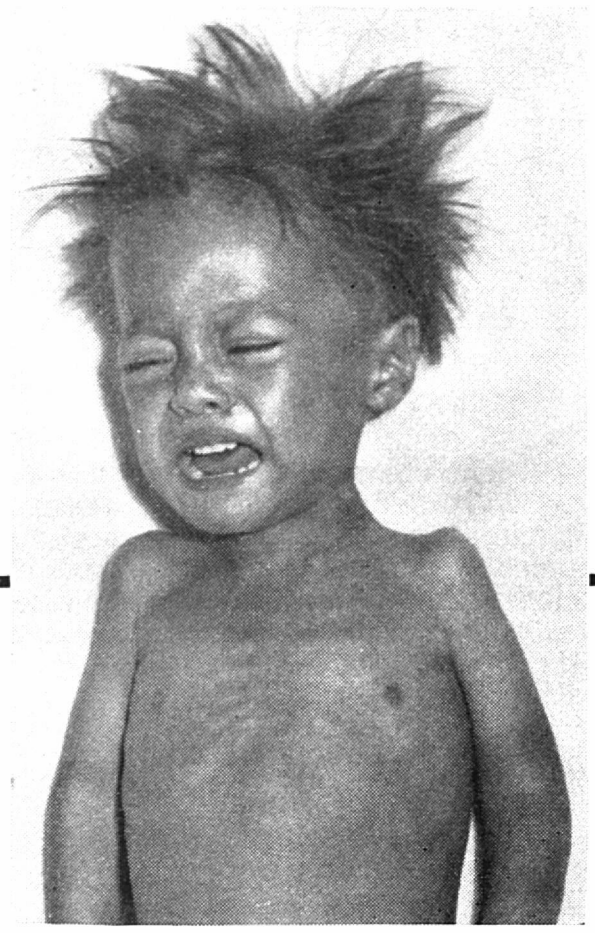
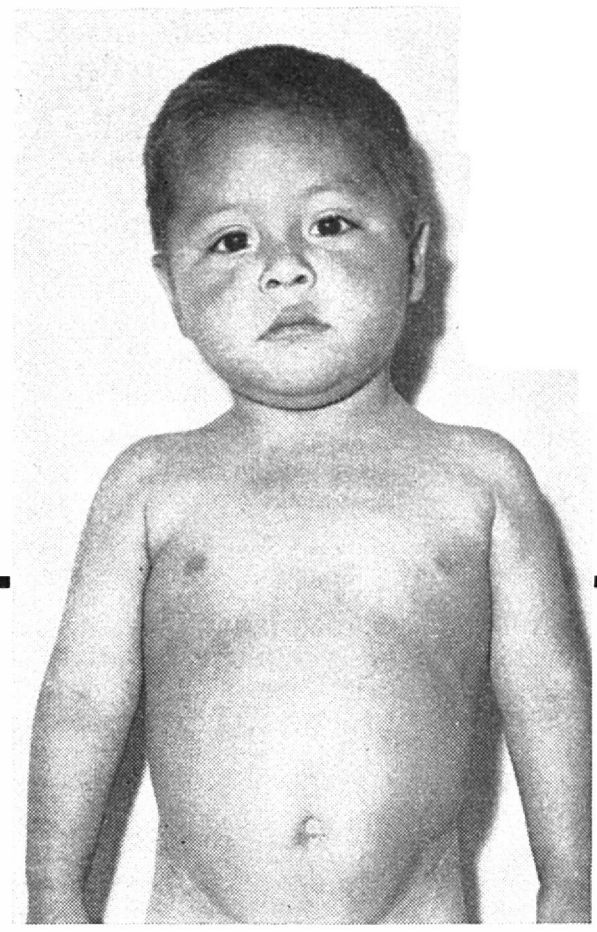
A WAR TO SAVE LIVES





CHILD with severe protein malnutrition (Kwashiorkor) before and after treatment with INCAPARINA as the sole protein source.

