STATE OF THE ART OF THE FORTIFICATION OF FOOD-FLAVOR IMPROVERS
(Condiments and other products)

Omar Dary M., Ph.D.
Head of Food Analysis and Safety Unit
Institute of Nutrition of Central America and Panama (INCAP), Guatemala City, Central America.

A. INTRODUCTION (SLIDE 1)

This presentation will focus on specific aspects related to the fortification programs which have contributed to the programs' success, rather than on technological descriptions of the fortification processes. I will present conclusions originated from our experiences with the fortification programs in Central America, and that I consider could be valid for other regions of the developing world. Some of these issues may be controversial, but the purpose to expose them is to contribute to the reflection and critical analysis that this kind of program deserve to really contribute to the prevention and control of micronutrient deficiencies in the world.

(SLIDE 2): 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 being predominant. Then the question is: why not use them as vehicles for micronutrients, assuring simultaneously that their intake will either be reduced or at least maintained invariable? On the other hand, most of the successful programs of food fortification in the developing world are those that use these flavor improvers. As examples, we have that through salt fortified with iodine, Ecuador and Bolivia, and many other countries in the world were able to 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 tooth decay nationwide; and through sugar fortified with vitamin A, El Salvador, Guatemala and Honduras are reducing considerably this nutrient deficiency, improving the general health status of their populations.

(SLIDE 6) 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; and they are widely consumed in constant amounts by all ages and social strata, and therefore very easy to be found in far away places. No other potential foods have so many practical advantages for being vehicles of essential micronutrients.

B. MISCONCEPTIONS THAT HAVE INCREASED THE COST OF AND/OR REDUCED THE APPRECIATION FOR THE FORTIFICATION OF FOOD-FLAVOR IMPROVERS

Even though the impact of the fortification of these staple foods has been proved, there is still some ideas that reduce its diffusion and fair judgement. I will refer them as five misconceptions. (SLIDE 7)

1. Fortification should be universal
2. The presence of the fortificant should be confirmed at each stage of the food marketing chain.
3. The level of the fortificant in food samples at the household level should be that indicated in the legislation for the product at the production site.
4. Fortification should correct completely the deficiency in those groups at higher risk.
5. Fortification could provide a significant commercial benefit to the participating industries.

1. 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 of this nutrient. Fortification of all salt, regardless of its use, has been recommended, that is "universal salt fortification[1]". Food-flavor improvers are also used in considerable amounts by food and non-food industries, and for some of them the presence of the fortificant is inappropriate, destroyed or unnecessary for the final product. Indeed, these "fortifiable foods" are ingredients and raw materials for many industries. Nowadays, universal fortification programs of these commodities are under the attack of 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.

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[1] The conception of "universal fortification" in Central American is to add the fortificant to all internal production of the food vehicle, either it be destined to direct human consumption of the industry.

(SLIDE 8): 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, seriously impairing 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 leakage of 20% of nonfortified sugar to homes, but this case exemplifies that if good labelling and distribution practices are implemented, the fortification programs could succeed without being universal.

Nevertheless, it is essential to point out here that the policy to permit production of non-fortified food is applicable only where reliable labelling and enforcing mechanism 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 the mechanisms to assure that only the fortified product reaches consumers at the household level.

2. Presence of the fortificant should be confirmed everywhere

(SLIDE 9) In this section, I will use the salt model. Several international cooperation institutions have been promoting the use of a "field kit" to detect the presence of iodine in salt. The intention has been good, but the final results, at least in our countries, have not been a reflection of that, because in some situations such "kits" have been promoted as "semi-quantitative" procedures, when indeed it is not the case. Thus, this advice has created more confusion and problems than beneficial contributions for improvement of the fortification programs. For example, producers in Guatemala reduced the amount of the fortified mixture used in salt iodization because they had a false sensation of a "work well done", because the "kits" gave the purple color in an intensity that was interpreted as if the salt were rich in iodine, when this was not the case. It is important to point out here, that the impairment of the salt fortification program was discovered thanks to a surveillance system sponsored by UNICEF. The alarm voice was given, and now the corrections are being implemented. Our most recent information shows that 30% of salt is adequate fortified at the household level.

The Guatemalan situation regarding salt fortification is very interesting, because this country was the first one in Latin American to control iodine deficiency by this means in the fifties. However, 40 year later the quality of the program is still unsatisfactory. This country decided for universal fortification instead of the industrial development of salt production, and it was the result.

