

# Food Fortification

## TO END MICRONUTRIENT MALNUTRITION

STATE OF THE ART

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## The Fortification of Food-Flavor Improvers

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**Abstract** *Fortification of condiments that improve the flavor of foods often does not fit concepts of "healthy" foods. However, these are part of human dietary tradition. It will be very difficult to replace them with healthier substances. Condiments are attractive vehicles because they are inexpensive and therefore affordable for most of the population, very stable under normal weather conditions and therefore very easy to store and to distribute. They are widely consumed by all ages and social strata and reach vulnerable populations and are consumed in constant amounts, making fortification levels relatively easy to establish. Few foods have so many practical advantages as vehicles of essential micronutrients.*

### Introduction

This presentation focuses on specific aspects of the fortification programs which have contributed to their success, rather than on technological descriptions of the fortification processes. The conclusions originated from our experiences with the fortification programs in Central America that could be valid for other regions of the developing world. Some of these issues may be controversial. However, if the programs in Central America are to contribute significantly to the prevention and control of micronutrient deficiencies in other parts of the world, these issues must be critically analyzed.

Fortification of condiments and other substances that improve the flavor of our diets has had opponents, because condiments do not fit the concept of "valuable foods". Indeed, reduction of their intake is recommended in many countries because of health considerations. Thus, high intake of salt is undesirable because of its putative association with high blood pressure. Similarly, intake of sugar is discouraged to prevent the development of dental caries. However, all these products are

part of human culture, and it is very difficult to replace them with healthier and less expensive substances. Therefore, their use will continue. Why not use them as vehicles for micronutrients, while simultaneously assuring that their intake will either be reduced or at least not increase?

Most of the successful food fortification programs in the developing world are those that use these flavor improvers. For example, through salt fortified with iodine, Ecuador, Bolivia, and many other countries in the world have overcome iodine deficiency, preventing endemic social scourges such as cretinism, mutism and mental retardation. Through double fortification of salt with iodine and fluorine, Costa Rica and Jamaica have accomplished the reduction of both IDD and tooth decay nationwide. Sugar fortified with vitamin A, El Salvador, Guatemala and Honduras are significantly reducing this nutrient deficiency, improving the general health status of their populations.

The proven efficacy of fortification of these food-flavor improvers is attributable to some of their special

characteristics. They are inexpensive and hence affordable for most of the population. These foods are very stable under normal weather conditions and therefore very easy to store and to distribute. Finally, they are widely consumed in constant amounts by all ages and social strata and therefore very easily found in remote places. No other foods have so many practical advantages for being vehicles of essential micronutrients.

### **Misconceptions About Food-Flavor Improvers**

Even though the impact of fortification of these staples has been proven, some misunderstanding remains and often creates resistance to the widespread acceptance of these successful experiences. I will refer to them as *Five Misconceptions*.

