

# *Dietary* MODIFICATIONS of *Plasma* CHOLESTEROL and PHOSPHOLIPID LEVELS in DIABETIC PATIENTS

## *The Effects of Mixed Diets High in Vegetable Fat*

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AS PREVIOUSLY reported from this laboratory, the administration of formula diets high in vegetable fat results in a striking fall in the level of plasma cholesterol and phospholipids in patients with a wide variety of disease states, including diabetes.<sup>1</sup> The present study describes the results obtained in a small group of diabetic patients and in one patient with "familial hypercholesterolemia" maintained on a mixed (non-formula) diet, also high in fat content, in which essentially all of the fat was of vegetable origin.

### METHOD

For the past three years, for reasons which will be presented elsewhere, all diabetic patients who are followed in the diabetes clinic of this institution are maintained on diets which contain larger amounts of fat and protein than is common practice. The greater portion of the fat is of animal origin. The

composition of these "standard" diabetic diets is shown in Table I.

A group of 70 diabetic patients maintained on such diets were "screened" for levels of plasma lipids, for evidence of peripheral vascular disease, and for evaluation of probable cooperation in the course of a semicontrolled, long-term study. From this group, five were chosen who had slightly or markedly elevated plasma lipid values, who had probable or definite peripheral vascular involvement, and in whom the probability of cooperation seemed good. After initial brief determination of base line values for plasma lipids on the original high "animal lipid diet," these patients were placed on a special diet which differed from the standard diet only in that the fat (and some of the protein) was of vegetable rather than animal origin. The sources of the vege-

TABLE I  
Standard Diabetic Diets

Diet number	Approximate calories	Carbo-hydrate	Protein	Fat	Daily calories
		Gm.	Gm.	Gm.	
1	1500	135	98	66	1526
2	1800	118	108	101	1813
3	2100	135	119	123	2123
4	2400	143	132	143	2387
5	2700	160	150	163	2707

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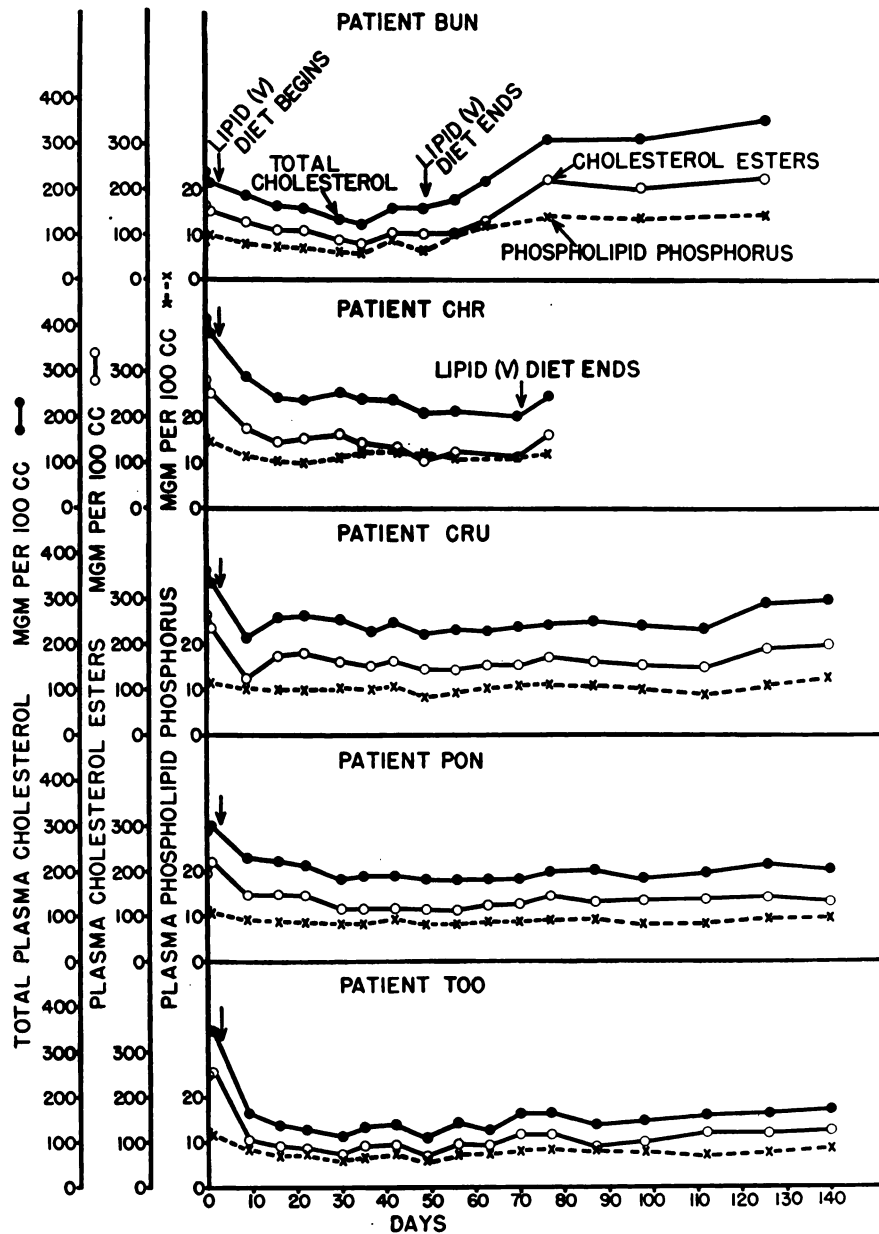


