

Progress in Solving World Nutrition Problems¹

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Inadequate food is particularly devastating in its effects on children. Much work is still to be done on some of the major international nutrition problems and there are far too few trained persons to do it. Ways in which members of The American Dietetic Association can help are discussed.

IT IS unnecessary to remind the members of The American Dietetic Association that even though serious nutritional deficiencies are no longer part of the experience of most nutrition workers in the United States, millions of persons in the world today bear or are acquiring the stigmata of malnutrition and hundreds of thousands are dying at an early age as a consequence. Human suffering and death not personally seen or experienced are difficult to comprehend, and it often seems that the greater the tragedy, the more likely it is to become unreal and to be easily shut out of our minds. In partial compensation, the specialized agencies of the United Nations concerned with nutrition, the World Health Organization (WHO), the Food and Agriculture Organization (FAO) and the United Nations International Children's Emergency Fund (UNICEF) have become a conscience for the world. The greatest advances of all in world nutrition have been the recognition of the nature and distribution of major nutritional disorders and the organized international effort on an unprecedented scale to do something about them.

These developments can be traced in the reports of the Joint FAO/WHO Expert Committees on Nutrition beginning with their first meeting held in October, 1949, soon after the two organizations

were established (1) and continuing through their fifth session held in November, 1957 (2). The last report discussed a number of nutritional problems of major importance in the world today and recommended vigorous action to combat them. These include protein and caloric malnutrition, vitamin A deficiency, beriberi, pellagra, goiter, and nutritional anemias. The Committee also stressed the need for further knowledge of the relationships between malnutrition and infection and between nutrition and atherosclerosis and other chronic degenerative diseases. This paper attempts to summarize these problems and some of the international progress toward their solution.

Protein and Caloric Deficiencies

KWASHIORKOR

An inadequate dietary intake of protein of good quality is the most widespread serious nutritional problem in technically underdeveloped areas and is particularly devastating in its effects on children. The problem of a high mortality from the severe form of protein deficiency, kwashiorkor, is in itself very serious, but for every child developing kwashiorkor there are likely to be over a hundred in whom underlying protein deficiency occurs. This is revealed by retarded growth and development during the critical pre-school age period and further indicated by the number of children dying from infections which do not ordinarily cause the death

¹INCAP Publication I-120. Presented at the 41st Annual Meeting of The American Dietetic Association in Philadelphia, on October 22, 1958.

of well nourished children. If the occurrence of protein deficiency is compared to a great underseas mountain, kwashiorkor is a small tip protruding above the surface of the water.

Most frequently protein deficiency begins when the mother's milk is no longer adequate in amount to supply the full needs of the growing child and appropriate supplementary sources of protein are not provided. The protein deficiency becomes more acute during and after weaning because the diet of the child of this age so frequently consists mainly of starch or cereal gruels of very low protein content, even when the diet of the rest of the family is reasonably adequate. The child with protein malnutrition of sub-clinical degree, sometimes referred to as pre-kwashiorkor, is vulnerable to further stress and frequently dies as a consequence of it. In the areas of Latin America, Africa, India, and the Far East in which protein malnutrition is common, the death rates of children one to four years of age are from ten to forty times higher than in the United States and Western Europe.

The commonest stress superimposed on protein malnutrition is that of infection which can be fatal in either of two ways:

(a) The infection is followed within a few weeks by the appearance of edema, skin lesions, and the rest of the signs of kwashiorkor due primarily to the adverse effect of most infections on nitrogen retention and to the poor diets which many mothers believe necessary under these conditions.

(b) The child succumbs to enteric or childhood infections which would not otherwise have been fatal.

The effect of these two factors on the mortality among young children is strikingly illustrated by data from four Guatemalan highland villages (3). In this area, of each 1000 infants born alive, over 130 are already dead before the end of the first year and out of every 1000 children still alive at age one, 168 will die before reaching the age of five. Of these, 67 will die with the signs and symptoms of clinical kwashiorkor and 91 will die of infectious diarrhea or complications of measles, whooping cough, and other infections.