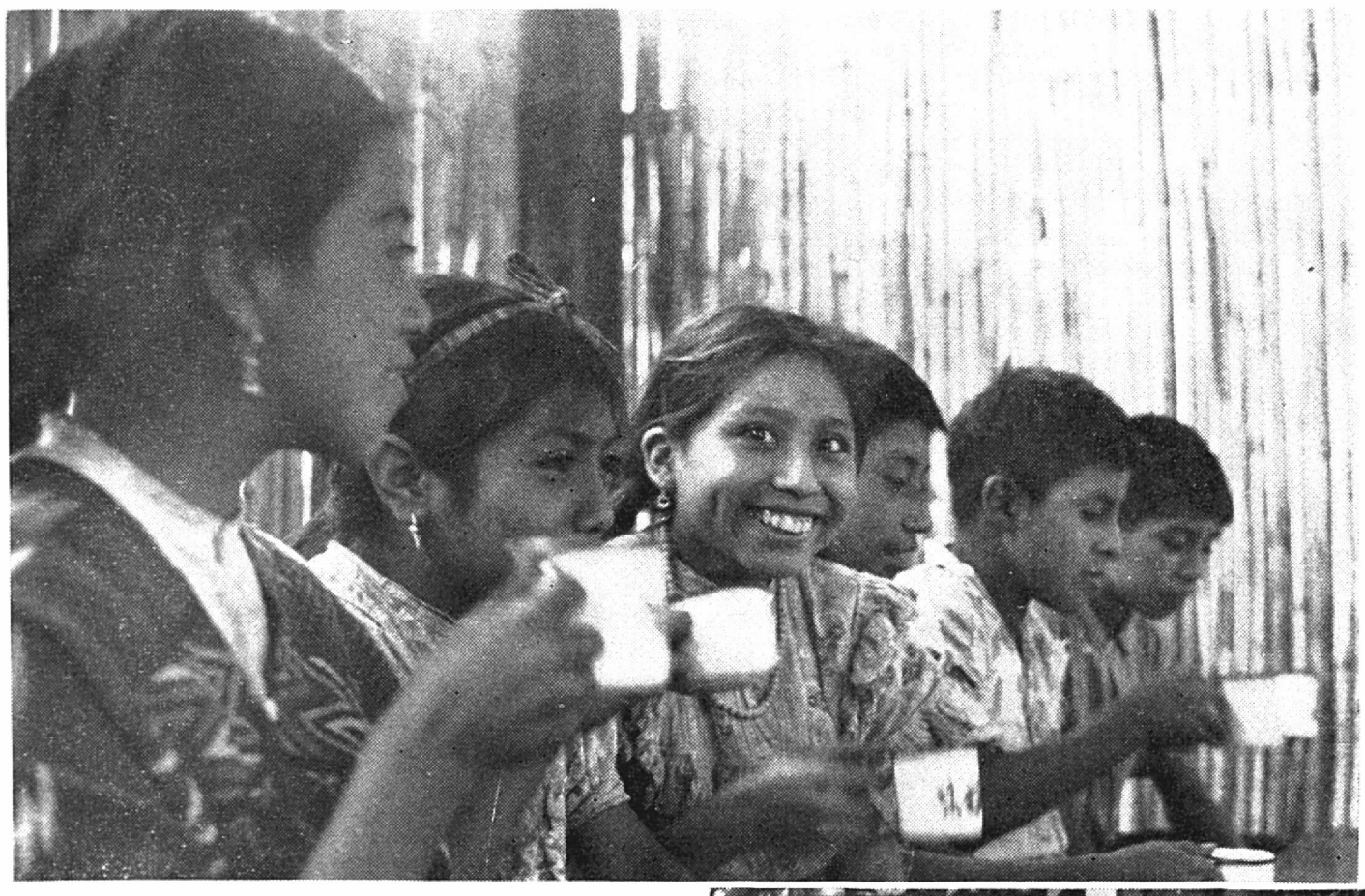
By N. S. SCRIMSHAW

DIRECTOR of the Institute of Nutrition of Central America and Panama since 1949, Scrimshaw is one of the outstanding leaders in clinical and public health nutrition. This summer he will return to the U.S. to head food science department at M.I.T.

AFTER NEARLY 10 YEARS of studying the serious problem of protein malnutrition among young children and working to develop practical preventive measures in its member countries, the Institute of Nutrition of Central America and Panama (INCAP) has concluded that a high quality cottonseed flour combined with a cereal grain is the best answer to an inexpensive source of good quality protein.

Mortality among pre-school children in most Latin American countries is 10 to 40 times higher than in the U.S. and Canada. This has been shown to be due primarily to insufficient protein in the diets, which results in the development of the deficiency disease, kwashiorkor, or in increased susceptibility to infections. Although there is a tremendous potential for increasing the production of animal sources of protein, preservation problems and particularly extremely low purchasing power prevent even greatly increased supplies of milk, eggs, meat, poultry and fish from providing the entire answer to this basic socio-economic problem. The need for developing less expensive sources of high quality protein has long been recognized, but the practical development of low cost products which could be produced from local resources has not been easy, and many possibilities have been explored by INCAP and other institutions in their research programs.