Using the same argument that quality of the fortification programs could be attained by testing the fortified products everywhere, currently there are a lot of efforts trying to device "field methods" to be used for untrained persons, and ever for consumers. These "kits" may contribute to monitor the compliance of the fortification programs at the local level. However, the overall picture of quality assurance and monitoring is becoming unnecessary complex and expensive. As a matter of comparison, let me pose some questions before you: How often and with which intensity are the fortified foods in the developed world being checked for each distribution truck and each retail store? Why then, is such a structure being promoted for poor countries, that do not have sufficient personnel nor resources to do so?

(SLIDE 10) We evaluated a quality control and quality assurance program in Honduras, and we 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, that is the case of artisanal produced salt. 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 levels is very useful. Such surveillance may consist of an annual sampling of the fortified foods at the household level. The data from this practice will not only show the performance of the quality assurance system but also it will provide an approximation of how the nutritional goals are being approached.

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

(SLIDE 11) Salt, sugar and similar products have very long shelf-lives, sometimes near a year. On the other hand, micronutrients, specially vitamins, suffer degradation when exposed to environmental factors. Therefore, it should be expected that the micronutrient content of the food be lower at the household level than during the moment of its production. This normal loss should not be considered as a failure of the program but a factor to be taken in consideration to estimate the original content of the nutrient in the food at the moment of its production, and 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 losses of retinol of the 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 these types. However, the retinol level of sugar at homes is high enough to be nutritionally important and to keep the intervention at an acceptable cost-effectiveness. In my opinion, sugar fortification has been very successful in Central America: it is providing vitamin A at safe levels to all persons who consume sugar. Indeed, more than 80% of homes during the moment of the surveys 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 of the prevalence of vitamin A deficiency in preschoolers of both countries, that otherwise would have a serious deficiency judging by the value of other indicators of nutritional status (SLIDE 12). Honduras and Guatemala show, among 6 other Latin American countries (Costa Rica, Panama, Colombia, Dominican Republic, El Salvador and Nicaragua), the worse situation in nutrition as revealed by the 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 similar to the situation found in Colombia, behind only to Costa Rica and Panama. This 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 case is still more illustrative if the plasma retinol levels are analyzed by age (SLIDE 13): Only children from 12 to 24 months are still a group with vitamin A deficiency using this biochemical indicator, but children from 24 to 59 months are near to overcome even moderate deficiency of this nutrient. This finding coincides with the lower intake of sugar by the younger children.

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

Fortification as well as the other interventions for preventing and correcting micronutrient deficiencies are aimed at minimizing the occurrence of clinical and subclinical signs of the deficiencies, specially in the most at risk population. For most nutritional deficiencies the most at risk groups are the infants, that is children between 1 and 2 years old. However, it is frequently overlooked that persons from other age could also suffer of these deficiencies too. Sometimes, the importance of food fortification, specifically that dealing with food-flavor improvers is not appreciated in all its dimension because the infants are not completely protected. However, for example in the case of sugar fortified with vitamin A in Central America, it is valid to state that deficiency is under control for any person older than 3 years old. These persons are fulfilling more than 50% of the RDA of this nutrient through sugar, and that 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 figures makes sugar an excellent source of vitamin A, even though it has not become the only necessary and sufficient source of this nutrient for this age group. Therefore, in general terms the outcome of the program is excellent, in spite of the fact some infants are still not completing the daily recommended intake of this nutrient from their normal diet.

This case also shows that fortification is important to overcome nutritional deficiencies, but it is not the only solution. Fortification must be complemented, specially for infants, by other strategies, such as breast feeding promotion and use of appropriate weaning foods, and in the absence of these practices by periodic supplementation (that is provision of high dosages of micronutrient 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.

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

(SLIDE 14) 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 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 raise 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 the 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 about 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 means to achieve a commercial edge.

