

Control of Vitamin A Deficiency

Fortification of Sugar with Vitamin A

Part I

Robert C. Dorion

Chairman of the Board
El Salto, S.A.

Lenin was supposed to have said, "There are no failures, just experience." If this is so, the Central American action team created by such experience and drawn from Instituto de Nutrición de Centro América y Panamá (INCAP) and El Salto, S.A., a medium-sized sugar mill in Guatemala, with the increasing support of others, deserve credit for the extension and application of the idea of adding Vitamin A to refined or plantation white sugar. Various social pressures raised great difficulties for this simple working solution to a nutritional problem. Winston Churchill said "out of great complications, great simplicities." Too often, just the reverse is true!

In 1970, Dr. Guillermo Arroyave and Richard Shar, two INCAP officials, visited this writer, an average industrialist, to discuss a project. They simply said: INCAP can add Vitamin A to sugar. After studying basic food sources, the

Instituto has found that white sugar is the best vehicle to transport Vitamin A to the rural populations in Guatemala, which have the highest deficiency of Vitamin A in their diet. If this project is successful, INCAP can feel satisfied that it is accomplishing its primary mission, *i.e.*, raising the average nutritional input of the needy segments of population in Guatemala. Generalizing the intake of Vitamin A will prevent a major cause of blindness and raise the health standards of a deprived group.

This specific Guatemalan experiment could have been done in less than two years, but it took seven years! Why? Let each reader, group or theorist explain it in his own fashion, chauvinistically or "objectively." This writer was very clearly impressed by the elegant simplicity of the project, as described, but replied, "It is just too simple, human nature will not let you get away with it! The politicians will give you a lot of trouble, unless they can get mileage for themselves." This particular part of the project's challenge was intriguing. Later, the prophecy proved all too self-fulfilling. However, the setbacks, disillusion and apparent injustices engendered an "esprit de corps" which could only have developed in adversity.

Considering that the Guatemalan Minister of Health had given 100 percent backing, one would wonder how the project could lose? However, in less than a year after the initial application techniques had been worked out, and serum studies had proven that sugar fortified with Vitamin A was a viable, simple, safe way to apply this sorely needed vitamin, all hell broke loose!

The sugar industry in general was adamant against change. When the

change became almost 50-percent inevitable, some enterprising sectors began to think of profiting by being importers of the "enforced" Vitamin A, as a *quid pro quo*. In fact, keen competition had shown some of its darker sides.

Local politicians within the sugar industry had a field day, both overtly and covertly. When the 50-percent inevitability point approached, one local came up with the idea of adding the cost of the application to the final consumer and raising the local price of sugar above the cost of adding Vitamin A. This, of course, was not the idea at all.

Another negative factor was the withdrawal of the same government officials who had promoted the original idea. The reasons for this change were evidently the strong industry resistance, plus a local chemist and pharmacist society which widely publicized that excess Vitamin A caused cancer!

As a generalist, not a specialist, this writer learned over the years that "future shock" is already upon us; one must become involved, rightly or wrongly, if one's point of view is to prevail. Giving up is hard, but a necessity for survival in many real life situations.

After a complete rout in the Guatemalan congress, a sad group of those who believed in the cause met with Dr. Bebb, director of INCAP, and Nevin Schumshaw, of the Massachusetts Institute of Technology, who were the prime developers of Incaparina, a high-protein, vegetable-based flour. The assembled "believers" decided to switch roles; somehow, the non-politicians had to become "politicians," *i.e.*, individuals charged with carrying out open policy in full view. In less than four months, without the complete backing

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of the already storm-battered Ministry of Health, the Vitamin A law was passed in Guatemala!

Invaluable aid was given to the project by Doña Elisa Molina de Stahl, president of the Guatemalan Aid Society for the Deaf and Blind, who had followed the group's progress and had a definite interest in preventing blindness. Indeed, Doña "Molly" became deaf to discouraging words and blind to failure. In one particular incident, she completely neutralized the negative sugar industry's most wily politician by reminding him that he was a "compadre" or co-Godfather, an important moral and social charge.

In another incident, attractive secretaries scratched their bosses' backs enticingly, believing themselves unobserved by Doña Molly, while serving the traditional "cafe." Doña Molly's keen eye took in the situation, and she launched herself into an impassioned speech to the co-owners of this rather difficult mill. "Tomorrow your children will be the heirs of your good actions because of the people's gratitude today," extolled Doña Molly. Because of her great sincerity and the special appeal of Doña Molly this group became "believers" and great allies to the cause, and the lonely ranks and numbers began to increase.

A big "faux pas" was committed by the opposition. The agent of a competitor posted a letter to a local newspaper, inadvertently using a printed envelope from his boss's sugar mill, rather than a plain one.

This was all that was required for a very able and experienced newspaperman to point to this "obvious" interested backing in a front page editorial, although the publication had never been known for any philanthropic work or social activities of any great standing.

Arriving late, a careless deputy of Congress approached this writer at a Rotary luncheon, whispering, "I really fixed the wagon of those Vitamin A nuts today in Congress." He evidently failed to realize that El Salto was 100-percent behind the Vitamin A project. Some time later, Dr. Carlos Tejada, the present director of INCAP, and your writer, working in concert, iterated our points, of view with the disgruntled deputy.

The "logic" of his resistance, at the later date, was based on the "freedom of man." He then stated that he was *not* against the needy getting Vitamin A through sugar. He defended the fact that every law was an encroachment on mankind's inherent "natural" liberties, and that each person had the inalienable right to determine for himself whether he wanted Vitamin A or not!