Soya, a common vegetable source of protein for infant and adult diets in the U.S., has thus far not been grown in significant quantities in Central America, nor has it been demonstrated that it can be adapted to tropical agriculture. Sesame, although of satisfactory protein content, presents harvesting and processing problems and has thus far proved too expensive to be practical as a major protein source in vegetable mixtures for human consumption. Because of their cost and the variable protein quality of the meal, peanuts have not yet been found practical for this purpose. Only cottonseed flour has been found to fulfill the requirements of low cost, high protein content, good protein quality when combined with cereal grains, stability and acceptable flavor. Its practical possibilities have been demonstrated by favorable biological and clinical results obtained with a vegetable mixture containing 38 percent cottonseed flour, now undergoing marketing trials in several countries and soon to be available commercially under the generic name INCAPARINA. "Harina" is the Spanish word for flour and the name means literally "INCAP flour".

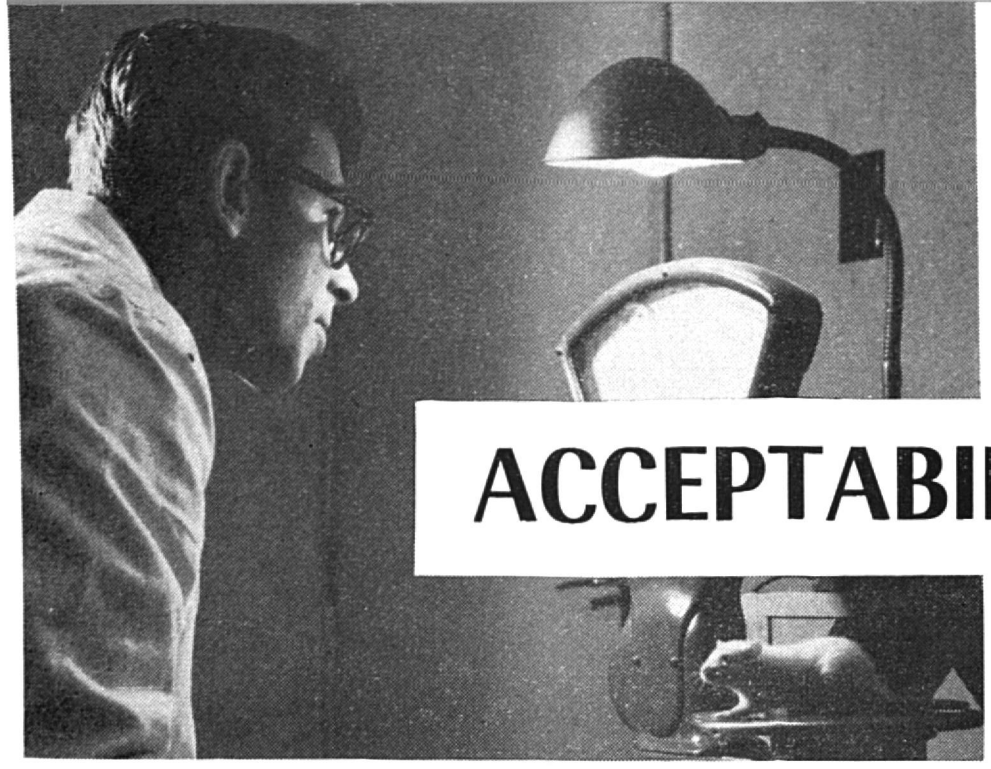


GUATEMALAN CHILDREN drinking INCAPARINA in one of the acceptability trials in a rural village.

Protein Requirements

Many factors must be considered in developing a new food intended to help solve the problem of protein malnutrition among human populations in techni-

MARKETING TRIAL of INCAPARINA in Palin, Guatemala.



ACCEPTABILITY A KEY FACTOR

DR. RICHARDO BRESSANI, chief, Division of Agriculture and Food Analysis, has been responsible for chemical studies and biological trials of INCAPARINA.

cally underdeveloped areas. In addition to containing an adequate quantity and quality of protein, the product must be simple to manufacture, inexpensive and easily preserved. It is equally important, of course, that it be readily acceptable from the standpoint of flavor, ease of preparation and physical characteristics. Acceptability is most easily achieved if the new food fits into existing dietary patterns and habits; certainly, it cannot run counter to them.