#### Fortification should be universal

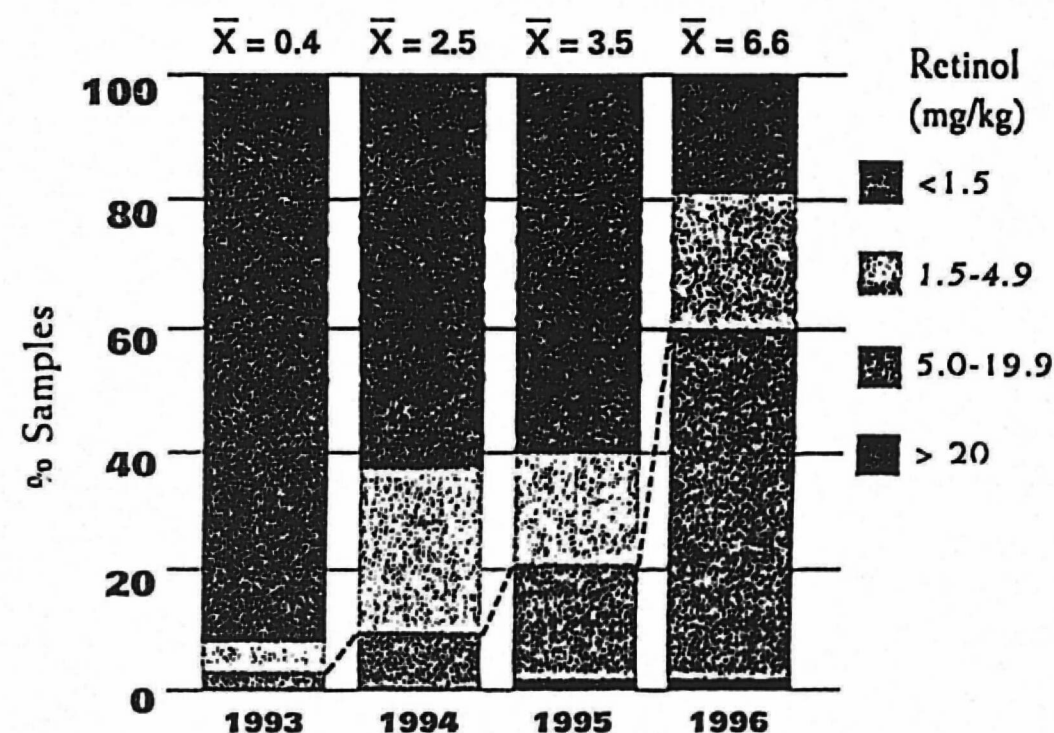
The prototype of "staple food" fortification is salt fortification with iodine. Fortification of this commodity is accepted almost everywhere, because almost all diets in the world are lacking in this nutrient. Fortification of all salt, regardless of its use, has been recommended—that is, "universal salt fortification." However, food-flavor improvers are also used in considerable amounts by food and non-food industries. For some of these the presence of the fortificant is inappropriate. In some cases the fortificant is destroyed or unnecessary for the final product. Nowadays, universal fortification programs of these commodities are under attack by such industries and importers because they see the demand for universal fortification as technical barriers to free trade. This circumstance is unnecessarily putting fortification programs at risk.

In Honduras, the government allows the production of non-fortified sugar for industrial use. In the past this constituted a problem, because there were no practical and inexpensive ways to distinguish the fortified from the nonfortified sugar, and both types of sugar were mixed at the household level. This seriously impairs the achievement of the program's nutritional goals. However, in the sugar harvest season of 1995-96 the producers adopted a special label for the fortified sugar and provided clear instructions to warehouses to distribute only the labeled product for domestic consumption. The result was good. Fortification of 40% of the national sugar production coincides with 80% of all the households having fortified sugar. There is still a 20% leakage of nonfortified sugar to homes. However, this case

demonstrates that if good labelling and distribution practices are implemented, fortification programs could succeed without being universal.

Nevertheless, it is essential to point out that this policy is applicable only where reliable labelling and enforcing mechanisms are in place, and where producers commit themselves to clearly identify and control the distribution of the fortified and the non-fortified products. It is very important to create mechanisms to assure that only the fortified product reaches consumers at the household level.

### **Honduras Trend of Sugar Fortification at the Household Level**



**The samples in the "target range" of 5-20 mg/kg increased to 60% while non-fortified samples (less than 1.5 mg/kg of retinol) dropped dramatically after the introduction of quality assurance practices by producers.**

#### Presence of the fortificant should be confirmed everywhere.

Several international cooperative institutions have been promoting the use of a "field kit" to detect the presence of iodine in salt. The intention was good, but the final results, at least in our countries, have not been acceptable. In some situations these kits have been promoted as semi-quantitative procedures, when they were not. Thus, the "field kits" created more confusion and problems than benefit or improvement of the fortification programs. In fact, producers in Guatemala actually decided to reduce the amount of the fortified mixture used in salt iodization because they misinterpreted the "field kit" results to mean the salt was rich in iodine when it was not. It is important to point out that the



impairment of the salt fortification program was discovered thanks to a surveillance system sponsored by UNICEF. The alarm was given, and now corrections are being implemented. Our most recent information shows that 30% of salt is adequately fortified at the household level.

The Guatemalan situation regarding salt fortification is very interesting, because this country was the first one in Latin America to control iodine deficiency by this means in the 1950s. However, 40 years later the quality of the program is still unsatisfactory. Guatemala decided on universal fortification instead of the industrial development of salt production.

