesterol. We believe the recommendations of DGAC regarding these necessary fats and cholesterol are inappropriate, given the amount of scientific literature supporting our contentions.

We also believe the recommendations regarding low-fat and nonfat milk are very inappropriate for children and infants. Babies and children need cholesterol-rich foods, such as butter and butterfat, throughout their growing years to ensure proper development of the brain and nervous system.

There are a number of nutritional differences between the meat of pasture-raised and feedlot-raised animals that should be noted by the Committee.

"Added sugars" should be returned to its prominent place in the Committee's findings, not buried under "Choose Carbohydrates Wisely for Good Health."

In addition, the DGAC Report should include warnings to avoid refined foods such as sugar, high fructose corn syrup, white flour, industrially processed vegetable oils, *trans* fats and artificial flavorings.

Lastly, the Dietary Guidelines should emphasize food quality, not on contrived macronutrient ratios.

By including our recommendations, the Foundation firmly believes that the 2005 Dietary Guidelines Advisory Committee and the forthcoming 2005 Dietary Guidelines will take a large step in the right direction in correcting nutritional imbalances found in the current Dietary Guidelines and the Food Guide Pyramid. This will only serve the American public.

Appendix I

BENEFITS OF SATURATED FATS

- Saturated fats (or, more properly, saturated fatty acids) occur in large amounts in animal fats such as butter, lard (pig fat) and beef tallow, and in tropical oils such as coconut oil and palm oil. Fats containing high levels of saturated fatty acids tend to be solid at room temperature.

- Saturated fatty acids are said to cause cancer, heart disease and obesity. Yet these diseases were rare at the turn of the century when consumption of saturated fats was much higher than it is today. The likely culprits for these conditions are polyunsaturated fatty acids and *trans* fats, which came into widespread use after WWII.[1]

- As saturated fats are stable, they do not become rancid easily, do not call upon the body's reserves of antioxidants, do not initiate cancer and do not irritate the artery walls.

- Saturated fats actually play many important roles in the body chemistry. Because they are needed in large amounts, the body makes the saturated fats it needs out of carbohydrates when they are not supplied in sufficient amounts in the diet.[2]

- Vitamins A and D, which are vital for proper growth and for protein and mineral assimilation, are found only in mostly saturated animal fats.

- Saturated fats enhance the immune system, thereby protecting us against infection and cancer.[3]

- Saturated fats help the body lay down calcium in the bones and help prevent osteoporosis.[4]

- Saturated fats provide energy and structural integrity to the cells.[5] At least 50 percent of many, if not most, of the cell membrane must be saturated fat for the cells to work properly.

- Saturated fats protect the liver from alcohol, drugs, pesticides and other poisons.[6]

- Saturated fats enhance the body's use of essential fatty acids, which the body needs in small amounts and obtains from whole foods.[7]

- Stearic acid, found in beef tallow and butter, has cholesterol-lowering properties and is a preferred food for the heart.[8]

- Saturated fats are needed for the kidneys to work properly.[9]

- The lung surfactants are composed of saturated fatty acids.[10] The lungs cannot work without adequate amounts of saturated fats.

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Appendix II

ADVERSE EFFECTS OF EXCESS POLYUNSATURATED OILS

- Polyunsaturated fatty acids occur in small amounts in all foods. Polyunsaturated oils contain large amounts of polyunsaturated fatty acids. Commercial polyunsaturated oils made from corn, soy, safflower and sunflower seeds are new to human diets. The use of these industrially processed oils is 4 fold higher today than it is was in 1900.[1]

- Polyunsaturated fatty acids are very fragile. When exposed to heat and oxygen, as during industrial processing, they form free radicals and other harmful breakdown products that damage the body in many ways.[2]

- Modern processing destroys the vitamins and antioxidants in vegetable oils, but the pesticides are retained. (Seed oils are highly sprayed.)[3]

- Polyunsaturated oils cause the formation of black-brown ceroid pigment deposits, a sign of aging.[4]