Fig. 1. Plasma lipids in 5 diabetic patients maintained on high protein-fat diets in which the source of the fat was of vegetable rather than animal origin during the greater portion of the study.

table fat for the most part were unsalted nuts and margarine. Insulin administration in a given patient remained nearly constant, and varied from 0 to 56 units of NPH insulin daily.

In Figure 1 are shown the changes in plasma cholesterol and phospholipids in these

patients during the study. It will be noted that without exception, a significant fall occurred in a short period of time when the "vegetable lipid diet" was consumed.

After a lapse of seven and ten weeks respectively, patients BUN and CHR returned to their original diets, with a rapid return of

their lipid values toward or above their control values. Patient CRU initially adhered to the vegetable fat diet, but has admitted that for at least ten weeks she has surreptitiously added some milk and meat to the dietary intake.

A similar semicontrolled study was carried out in a patient with "familial hypercholesterolemia." On the mixed high vegetable lipid diet, in the space of thirty days her total cholesterol fell from 420 mg. to 260 mg./100 cc., and a nearly comparable fall occurred in the plasma phospholipid phosphorus.

From the foregoing, it was apparent that a mixed diet containing large amounts of vegetable fat and essentially no animal fat resulted in the same changes in plasma lipids which occurred in patients receiving formula diets, also containing large amounts of vegetable fat. The question, therefore, arose as to whether this change in lipids was referable to the absence of cholesterol and of certain other lipid materials in the vegetable as compared to the animal fat, or whether the fall was referable to a positive effect of some constituent of the vegetable fat, or to some other dietary entity. With this in mind, a young diabetic patient with extensive vascular disease and with marked elevation of plasma lipids was admitted to the metabolic ward for more precise study. After a control period on a "standard" diabetic diet of 1800 calories daily, mixed nuts equivalent to 1600 calories were added to the diet, bringing the total caloric intake to 3400. The laboratory findings in this patient are shown in Figure 2. During the first week on this program, the plasma lipid values rose to 580 mg. per 100 cc., followed by a gradual fall, so that after 35 days on this diet, the total cholesterol was 300 mg. per 100 cc. and the phospholipid phosphorus 12 mg. per 100 cc. The patient was then placed on a vegetable fat formula diet, with a further marked fall in plasma lipids.

#### SUMMARY AND CONCLUSIONS

Substitution of fat of vegetable origin for "animal fat" in high protein, high fat, diabetic diets, the total protein, fat, and carbohydrate content remaining unchanged, resulted in a

major fall in levels of plasma cholesterol and phospholipids in diabetic patients, and in one