In recent years the appearance of children with kwashiorkor has been frequently described (4-7). They are characterized by retarded growth and maturation, edema, alterations in the color and texture of the hair, pellagroid lesions of the skin, profound apathy, marked anorexia, and diarrhea. Kwashiorkor is basically the same wherever it occurs; it has been reported from twenty-three countries or territories in the western hemisphere, twenty-one in Africa, and some twenty in other parts of the world. Therefore, kwashiorkor should never be thought of as a rare or exotic disease.

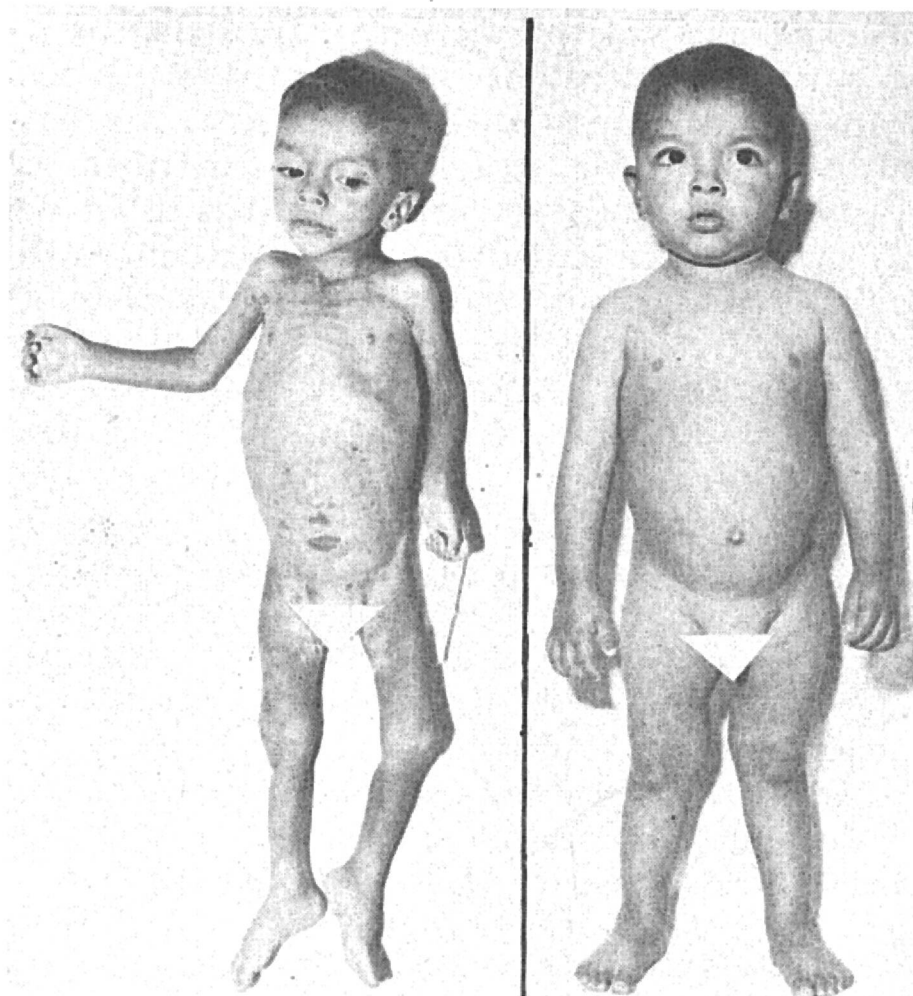
To assist in preventing protein malnutrition, surplus skim milk has been made available through

UNICEF for a number of years and used in supplementary feeding programs in technically underdeveloped areas, but these have not been able to help a very large proportion of the needy pre-school children because of the administrative difficulties of reaching this age group. In a number of countries, local milk production has been increased with FAO assistance, and milk conservation programs have been introduced with UNICEF aid. However, the world-wide effort to develop other protein-rich foods of lower cost has been the most important new effort for the prevention of protein malnutrition.

