Abstracts of the 45th Annual Meeting of the American Dietetic Association*

Fats, Rats, Chickens and Men—Results of Feeding Frequency. CLARENCE COHN, M.D., M. DAVID ALLWEISS, M.D. et al. Department of Biochemistry, Medical Research Institute, Michael Reese Hospital and Medical Center, Chicago, Ill.

Studies of the metabolic reactions of man to different feeding frequencies are being accomplished on volunteer subjects under the conditions of a "free-living" population. We believe that psychologic complications attendant on placing individuals in the confines of a "metabolic unit" are thereby avoided. The volunteer subjects, chosen on the basis of both their physical well-being as well as their motivations, have been studied under the conditions of eating three and six meals daily; each individual serves as his own control. A number of methods for feeding appetizing and nutritious diets, differing only in the number of times fed daily, were tried and evaluated. The food intakes were adjusted to the preferences of each individual subject.

Our findings to date include (1) an increase in serum protein-bound iodine levels when volunteer subjects are changed from three to six meals daily; and (2) an increase in the clearance rate of excess glucose from the blood after intravenous injection (increased glucose tolerance) and a decrease in fasting blood sugars when volunteer subjects are placed on six meals a day. There appears to be an increase in thyroidal I^{131} uptake in normal subjects and a lowering of the elevated serum lipids in those with hyperlipemia following an increase in feeding frequency. The utilization of ingested protein appears to be more efficient when six meals a day are eaten. Over a six-week period of study, no changes in body composition (using whole body K^{40} determinations) could be detected when six subjects were changed from three to six meals daily.

Nutritional Aspects of a Shelter Habitability Study with Ninety-Six Naval Recruits. ROBERT VAN REEN, PH.D. Nutritional Biochemistry Division, Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.

A shelter habitability study was conducted from February 17 through March 3 at the National Naval Medical Center under the auspices of the Bureau of Yards and Docks. The primary purpose of the trial was to evaluate the engineering features of the protective shelter; however, it was an excellent opportunity to study the nutritional adequacy of a survival ration. This paper describes the nutritional aspects of the study.

The ration decided upon had a commercial survival ration cracker (National Biscuit Co.) as the major source of food, providing some 80 per cent of the total calories. Other minor foods were jam, peanut butter, soups, sugar and Pream.® Two meals were provided in a twenty-four hour period. The first or cold meal provided approximately 898 calories. During the first eight days of the trial, the second meal provided 585 calories and during the last six days, 963 calories. Thus, the total values of the issued foods were 1,483 calories per man per day for days 1 through 8 and 1,861 calories per man per day for days 9 through 14. The acceptability of the crackers was good with well over 90 per cent of the crackers issued consumed.

There was a sharp loss in body weight of about 5 pounds during the first eight days of the test. On increasing the caloric value of the ration, the rate of weight loss was reduced but an additional 0.4 pound loss was encountered up to emergence from the shelter. It is not known whether the weight losses were due to loss of

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water or body muscle and fat. A mean daily water intake of 1.29 L. and a mean daily urine volume of 0.79 L. were found during the two week period.

It is concluded that the austere type of ration utilized can be employed with safety in a two week shelter stay. It should be emphasized, however, that in this study the subjects were all young (mean nineteen years) healthy, well adjusted men; and the results can only be discussed in regard to such a group.

The Significance of Serum Triglycerides. MARGARET J. ALBRINK, M.D. West Virginia University School of Medicine, Morgantown, W. Va.

Patients with coronary artery disease have been found to have high concentrations of one of the blood fats—the triglycerides. Indeed, triglyceride levels are much more likely to be abnormal than the more frequently studied cholesterol. Because high serum triglyceride levels in a supposedly normal person might be an indication of future coronary disease, a search was undertaken to find out what type of people have high triglyceride levels and why.

An extensive study of healthy factory workers uncovered many middle-aged men with high triglyceride levels. These men tended to have several things in common: they had gained a considerable amount of weight since the age of twenty-five (not enough to make them really fat—triglyceride levels in the really fat men were normal—just enough to change them from average or lean young men to moderately stocky middle-aged men); and those with a family history of diabetes or coronary heart disease also had high triglyceride levels, an indication of the role of heredity. A group of patients with diabetes were studied, like the patients with coronary heart disease, triglyceride levels tended to be high.

The composite picture of the individual with high triglyceride levels, then, is a man with coronary artery disease or diabetes in his family, a man who has or may eventually have diabetes or coronary heart disease, and a man of medium stocky build who has gained more than 10 pounds since the age of twenty-five. Of these factors, weight gain appears to exert the strongest influence.