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Head of Food Analysis and Safety Unit
Institute of Nutrition of Central America and Panama (INCAP)
Guatemala City, Central America

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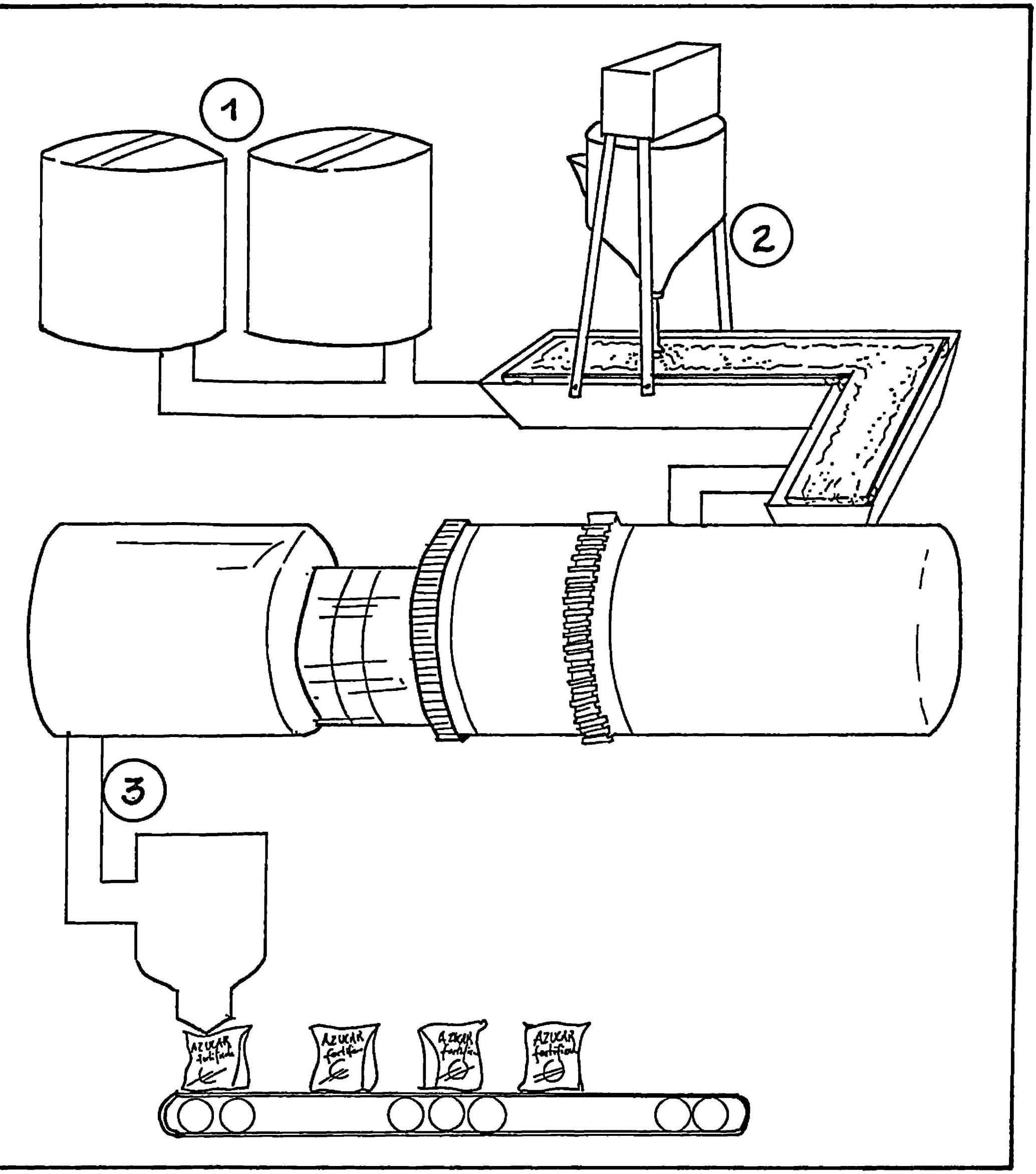
CHARACTERISTICS OF THE SUGAR FORTIFICATION PROGRAM:

A. PREMIX PREPARATION:

Sugar + Retinyl palmitate beadlets (250,000 IU/g) + Vegetable oil + Antioxidants

B. SUGAR FORTIFICATION

Premix (1) + Sugar (1,000) => Fortified sugar with Vitamin A (15.0 mg/kg)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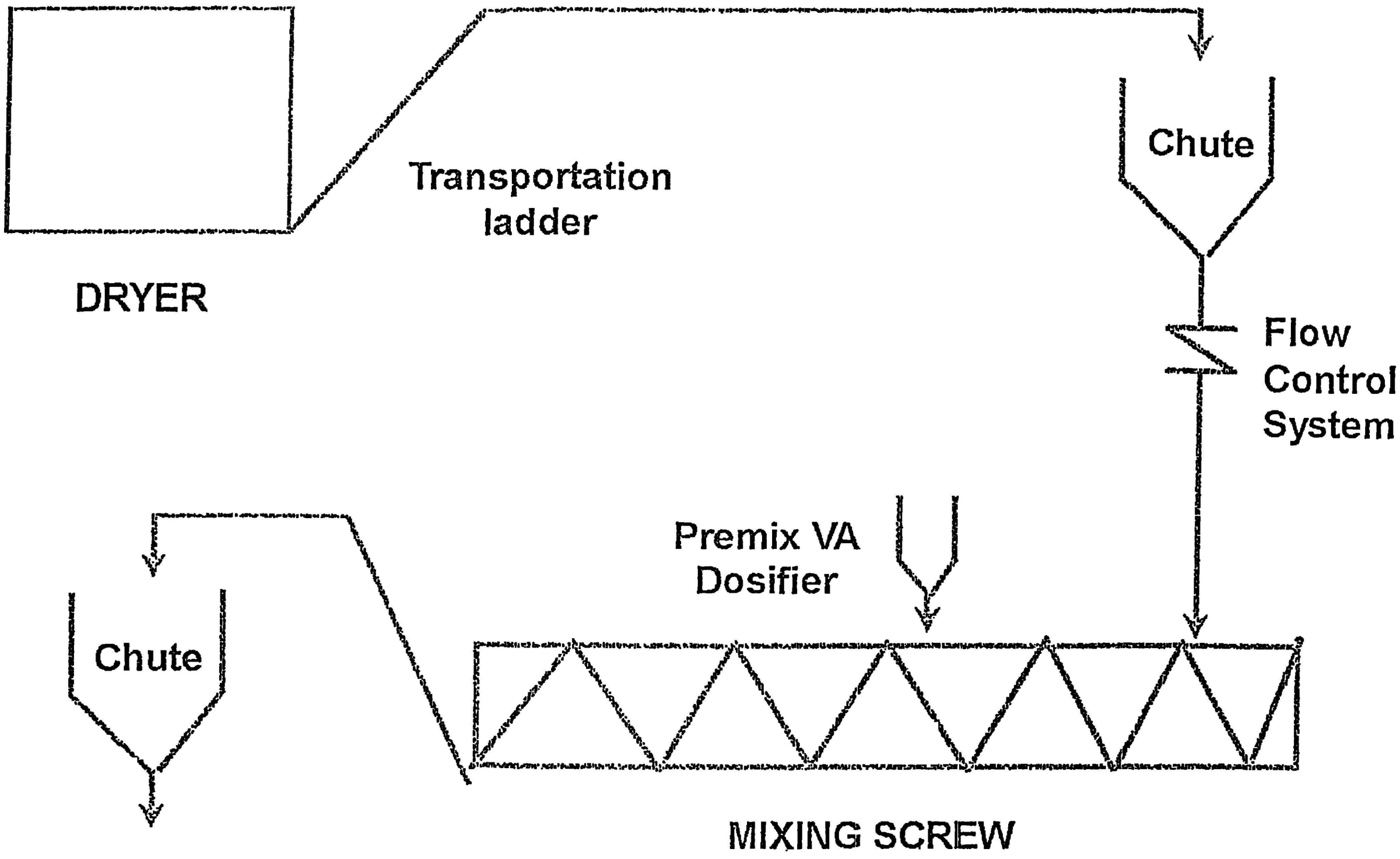
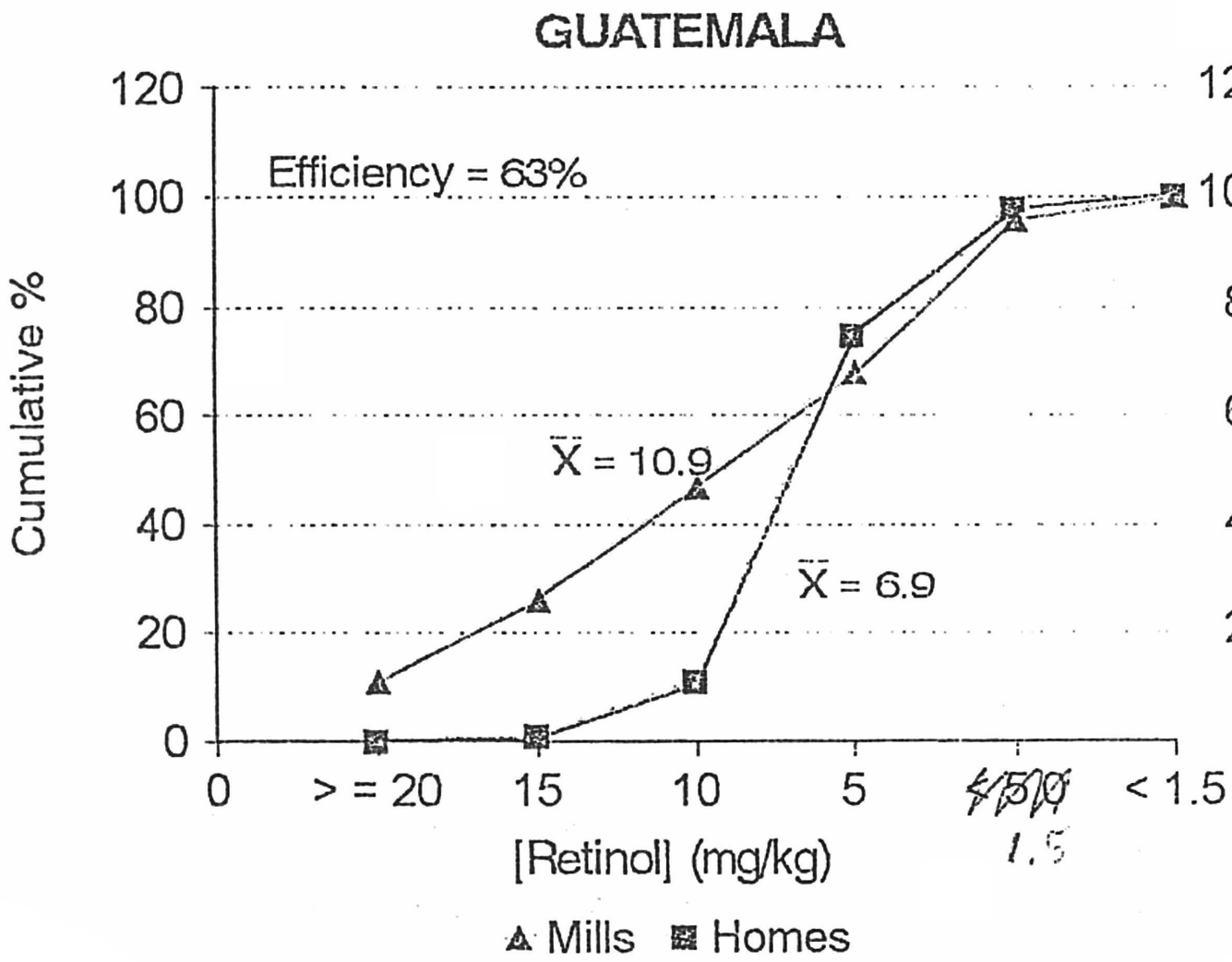