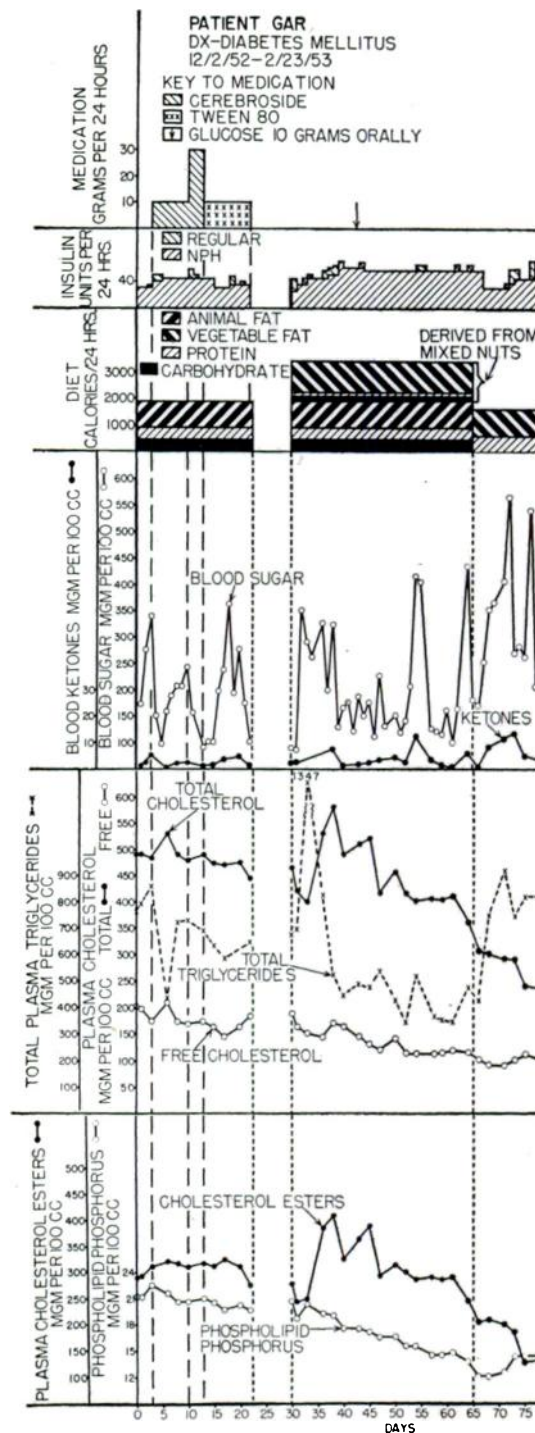


Fig. 2. Effects of added fat and protein of vegetable origin upon the plasma lipids of a diabetic patient maintained on a high animal fat diet.

patient with "familial hypercholesterolemia." In one patient with severe diabetes, the addition of 134 Gm. of vegetable fat (as nuts) to a high animal fat "standard" diabetic diet, also resulted in a slow but major fall in plasma lipids. It seems probable, therefore, that the explanation for such changes in plasma lipids lies outside the mere absence of dietary cholesterol.

To further clarify the meaning of these findings, the effects of sterols and phospholipids of vegetable origin upon plasma lipids in patients maintained on high animal fat intake are being evaluated.

#### ACKNOWLEDGMENT

Grateful acknowledgment is made to Circus Foods, Incorporated, for supplies of nuts used in this study.

#### REFERENCES

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amounts of vegetable fat. *J. Clin. Nutrition* 1: 224, 1953.

#### RESUMEN

*Modificaciones dietéticas de los niveles de colesterol y fosfolípidos en el plasma de diabéticos. Efectos de dietas mixtas ricas en grasa vegetal*

La sustitución de grasa de origen vegetal por "grasa animal" en dietas diabéticas ricas en grasas—el contenido en proteínas totales, grasas e hidratos de carbono quedando lo mismo—resultó en un descenso importante de los niveles de colesterol y fosfolípidos plasmáticos en pacientes diabéticos y en un paciente con "hipercolesterinemia familiar." En un paciente con diabetes severa, la adición de 134 grs. de grasa vegetal (en forma de nueces) a una dieta diabética "standard" rica en grasa animal, resultó también en un lento pero importante descenso de los lípidos del plasma. Parece, pues, probable que dichos cambios en los lípidos del plasma tienen que explicarse de otro modo que no por la mera ausencia de colesterol dietético.

Para esclarecer mejor el significado de estos hallazgos, se están analizando los efectos de esteroides y fosfolípidos de origen vegetal sobre los lípidos plasmáticos en pacientes sometidos a una dieta rica en grasa animal.

#### "The Fat Organ"

"In passing, it is amusing to play with the theory that fat is not a store of food but is an active organ—the fat organ—of the body, which is necessary for dealing with carbohydrates. When the diet contains large amounts of carbohydrate the fat organ, having little work, shrinks. The obese patient is one whose fat organ is degenerate, and it therefore has to grow large to deal with the same amounts of carbohydrate that a small, healthy fat organ can handle. On this theory the obese patient dies young not because of his fat, but because he has a constitutional degeneration which though it shows itself so obviously in his fat organ is equally present in his heart, blood vessels, joints, etc. There are no figures to show that dieting has ever prolonged life: that the fat do not die early whether they are fat or thin through dieting, though of course it would seem probable that the degenerate organs of the obese will fail more tardily if the fat organ ceases to be a heavy burden on them."

—F. Bicknell. *The Medical Press* 228: 491–492, 1952.