THE ROLE OF ANIMAL FATS IN HUMAN NUTRITION

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Functions of Fat

Energy

Protein, carbohydrate and fat are the three important sources of energy as calories in our diets. Of these, fat is the most concentrated source, supplying more than twice as many calories per unit weight as either protein or carbohydrate. Because of the concentration of energy in fats, generous amounts in the diets of active growing children and of adults engaged in heavy labor are important and help to make it possible to maintain caloric equilibrium without experiencing the discomfort of over-loading the stomach. It is noteworthy that all fats saturated and poly-unsaturated have very nearly the same caloric value.

Various fats show fairly wide variation in rate of digestion, dependent largely on the melting point, but all natural fats, animal and vegetable are nearly completely digested by the normal human with reported digestibility coefficients ranging from 93 to nearly 100. Even these small differences in digestibility largely disappear on a practical mixed diet containing a mixture of fats.

Essential Fatty Acids

In the early days of vitamin research it was shown that certain fatty acids, mainly linoleic and arachidonic acids were essential in rats to prevent a deficiency characterized by retarded growth, scaly skin, kidney ailments and increased incidence of infections. Similar deficiencies have since been produced in many other species of experimental animals by rigid exclusion of fat from the diets of young animals. It is now well recognized that polyunsaturated fatty acids are essential for humans especially infants to prevent and cure certain types of eczema. In this connection it is mentioned that lard was used by Hansen[1] in his early studies to effectively treat this condition in infants. About 10% of the total lipids of lard and pork cuts is linoleic acid while beef tallow and beef cuts contain 3-4% of linoleic acid in the fat.[2] Only small amounts of polyunsaturated fatty acids are necessary for growth and prevention of skin abnormalities. There is evidence[3] that only 2% of the total calories as polyunsaturated fatty acids is adequate in humans, rats and pigs to meet their essential fatty acid requirements.

Satiety Value

It has long been recognized that over and above its nutritional merits, fat has a satiety value, an expression with many meanings. The usual definition of satiety such as gratification beyond desire is one for which fat qualifies, probably through a psychological effect or a physiological adjustment of the body to prolonged consumption of substantial amounts

of fat. In this connection fat shortage in wartime Europe reduced the energy and efficiency of workers[4] and it has been reported that many people developed a craving for fat when deprived of it for a long time. The oriental soldier, on the other hand, subsisted on a ration largely of cereals and vegetables which supplied only 3% of the calories as fat and apparently experienced no lack of satiety. The usual nutritional meaning for satiety is related to the ability of foods to delay the onset of hunger pangs between meals. Fat is eminently qualified in this respect since it is well established that fat delays gastric emptying time not only of itself but of other foods as well. The rate of intestinal digestion of fat is slower than of other nutrients and the presence of food in the gastrointestinal tract is an important factor in delaying hunger. The higher melting points of the animal fats as compared with most of the liquid vegetable fats would be expected to give them a particular advantage in this respect since it has been shown in rats by Steenbock et al[5] that these differences in absorption rate do exist.

Other Functions

Fats make substantial contributions to our fat-soluble vitamin intake with vitamins A and D in butter fat and vitamin E in most vegetable oils which is important in the latter oils to prevent the rapid rancidification of the high levels of polyunsaturated fatty acids.

Of considerable interest and possible significance for future generations is the observed property of fat to protect animals from irradiation.[6] Other non-nutritional functions of fat are for thermal insulation and for the cushioning of vital organs.