In South Africa and Chile, fish flour plants have been set up to provide a low-cost source of animal protein. In Dakar, French West Africa (8) and in Mexico (9), fish flour is being used in demonstration feeding programs. Ponds for raising fish and the greater exploitation of marine resources are now being planned in a number of countries.

Efforts to develop vegetable sources of protein have been greatly stimulated by WHO, FAO, and UNICEF, and financial support for this purpose has been given by the National Research Council, using funds made available by the Rockefeller Foundation. In Uganda, soya and sunflower seed press cake are being used (10). Peanut flour is being explored as a source of protein for child feeding by groups in French West Africa (8) and the Belgian Congo (11). Soya products prepared by traditional fermentation methods are receiving intensive study in both the Food Research Institute and the Nutrition Institute of Japan.

In India, South Africa, the Belgian Congo, and Central America, inexpensive mixtures of vege-



Effect of nine-week treatment with INCAP Vegetable Mixture 9 in a two-year-old child with kwashiorkor

table origin with a high protein content of good biologic value have been devised and are being fed experimentally to young children even in cases of severe kwashiorkor. A year ago, the Institute of Nutrition of Central America and Panama described INCAP Mixture 8 (12) which was fully satisfactory except for the cost of sesame, one of its principal ingredients. This has now been superseded by INCAP Mixture 9B which contains 29 per cent corn, 29 per cent sorghum, 38 per cent cottonseed meal of a low-gossypol type prepared specifically for human consumption, 3 per cent dry torula yeast, 1 per cent calcium carbonate, and 10,000 units of added vitamin A per 100 gm. This mixture is very low in cost and is now scheduled for commercial production and extensive promotion among low-income groups. Although intended only as a dietary supplement capable of matching the role of animal products as a protein source, experience has shown that these vegetable mixtures can be fed indefinitely as the sole food if sources of ascorbic acid and additional calories are provided. In balance studies, retention of nitrogen by the body is as good with these mixtures as with milk, at least when fed at adequate protein levels.

The illustration on page 442 shows a two-year-old child with kwashiorkor at the time of his admission to the hospital and again after nine weeks of treatment with Mixture 9. Similar before-and-after illustrations might have been included, showing good results from treatment with adequate quantities of milk and also with INCAP Mixture 8.

One desirable consequence of the aroused awareness of the problem of protein malnutrition in the pre-school child has been a growing tendency to re-evaluate maternal and child-care programs in underdeveloped areas. An important result has been dissatisfaction with the pattern of so-called well-baby clinics limited to children under one year of age which have so frequently been established in imitation of the pattern in the United States and Europe. This dissatisfaction is leading to a longer period of supervision to include the entire age range of maximum risk, placing emphasis on the weaning and immediate post-weaning period.

Improved treatment of kwashiorkor has also lowered the mortality rate among hospitalized children. The two most significant improvements in therapeutic procedures are the early correction of electrolyte imbalance and better protection of the child from the secondary infections which so often slow recovery or result in death.

MARASMUS

Closely associated with the problem of severe protein malnutrition exemplified by kwashiorkor is the prevalence of marasmus whose appearance is also illustrated. Marasmus is a form of partial starvation

which develops when the mother is unable to nurse her child and the artificial feeding offered instead is grossly inadequate in quantity as well as in quality (12). It arises from the twin evils of poverty and ignorance in populations in which breast-feeding is the norm.