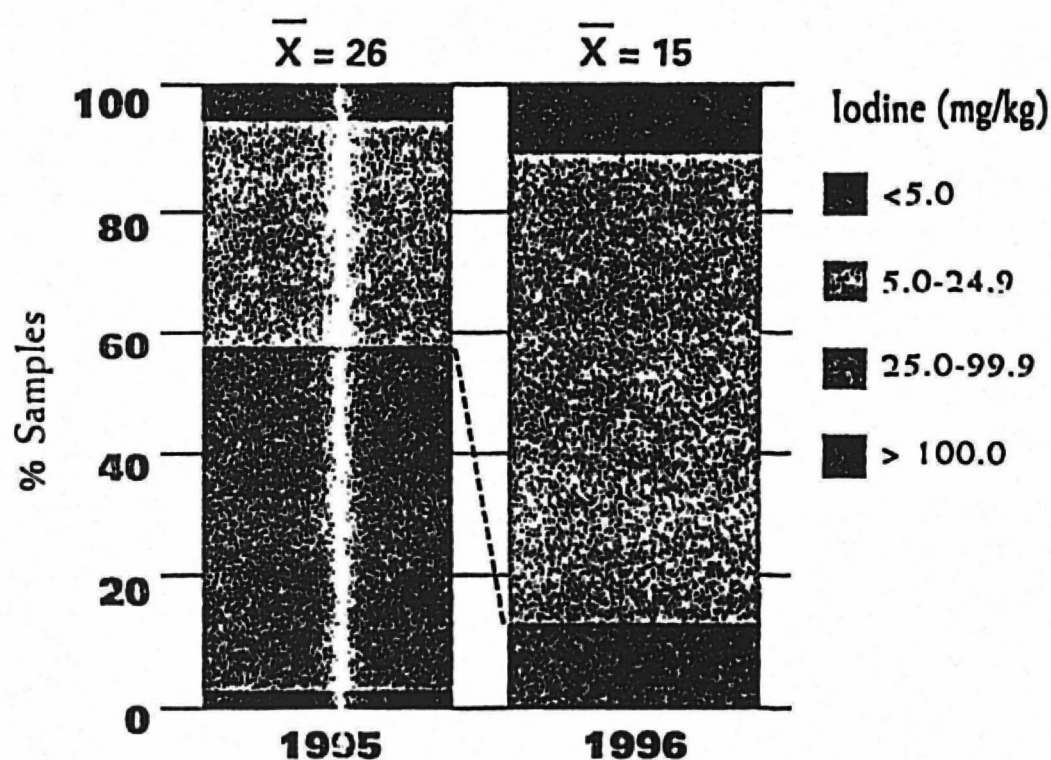
Using the same argument that quality of the fortification programs could be improved by testing the fortified products everywhere, currently there are many efforts to develop "field methods" to be used for untrained personnel and for consumers. These kits may contribute to monitoring the compliance of the fortification programs at the local level. However, the overall picture of quality assurance and monitoring is becoming unnecessarily complex and expensive. As a matter of comparison, how often and with what intensity are the fortified foods in the developed world being checked in each distribution truck and each retail store? Why, then, is such a structure being promoted for poor countries that do not have sufficient personnel or resources to do so?

We evaluated a quality control and quality assurance program in Honduras, and concluded that the key point of success is quality control at the factory level, coupled with identification of the product with a proper label and the possibility of the producers being subject to inspection. When producers cannot implement a quality control process, government should take that responsibility until it is adopted by the food industries. Monitoring practices at other stages of the marketing chain should be very simple and based more on enforcement of labelling and packing rather than on chemical analysis of samples. However, because human nature is weak, and because this characteristic is more widespread where poverty and ignorance are prevalent, we found that the presence of a surveillance system at the household level is very useful. Such surveillance may consist of an annual sampling of the fortified foods at the household level. The data from this practice not only will show the performance of the quality assurance system but also will provide an approximation of how the nutritional goals are being approached.

The level of the fortificant in food samples at the household level should be that indicated in the legislation.