Fats in Atherosclerosis

It has for a long time been recognized by nutritionists that animal products have made important contributions to our nutritional health. In recent years there has been growing concern over the increased incidence of cardiovascular disease and other degenerative diseases in this and other developed countries. Epidemiology studies of various population groups showed fair correlations between intake of animal products, animal fat and cholesterol and incidence of heart disease. Such studies, although interesting and serving as a stimulant to research support, can be misleading, subject to misinterpretation and do not give direct scientific proof. It is of interest that the same information can also be interpreted to show a direct correlation between cholesterol intake and length of life in various parts of the world.[7]

A most complicating factor in world population studies is the rapid strides made in increasing longevity in the developed parts of the world. The average life span of about 70 years at present in the United States has increased from about 50 years in 1900 and has doubled since the republic was founded. This remarkable progress has been accomplished chiefly through more effective prevention and control of infectious diseases through improved sanitation and the development of more effective biologicals and chemotherapeutic agents. No longer are infant mortality, childhood diseases, influenza, pneumonia, poliomyelitis, typhoid, smallpox, tuberculosis, diarrhea and enteritis responsible for heavy death loss.

Commenting on this situation recently at the World Food Forum, Mr. Frank W. Notestein,[8] president of The Population Council, Inc., New York, stated, "A white girl born in 1960 has a better chance of reaching 60 than of reaching age 5 if she were born in 1900." As a result of better control of infectious diseases, a very large percentage of our population survives to old age and the same degenerative diseases which have always exacted their toll of the aged are still prevalent and there has been little or no progress in their control. The average life expectancy of a man of 50 or 70 years of age today is not appreciably different from what it was in 1900.

Diseases of the heart and circulatory system (cardiovascular) are extremely prevalent and are responsible for over 50% of the total deaths occurring in this country. There are many factors which appear to be related to cardiovascular disease including age, sex, heredity, metabolic rate, level of activity, tobacco consumption, nervous stress, blood pressure and nutrition.

Atherosclerosis and/or high blood pressure, resulting from atherosclerosis are the cause of 90% of the cardiovascular deaths. In atherosclerosis there is a deposition of fatty substances as streaks in the cells of the walls of the blood vessels. These fatty deposits contain many types of substances, including cholesterol, true fats, phospholipids, proteins, and minerals in many types of combinations. The fat deposition may start in individuals only a few years old and progress at variable rates throughout life. When these fatty deposits become sufficiently large they may impede the flow of blood or stop it altogether in which event the blood supply to a vital organ, such as the heart or brain, may be sufficiently interrupted to produce a heart attack, stroke, or death. Most of these above factors cannot be controlled by the individual and this is why the nutritional factors have been so greatly emphasized in recent years.

The nutritional factors which have received the most attention are overweight, cholesterol intake, fat intake, and type of fat.

Overweight

Overweight is one of the most serious nutritional problems in this country and in most cases is a result of the decreased activity of our population with increased mechanization together with over-consumption of calories. There is no direct cause and effect relationship proven between overweight and the incidence of cardiovascular disease; however, life insurance statistics show that on the average, people who are overweight have a shorter life expectancy.

It appears that in order to reduce the risk of developing atherosclerosis, the prevention of overweight throughout one's lifetime by maintaining an appropriate level of physical activity and by not over-consuming calories regardless of their source would be the most important preventative nutrition approach. For those who are overweight, it has not been proven that removal of excess body fat once it has been deposited will be beneficial in reducing the likelihood of atherosclerosis; but it would be well-taken advice to institute a sound health program including regular exercise and a sensible reducing diet to produce a constant but slow (1-2 lb/week) loss in weight. Such a reducing diet should be adequate in

protein, minerals and vitamins, restricted only in calories to minimize loss of body nitrogen and minerals. Carefully controlled studies with overweight men[9] and women[10] by Young summarized in Science Digest[11] show that there is no "magic formula" for weight reduction and that for best results diets should supply moderate amounts of fat, high protein and low carbohydrate employing a wide variety of foods from all food groups. These studies are the basis for the reducing diets provided by the National Live Stock and Meat Board in the booklet "You Can Reduce".