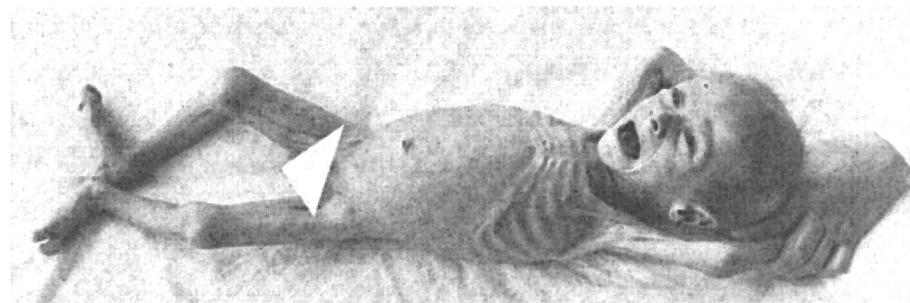
Because of this, mortality rates are high not only between the ages of one to four but also during the first year. Symonds (13) has recently found in Trinidad that among 163 deaths of children one month to one year of age, malnutrition was the sole cause in one-third and a major contributing factor in another third. He summarizes the common history for those dying of malnutrition in these words:

"It appeared that breast-feeding had not been instituted, had ceased prematurely, or had been intermittent in those infants whose deaths were related to malnutrition. As a substitute for breast milk, the infants had received small amounts . . . of dried milk . . . or of condensed milk. . . It was commonly claimed that a one-pound tin of dried milk lasted as long as one month. In most cases the milk was eked out with arrowroot or sago. The common technique was summarized by the mother who said, 'I feeds the baby arrowroot, but whitens it with milk.'"

In other areas, the history might have shown that the child under one year was given, as a substitute for mother's milk, sugar water or the cooking water of rice or barley, with no attempt to give any protein source. If the total calories given are small relative to the needs of the child, marasmus is the result, but abundant calories given even to the child under one will produce kwashiorkor if the diet contains no adequate source of protein.

Marasmus is a very important cause of death in children under one year and is the usual fate of a child who cannot be breast fed by his mother or suffers from chronic diarrhea. It also contributes importantly to the appearance of the child who subsequently develops kwashiorkor. Because of the gap between the nutrients supplied by breast-feeding toward the end of the first year and the physiologic requirements of the child, most children in technically underdeveloped areas enter their second year with some degree of caloric deficiency on which a severe protein deficiency may be superimposed. It is partly for this reason that the most common form of kwashiorkor is the so-called marasmic type.

The principal advance in combating marasmus lies in the increased recognition of the problem and the



Typical appearance of a child with marasmus

orientation of maternal and child care programs to prevent it. Prophylactic measures include the extension of well-baby clinics to cover a larger proportion of the infant population, the expansion of visiting nurse programs, the distribution of milk to mothers and children at health and welfare centers, and the education of both professional health workers and the public in the proper supplementary feeding of the young child. The availability of the low-cost vegetable mixtures of high protein value, which has been mentioned earlier, should make the task of prevention easier in regions in which the high cost or short supply of cow's milk has been a serious limiting factor.

Vitamin A Deficiency

Severe vitamin A deficiency is still an important problem in some parts of the world and may be a major cause of blindness and even death. Oomen, working in Indonesia, feelingly relates the heart-breaking experience, repeated hundreds of times over, of seeing children with keratomalacia in both eyes in whom blindness could have been prevented if only the mother had given the child some source of vitamin A or had brought the child in a few days, sometimes a few hours, sooner (14). Xerophthalmia and the lesion known as Bitot's spot are of great significance in revealing vitamin A deficiency as it occurs throughout much of the Far East and in parts of India, the Near East, Africa, and Latin America.

Although few nutrition workers in the United States have had an opportunity to see the lesions, a Bitot's spot consisting of a superficial foamy white material accumulating in the bulbar conjunctiva is a distinct and easily recognized entity. Xerosis or dryness of the conjunctiva is usually also present and if the vitamin A deficiency continues is soon followed by xerosis, small ulcerations, and finally perforation of the cornea or by keratomalacia. In either case, blindness is the usual consequence. At any stage, a conjunctivitis may develop and not uncommonly a panophthalmitis which also commonly signifies a permanent loss of vision.