Salt, sugar and similar products have very long shelf-lives, sometimes nearly a year. On the other hand, micronutrients, especially vitamins, suffer degradation when exposed to environmental factors. Therefore, it should be expected that the micronutrient content of the food would be lower at the household level than during production. This normal loss should not be considered as a failure of the program but as a factor to be considered in estimating the original content of the nutrient in

#### Guatemala Trend of Salt Fortification at the Household Level



**After introduction of field kits for "quality control", the percent of samples in the target range of 25-99.9 mg/kg of iodine dropped significantly.**

the food during production. This fact should be reflected in the regulations. The basic objective is that the fortified food should contain effective biological levels of the nutrient when it is being consumed by the population.

In Guatemala and Honduras, we have been monitoring the loss of retinol in fortified sugar between factories and homes. In general terms, homes received 50-60% of the initial content of retinol added during production. This stability is acceptable for a nutrient and a food of this type. The retinol level of sugar in homes is high enough to be nutritionally important and to keep the intervention at an acceptable cost. In my opinion, sugar fortification has been very successful in Central America,

as it is providing vitamin A at safe levels to all people who consume sugar. Indeed, recent surveys show more than 80% of homes had sugar containing retinol at concentrations high enough to make sugar the main source of this nutrient for the population.

The biological impact of this intervention has been clearly shown by the reduction in the prevalence of vitamin A deficiency in preschoolers of both countries. Among eight Latin American countries (including Costa Rica, Panama, Colombia, Dominican Republic, El Salvador and Nicaragua) Honduras and Guatemala show the worst situation in nutrition according to indicators of low weight by age and low height by age. However, their vitamin A status measured by means of low levels of plasma retinol (<20 µg/dL) places these countries in a situation similar to that found in more prosperous nations such as Colombia, Costa Rica and Panama. These anomalous lower percentages of vitamin A deficiency are attributable to the presence of fortified sugar with vitamin A in Honduras and Guatemala.

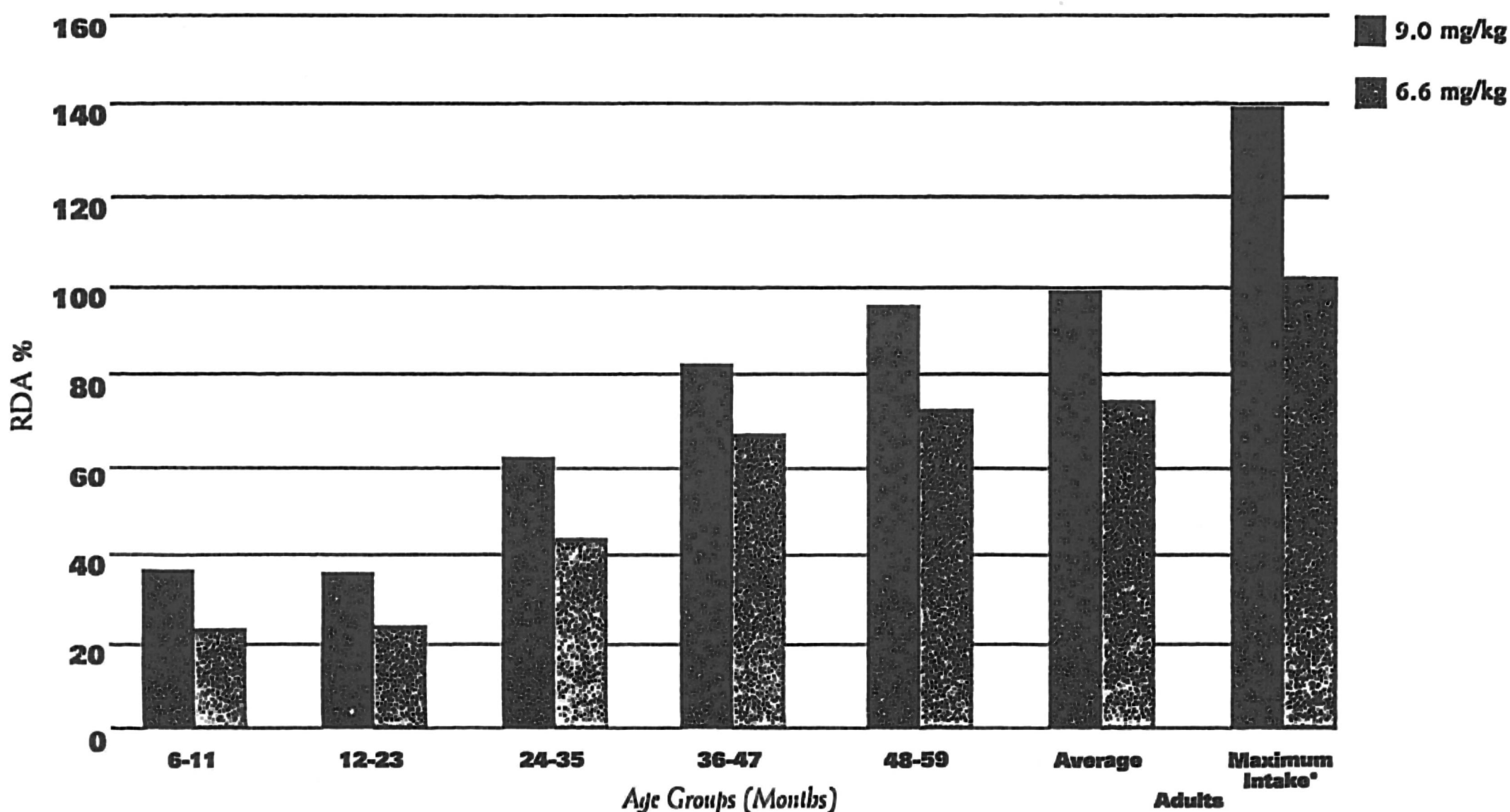
The Honduran and Guatemalan cases are still more illustrative if the plasma retinol levels are analyzed by

