Letter to the Editor

October 1, 1956.

THE CURRENT DISCUSSIONS and investigations on the influence of fat in the diet on health have emphasized, as never before, the dangers of dietary excesses, prejudices, and fads.

Not many years ago those who were easily influenced by half knowledge and immature observations were frightened from eating more than a minimum of protein for fear of developing high blood pressure and kidney damage.

For decades carbohydrates have been castigated as the cause of diabetes, dental caries, and obesity, also because of incomplete knowledge and immature conclusions.

Very recently incomplete experimental and statistical data have been gathered purporting to show that the fat in the diet increases the level of cholesterol in the blood. This, in turn, is supposed to result in the deposition of fatty plaques, containing a large percentage of cholesterol, in the arteries, causing angina and coronary thrombosis. Because of these incomplete observations people are being told to exclude as much fat as possible from their diet, and again it is becoming apparent that the admonition is premature. More mature study indicates that by eliminating fat from the diet one upsets his nutritional balance and may actually exaggerate the condition he is trying to prevent.

THERE are two sources of cholesterol in the body. It can be made by body tissues and is also absorbed from the diet. However there is only one major method of disposition. It must be excreted by the liver into the bile, either unchanged or in the form of the bile acids and salts.

It has been known for almost half a century that cholesterol and fat in the diet of rabbits and birds will lead to the rapid development of atherosclerosis (arterial fatty plaques) in those species. Only comparatively recently has a similar effect of these food constituents in the diet of man been seriously considered by more than a few physicians and scientists. It has been more or less assumed that the rabbit has an inadequate mechanism for handling cholesterol since this substance occurs only in animal tissues and is foreign to its normal diet. However cholesterol is a normal constituent of human diet, and it was thought that the two species should not be compared. Furthermore long series of analyses of cholesterol levels in human blood yielded conflicting evidence of any direct relation between the level of cholesterol in the blood and the incidence of atherosclerosis.

Renewed interest in the relation of blood cholesterol and other blood fats to coronary heart disease was recently stimulated by reports that it is not the level of cholesterol itself in the blood which predisposes to arterial fatty plaque formation but compounds of cholesterol and fat with the blood proteins, known as lipoproteins. These reports purported to demonstrate that fat, especially cholesterol, in the diet leads to the formation of abnormal amounts of these lipoproteins in the blood and that the lipoproteins deposit their fat in the lining of the arteries.

CONFLICTING evidence soon appeared throughout medical and scientific literature. Very reputable laboratories reported that only extreme changes in cholesterol levels in the diet are able to affect blood cholesterol levels. Furthermore a direct relation between the levels of lipoproteins or cholesterol and arterial disease could not be unequivocally demonstrated.

From the great mass of laboratory and statistical studies on the interrelation of diet, blood fats, and coronary disease in humans, the fact emerged that high levels of certain kinds of fat in the diet, whether or not they contain cholesterol, raise the level of blood cholesterol. Studies on the relation of dietary habits in different areas of the world to the incidence of atherosclerosis in those areas showed that the disease is more common in the better fed populations and most common in areas where 40% and more of the calorie intake is in the form of fat.

These observations appeared to close the case against fat even though a direct relation between blood cholesterol levels and the deposition of arterial fatty plaques had not been conclusively shown. The apparently logical sequence of high fat in the diet to high fat in the blood to high fat deposition was too tempting to cast aside.

There are some other facts however, which disconcertingly intrude themselves into this picture. It has been shown that although a low fat diet may lower cholesterol levels in the blood, it results in inordinately high levels in the liver and other tissues. Since the arteries are also tissues, one immediately wonders whether they, too, might not be a place for cholesterol to be deposited when it disappears from the blood.

Pathologists have shown that arterial plaques probably form on those places in the lining of arteries where there has been some sign of damage or inflammation. This, combined with the fact that artery tissue itself can make cholesterol, has led to the postulation that the formation of plaques is a repair mechanism inherent in the artery itself.