Recognizable ocular damage from vitamin A deficiency is only part of the problem. The effect of the mild to moderate vitamin A deficiency common in persons of all ages in large areas of the world, is harder to evaluate, but it seems certain that it contributes to the much lower resistance to infections characteristic of the populations of these areas. WHO is strongly recommending that specific studies on this point be carried out.

Certainly, a relative inadequacy of vitamin A activity is the commonest deficiency revealed by family dietary surveys in underdeveloped regions, even though a deficiency of protein of good quality is an even more serious problem for young children. The recognition of the nature and extent of the

vitamin A deficiency problem is leading to public health, agricultural, and educational measures to increase the production and consumption of foods with vitamin A activity. For a number of years, UNICEF has been including vitamin A supplementation as part of programs in which skim milk is distributed to children whose diets are deficient in vitamin A activity. School and home gardens are also being encouraged and supported in a number of countries by FAO and UNICEF as a means of encouraging the consumption of vegetable sources of vitamin A activity. Technical difficulties in the addition of vitamin A to dried skim milk have now been overcome, and this is also seen as a measure of practical importance in areas producing dried skim milk for human consumption.

Beriberi

The classical problem of adult beriberi in areas in which the principal dietary staple is polished rice is a familiar one. Although in some countries like Japan, this type of beriberi has largely disappeared because of the greater variety in the diet, in many other Far Eastern countries, the problem persists, despite the possibility of eliminating it cheaply and effectively by enriching rice with thiamine. Because of administrative and cultural reasons, progress in achieving rice enrichment has been slow.

In the meantime, another form of beriberi is acquiring increasing public health importance as a direct consequence of modern labor-saving machinery. Throughout Burma, Thailand, and Viet Nam, beriberi was formerly uncommon despite the importance of rice as a basic staple of the diet because the grain was dehulled by pounding it at home and thus, in the form in which it was consumed, still contained an appreciable amount of thiamine. In the last few years, small gasoline-driven mills have been introduced into the villages and the rice of each family is brought to these mills for processing. The resulting dietary deficiency of thiamine among nursing mothers has a particularly serious effect on the infants, since the breast milk becomes grossly inadequate in thiamine content. As a direct consequence, these infants at the breast are dying suddenly and in large numbers between the second and fifth month after birth of infantile beriberi.

The child gradually becomes restless, anorexic, pale, and prone to vomiting and then one day suddenly becomes cyanotic, dyspneic, develops a very rapid heart beat, and is dead within a few hours. There is also a subacute form in which the child becomes aphonic, edematous, develops oliguria and opisthotonus, and takes a little longer to die. A moribund infant with symptoms of infantile beriberi can be almost miraculously restored to an apparently normal state in a few hours by the injection of thiamine.

The growing problem of infantile beriberi is now recognized by health authorities and a variety of steps are being taken to insure a greater thiamine intake for the pregnant and lactating woman, but the task is difficult. The administration of an enrichment program involving many small mills is at present seemingly almost impossible in the Orient. The use of parboiled instead of raw rice runs counter to the ingrained preference of rice eaters for the kind of rice to which they are accustomed.

As Aykroyd has pointed out, the general improvement of rice diets is the most satisfactory method of approach, but it takes time and more rapidly effective measures are needed (15). The wide distribution of synthetic thiamine, which is now cheap and abundant, is the best immediate hope for prevention but will be difficult to realize.

Pellagra

Although the incidence of pellagra has now diminished to the vanishing point in the southern United States where it was once prevalent, this nutritional disorder is still a problem for many regions in which corn supplies 60 per cent or more of the caloric intake and the remainder of the diet contains no good source of niacin. In Mexico and Central America, beans (16), and to a lesser extent coffee (17), supply sufficient niacin or tryptophan to prevent pellagra, despite the consumption of diets containing up to 80 per cent corn. In parts of Yugoslavia, Egypt, Basutoland, and Southern Rhodesia, however, the skin lesions of pellagra are common. Glossitis is also commonly present, and cheilosis with or without angular fissures may occur. In the more severe cases, diarrhea and mental changes are often seen. The disease responds dramatically to nicotinic acid therapy.