age. Only children from 12 to 24 months remain deficient in vitamin A. Children from 24 to 59 months are close to overcoming even moderate deficiency of this nutrient.

Fortification should completely correct the deficiency in those groups at higher risk.

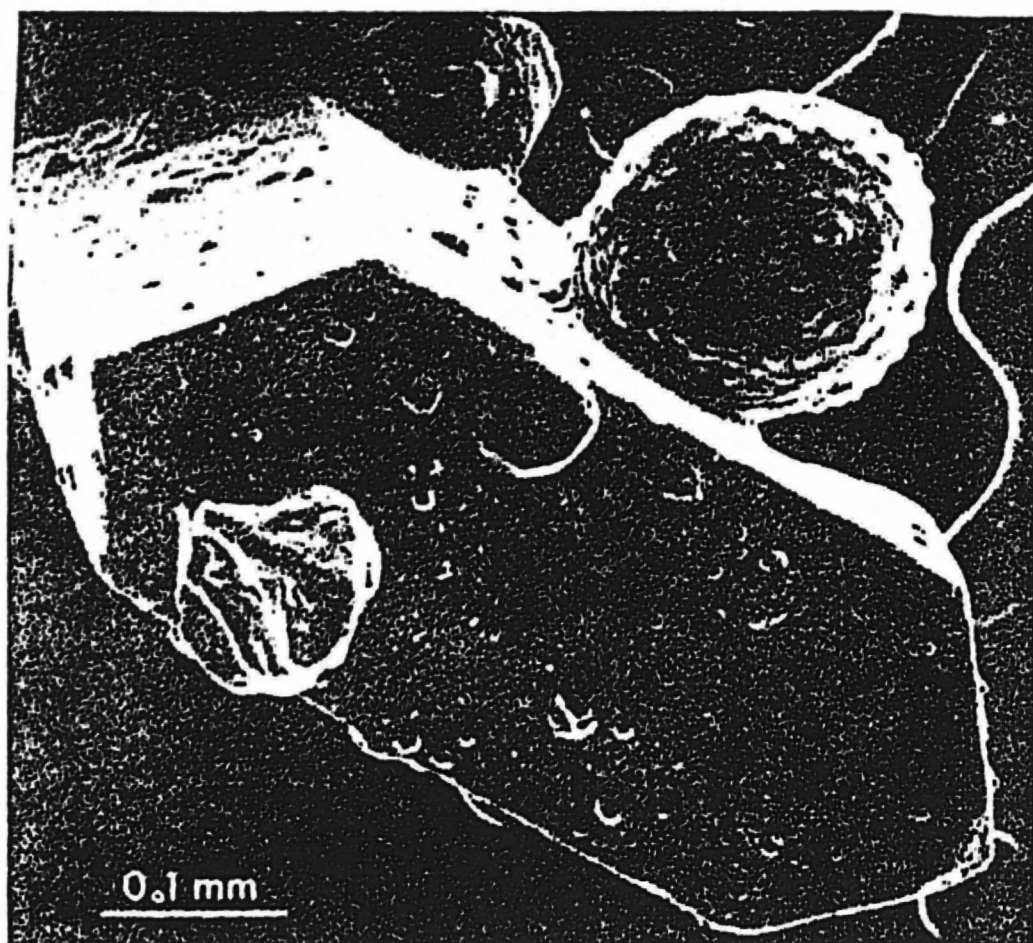
Fortification, as well as the other interventions for preventing and correcting micronutrient deficiencies, is aimed at minimizing the occurrence of clinical and sub-clinical signs of the deficiencies, especially in the most at-risk population. For most nutritional deficiencies the most at-risk groups are infants, that is children between one and two years old. However, it is frequently overlooked that other ages could also suffer from these deficiencies. Sometimes the importance of food fortification, specifically that dealing with food-flavor improvers, is not appreciated in all its dimensions because the infants are not completely protected. However, in the case of sugar fortified with vitamin A in Central America, for example, it is valid to state that deficiency is under control for any person older than three years old. These people are