It is important to be certain that it contains no toxic or inhibiting substances and that its nutritive value is not easily damaged by processing. Careful laboratory testing is required, including biological trials in at least two species of animals, before clinical testing can be initiated. Tests in man should include determination of acceptability, biological effectiveness and absence of any adverse symptoms from long continued use.

A severe test of protein-rich food is its ability to initiate cure in children with kwashiorkor, a severe form of protein malnutrition, characterized by growth failure, edema, skin and hair changes, apathy, anorexia and biochemical alterations. As mentioned previously, it is one of the most common causes of death among children of preschool age in most Latin American countries. Finally, the practicality of any new food which appears to fulfill the above criteria can only be determined by market trials in representative communities.

Cottonseed Flour

Ordinary expeller process cottonseed cake, even if finely ground, would be completely unsuitable for use in a food for children, not only because it is too high in crude fiber and low in protein, but also because the protein is likely to have been damaged by excessive processing temperatures and the gossypol content to be too high. To be suitable for human use, processing temperatures must be kept sufficiently low so that the quality of the protein is not seriously affected. Under these circumstances, less gossypol is bound to the protein and, instead, is expressed with the oil.

Clean, mature seed must be used, and that from certain areas is too high in gossypol to be suitable, even if carefully selected and processed. Finally, either air separation or screening must be employed to remove a substantial proportion of the crude fiber and raise the protein percentage. Detailed specifications for such a meal have recently been drawn up by the WHO/FAO/UNICEF Protein Advisory Group. The principal requirements are a protein content of 50 percent or greater with an available lysine of at least 3.6 percent, a gossypol concentration not to exceed one percent total and 0.055 percent free, crude fiber less than five percent and fat not to exceed six percent.

Experimental Work

Initial studies involved determination of the optimum combination of cottonseed flour of this type with corn, the principal staple of Central American diets. It was determined that weight gains and feed efficiencies of rats were superior with 15-25 percent of the protein of the diet from corn and 85-75 percent from the cottonseed flour. When cottonseed flour contributes a smaller or larger proportion of the total protein, there is a drop in protein efficiency. Combined with cottonseed for this purpose, corn, sorghum and rice were interchangeable. To insure adequate vitamin A and B complex vitamins, respectively, three percent leaf meal and three percent Torula yeast were added. This type of mixture with 38 percent cottonseed flour, and 56 percent corn or equal proportions of corn and sorghum gave biological results in rats which were equivalent at adequate levels of intake to those with an equal amount of milk protein.

The rats continued to grow well even when the percentage of protein in the diet was 10 percent, although lysine addition further improved growth and feed efficiency. Results with chicks were similiar although the need for added lysine for optimum results was more pronounced. Net protein utilization (N.P.U.) in chicks was 63 percent. As determined in dogs, the average biological value of INCAPARINA was 74 percent and that of casein 78 percent. Results with pigs were also highly satisfactory, and no signs of toxicity were noted in any of these trials.

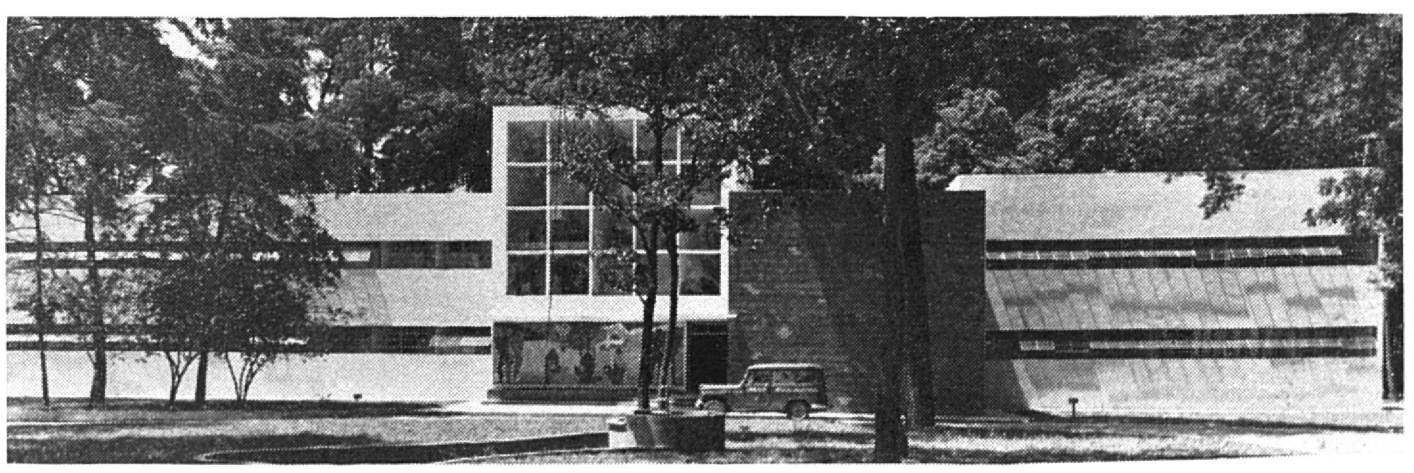
For use in human feeding, synthetic vitamin A was substituted for leaf meal, and calcium carbonate was added as a calcium source. The formula now adopted for INCAPARINA is 56 percent corn (or 28 percent corn and 28 percent sorghum) combined with 38 percent cottonseed flour, three percent Torula yeast, one percent calcium carbonate and 4,500 units of vitamin A per 100 g. It contains approximately 27.5 percent protein and balanced amounts of all other essential nutrients except ascorbic acid, which is already adequate in most tropical and subtropical dietaries.