Fundamentally the eradication of pellagra depends on improvement of the dietary pattern, and in many areas this means a change in agricultural policy as well as in cultural attitudes. At the urging of WHO and FAO, countries in which pellagra is a public health problem are trying to replace some of the corn in the diet with other cereals or staple foods, and to increase the production and consumption of foods which are pellagra-preventing because they are good sources of niacin or tryptophan. In Yugoslavia and Southern Rhodesia, trial programs of enriching the corn meal ground in small local mills appear to be meeting with success (2). It is hoped that this procedure can be employed more widely within these and other areas in which pellagra is still a problem.

Endemic Goiter

One of the most widespread nutritional deficiencies in the world today is endemic goiter. It occurs

independently of climate, season, or weather and makes no distinction of race or nationality. As Kelly and Snedden have recently pointed out (18), the North American, the European, the Chinese, the Himalayan Indian, the Turkoman, and the peoples of Central and South America all suffer from it under certain conditions. They list over a hundred countries or territories in which endemic goiter is found to a significant degree.

Although salt iodized with potassium iodide has long been known to be effective in preventing endemic goiter, this compound is unstable when added to the crude, moist salt commonly sold in many countries. Field trials with a more stable compound, potassium iodate, carried out largely by INCAP in El Salvador and Guatemala (19, 20) showed that this compound could be employed, even in humid tropical areas, without the need for refining the salt or protecting it from moisture. As a result of the continued stimulus and technical help of WHO and the availability of the potassium iodate method, there has been a steady increase in the number of countries protecting their populations by the compulsory iodization of salt.

It has long been recognized that cabbages and certain other plants of the same family contain goitrogenic factors which increase the amount of dietary iodine necessary to prevent goiter. An interesting variant is the finding of Clements in a group of school children in Tasmania (21): these children developed endemic goiter despite an apparently adequate iodine intake, due to the consumption of milk from cattle feeding on thousand-headed kale.

From the discrepancy in the levels of iodization believed necessary for the prevention of goiter by persons working in the Americas and those working in Europe (22), it appears probable that there are other still unidentified goitrogenic factors of importance contributing to the prevalence of goiter in some populations.

Nutritional Anemia

The fifth report of the Joint FAO/WHO Expert Committee on Nutrition (2) emphasized that:

"Anemia constitutes a public health problem of great magnitude, particularly in the underdeveloped and tropical areas of the world. Malnutrition underlies most of these anemias which affect particularly certain vulnerable groups in the populations, i.e., expectant and lactating mothers, infants, and young children. The high rates of maternal mortality in some countries—for example, Mauritius—are unquestionably influenced by the prevalence of anemia. Since it is usually a chronic condition, anemia impairs health and working capacity and hence leads to economic loss."

Except for some attention given to the iron deficiency types of anemia specifically associated

with hook-worm or chronic malaria, anemia has been too often ignored or underestimated as a health problem. Recent studies suggest that protein, vitamin B₁₂, and folic acid, and probably other B-complex vitamin deficiencies are responsible for part of the anemia in tropical and sub-tropical areas and very frequently are combined with chronic iron depletion.

The problem is sufficiently serious that WHO convened a study group on nutritional anemias which met in Geneva in October, 1958. Out of this pooling of experiences from many different areas of the world should come an authoritative statement of the problem and practical suggestions for its prevention.

