

The Use of Diets Containing Large Amounts of Linoleic Acid

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THE study of certain aspects of lipid metabolism has been the major interest of this Institute for the last eight years. During this time, patients on constant-intake balance studies have been fed various formulae, either through polyethylene tubes, or orally, as described in an earlier paper.¹ Evaluation of the plasma lipid patterns of these patients has led to increasing emphasis on the inclusion of polyunsaturated fats in both formula and mixed diets in ambulatory and hospitalized patients with certain diseases, particularly atherosclerosis and diabetes. In this paper we present the details of the diets used in our studies.

The mixed diets presently in use (Tables I and II) contain, per 2,000 cal, approximately 80 g protein, 170 to 200 g carbohydrate and 100 to 115 g of fat, including approximately 58 g of linoleic acid.

The group I diet contains no animal fat. Protein is supplied by nonfat milk, nuts, cereals and vegetables.

The group II diet differs from group I by including fish, fowl and liver, with a slight reduction in nonfat milk protein.

The group III diet adds to the group II diet small quantities of lean beef, veal, lamb, lean

ham, and eggs, with a further reduction of non-fat milk protein.

If the diets are to be followed successfully, the patients must be adequately motivated and properly instructed. The psychologic problems are essentially the same as those encountered in the routine care of diabetics.

In some individuals with advanced atherosclerosis, even the group I diet fails to bring the plasma cholesterol and other lipids to normal levels (below 200 mg per 100 ml). Such patients are given a "safflower-milk" diet (Table III) consisting of an emulsion of 300 g "Saf-Lac"† powder (1,700 cal) with sufficient low carbohydrate vegetables and fresh fruit to bring the intake to 2,000 calories. This diet provides approximately 85 to 90 g. of linoleic acid.

References 2-10 list sources of information regarding fatty acid composition of various foods.

GENERAL INSTRUCTIONS

Fruits and Vegetables

Consider banana, red and white grapes and sweetened canned fruits as 20 per cent fruits, and all other fruits, either fresh or canned without sugar, as 10 per cent fruits. Consider potato, cooked dried beans, corn and cooked rice as 20 per cent vegetables; and beets, carrots, peas, onion and winter squash as 7 per cent vegetables. Other vegetables are unclassified.

† "Saf-Lac," a modified milk preparation which is free of butter-fat and contains 40 per cent safflower oil. A dried powder, it readily reconstitutes when water is added. Manufactured by the Carnation Co.

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Presented at the *Sixth Annual Symposium on Chemistry, Biochemistry and Metabolism of Lipids*. Institute for Metabolic Research, February 24-28, 1958, Oakland, California.

This work has been supported in part by the Armour Laboratories, Carnation Company, the Alameda County Heart Association, the National Institutes of Health, and the Nutrition Foundation.

TABLE I
2,000 Calorie Diets for Achieving and Maintaining Plasma Cholesterol below 180 mg/100 cc

| Food | Group I | | Group II | | Group III | |
|--|------------------------------|------------|--|------------|--|------------|
| | Household measure | g | Household measure | g | Household measure | g |
| †Nonfat milk solids or liquid skimmed milk | $\frac{3}{4}$ cup or 1 qt | 90 | $\frac{1}{2}$ cup or $2\frac{1}{2}$ cups | 60 | 3 tbsp or 1 cup | 25 |
| Low-calorie cottage cheese | $\frac{2}{3}$ cup | 130 | $\frac{1}{2}$ cup | 100 | $\frac{1}{2}$ cup* | 100 |
| Fish, fowl, liver | None | None | 4 oz | 120 | 4 oz or | 120 or |
| Lean beef and veal round, lamb leg, lean ham | None | None | None | None | 4 oz | 120 |
| †Oil—safflower, corn, cottonseed, soy | $\frac{1}{4}$ cup or 4 tbsp | 60 ml | Same as group I | | Same as group I | |
| Nuts—at least 50% walnuts | $\frac{2}{3}$ cup | 65 | Same as group I | | Same as group I | |
| Cooked whole-grain cereal | $\frac{1}{2}$ cup | 100 | Same as group I | | Same as group I | |
| Fruits—20% (or) 10% | $\frac{1}{2}$ cups or 3 cups | 300 or 600 | Same as group I | | Same as group I | |
| Vegetables—20% (or) 7% | 1 cup or 3 cups | 200 or 600 | $\frac{1}{2}$ cup or $1\frac{1}{2}$ cups | 100 or 300 | $\frac{1}{2}$ cup or $1\frac{1}{2}$ cups | 100 or 300 |
| Unclassified | As desired | | As desired | | As desired | |
| Low-fat bread | 1 slice | 25 | 2 slices | 50 | 2 slices | 50 |
| Total | Protein | 78 | Protein | 87 | Protein | 73 |
| | Fat | 100 | Fat | 107 | Fat | 118 |
| | Carbohydrate | 209 | Carbohydrate | 188 | Carbohydrate | 170 |
| | Linoleic acid | 58 | Linoleic acid | 58 | Linoleic acid | 58 |
| | | (approx) | | (approx) | | (approx) |

* Three times weekly, one egg may be substituted for $\frac{1}{4}$ cup of cottage cheese.