Cholesterol Intake

Since cholesterol is one of the fatty substances which are deposited in the blood vessels in atherosclerosis it was at one time thought by some that all we would have to do to control this condition was to limit the amount of dietary cholesterol supplied by meat, milk, and eggs. It is agreed by most investigators that within reasonable limits the level of dietary cholesterol has little or no effect upon the level of cholesterol occurring in the blood. Cholesterol is a normal constituent of our bodies and we apparently operate on about two grams of cholesterol per day. Every cell in the body is capable of making cholesterol and if dietary cholesterol is not supplied, the body (especially the liver) will make enough to compensate for this dietary restriction. If dietary cholesterol were proven to be a factor, which is not the case, the amount of cholesterol contained in an average 100 gram serving of cooked beef is less than 3% of the above 2 gm. Of this small amount of cholesterol in meat, over one half is in ester form[12] which has been shown to be more slowly absorbed than the free form in the rat[13,14] and the chicken,[15] and is distinctly different from the form of cholesterol in milk and eggs, where it is nearly all in free form. Furthermore, there is no proof that the level of cholesterol in the blood in any way influences deposition of fatty substances in the blood vessels. Many people with elevated blood cholesterol do not develop atherosclerosis and many people die from atherosclerosis without having elevated serum cholesterol. The cells lining the arterial walls themselves are capable of manufacturing cholesterol, fats, and other fatty substances and it is not established to what extent levels in the blood or levels of dietary intake influence this fatty deposition in the blood vessel walls.

Fat Intake

Various sources of information indicate that fat consumption in the U. S. is 40-45% of the total caloric intake. This is a point of concern of many nutritionists who feel that levels of fat intake should be reduced so that fat would comprise 25-30% of total calories. Fat is essential in the diet and in addition, has a satiety value due to its effect upon delaying the passage of food through the stomach. A moderate amount of fat is desirable in reducing diets for this reason. There is no proof of a direct relationship between fat intake and the incidence of atherosclerosis. However, if there is excessive caloric intake, whether from consuming too much fat, carbohydrate or protein, obesity will result and there is a higher incidence of cardiovascular disease in obese than in non-obese individuals.

Type of Fat

There is currently much discussion about the types of fat in the diet and consideration of the desirability of substituting polyunsaturated

fats for saturated fats. The fats in animal products are predominantly hard fats (saturated) whereas the vegetable oils (corn, cottonseed, peanut, soybean and safflower) are predominantly polyunsaturated fats. If polyunsaturated fats are substituted for saturated fats without increasing calories the levels of cholesterol and fat in the blood of many people are lowered,[16-19] but results are variable and in some individuals blood cholesterol and lipids are not lowered and may even increase.[20] Most of the polyunsaturated fat studies with humans and animals have been of short duration and there is evidence in humans[20] and in long term animal studies with swine[21] and chickens[22] that in due time the body will adjust to the intake of polyunsaturated fats and the blood levels of these fatty substances will return to the pretreatment levels. It is not known what happens to the cholesterol and other fatty substances when they are removed from the blood by polyunsaturated fat in the diet. It is possible that there is increased deposition in the blood vessels and other tissues of the body as a result of this treatment. Russel et al[23] showed that in normal and alloxan-diabetic rats, corn oil feeding produced greater liver cholesterol levels than lard. Similarly, Gerson, Shoreland and Adams[23a] in several well controlled experiments with rats of various ages found that although corn oil feeding lowered serum cholesterol and lipids, total cholesterol was increased in the entire body as well as in the aortas, heart, muscle, testes, adipose tissue and gut.

In studies of the effect of polyunsaturated fats upon actual atheroma development in the arterial walls, Lofland et al[24] found that corn oil feeding of pigeons produced lower serum cholesterol than coconut oil but there was no significant differences in the aorta plaques. Similarly, in baby monkeys fed 47% of the calories as butter fat or mixed vegetable oils, values for certain serum lipid components were different in the two groups. Both groups developed lesions typical of atherosclerosis in the aorta and muscle arteries with no differences with the two types of fat.[25]

Further indication that lowering serum cholesterol and lipid levels may not influence what happens in the artery walls is available in the studies of Oliver and Boyd.[26] Estrogen was given to fifty male survivors of a first myocardial infarction over a 5-year period and a lactose placebo to a similar group of fifty. Serum cholesterol was lower in the estrogen group but both groups had the identical number (eighteen) of further myocardial infarctions.