Transportation
ladder
DRYER
Chute
Flow
Control
System
Premix VA
Dosifier
Chute
MIXING SCREW
PACKAGING
of fortified sugar

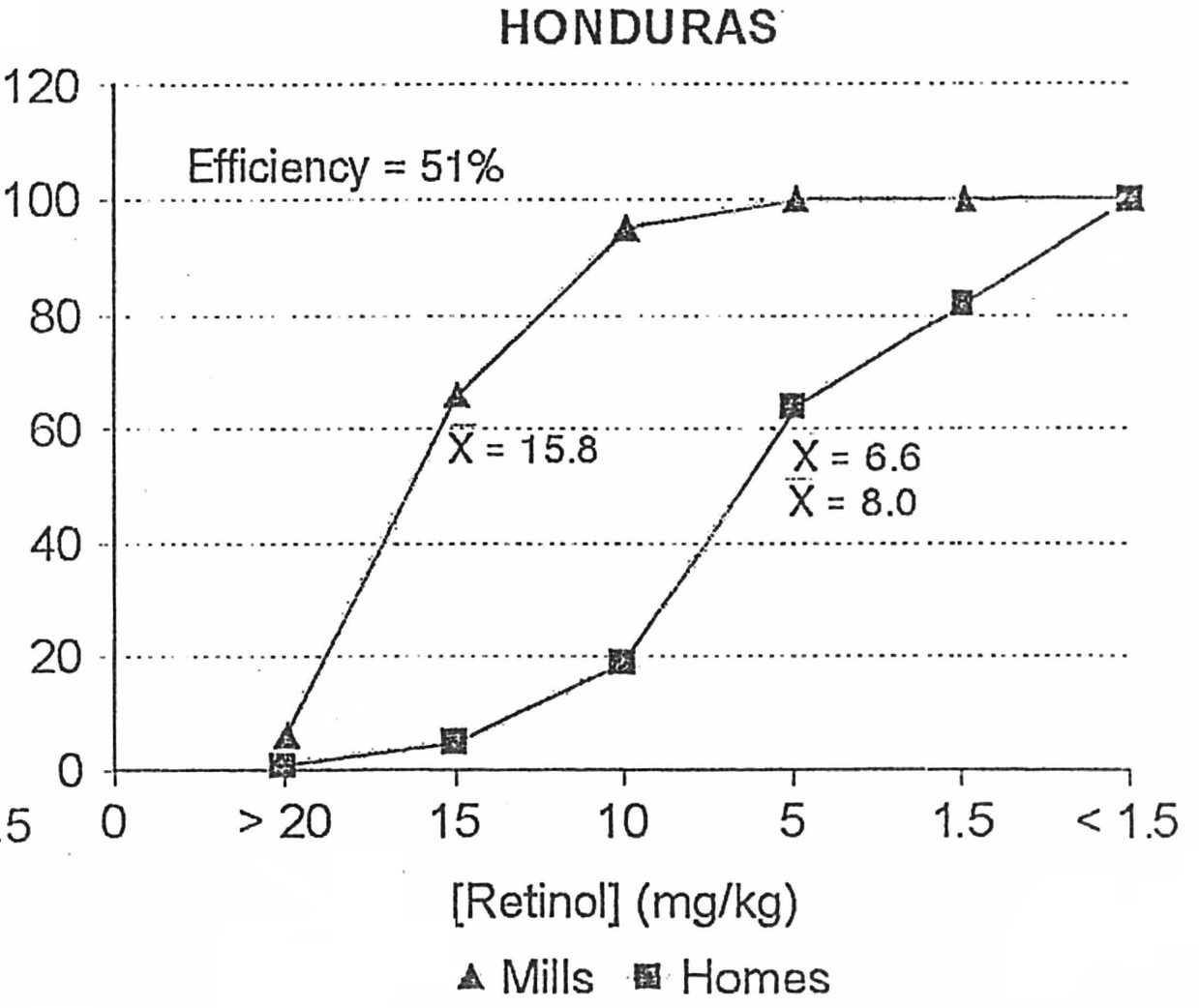
EFFICIENCY OF SUGAR FORTIFICATION PROCESS IN THE MILL GUATEMALA AND HONDURAS (1995-1996)

MATERIAL	GUATEMALA	HONDURAS
Premix:		
[Retinol] (g/kg)	15.6	16.4
Used quantity (qq)	8, 784	1, 760
Fortified Sugar		
[Retinol] (mg/kg)	10.9	15.9
Produced quantity (qq)	8, 860, 054	1, 518, 136
EFFICIENCY (%)	70.5	83.6