† 1 cup (16 tablespoonfuls) of "Saf-Lac" is equivalent to $\frac{3}{4}$ cup nonfat milk solids and 3 tablespoonfuls of oil.

Low-Fat Breads

These include sweet or sour French bread, Milwaukee pumpernickel, English muffins, and Ry-Krisp.

Oils

Safflower, corn, cottonseed and soy oils may be used in cooking, as a salad dressing, added to cereals, or emulsified with skimmed milk.

Be sure that all oil is used and none is left in the bowl or on cooking utensils.

Nuts

Nuts add variety. They may be eaten as such, blended with milk, or added to prepared dishes. At least half the nuts eaten should be walnuts, which are particularly rich in linoleic acid. Commercially fried nuts should be

TABLE II
Basic Meal Plan (For Group I)

| | | |
|-------------------|---|--|
| Breakfast: | 1 cup 10% fruit | as salad dressing. Make salad dressing using egg white, but no yolk, so that 1 tbsp dressing = 2 tsp oil |
| | $\frac{1}{2}$ cup cooked whole grain cereal | |
| | 1 tbsp oil added to cereal during cooking | |
| | 1 cup skimmed milk | $\frac{1}{2}$ cup 20% fruit or 1 cup 10% fruit |
| | Coffee or tea, as desired, with all meals | Dinner: $\frac{1}{3}$ cup low calorie cottage cheese |
| Lunch: | Soup made with skimmed milk, vegetables and part of oil | 1 cup 20% vegetable |
| | $\frac{1}{3}$ cup low calorie cottage cheese | Other vegetables, as desired, cooked or raw |
| | Cooked or raw non-starchy vegetable, as desired | $1\frac{1}{2}$ tbsp oil, used as salad dressing, or added to vegetables |
| | $\frac{1}{3}$ cup nuts | $\frac{1}{2}$ cup 20% fruit or 1 cup 10% fruit |
| | 1 slice low-fat bread | $\frac{1}{3}$ cup nuts |
| | $\frac{1}{2}$ tbsp oil added to soup or vegetable or | Complete skimmed milk allowance |
| | | <i>Make meal plan changes according to each group food allowance.</i> |

TABLE III
2,000 Calorie "Safflower Milk" Diet
Fat: 120 g; Protein: 71 g; Carbohydrate: 167 g; Linoleic Acid: 85-90 g

| Food (use daily) | Household measure | Gram weight | Protein | Fat | Carbohydrate |
|--|-----------------------|-------------|---------|-----|--------------|
| "Saf-Lac" (mix total solids in 7 cups water as day's supply) | 3½ cups | 300 | 63 | 120 | 92 |
| 10% fruit | 2 cups | 400 | — | — | 40 |
| 7% vegetable | 1 cup | 200 | 4 | — | 14 |
| Group A unclassified vegetables | As desired | — | 4 | — | 15 |
| Coffee or tea | As desired, all meals | — | — | — | — |
| | Total | — | 71 | 120 | 161 |

All food should be prepared without added fat. "Saf-Lac" may be used in soups or as a vegetable sauce. Only noncaloric sweeteners should be used. The unclassified vegetables may be eaten in any reasonable amounts.

avoided, but nuts may be fried at home in one of the recommended oils.

Iron and Vitamin Supplements

All the diets described require iron and multi-vitamin supplementation.

Vegetable Fat "Cream"

A "cream" which may be used in coffee or with cereals and fruit may be prepared by homogenizing in a blender: ⅓ cup (80 ml) safflower, corn or cottonseed oil; ⅓ cup (40 g) nonfat milk solids; 1½ cups (300 ml) water; and ½ to 1 teaspoon (1.5-3 g) of emulsifier (Gliddophil S.C., obtainable from Glidden Co., Chicago).

SPECIAL INSTRUCTIONS FOR GROUP II AND III DIETS

Group II

Liver, fish, and both dark and light meat of lean fowl are allowed. Remove skin and visible fat.

Group III

Lean meat includes lean beef round and sirloin, lamb leg, and lean ham. Allow three eggs per week in this diet. When an egg is taken, reduce cottage cheese to ¼ cup.

Coffee and tea, sweetened with Succaryl® or saccharin, may be used as desired.

The amounts of linoleic acid indicated are based upon the use of safflower oil (approximately 75 per cent linoleic acid). If corn or cottonseed oil are used (approximately 50 per cent linoleic acid) the amounts must be increased and carbohydrate calories (bread and

20 per cent vegetables) decreased proportionately.

ACKNOWLEDGMENT

Grateful acknowledgment is made to The Borden Company for instant coffee, Carnation Company for "Saf-Lac," Circus Foods Products for nuts, The Pacific Vegetable Oil Company for safflower oil, and The Corn Products Refining Company for supplies of corn oil.

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