Detailed studies of the biochemical composition of lipid extracts of human intima/maxima preparations from aortas, coronary and brain arteries have been made for the purpose of determining differences between relatively undiseased and severely atherosclerotic arteries (Böttcher et al)[27]. In atherosclerosis the total lipids, cholesterol and cholesterol esters increased in all artery preparations while triglycerides and free fatty acids decreased and phospholipid changes were variable. Polyunsaturated fatty acids consistently increased in the cholesterol ester and triglyceride fractions of all atherosclerotic arteries and saturated fatty acids decreased in these fractions. These results are of particular significance since the food consumed in Netherlands is relatively rich in saturated animal fats and even under these dietary circumstances polyunsaturated fatty acids increased in artery walls in atherosclerosis. Kummerow[28] has found similar increases in polyunsaturated fatty acids with increased severity of

atherosclerosis in aortas collected from many parts of the world. These results could indicate a desirability to exercise reasonable moderation in the use of polyunsaturated fats.

The Position of Meat in Heart Disease

If animal fat is proven to be involved in heart disease, it should be recognized that live stock producers are continually producing meatier type animals, that most of the fat of meat is separable and is either trimmed off by the packer, by the retailer, or is discarded at the table as plate waste. Our annual per capita consumption of beef, pork, lamb and veal is approximately 160 pounds (carcass basis). When this meat is cut, merchandised and cooked for table use the lean and marble portions of this amount of cooked meat provides an average daily intake of 2.5 ounces per person. It is difficult to accurately estimate the amount of fat from meat which is actually consumed because there are wide differences in personal preference as far as meat fats are concerned. It is probable that most people trim off most of the separable fat from most cuts of cooked meat and that most of the fat in the drippings is discarded if gravy is made. It is believed that the fat content of the lean and marble portions of cooked meat is fairly representative of actual consumption of most people. This 2.5 ounces of lean and marble meat supplies less than 10 grams of fat which is based upon all retail cuts of the carcass in the amounts they are contained. This amount of fat from meat is less than 7% of the estimated average fat consumption in this country and supplies less than 3% of the caloric requirement of an adult man. At the same time, this amount of meat supplies approximately 30% of the protein requirements of an adult man and in addition, is a valuable source of many minerals and vitamins.

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(Applause)

MR. DOTY: We are running behind, but I hope there is time for one or two questions or comments if anyone wishes to make any. Are there any questions you would like to ask?

MR. ALLEN: (University of Wisconsin) Sir, in some of the literature that has been done in studying atherosclerosis in the animal, it has been reported that the atherosclerosis are not the same as that found in the human atherosclerosis. Is this true and what are some of the complications in securing this data and applying it?

MR. SHERMAN: There is a lot of work in chickens of course; there is a lot in rats as compared with humans. I think there is certainly a difference in all of them. Some of these nutritional factors that affect one species, for example a chicken, will not necessarily do the same thing in a human at all, or a rat. Is this your question, the chemical composition?

MR. ALLEN: Yes.

MR. SHERMAN: I don't know if there is such a large amount of difference in the chemical compositions or not. I would think the fatty acid composition could be quite different and this would be to some extent at least, dependent upon diets. I think the same type of compounds would be present in all of them.

DR. DOTY: Any other questions? If not, I'll turn the meeting back to our Chairman.

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THE CHAIRMAN: Thank you, Dr. Doty, for two very interesting and informative papers.

We would like to take a ten-minute break here and return to handle this business session with dispatch. If you can make this break shorter than that, we'll get started earlier. There has been a request for a short break.