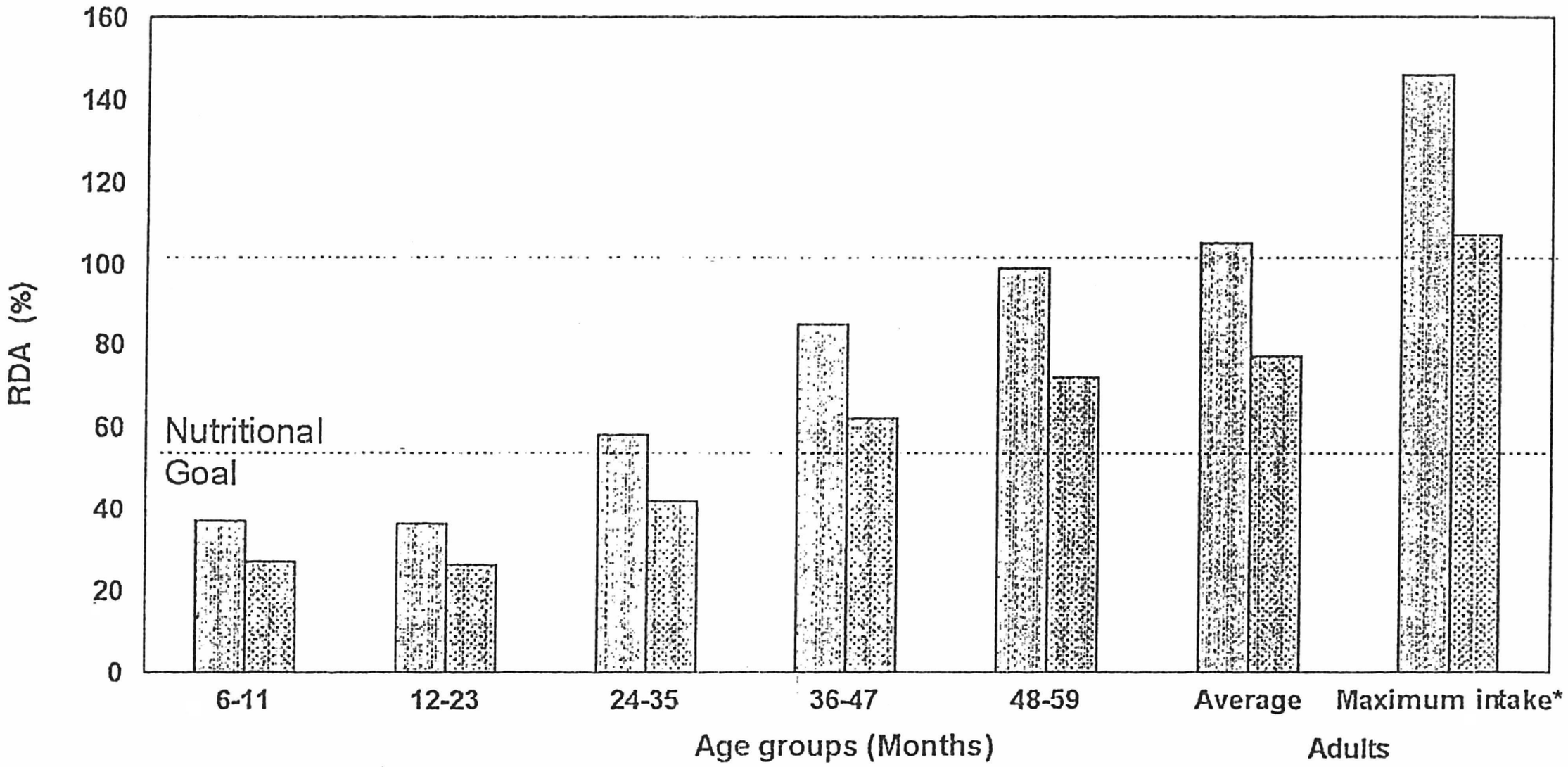
qq = 45.5 kg

CHANGES OF RETINOL CONTENT IN SUGAR FROM FACTORY TO HOME (1995-96)





CONTRIBUTION TO VITAMIN A RDA (%) FROM FORTIFIED SUGAR (Guatemala)