- In animal studies, polyunsaturated oil shorten life-span and increase the possibility of atherosclerosis, cancer and other disease.[5]

- Polyunsaturated oils increase the levels of uric acid in the body, a sign of the destruction of protein. An elevated level of uric acid is a heart disease risk factor.[6]

- In animals, consumption of excessive polyunsaturates causes cirrhosis of the liver, similar to that caused by excessive alcohol.[7]

- Many studies have shown that polyunsaturated oils cause cancer.[8]

- Polyunsaturated oils are particularly damaging to the reproductive organs and the lungs.[9]

- Polyunsaturated oils depress learning ability, especially under conditions of stress.[10]

- Polyunsaturated oils given to young animals and impair growth.[11]

- When heated, as in cooking, polyunsaturated oils bond to each other forming polymers, leading to digestive problems (varnish and shellac are polymers).[12]

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Appendix III

BENEFITS OF CHOLESTEROL

- Along with saturated fats, cholesterol in the cell membrane gives our cells necessary stiffness and stability. When the diet contains an excess of polyunsaturated fatty acids, these replace saturated fatty acids in the cell membrane, so that the cell walls actually become flabby. When this happens, cholesterol from the blood is "driven" into the tissues to give them structural integrity. This is why serum cholesterol levels may go down temporarily when saturated fats are replaced with polyunsaturated oils in the diet.[1]

- Cholesterol acts as a precursor to vital corticosteroids, hormones that help us deal with stress and protect the body against heart disease and cancer; and to the sex hormones like androgen, testosterone, estrogen and progesterone.

- Cholesterol is a precursor to vitamin D, a very important fat-soluble vitamin needed for healthy bones and nervous system, proper growth, mineral metabolism, muscle tone, insulin production, reproduction and immune system function.

- The bile salts are made from cholesterol. Bile is vital for digestion and assimilation of fats in the diet.

- Research shows that cholesterol acts as an antioxidant.[2] This is the likely explanation for the fact that cholesterol levels go up with age. As an antioxidant, cholesterol protects us against free radical damage that leads to heart disease and cancer.

- Cholesterol is needed for proper function of serotonin receptors in the brain.[3] Serotonin is the body's natural "feel-good" chemical. Low cholesterol levels have been linked to aggressive and violent behavior, depression and suicidal tendencies.

- Mother's milk is especially rich in cholesterol and contains a special enzyme that helps the baby utilize this nutrient. Babies and children need cholesterol-rich foods throughout their growing years to ensure proper development of the brain and nervous system.

- Dietary cholesterol plays an important role in maintaining the health of the intestinal wall.[4] This is why low-cholesterol vegetarian diets can lead to leaky gut syndrome and other intestinal disorders.

