



FOOD AND NUTRITION OF THE MAYA BEFORE THE CONQUEST AND AT THE PRESENT TIME¹

Moisés Béhar

"... and grinding then the yellow and the white ears of corn, the goddess Ixmucané prepared nine beverages, and from this food came strength and stoutness and with it they created the muscle and vigor of man. . . ."

"Their flesh was made from yellow and from white corn; from ground and kneaded corn were moulded the arms and legs of man. Only damp, ground corn went into the flesh of our fathers. . . ."

A great civilization developed in Middle America on the basis of corn. The above quotations from the *Popol Vuh*, the sacred book of the ancient Quiché Maya, emphasize the importance ascribed to this staple grain by the Mayan populations. Nevertheless, our present knowledge of nutrition has demonstrated that corn, if not properly supplemented (16), is nutritionally very poor as a staple. As in most of the cereal grains, its protein concentration is low; in addition, corn proteins have a very low biological value. They are deficient in at least two of the essential amino acids: lysine and tryptophane (5). Furthermore, the deficiency of tryptophane in corn, plus a low concentration and/or availability of niacin, favor the development of pellagra in those whose diet is based on it (10).

It must therefore be asked how an important civilization like the Mayan could develop with such a great dependence on corn as its staple food; and why the present-day descendants of the Mayas have serious nutritional problems, also because of their dependence on corn.

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In this paper I shall try to review our unfortunately small store of information on the dietary practices and nutritional status of the Mayan populations before the Spanish conquest of this region. I shall examine the same conditions in their direct descendants, the Guatemalan Indians of today, and attempt to determine the main changes that have come to pass. It is my hope that, in so doing, some general principles applicable not only to this particular group of American Indians but to others as well will emerge. This seems to me more useful than a purely descriptive paper on the nutritional problems now afflicting the American Indian groups.

Dietary practices and nutritional status of the pre-Columbian Mayan Indians

Corn, prepared in many different ways, was eaten at every meal, every day, as the most important food. In addition, the Mayas cultivated and consumed beans, vegetables, fruits, roots, tubers, cacao, and spices (15). Animal products, mainly meat and to a much lesser extent eggs, were apparently not a regular item in their dietary; they were consumed sporadically and on special occasions, and were obtained mainly by hunting. Very significant in this regard is the existence, in a Mayan dialect of the Guatemalan highlands, of a special word, *tcibex*, for "to eat meat," as distinct from the general word *lobex* meaning "to eat" (14). Only the groups living on the coasts consumed fish. Milk was not used at all.

Our present knowledge of nutrition indicates

that, with such a diet, it is difficult to satisfy the requirements for at least three important nutrients: protein, calcium, and niacin. The deficiency of calcium and niacin was corrected by the way in which corn was processed. For the preparation of *tortillas* and other corn products, the grain was first soaked overnight in lime water and then cooked in the same water (the purpose was to remove the husk). The result was a product very rich in calcium, for which the Mayas had no other adequate dietary sources. This method also yielded a higher concentration of tryptophane, in relation to the other amino acids, and more available niacin (13), thus preventing pellagra. We can only speculate on how this practice was adopted, but it is now evident that it was indispensable for their survival.

We are still left with the problem of how they satisfied their nutritional requirements for protein. As I have said, the main drawback of corn proteins is that they are deficient in some essential amino acids, particularly lysine and tryptophane. However, an amount of 39 grams of corn protein a day, which satisfies the average protein requirement in an adult male weighing 65 kilograms (17), does contain the needed amounts of all essential amino acids (12). This amount of protein is provided by about 370 g of corn, which is not an unreasonable quantity for a man to consume per day—in fact, Guatemalan Indians now consume around 500. In spite of the low biological value and low concentration of proteins in corn, it is therefore possible for adults to satisfy their protein needs with this grain as the main staple, if they consume enough of it.

But the situation is completely different for small children, who have relatively higher protein requirements and in whom the need for essential amino acids is also greater. A two-year-old child, for instance, would need about 18 g of protein a day to satisfy his nitrogen requirements if the protein has an ideal composition, with a biological value of 100 per cent; in other words, if it is fully utilized (17). With corn as the source, the child would need 36 g of protein,

because the biological value of corn protein is about 50 per cent (4). This means that he would have to consume about 450 g of corn a day, or about 800 g of *tortillas*, to satisfy his protein needs. Not only is this physically impossible but, in addition, the child would be receiving many more calories than he needs.

Of course, the Mayas did consume other foods besides corn. From what we know, the other important items in the regular daily diet were beans, fruits and vegetables, and roots and tubers. Beans are a more concentrated source of protein, but the remaining food items, although they contribute other needed nutrients, reduce the over-all concentration of protein in the diet. The situation would again be one in which adults can satisfy their nutritional needs but small children cannot.