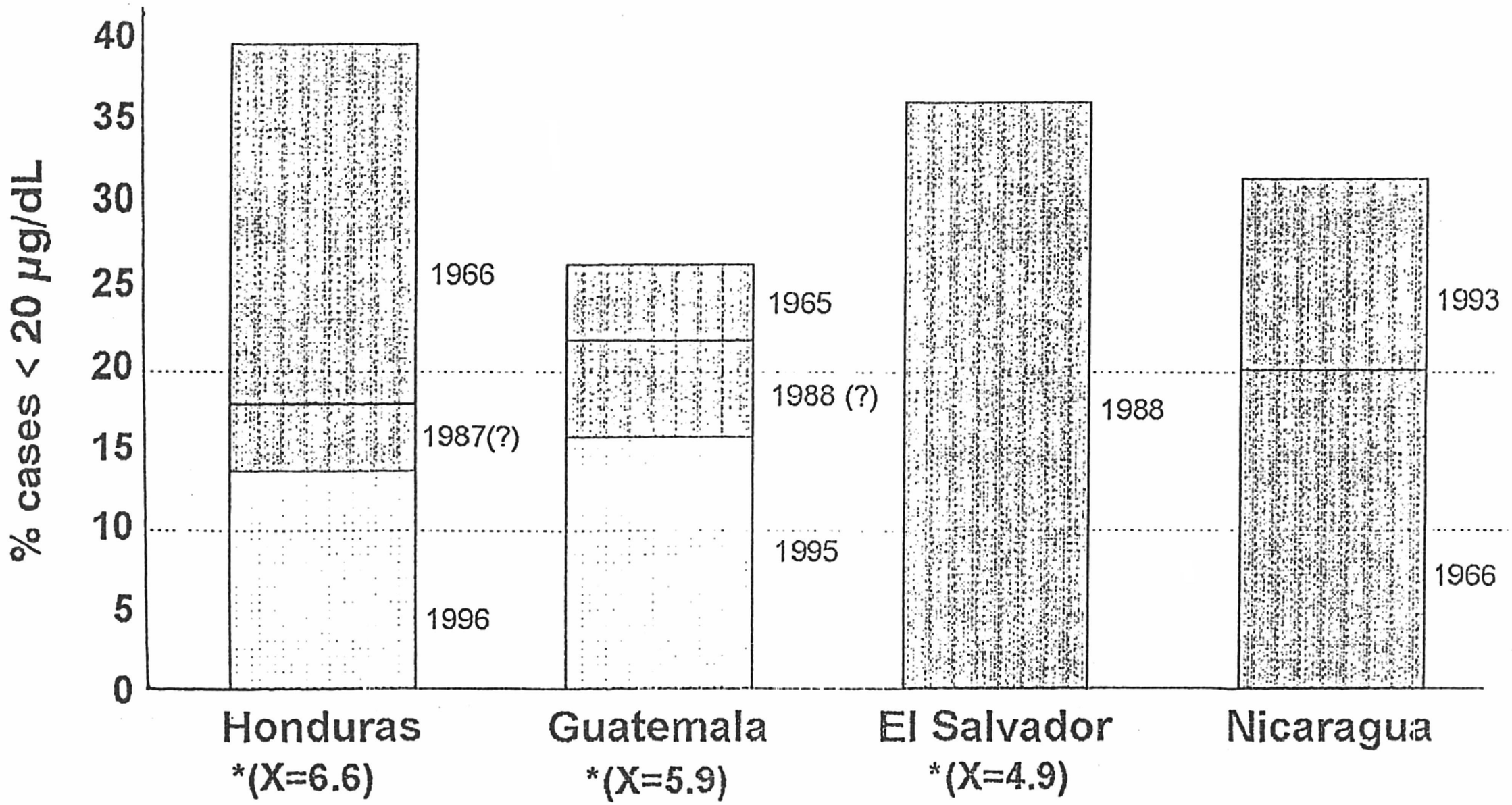
*sugar from all sources.

9 mg/kg 6.6 mg/kg

PROBABLE IMPACT OF THE SUGAR FORTIFICATION PROGRAMS IN CENTRAL AMERICA

3/x

Plasma Retinol in Pre-schoolers



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RETINOL STABILTY IN DIFFERENT INDUSTRIAL PROCESSES

FACTORY	SUGAR TYPE	LOST RETINOL (%)
Soft drinks	Direct white	100%
	Refined	33%
Candies	Raw	5%

COST-EFFECTIVENESS OF VITAMIN A INTERVENTION IN GUATEMALA

(HIGH RISK POPULATION: PRESCHOOLERS AND PREGNANT WOMEN) (1991)

INTERVENTION	COVERAGE (persons included in the program)	EFFECTIVENESS (persons who overcome deficiency)	COST/PERSON/ YEAR (US$)
Sugar Fortification [Retinol] 7.3 mg/kg	3, 643, 000	2, 418, 362 (67%)	0.98
Supplementation (Distribution of capsules)	46, 956	38, 405 (82%)	1.52
Long term gardens	23, 483	10, 503 (45%)	3.63

Source: Latin American and Caribbean Health and Nutrition Sustainability.