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Appendix IV

HEALTH IMPLICATIONS OF FRUCTOSE

1. Fructose has no enzymes, vitamins, and minerals and robs the body of its micronutrient treasures in order to assimilate itself for physiological use.
2. Fructose browns food more readily (Maillard reaction) than with glucose. The Maillard reaction, a browning reaction, happens with any sugar. With fructose it happens seven times faster with than glucose, results in a decrease in protein quality and a toxicity of protein in the body.[1] This is due to the loss of amino acid residues and decreased protein digestibility. Maillard products can inhibit the uptake and metabolism of free amino acids and other nutrients such as zinc and some advanced Maillard products have mutagenic and/or carcinogenic properties. The Maillard reactions between proteins and fructose, glucose, and other sugars may play a role in aging and in some clinical complications of diabetes.[2]
3. Research showed that in subjects that had healthy glucose tolerance and those that had unhealthy glucose tolerance, fructose caused a general increase in both the total serum cholesterol and in the low density lipoproteins (LDL) in most of the subjects.[3] This puts a person at risk for heart disease.
4. Another study showed that the very low-density lipoproteins (VLDL) increased without an apparent change in high-density lipoproteins (HDL). The VLDL and the LDL should be as low as possible and the HDL should be as high as possible.[4]
5. There is a significant increase in the concentration of uric acid that is dependent on the amount of fructose digested. After glucose no significant change occurs. An increase in uric acid can be an indicator of heart disease.[5]
6. Fructose ingestion in humans results in increases in blood lactic acid, especially in patients with preexisting acidotic conditions such as diabetes, postoperative stress, or uremia. The significance to human health is that extreme elevations cause metabolic acidosis and can result in death.[6]
7. Fructose is absorbed primarily in the jejunum and metabolized in the liver. Fructose is converted to fatty acids by the liver at a greater rate than is glucose.[7] When consumed in excess of dietary glucose, the liver cannot convert all of the excess of fructose in the system and it may be malabsorbed. What escapes conversion and being absorbed into the cells may be thrown out in the urine. Diarrhea can be a consequence.[8]
8. Fructose interacts with oral contraceptives and elevates insulin levels in women on "the pill." [9]
9. Fructose reduced the affinity of insulin for its receptor. This is the first step for glucose to enter a cell and be metabolized. As a result, the body needs to pump out more insulin, to handle the same amount of glucose.[10]
10. Fructose consistently produced higher kidney calcium concentrations than did glucose in a study with rats. Fructose generally induced greater urinary concentrations of phosphorus and magnesium and lowered urinary pH compared with glucose.[11] The balance of minerals in the body is very important for the function of vitamins, enzymes and other body function. When the minerals are out of the right relationship, the body chemistry suffers. The presence of diarrhea might be the cause of decreased absorption of minerals.
11. Fructose-fed subjects lose minerals. They had higher fecal excretions of iron and magnesium than did subjects fed sucrose. Apparent iron, magnesium, calcium, and zinc balances tended to be more negative during the fructose feeding period as compared to balances during the sucrose feeding period.[12]
12. A study of 25 patients with functional bowel disease showed that pronounced gastrointestinal distress may be provoked by malabsorption of small amounts of fructose.[13]
13. Many times fructose and sorbitol are substituted for glucose in parenteral nutrition (interventions feeding, IV). This can have severe consequences with people with

hereditary fructose intolerance, a congenital disorder affecting one in 21,000. A European doctor declared: "Fructose and sorbitol containing infusion fluids have no further place in our hospital pharmacies."

14. There is significant evidence that high sucrose diets may alter intracellular metabolism, which in turn facilitates accelerated aging through oxidative damage. Scientists found that the rats given fructose had more undesirable cross-linking changes in the collagen of their skin than in the other groups. These changes are also thought to be markers for aging. The scientists say that it is the fructose molecule in the sucrose, not the glucose, which plays the larger problem.[14]
15. Fructose is not metabolized the same as other sugars. Instead of being converted to glucose which the body uses, it is removed by the liver.[15]
16. Because it is metabolized by the liver, fructose does not cause the pancreas to release insulin the way it normally does. Fructose converts to fat more than any other sugar. This may be one of the reasons Americans continue to get fatter. Fructose raises serum triglycerides significantly. As a left-handed sugar, fructose digestion is very low. For complete internal conversion of fructose into glucose and acetates, it must rob ATP energy stores from the liver.[16]
17. Fructose inhibits copper metabolism. A deficiency in copper leads to bone fragility, anemia, defects of the connective tissue, arteries, and bone, infertility, heart arrhythmias, high cholesterol levels, heart attacks, and an inability to control blood sugar levels.[17]

Although these studies were not designed to test the effects of fructose on weight gain, the observation of increased body weight associated with fructose ingestion is of interest. One explanation for this observation could be that fructose ingestion did not increase the production of two hormones, insulin and leptin, that have key roles in the long-term regulation of food intake and energy expenditure.

[Table developed by Nancy Appleton, Ph.D., clinical nutritionist, researcher, lecturer, and author of *Lick the Sugar Habit, Healthy Bones, Heal Yourself With Natural Foods and the Curse Of Louis Pasteur and Lick the Sugar Habit Sugar Counter*]

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