Clinical Trials

The basic animal trials showed the mixture to be safe and nutritionally effective and its acceptibility was soon established by feeding it to children recovered from severe protein malnutrition. Over 150 individual five-day metabolic balance periods equally divided between INCAPARINA and milk as the sole protein source, have shown the protein from either to be equally good at levels of intake satisfying protein requirements. At inadequate levels of intake, strongly positive nitrogen balance was still observed, although slightly higher retention figures were observed with milk.

Plasma amino acids changes following a test meal were studied in children fed either milk, INCAPARINA or a corn-bean diet for several weeks. The magnitude of the increase in individual plasma amino acid levels was essentially the same with either milk or INCAPARINA and much greater than in children who had been receiving corn and beans. Even more significant were the dramatic results achieved when INCAPARINA was used as the sole source of protein in the hospital treatment of cases of kwashiorkor, a recovery indistinguishable from earlier findings with milk as the protein source.

In field trials with INCAPARINA, involving daily administration to 115 children in Guatemala for 15-19 weeks and 53 in El Salvador for four weeks, approximately 97 percent of the offerings were accepted and only three percent rejected. Preliminary results of acceptability trials in Honduras and Nicaragua are similiar. In a marketing trial in Guatemala from March 22 to Sept. 30, 1960, nearly one million packages containing 75 g each at a price of three cents, or their bulk equivalent, were sold.



MAIN BUILDING of INCAP in Guatemala City.

Acceptibility was good and there were no complaints or reports of intolerance; all reports that have come to the attention of the Institute have been favorable.

Commercial Production

The directing council of INCAP, directors of public health of the six member countries—Costa Rica, Guatemala, Honduras, Nicaragua, El Salvador and Panama—has established certain principles for the manufacture and distribution of INCAPARINA which include: INCAP approval of packaging, advertising content and maximum price and strict quality control.

Authorization has been given to manufacturers in Guatemala and El Salvador to produce and sell INCAPARINA made with a pre-press solvent extracted cottonseed flour from El Salvador which meets the quality criteria established. Arrangements are in progress for the production and distribution of INCAPARINA in several other Latin American countries, and INCAP has received letters of inquiry from all parts of the world.

Future Prospects

The widespread occurrence of protein malnutrition among pre-school children in technically underdeveloped areas requires effective counter-measures to supply protein of good quality in adequate quantity at a price within reach of lower socio-economic groups. Wherever cottonseed flour of the requisite quality is produced, INCAPARINA should be a useful and practical contribution toward solving this major nutrition problem, and to making protein of good quality available to pregnant and nursing mothers and other vulnerable groups, as well as the population in general. Although many other protein sources for this purpose are presently being explored, including coconut and soya, and the use of other oilseed press cakes, such as those from sesame, sunflower seed and peanut, as well as the production of fish flour, cottonseed flour seems likely to be the cheapest and most acceptable low cost protein source for many areas. The demonstration by INCAP of the close comparability of protein from properly balanced cottonseed flour-cereal grain mixtures and that in products of animal origin should lead to the increased use of cottonseed flour in protein-rich foods for human consumption, not only in the form of INCAPARINA but in a variety of other products.

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