Whether excessive calories in general or whether some particular foodstuff eaten in excess is responsible for an increase in serum triglycerides in weight-gaining middle-aged men has not yet been determined for healthy men. For a particular group of people (those with diabetes), a trend during the past thirty years away from high fat, low carbohydrate diets toward diets lower in fat and more liberal in carbohydrate has been associated with an increase in coronary artery disease and an increase in serum triglyceride concentration. This finding casts some doubt on the advisability of high carbohydrate, low fat diets for all persons, particularly those with a tendency towards diabetes or with excessive triglycerides in their blood.

Status of Diet, Serum Lipids and Atherosclerosis. SAMI A. HASIM, M.D. Columbia University and St. Luke's Hospital, New York, N. Y.

It is now established that manipulation of the fatty acid pattern of the diet will influence the level of serum cholesterol in man. Such a manipulation, if aimed at lowering serum cholesterol levels, involves a substantial increase in the ratio of polyunsaturated fatty acids to saturated fatty acids (P:S ratio) without a decrease in the percentage of calories derived from fat. Such a diet is now widely known among nutritionists. That protection from coronary heart disease or other manifestations of atherosclerosis will result from the consumption of such diets remains to be demonstrated.

The increase in serum triglycerides that is often seen following a drastic lowering of total fat in the diet is presently being investigated. Thus, care must be exercised in distinguishing between a diet low in fat and a diet high in polyunsaturated and saturated fatty acids.

It has been suggested that increasing the polyunsaturated fatty acid content of the diet may cause an increase in tocopherol requirements. It is well known that man can absorb and store polyunsaturated fatty acid. Commonly available fats rich in polyunsaturated fatty acids naturally contain a great deal of tocopherol. The "shelf-life" of tocopherol varies, and oxtocopherol is apparently the only tocopherol

which is absorbed to any significant degree in man. The precise characterization of tocopherol demands in adult man imposed by diets rich in polyunsaturated fatty acids remains to be elucidated. The role of tocopherol in infants continues to be a subject of interest.

The relationship of dietary fats to thrombosis remains a complex phenomenon. Clotting of the blood *in vitro* is not the same as thrombosis *in vivo*. Studies of the effects of dietary fats, lipemia and clotting have led to contradictory claims and results. It is now possible to produce a coagualum *in vitro* morphologically indistinguishable from a thrombus. Thus, the effect of fatty acids and lipemia on blood coagulation can now be studied better.

The phenomena of digestion and absorption provide the body's first "lines of defense" in handling dietary fats. Water-insoluble lipids are made suitable for transport by the intestinal mucosa. Mechanisms of fat absorption are attracting greater research efforts which will undoubtedly enhance our knowledge of the role of fats in health and disease.

The relationship between diet, serum lipids and atherosclerosis is proving to be complex, yet challenging. It will require increasing collaboration among workers in different disciplines. Such a multidisciplinary approach is well justified in view of the importance of the problem.

Radioactivity in the Diet. GORDON M. DUNNING. Division of Operational Safety, U. S. Atomic Energy Commission, Washington, D. C.

Since the start of nuclear weapons tests in 1945, it has been announced that about 300 detonations have been set off in the atmosphere by all nations. The total energy release has been equivalent to over 300 millions tons of TNT, including more than 115 million tons equivalent of fission.

The Federal Radiation Council estimated that as a result of the fallout from all nuclear tests through 1961, the radiation dose to the whole body (accumulated over the next thirty years) will be about 100 mr. (A milliroentgen (mr.) is one thousandth of a roentgen. A roentgen (r.) is a measure of the amount of radiation exposure.) The radiation dose to the bone of the most highly exposed segment of the population (accumulated over the next seventy years) will be about 650 milliroentgens. (The accumulated seventy year dose to the whole body *from naturally occurring radioactive substances in the environment* is about 7,000 mr.)

Strontium^{90}. From many studies of total diets, the highest daily average intake of Sr^{90} reported is 17 "strontium units." (A strontium unit is 1 $\mu\mu$c.—one millionth of a millionth of a curie—of Sr^{90} per gram of calcium. A micromicrocurie ($\mu\mu$c.) also is 2.2 disintegrations per minute.)

The Federal Radiation Council's Guide for *normal peacetime operations* is 200 $\mu\mu$c. intake per day (corresponding to about 200 strontium units) as a population average for a *lifetime*. (See subsequent statements for discussion of Federal Radiation Council Guides.)