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THE CHAIRMAN: Let's be seated and come to order, Please. We will move just as rapidly or spend as much time as you desire on any subject.

I think, first of all, we should take some action regarding the minutes. We have had about eight months to review them. They appeared in

the Proceedings. I presume you have all read them. Are there any corrections or additions to the minutes as they appear in the Proceedings that should be noted at this time? If not, we'll entertain a motion that they be adapted as written.

FROM THE FLOOR: I move.

FROM THE FLOOR: Second.

THE CHAIRMAN: All in favor, say aye.

(Chorus of ayes.)

THE CHAIRMAN: Opposed, same.

(No audible sound.)

THE CHAIRMAN: Motion carried.

We'll first dispose of several of the Committee reports. I would like to ask Ken Franklin to give the report of the Memebership Committee. He is pinch-hitting somewhat, for George Wellington who is out of the country this year. I think Ken can give us the activities of this Committee because he has done most of the work.

MR. FRANKLIN: I hasten to say I am not a Committee member. However, we felt that with the changes that you voted last year in the Proceedings, that it would be unfair to delegate the job of handling membership applications, dues, and so forth, since the Chairman was out of the country, and that task will be turned over to that Committee on his return. I am sure that George will be very happy to hear that.

As you know, we are in the middle of compiling new information for the membership directory and that too, will be one of the Committee's first chores for the coming year.

I thought you might like to have an interim report of how this group does stand and the present count as it stands today according to our list. We have 9 life members, 10 until the passing away of Professor Loeffel; in addition we have 113 full members carried on the list, and at the present time 45 associate members. So, that is a total of 167 members in this Reciprocal Meat Conference.

We do hope to finally get that directory out, and may I urge you if you have not submitted your biographical information or your picture -- if you so desire to have it in the directory -- please mail that to the Meat Board's office as soon as possible so we can turn the complete list over to George Wellington.

There has been a suggestion that I would like to put before you. It came from Bob Merkel of Michigan State. I would like to heartily endorse it myself: That we include in the directory the home and the office telephone numbers of all of our members, including the area codes. If this makes sense to you, and it certainly does to me, we would like to get that information from you and include it in the directory.

THE CHAIRMAN: We'll entertain any motions to that effect.

FROM THE FLOOR: I so move.

MR. ADAMS: Second.

THE CHAIRMAN: Is there any discussion?

(Question.)

THE CHAIRMAN: All in favor respond by saying aye.

(Chorus of ayes.)

THE CHAIRMAN: Contrary?

(No audible sound.)

THE CHAIRMAN: The motion is carried.

For those of you who have already submitted your biographical information -- and thank you for having done so -- we'll send you a card reminding you to send it back to us with your telephone number, both home and office, and the area codes. We'll include that in the directory.

MR. FRANKLIN: May I proceed from that into the treasurer's report? This has a direct bearing on the fact that we have not printed a directory this year, so that our treasury is fairly substantial. As of last year you had in your proceedings an interim report, a total of $624.00. This item stands as correct for the 1961 treasury, since there were no further expenditures after the Conference. Membership dues to date have increased that figure to $814.00, and in the interim since the first of January, there has been an expense of $50.00 for Conference awards leaving to date a figure, and this is an interim figure of $764.00 because there are probably membership dues back at the Meat Board office, and there are also those of us who have not paid our dues. In that connection may I also urge you, if you have not as yet sent in your dues, we would appreciate your doing it within the next month so that we can have a final figure for our treasurer's report. I think, Mr. Chairman, that concludes the treasurer's report.

THE CHAIRMAN: Thank you, Ken. We have kicked this Personnel Committee around quite a lot today. We have moved them two or three times. We would like to call on Larry Kunkle at this time, to comment on the activities of the Personnel Committee during the past year.

MR. KUNKLE: Mr. Chairman, I'll give it, the page and a half, to the stenotypist for the record in the interest of conserving time. You can read what we have supposedly done and I'll let you take our word for it.

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