Studies on the Masai1, 2, 3

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A summarized report on a multidisciplinary study of some unique biological characteristics of the Masai of East Africa appeared in the April 1971 issue of the New England Journal of Medicine (1), and a detailed description of the study was published in the May issue of the Archives of Pathology, 1971 (2). The authors have been invited to write an editorial summarizing their experience for this journal.

First of all, we would like to say a few words as to the genesis of such a research project. One of our group, Dr. K. Biss, served in a "mobile hospital" (a medically equipped Volkswagen) in Masailand as a volunteer physician under the sponsorship of the Ministry of Health of Kenya during 1965. He was then fully aware of the low serum cholesterol levels and total absence of atherosclerotic coronary heart disease among the Masai, in spite of their unusual but customary diet composed entirely of animal fat, carbohydrates, and proteins, as first reported by Mann et al. (3). Mann, Shaffer and Rich (4) believed that this might be due to freedom from emotional stress and an abundance of physical exercise. However, Dr. Biss was not entirely satisfied by this explanation. He was especially impressed by the fact that the physically active part of a male Masai's life is over when he completes his warrior period and marries, usually by the age of 24. After this, his wife or wives perform most of the work. Upon Dr. Biss' return to the United States, a team was formed to explore this mystery further.

Part of the field work was done at the Narok District Hospital, Narok, Kenya, and at St. Joseph's Hospital, Kilgoris, Kenya. However, the most important metabolic study was performed under rather primitive laboratory conditions at the Narok District Secondary Agricultural School. All the necessary facilities were shipped from the United States. The studies were carried out carefully and precisely following the original plan.

The Masai's dietary habits were observed, and their main dietary constituent, milk, was analyzed. The average daily caloric intake was estimated to be about 3,000 kcal, with 66% of the calories derived from fat. The estimated average daily cholesterol intake was from 600 to 2,000 mg per person.

The serum cholesterol levels of 254 Masai of various ages were determined; a low average value of 135.4 ± 33.5 mg/100 ml (mean ± standard deviation) was observed, confirming the previous report by Mann et al. (3). Also low plasma β-lipoprotein levels were consistently found. No significant changes with age (after 15 years of age) or differences between the sexes were noted, except for pregnant Masai women, who had an average rise of 50% in their serum cholesterol levels during the 3rd trimester. Gross, histochemical, and chemical studies of the aortas and coronary arteries of 10 consecutive autopsies gave

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2 Supported by grants from the Chicago and American Heart Associations, and from the Glenview Area and Arlington Heights United funds; by Public Health Service Grants HE-11029 and HE-13612 from the National Heart and Lung Institute; and by General Research Support Grant FR-0529 from the National Institutes of Health.
3 The nondairy coffee creamer used in this study was provided as Coffee-Mate by the Carnation Company, Los Angeles.
direct proof of the paucity of atherosclerosis in the Masai.

The cholesterol metabolic study was designed to investigate its homeostatic mechanisms and involved 24 healthy, adult Kenyan Masai students. One-half of them were on a cholesterol-free, semisynthetic diet and the other half were fed a diet supplemented with 2 g cholesterol in their daily ration. By mixing a daily trace dose of cholesterol-4-14C in the diets of both groups of subjects, it was possible to determine the rate of absorption of dietary cholesterol and the synthesis, excretion, turnover, and pool size of body cholesterol. The results indicate that the Masai have a much larger capacity for intestinal cholesterol absorption than whites and a greater ability to suppress endogenous cholesterol synthesis, averaging 50.5%, for compensation of their intestinal absorption of dietary cholesterol. This efficient feedback control is the only homeostatic mechanism that protects the Masai from developing hypercholesteremia.

Further measurements of cholesterol contents of various tissues from the autopsied Masai gave no evidence of excess cholesterol deposits in the tissues. Analysis of their gallbladder bile revealed a remarkably low cholesterol concentration, which not only verified their inability to increase fecal excretion of sterols as a protective mechanism for the compensation of intestinal absorption of cholesterol, but also serves as a base for the explanation of a nearly total absence of cholesterol gallstones.

Another fascinating fact we disclosed is the universally high serum IgA among the Masai. Their serum IgA concentration was two times greater than that of Caucasians in United States. The serum IgA levels of Masai children reached adult levels by the age of 3 to 4 years, whereas Americans required 12 years. It is suggested that their rapid development of high levels of serum IgA may be related to their primitive environmental conditions and is essential for their survival.

All these biological characteristics are unique and uniformly present in the Masai. This leads us to believe, but without direct proof, that the Masai have some basically different genetic traits that result in their having superior biologic mechanisms for protection from hypercholesteremia and from many pathogenic organisms.

It would be of great interest to observe whether the adoption of a more Western style of life would alter these characteristics. We were able to locate only one Masai in the United States who has been exposed to Western style living for more than 10 years but who still has a low serum cholesterol, low β-lipoprotein, and high serum IgA. These well-documented observations can serve as a reference for comparison of studies carried out in the future on the Masai if their environmental conditions and dietary habits are changed.

There are other tribes in Africa that should be studied further. The Samburu tribe (5, 6) of northern Kenya, closely related to the Masai ethnologically, also live on a diet of milk and meat. However, they have higher average levels of serum cholesterol than the Masai. The Rendille (6) tribe, also in northern Kenya, who subsist on camel's milk, blood, and meat have even higher serum cholesterol levels. There must be some basic genetic or environmental factors, or both, accounting for such differences.

The last point we would like to make is that a sophisticated metabolic study can be performed even in a very primitive environment provided that the experiment is soundly designed and carefully controlled. A metabolic ward is usually not available and too costly. Currently our group is engaged in a cholesterol metabolic study on Alaskan Eskimos, also in a rather primitive environment (7). Our preliminary results indicate that the Eskimos in Point Hope, Alaska, absorb an amount of cholesterol linearly proportional to the amount in the diet, over a wide range, to the degree of suppression of endogenous synthesis, to the amount excreted, and also to the elevation of serum cholesterol levels. Such remarkable responses to dietary cholesterol may be the result of long-term adaptation to their customary high fat diet.

References
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