Whereas, milk may account for a third to a half of the daily intake of Sr^{90}, it also supplies over three-fifths of the calcium needs. In fact, ". . .a diet without milk would most likely have as much as two or three times the Sr^{90}/Ca level. . ." as would milk. (Dr. Cyril Comar, New York State Veterinary College, Cornell University, Ithaca, New York.)

The highest amount of Sr^{90} in human bone reported in the United States was about 3 strontium units in 1960 (the latest complete set of data). This is somewhat less than that estimated from dietary intakes. The corresponding dose rate to the bone would be less than 10 mr. per year. The Federal Radiation Council's Guides for doses to the bone for a lifetime are 1,500 mr. per year if measurements are made on individuals, and 500 mr. per year if the technic used measures a suitable sample of the population.

Iodine^{131}. Relatively high concentrations of I^{131} in milk have been reported but since it decays away rather rapidly (a half-life of eight days) it does not constitute a long-term problem. The highest estimated exposure to the thyroid in any year at any monitoring station was about 1.5 r.

The Federal Radiation Council reported that ". . .Doses to the thyroid from the major past tests were estimated to have ranged from 100 to 200 millirems" (milliroentgens) per year

(national average) "during and immediately following periods of testing. These values apply only to individuals who were infants at the time of highest concentration of radioactive iodine. . ." The adult thyroid is about ten times as large as infants' thyroids and receives only one-tenth the radiation dose for the same amount of I^{131} ingested. Thus, if man is conceived, born, lives his full life span in an environment where the I^{131} remains constant (by continuing nuclear tests) at a level to produce 200 millirads per year to the thyroid as a child, his seventy year lifetime dose might be about 2r.

The Panel of Experts from the Committee on Biological Effects of Atomic Radiation: National Academy of Sciences-National Research Council in their report of July 1962 states in relation to use of I^{131}: ". . .There is no evidence at hand, except for one doubtful case in a child, that any of the treatments for hyperthyroidism has produced a thyroid cancer, although doses have ranged from a few thousand rads upward. . ."

Countermeasures. There are countermeasures that may be taken to reduce the intake of such radionuclides as Sr^{90} and I^{131}. However, such countermeasures should not be instituted lightly since there may be direct hazards from their use as well as indirect risks (such as unnecessarily removing essential food items from the diet). The Federal Radiation Council Guides do not represent levels of radioactivity that constitute health hazards requiring countermeasures. . . . This ". . . misunderstanding concerning the Guides. . ." has been the cause of countermeasures that were not called for. This is no reflection on the layman (in these matters). It does point up the responsibilities of scientists not only to establish radiation protection criteria, but also to insure their proper interpretation.

Federal Radiation Council Radiation Protection Guides. The Federal Radiation Council Guides for radiation doses to the body organs are based on *lifetime* exposures at the stated levels. It is only for administrative and regulatory purposes that averages of intake of radioactive materials are based on a time period in the order of one year. This criterion is needed for these purposes but it should not be confused with the basic criterion of a lifetime exposure, i.e., there should not be alarm if high levels in the environment are found in some years, especially for short-lived radionuclides. In addition, for I^{131}, a daily intake of 100 $\mu\mu$c. corresponds to 500 mr. dose per year to the thyroid—a dose permitted each and every year for a lifetime according to the Federal Radiation Council Guides—only during early childhood. As one grows older the dose to the thyroid decreases until adulthood, when a daily intake of 100 $\mu\mu$c. of I^{131} would correspond to only 50 mr. per year.

The Federal Radiation Council's Guides were developed primarily for use by industry in restricting releases of their radioactive effluents to the general environment outside of their controlled areas. *Obviously Guides recommended for this purpose are substantially lower than those associated with a hazard to the health of the public. . .* The total seventy year dose to the thyroid would be only about 5 rads even if man were to live in an environment where the I^{131} levels were maintained (by continued additions, since it loses half of its remaining activity every eight days) as high as the Federal Radiation Council Intake Guide. This (5 rads) is roughly a thousand times less than the ". . . few thousand rads upward. . ." quoted by the Panel of Experts of the National Acedemy of Sciences as the dose for which there was no evidence of thyroid cancer production (except for one doubtful case). The Federal Radiation Council Guides were developed (in the proper context of guidance to industry) by balancing the anticipated benefits from normal peacetime operations against the potential risks (radiation doses). Activities other than normal peacetime operations, require balancing of their benefits against the resultant potential radiation exposures in order to derive appropriate Guides.