Atherosclerosis

It is evident that research into atherosclerosis is of major concern in this country and that North American workers are extremely active in this field. Much international interest has also been aroused in regard to the problem since there are great differences in incidence among countries and among socio-economic groups within many countries. WHO has convened two study groups of active workers from various parts of the world to discuss the different aspects of the problem. The study group on ischemic heart disease which met in Geneva in 1957 revealed the unsatisfactory nature of the evidence to support any of the hypotheses currently advanced to explain regional and occupational differences, although it agreed that the role of nutrition deserved intensive study (23). The discussions indicated such variability in the classification of heart disease and even in the evaluation of the pathologic lesions that the study group recommended a meeting for the specific purpose of developing uniform criteria. The second study group met in Washington in 1957 and agreed on criteria which it is hoped will be generally adopted (24). In the meantime, WHO has made a special effort to improve the reporting of mortality data in this field to make possible more valid comparisons among countries.

Subsequent studies leave no doubt that the lower income populations of most of the less highly developed countries have a much lesser tendency to develop the complications of aortic and coronary atherosclerosis (25). For example, as indicated in Figure 1, Tejada and others have shown that the more advanced lesions of aortic atherosclerosis which begin to appear in persons dying in Charity Hospital in New Orleans in the third decade of life do not develop in persons dying in the main charity hospital in Guatemala until the fifth decade, that is, some twenty years later (26). Furthermore, while coronary heart disease is an important cause of death in autopsy series in the United States, it was

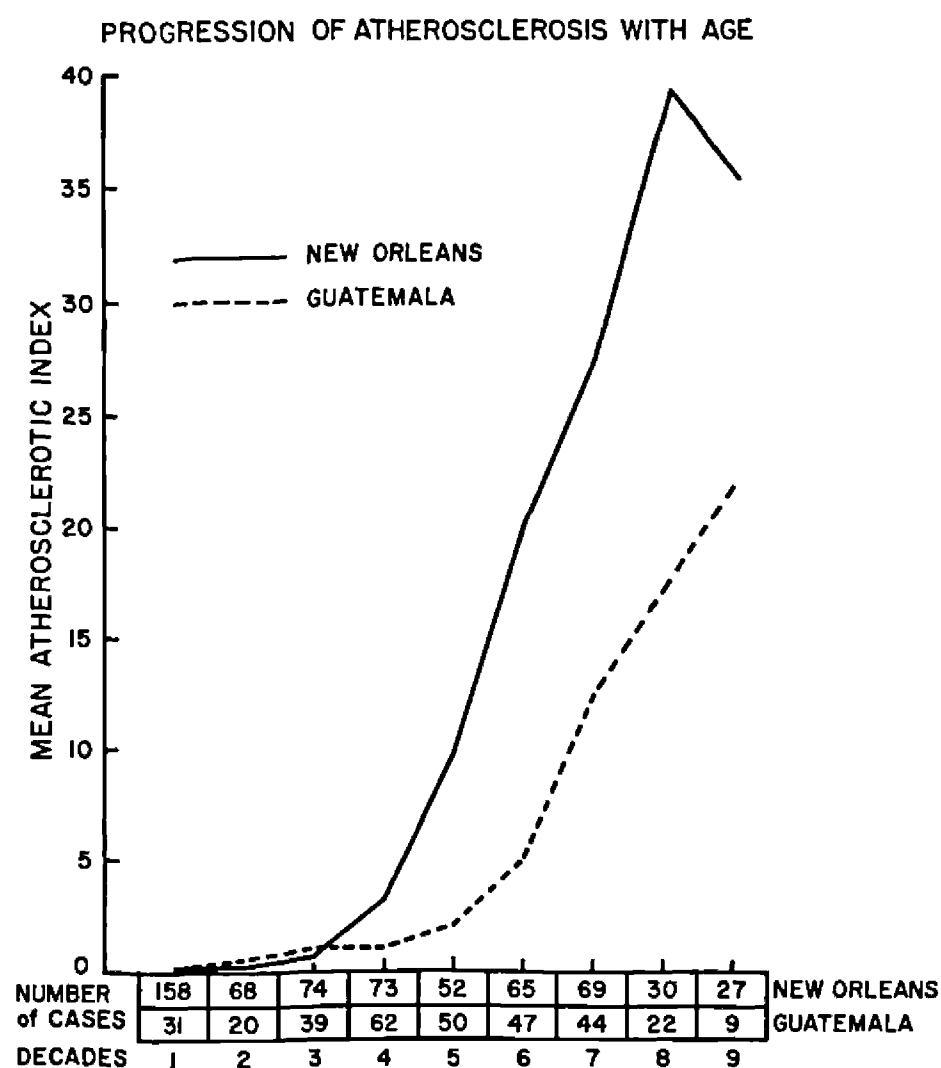


FIG. 1. Progression of atherosclerosis with age in Guatemala and New Orleans (26). Reprinted by permission of the American Journal of Pathology.