I have mentioned that the Mayas did not consume milk, and that other animal products (meat and eggs) were only eaten irregularly. It is also very unlikely that they fed meat to infants and small children, for they had not developed the required processing facilities. There was only one solution, and they applied it—prolonged lactation. The information now available indicates, in fact, that Mayan mothers breast-fed their children for at least three years and frequently even longer (15, p. 44).

Our present knowledge indicates that breast milk can satisfy all the nutritional requirements of a baby up to approximately six months of age. It is probable that from about that age Mayan mothers started to give their children what the rest of the family ate but continued to feed them breast milk as an indispensable protein supplement. By the time they were completely weaned, after the age of three, they were able to eat enough of the family food to satisfy their nutritional requirements without the use of any special product, such as milk in the case of Western civilization. It is also probable that during this transitional period, from about six months to three or four years of age, they did not grow to their full genetic potential. This could be the main reason for the small size of the adults, which is well documented. This

reduction in body size, a consequence of environmental conditions and particularly of nutrient availability, can also, I believe, be considered a mechanism of adaptation to those environmental conditions. In fact, with reduction in body size resulting in a similar reduction in nutrient requirements, the Mayas were better able to meet these requirements with the available foods.

Unfortunately, we have no information on the health conditions of children in those populations. Data on infant and early childhood mortality could be particularly illustrative. The information available indicates that, in general, the children were healthy. De Landa (15) says:

They grew wonderfully handsome and fat during the first two years. Later, their skin waxed dark with continuous bathing by mothers and many suns; they were nonetheless bonny and mischievous throughout childhood, never ceasing to wander about carrying bows and arrows and frolicking among themselves and thus they grew until they began to adopt the ways of the youths and to acquire a more exalted self-concept, and to leave behind the things of childhood.

We cannot say the same about the majority of preschool children of Mayan descent today; they are usually apathetic and very often sick.

Another important deduction that can be made from the information on late weaning concerns birth spacing. The mothers probably had at least three years between one birth and the next. To what extent prolonged lactation contributed to this situation we still do not know. However, it was definitely very convenient, because only in this way could the mothers breast-feed their children as required. Accurate information on the nutritional condition of pre-Columbian Mayan adults is also nonexistent, but all known facts indicate that, although small, they were in general strong and healthy. We can thus conclude that, in terms of nutrition, they did not have serious problems and were well adapted to their environmental circumstances and degree of cultural and technological development. They did, however, undergo acute crises, and there is information on the famines they suffered when natural disasters (droughts or locust invasions) interfered with their corn crops.

Dietary practices and nutritional condition of the Guatemalan Indians of today

The dietary practices of the Guatemalan Indians of our time have not changed very much from those of their pre-Columbian ancestors. The changes that have occurred, however, have gradually brought about a deterioration in their diet and have upset the balance under which they lived.

Corn, processed in the same way, is still the main staple. It provides up to 80 per cent of the calories and 70 per cent of the proteins in the diet of the adult population (9). Beans, vegetables, and fruits complement the basic diet (8). These products, however, now have a market value for which the more affluent non-Indian groups in the population are better able to compete. This is even more true of animal products. Wild animals have practically disappeared, and hunting is no longer an important means of obtaining precious foods. Domestic animals are now the only important source of animal products, and the market for them is very competitive. The majority of the Indian families raise some animals in their homes, mainly poultry and pigs. But these are more a source of badly needed cash than of food. They and their products are consumed only on very rare occasions; most of the time, they are sold. The meat most frequently consumed is beef, which has to be obtained from the market and therefore is one of the luxury items for which cash is needed.

Not only have the Indians lost their old sources of food in the wild forests, but also the amount of land available to them for cultivation has been drastically reduced. Before the Conquest, they had all the land they needed to produce their corn. Although the method of cultivation they used cannot be considered very efficient today, its relative inadequacy was compensated for by the availability of sufficient land for a rotation system. They did not need to produce cash crops, which now compete with food crops for the best lands.

Under present-day circumstances, the Indians are frequently forced to buy even their corn, which they had always produced before. Owing

to their poverty, this greater dependence on the market to satisfy food needs has caused their diet to deteriorate. Another change in the adult diet is the introduction of coffee, which has replaced the more nutritious corn and chocolate beverages they used to drink. Distilled alcoholic beverages have also become part of their consumption habits, with deleterious effects from the nutritional and even more from the economic standpoint.

Changes in dietary practices concerning small children are even more important, and these have been mainly the effect of cultural influences. In the first place, the period of weaning has been shortened. In pure Guatemalan Indians, prolonged lactation is still essential to children's survival. Complete weaning in these populations now takes place between the ages of about two and two and a half years; this time, already shorter than it used to be before the Conquest, is being progressively reduced as the process of integration into the *ladino* or Western culture advances (11). This situation is very dangerous and has caused acute nutritional problems, since the populations adopting earlier weaning are not as a rule prepared culturally and economically to feed their children properly during the critical post-weaning period. Their general ignorance in matters of hygiene, and the lack of the most elementary physical facilities in their homes, renders the use of milk very dangerous. Most of them, in any case, cannot afford to feed milk to their children.