RECENTLY a very important new fact has emerged. It was found that animal fat raises the level of blood cholesterol but that vegetable fat, when substituted for animal fat, actually lowers blood cholesterol perhaps even to a greater degree than a fat-free diet. This was quickly followed by the observation that the hard fat in animal fat is responsible for its effect, and that hardened, that is, hydrogenated, vegetable fat will have the same effect.

This is an extremely important observation. It has long been known that constituents of fats, known as the essential fatty acids, are required in the diet. One of these, linoleic acid, is found in vegetable fat. The other, arachidonic acid, as well as linoleic acid, is found in animal fat, especially in certain organs. It is probable that these essential fatty acids are required for the transport of cholesterol from the tissues, where it is made, to the blood, and eventually to the liver and bile where it is excreted. Without these essential fatty acids the cholesterol probably accumulates in the body, and some finds its way into the walls of the arteries.

The tables thus seem to be turned. Instead of fat being the cause, it may well be the cure and prevention of atherosclerosis. Fat serves many functions. It is our best source of energy. It gives that feeling of well-being that comes at the end of a good meal. It aids in the utilization of certain vitamins. It adds flavor to food. It increases the emptying time of the stomach and thus keeps one from getting hungry too

soon between meals, actually helping to prevent overeating. These facts mean that one must not eliminate fat from his diet or he runs the risk of depriving himself of an essential nutrient and possibly the means of ridding the body of its excess cholesterol.

It is thus not fat in the diet which is harmful, but an unbalance in the kinds of fat. An excess of vegetable fat is also harmful, as is an excess of water. Linseed oil contains very large amounts of the essential fatty acids but cannot be eaten in large amounts. Rats receiving a diet in which the fat is exclusively essential fatty acids fail to grow normally. What is needed is a balance of animal type and vegetable type of fats.

Man is an omnivorous animal; his digestive system is adapted to a variety of plant and animal tissues. His requirements for fat, protein, carbohydrate, minerals, vitamins, energy, and possible roughage can be met only by a broad spectrum diet.

There can be little doubt that the amount and kind of fat in the diet plays some role in the control of the amount of fat and cholesterol in the blood. Probably 40% of dietary calories from animal fat is too much. To attempt to eliminate all fat from the diet is to err in the other direction. To eliminate animal fats or to include disproportionate amounts of animal or vegetable fats have the common faults of all excesses. Moderation and balance should be the watch-word of what we eat as well as all our other behavior.

Let's keep our balance.

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ABSTRACTS . . . . . R. A. Reiners, Editor

• Oils and Fats

S. S. Chang, Abstractor
Sin'itiro Kawamura, Abstractor
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Effect of ionizing radiations on carotenoid stability. A. Lukton and G. Mackinney(Univ. of California). *Food Tech.* 10, 630–2 (1956). The destruction of carotenoid pigments on exposure to gamma radiation is caused by secondary reactions and depends upon the extent to which free radicals or peroxides formed in the surrounding medium are available for reaction. Three carotenoid-containing oils were tested; namely that extracted from the carrot root, corn oil, and salmon oil. The carotenoid in carrot root oil was very stable; of the three oils tested, the pigment in salmon oil was least stable. Crystalline carotene and lycopene, dissolved in petroleum ether solution, in the absence of any antioxidant, are highly unstable. Stability was also markedly decreased when pure lycopene was dissolved in methyl stearate, methyl oleate, and methyl linoleate. Films of pure *beta*-carotene and lycopene in the solid state appear to be remarkably stable, even in the presence of air, and the authors conclude that where destruction occurs, it is initiated by products of other reactions, normally to be sought in the lipid fraction. The differences in stability of the carotenoids in the natural oils examined may be explained in one or more of the following ways: the carotenoids themselves differ in each of the oils, the oils differ in their content of unsaturated fatty acids, and finally in their content of antioxidants.

