Letters to the Editor

A Relation Between Dietary Protein and Total Calorie Intake of Large Population Groups

Dear Sir:

The FAO[1] statistics of food consumed in 32 nations show a striking relation between dietary protein and total calories (Fig. 1). Although the data obviously involve many approximations, the errors of estimation and differences in kind of food available would tend to cause dispersion rather than a correlation between the two variables. Moreover, a detailed survey of food consumption by different income groups in the United States[2] yields a similar regression, with the same coefficients over equal ranges of the variables (Fig. 2). In practically all groups, protein provided 10 to 13 per cent of the total calories consumed.

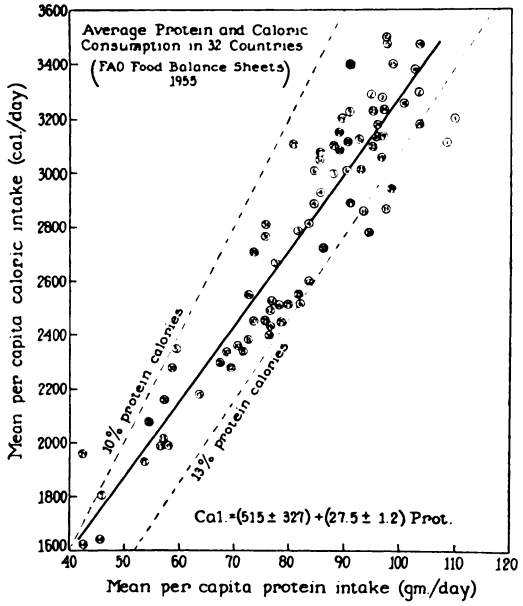

Fig. 1. Relation between average daily calories and protein in 32 countries (FAO statistics).

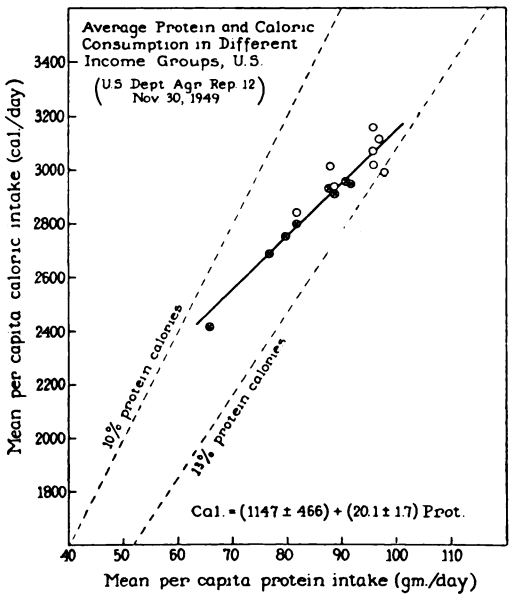

Fig. 2. Relation between average daily calories and protein in different income groups of the United States urban population (U. S. Department of Agriculture statistics). The open and hatched symbols distinguish two separate surveys.

These results were of particular interest to us because of the observation that control of protein intake in metabolic studies exerted an indirect control of the patient's appetite for non-protein calories[3,4] The self-determined intake of calories was found to vary with the prescribed intake of protein-rich foods. The regression coefficient in these studies had a lower value (14.6 ± 1.2) than that shown by the FAO statistics (27.5 ± 1.2), presumably because the subjects of the metabolic studies gained or lost tissue of low nitrogen content, whereas a large population group remains approximately in a steady state during a period of one year. Yet, despite the differences in factors controlling the diet, the result was the same: a variation of dietary protein was systematically associated with variation in the amount of calories consumed.

The correlation is not an inevitable result of food composition or availability. Most of the cheaper foods have a lower protein-to-total-calories ratio than the 10 to 13 per cent of the statistics, and a number of foods available in surplus in this country have a substantially higher ratio. If simple hunger for calories were independent of protein in the diet, it could

be satisfied with sugar costing only five cents per 1000 calories at present market prices, or margarine costing about ten cents. If the hunger for protein were unrelated to calories, the average person in this country by eating a pound of cottage cheese could double his daily intake for the price of a gallon of gasoline.

The special value of animal proteins for growth has been emphasized by many studies, but there is no evidence that these foods excel as fuel for mature individuals. Indeed, the statistics indicate that vegetable proteins have equal fuel value since the caloric expenditure in marginal countries follows the total protein rather than the fraction derived from animal sources.

No doubt the meager supply of protein limits growth and vigor in many regions of the world. Milk and other digestible sources of protein are urgently needed for infant feeding. However, the statistics, strongly indicate that in adults the requirements for protein and non-protein calories are interrelated. If we assume that every adult needs a fixed quantity of protein, and try to give protein-rich foods to an adult population without a proportionate increase of calories, especially fat calories, it is probable that we will be disappointed by their refusal of what we have judged to be a needed food.

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REFERENCES

1. Food Balance Sheets. Second Issue, *Food and Agriculture Organization of the United Nations*, Rome, 1955.
2. Nutritive Value of Diets of Urban Families United States, Spring 1948, and Comparison with Diets in 1942. *U. S. Department of Agriculture, 1948 Food Consumption Surveys*, Washington, D. C. Preliminary Report No. 12, November 30, 1949.
3. DOLE, V. P., DAHL, L. K., SCHWARTZ, I. L., COTZIAS, G. C., THAYSEN, J. H., and HARRIS, C.: Dietary treatment of hypertension. III. The effect of protein on appetite and weight. *J. Clin. Investigation* 32: 185, 1953.
4. DOLE, V. P., SCHWARTZ, I. L., THAYSEN, J. H., THORN, N. A., and SILVER, L.: Treatment of obesity with a low protein calorically unrestricted diet. AM. J. CLIN. NUTRITION 2: 381, 1954.

PROTEIN REQUIREMENTS FOR HEMOPOIESIS.

Dear Sir:

In your recent issue[1] dealing with "Nutritional Aspects of Blood Formation," Professor Vilter said "so little is known concerning the protein requirements for hematopoiesis in human beings, that no full-dress discussion of the subject was considered to be profitable." The writer considers that our information on this subject for humans is perhaps not quite as inadequate as Professor Vilter indicates.

According to Whipple,[2] experimental studies on dogs indicate that hemoglobin formation takes precedence over the formation even of serum protein, that the body stores must be greatly depleted, and the intake of protein greatly deficient over a long time before delay in hemoglobin formation occurs. Obviously, Whipple had in mind changes consequent on severe and prolonged dietary privation, and not changes in blood volume, etc., arising from minor changes in body weight.

The purpose of this letter is to suggest the following: (1) as a normal accompaniment to loss in weight, hemoglobin production diminishes at an early stage of dietary restriction when body protein stores may be little depleted and when protein intake is not necessarily low; (2) in prolonged severe undernutrition, although circulating hemoglobin mass is greatly reduced, it is probable that the amount does not fall to that level where obvious clinical manifestations would be expected; (3) in severe undernutrition, protein requirements for hemopoiesis are very small in comparison with total body protein mass and protein intake obtaining; and (4) in severe undernutrition, diminished hemoglobin production is due not to deficiency of protein or other nutrients *per se*, but rather to the concomitant low tempo of metabolism prevailing.

Amplifying these points:

(1) Reduction in weight, whether in the obese or in persons of normal weight, is accompanied by a diminution in the volume of total body fluids, including plasma. Since hemoglobin *concentration* does *not* rise during loss in weight, but is maintained, at least initially, it follows that hemoglobin production must be