almost never found at autopsy in Central America except in business and professional persons and members of their families. As Figure 1 suggests, the lesions begin later and develop more slowly in lower income Guatemalans, so that in the aorta they never become as serious as those found in New Orleans and almost never extend to the coronary vessels sufficiently to result in occlusion. In all of these comparisons, the effect of different age distributions in the populations has been eliminated by making comparisons only between age-matched subgroups.

Average cholesterol levels parallel these differences in incidence of heart disease and a number of experimental studies are in progress to determine what dietary and other changes will raise the cholesterol levels from the low values generally encountered in the populations of technically underdeveloped areas. This is, of course, the reverse of most of the studies in North America which are designed to test the effects of various treatments on cholesterol levels which are already relatively high.

In Guatemala, rural and poor urban school children have low serum cholesterol levels and urban children in private schools have relatively high ones (27). INCAP studies have shown that added animal protein in the form of dried skim milk or additional fat in the form of 48 gm. daily of lard, cottonseed oil, or hydrogenated cottonseed oil does

not raise the low cholesterol levels of rural school children (28), although placing them on a controlled diet simulating that of private school children of upper-income parents does bring about an increase. The possible factors involved are, of course, under intensive study.

International Exchange of Workers

A trend of great scientific importance is the extent to which workers from formerly isolated areas have been enabled to visit one another and to join together in discussions at specialized international conferences. In the past two years alone, there have been international nutrition committees, study groups, or conferences meeting in such widely scattered places as Rome, Geneva, Washington, Princeton, Guatemala, Cali (Colombia), La Paz (Bolivia), Lisbon, Miami, Paris, Manila, and this list is not complete. It is noteworthy that most of these were under the auspices of WHO, FAO, or the two organizations jointly. WHO has been particularly active in sponsoring travel of workers between countries and between regions. For example, during one two-week period last June, outstanding nutrition workers from Coonor, Delhi and Bombay, India; from Indonesia, Belgian Congo, and Portugal were enabled by fellowships or travel grants to visit INCAP in Central America. In the last eighteen months alone, at least thirty nutrition workers from other countries have been given an opportunity by WHO, the U.S. International Cooperation Administration (ICA), and other organizations to visit the United States, and those from other regions have frequently also been given an opportunity to visit one or more centers in Latin America. This is a development of tremendous import for the science and practice of nutrition.

Role of North American Nutritionists and Dietitians

Some of the major international nutrition problems and the progress which is being made toward their solution have been mentioned. Obviously there is much still to be done and far too few trained persons to help to do it. The members of The American Dietetic Association can help by widening their knowledge of the seriousness of malnutrition in many parts of the world and using this knowledge to help mold professional and lay opinion in support of the international efforts being made to assist in the solution of these problems.

With more awareness and understanding of problems in underdeveloped areas, dietitians can help students and visitors from these lands interested in nutrition to obtain the greatest possible benefit from their stay. In turn, these visitors offer the opportunity to learn more about nutritional conditions elsewhere.

Nutrition work, because it involves close association with people, is a specialty in which knowledge of the local language is particularly important. These areas represent a challenge to all dietitians who, with a knowledge of languages, could make great contributions in foreign posts.

The world-wide efforts to eliminate nutritional disease and to promote better health through improved nutrition depend largely on the interest of professionally trained individuals, such as the members of The American Dietetic Association.

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