The situation is further aggravated by the introduction, by foreign civilizations, of refined products with a much lower nutritive value than the foods they replace. This is particularly true and deleterious for the child during the post-weaning period. An example of this problem is the pure starch preparations made from corn or manioc that are often used nowadays in gruels for small children, instead of the more nutritious whole-corn gruels of old.

The Guatemalan Indians of today thus seem to be in a less favorable balance with their environment than their ancestors were, and their dietary practices have deteriorated. Food intake

at the present time is barely adequate for adults and frequently inadequate for children. As a result, environmental stresses, particularly the heavy burden of frequent infections in early childhood, have caused poor nutritional conditions for the general population, with frequent and severe cases of nutritional deficiencies found particularly in early childhood. Briefly, the nutritional problems now affecting the Guatemalan Indians are as follows:

The most important by far is protein-calorie malnutrition (19). As has been indicated, it is the result of the synergistic effect of an insufficient and inadequate dietary intake and frequent infectious episodes, particularly diarrheal processes and the common diseases of childhood (3). This condition contributes very significantly to the high mortality rates in infancy and early childhood (2). It causes a relatively high prevalence of severe cases of protein-calorie malnutrition (kwashiorkor and marasmus) (1), which are usually fatal if not properly treated in a hospital. Even more important from the public health standpoint are the chronic, subclinical forms of malnutrition, which usually go unrecognized. These affect a large majority of the population, both children and adults (18). The consequences of this condition are not yet clear, but there is information suggesting that it may interfere significantly with mental development in children (6) and with work performance in adults (20). If these observations are confirmed—and studies are now under way to test the hypothesis—it is easy to understand the tremendous importance of the problem in terms of the general well-being of these populations and of their participation in the social and economic development of their societies and countries.

Among the other nutritional problems may be mentioned vitamin A deficiency, primarily the result of diets in which the sources of this vitamin are vegetable products with low biological activity consumed in insufficient amounts (8). This deficiency results in problems as serious as keratomalacia, which ends in total blindness during early childhood. Riboflavin deficiency is among the most prevalent of the vitamin defi-

ciencies (8). It is closely interrelated with protein deficiency, since the adequate dietary sources of the two are frequently the same. Mucosal and cutaneous lesions characteristic of this deficiency are frequently seen. Its possible general effects are not clearly understood.

Nutritional anemias are also highly prevalent; the deficiencies of iron and folic acid are the factors most frequently responsible, but again protein malnutrition contributes to their development (21). Anemias may also be important in restricting work capacity. Endemic goiter used to be highly prevalent in Guatemala, but fortunately it has now been controlled by means of salt iodization (7).

The nutritional problems herein summarized do not affect the Indian population in Guatemala specifically or preferentially. They are associated with low educational and economic levels and poor sanitary conditions. There are non-Indian populations in similar conditions, but practically all the Indian populations fall into this category. Their difficulty is one of proper integration into and adaptation to new ecological and cultural conditions and social structure.

In my opinion, the situation described in relation to the Mayan Indians, and the changes that have come to pass, are applicable to a lesser or greater extent to other Indian groups now living in touch with Western civilization in the Latin American countries. On the other hand, many Indian groups still living in isolation from Western culture and from the present Latin American societies have less serious nutritional problems; some of them seem to be living under excellent conditions in this respect. These groups are still very dependent on hunting and fishing to satisfy their food needs, and still follow the "primitive" practice of raising their children at

the mother's breast for as long as possible. They do not have at their disposal the "benefits" of civilization, such as the practice of bottle feeding and very inadequate weaning foods. We must consider the situation of these groups of primitive Indians as they become incorporated into our societies, with the hope that we will find means to prevent or minimize the nutritional deterioration to which they may be exposed in the process of integration.

Summary

An analysis of the dietary pattern and the nutritional condition of the Mayan populations before the Conquest and at the present time indicates that, although corn constitutes the main staple for both population groups, the pre-Columbian Mayas were probably better adapted to ecological conditions. The availability of game, greater availability of land for cultivation, the absence of competitive markets, prolonged lactation of infants, and the lack of industrialized products were among the factors that brought about a better diet for the Indians at that time. The sociocultural and economic changes that have taken place since the Conquest have worsened the diet of the present Indians and resulted in serious nutritional problems, among which protein deficiency—particularly in small children—is the most important. This experience should be considered both in trying to solve the nutritional problems of this and other American Indian groups now living with populations of Western culture and in preventing similar changes that could occur as the still primitive and isolated Indian groups are incorporated into modern Latin American culture.

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