Relation of stage of lactation to volatile and unsaturated fatty acids of Egyptian cow and buffalo butterfat. M. M. Taha El-Katib(Nile Agr. Co., Egypt). *Oil and Soap* (Egypt) 3, 331–337(1956). Samples of butterfat were collected at weekly or fortnightly intervals from 3 cows and 5 buffaloes throughout the entire lactation period and analyzed for Reichert, Polenske and iodine values. The average Reichert values of buffalo and cow butterfat were 29.18 and 25.14, respectively. Throughout the lactation period the Reichert value of the buffalo butterfat was higher than that of the cow butterfat. The Reichert value of the butterfat of both species declined gradually from the beginning to the end of the lactation period. The Polenske value of cow butterfat was higher than that of buffalo butterfat throughout the lactation period. The average iodine values of cow and buffalo butterfat were 33.01 and 32.10, respectively. The iodine value increased as the lactation period advanced.

Extraction of oil by solvents at elevated temperatures. II. A. G. Antonioli and R. Turriziani. *Ann. chim.* (Rome) 45, 1035–40 (1955). The diffusion coefficients of mixtures of peanut oil and benzene were determined at temperatures between 15.4 and 52.4°. By applying Eyring's theory it was found that the energy of activation of the diffusion process is almost equal to the activation energy of the viscous flow of the solvent. These results confirm that the resistance of cellular membranes is an important factor in extracting oil from seeds. (*C. A.* 50, 12508)

The ultraviolet absorption of isolated double bonds. O. H. Wheeler and J. L. Mateos(The Inst. de Química, Univ. Nacio. Autónoma de México). *J. Org. Chem.* 21, 1110–2(1956). The apparent absorption, in the region 200–215 mμ, of some 40 acyclic compounds containing isolated double bonds has been measured. Substituents on the double bonds, strain effects in the rings, and the proximity of ionic groups increase the apparent absorption intensity.

Crystalline deposit from soybean oil. Yoshiyuki Toyama and Hideko Takai. *Research Rept. Nagoya Ind. Sci. Research Inst.* 8, 44–5(1955). Soybean oil remains transparent even in the winter in Japan. However, soybean oil of lower iodine number (126–7) extracted with hexane from soybeans produced in the United States gave a solid deposit. Such deposits consisted of small amounts of wax esters containing fatty acids higher than C_{22} and considerable amounts of diunsaturated and monounsaturated triglycerides containing stearic and higher acids as well as linoleic acid. (*C. A.* 50, 12509)

Vegetable-oil polymerization. R. P. A. Sims(Can. Dept. Agr., Ottawa). *Chemistry in Can.* 8(6), 71–4, 76–8(1956). Review with 43 references. (*C. A.* 50, 12508)

Utilization of Indian bentonite in the refining of vegetable oils. II. B. Chaliha, R. N. Bagchi, and M. M. Chakrabarty (Univ. Coll. Technol., Calcutta). *Science and Culture(India)* 21, 161–3(1955). In Bihar, Kashmir, and Jodhpur two types of bentonite occur: one which absorbs much water and remains suspended; and another which absorbs little water and settles rapidly. The latter after activation can be used for refining of vegetable oils. (*C. A.* 50, 12507)

Adulteration of fats and its prevention. N. G. Wagle(Univ. Bombay). *Bombay Technologist* 6, 76–8(1956). The determination of adulterants in fats and oils is reviewed. (*C. A.* 50, 12505)

Polyoxyethylene monostearate in the bakery. E. S. Lower and S. C. Cressey. *Food Manuf.* 31, 277–9(1956). (*C. A.* 50, 12318)

Antioxidant action of electron-attracting and electron-repelling substituents in the 2 and 6 positions of phenol. J. Miller(Purdue Univ., Lafayette, Indiana). *Univ. Microfilms*(Ann Arbor, Mich.). *Publ. No. 16481,* 40 pp. (microfilm, $1.00; paper enlargement, $4.00; Dissertation Abstr. 16, 1057 [1956]). (*C. A.* 50, 11967)

Antioxidants of butter. Yasuro Ozawa. *Bull. Natl. Inst. Agr. Sci.(Japan).* Ser. G, No. 4, 29–39(1952). To prevent the oxidative deterioration of butter, some practical and effective methods were tested as regards some antioxidants added during the working process. Among water soluble antioxidants tested, vitamin C was superior to hydroquinone and tannic acid. However, vitamin C discolored the butter so excessively