**Contribution of Sugar towards RDA of Vitamin A in Guatemala.**



**Sugar is the main source of vitamin A for the people of Guatemala. With the exception of children below three years of age, severe vitamin A deficiency has been overcome. Children between two and three years of age will also be covered once the mean average of sugar retinol reaches 9 mg/kg or greater.**





**New bonding technologies efficiently adhere fortificant compounds to condiment particles, preventing segregation during production and storage. Pictured above is a beadlet of vitamin A adhering to sugar crystal.**

receiving more than 50% of the RDA of this nutrient through sugar. 50% is the nutritional gap determined by means of dietary surveys. For younger children, the vitamin A intake through sugar represents about 30% of the recommended daily allowance. That makes sugar an excellent source of vitamin A, even though it has not become the only necessary source of this nutrient for this age group. Therefore, in general terms, the outcome of the program is excellent, in spite of the fact that some infants are still not receiving the daily recommended intake of this nutrient from their normal diet.

This case also shows that fortification is important in overcoming nutritional deficiencies, but it is not the only solution. Fortification must be complemented, especially for infants, by other strategies such as breast feeding promotion and use of appropriate weaning foods. In the absence of these practices it must be complemented by

periodic supplementation that provides high dosages of micronutrients by means of pharmaceutical presentations. However, with fortification, the scope and cost of all these complementary programs is greatly reduced, because fortification has already significantly narrowed the population at risk.

*Fortification could provide a significant commercial benefit to the participating industries.*

Commerce of food-flavor improvers in the developing world is not driven by quality but by economic gain and by consumer affordability. On the other hand, increases in the consumption of these commodities should not be promoted based on the benefits of fortification. Producers should not cash in on fortification, but rather pass the cost of fortification on to the consumers. Therefore, fortification of salt, sugar and similar products does not in principle have profit motivation to producers. Furthermore, as mentioned before, these commodities are widely consumed because of their low price. However, this characteristic is also a disadvantage for fortification, because the proportion of cost increment due to fortification is larger than with other foods. Although the increase in cost is apparently small, it is large in terms of competitiveness for the involved industries. Thus, if any developing country decides to fortify any of these commodities, this practice should be mandatory both for internally produced as well as for similar imported products. That does not mean that the industry should be obligated by the government to implement the program. The willingness of industry is still a key factor of success and sustainability of the fortification programs. The industrial sector should accept this practice and become committed to it out of conviction to its social benefits. General enforcement of the fortification programs should be seen as a motivational and protective tool for those industries that follow regulations responsibly. Fortification of staples and food ingredients are public health programs and not a means to achieve a commercial edge.