Proponents of Vitamin A argued that both the "rich" and "poor" city people lived in a cash economy and were obliged to assimilate some vitamin-enriched foods or had access to public health doctors, while the great rural groups did not. It was pointed out that fluorine and chlorine had been added to drinking water without a popular vote, and that INCAP had been instrumental in adding iodine to salt and developing Incaparina. In addition, INCAP was founded by the United Nations, its expertise had been well proven over the years and its primary concern was for the nation as a whole, not the individual!

No one won or lost the argument, but it helped neutralize this frantic negative public voice. Bit by bit, the "opposition," now clearly defined, identified and in the open, began to crumble or hide behind the "Vitamin A causes cancer" slogan, which was met squarely with vigor and fact. By that time, it had been found that the dosage could be cut by 50 percent and a method for preventing overdosage by a "pre-mix" intermediary step (based on the British Navy's time-proven "Grog" system) had been developed, sweeping away these arguments or at least making the "believers" more confident.

When the government approval was finally given, it was found that the sugar industry was in mid-crop and Vitamin A fortification was not practical to enforce, so another year was lost. Feeble, but determined quarters tried to postpone the law behind the scenes during the off-crop season, but met with failure. At last, the great day came. With official fanfare, INCAP and the government inaugurated the beneficial Vitamin A-fortification program, but at a competing sugar mill.

The government of Costa Rica was the first to apply the system. Ironically, Guatemala, the developer, was number two. It was also ironical that El Salto makes a premium-grade Plantation White sugar, used primarily by local industry. Industrial sugar does not require the addition of Vitamin A, since it is assumed that the person who can purchase soft drinks, cough syrups and medicines is not essentially Vitamin A deficient. A point had been made; the industrial user had fears that the added Vitamin A could affect their processing.

It is obvious from the above that technology alone is not the whole answer when a really new idea is to be introduced. It is necessary to have a proper blend of talents and expertise in the hard and soft disciplines, working as a team with clearly defined and understood objectives and goals. Such an action team should be reflective and flexi-

ble; the hard line of the purish is incompatible, inefficient and time consuming.

By the time a tenth country legislates Vitamin A as a required additive to non-industrial sugars, new "experts" for Vitamin A will appear. However, excess technocracy at either extreme, pro or con, should be avoided. Each nation, each sugar industry, each nutritionist and each government leader should work within the existing framework, in order to sell the idea to each sector on the real merits of the idea. One cannot legislate goodwill, regardless of cause.

Human nature resists change and new ideas. Persistence should not be confused with insistence. The members of the team which fought for the fortification of sugar with Vitamin A are all better and wiser for a good fight, but all would have been losers if new ideas, inventions or concepts fail to be developed, even at their own expense. "There is always a better way", a sage once said. It is up to the reader to see if this statement applies, in all clear conscience, to himself, his particular situation and subsequent actions, in the name of "progress," logic and just plain common sense.

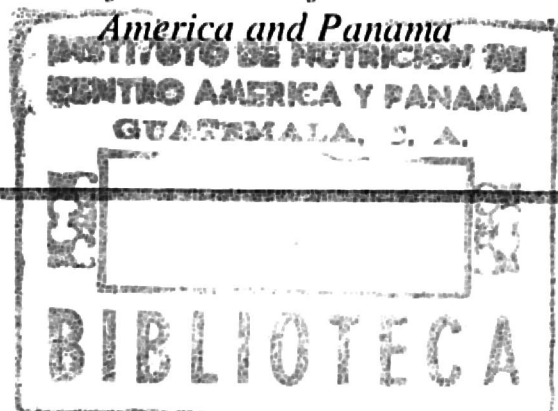
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INCAP I-936

Part II

Guillermo Arroyave

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This article is a case report on the work that led to the fortification of sugar with Vitamin A at the national level in two Central American countries. It is intended herein to show different aspects of the overall program, in the research and development phase, the industrial and technological feasibility, the economic aspects, and, finally, the administrative and political factors which had to be taken into account to reach the final goal.

The first step necessary in the development program was the definition

of the problem of Vitamin A deficiency both from the qualitative and quantitative viewpoints. This writer would like to emphasize that this phase is a very fundamental one, because only when the problem is carefully defined, and its nature, magnitude and distribution among a population are established, is it possible to take specific steps leading to its practical solution.

The data that had been collected during extensive nutritional surveys carried out in the Central American area provided base-line information that demonstrated that Vitamin A deficiency was one of the most severe and generalized nutritional problems among the populations of Central America. This was the result of a very inadequate intake of foods containing Vitamin A. When the intake of Vitamin A of large sectors of the population, particularly those in the rural, low socio-economic level, were compared with the recommended dietary allowances proposed by the World Health Organization (WHO) and the Food and Agricultural Organization (FAO) of the United Nations, it was evident that there were large sectors consuming extremely inadequate amounts of vitamin A, with a consequent insufficient supply of this important vitamin to the tissues.

These dietary data were confirmed by analyses of blood serum in a representative sample of the population, indicating that a very significant portion of the population, particularly in the one to 15-year age group, had levels below 20 micrograms of retinol per 100 milliliter of serum, while a still important portion had levels below 10 micrograms per 100 milliliter of serum. The segments of the population with these low values are considered the population at risk. Not all members of this population were suffering from overt, clinical manifestations of vitamin A deficiency but it was obvious that the serum levels reported suggested that the liver reserves of vitamin A in these subjects were either nonexistent or very small. This population group was considered to be "at the risk" of falling into a more severe and actual stage of vitamin A deficiency, with clinical manifestations.

The data described were considered sufficient reason for concern to the Institute of Nutrition of Central America and Panama, one main responsibility of which it is to design and develop intervention programs to be proposed to the governments of Central America and Panama to solve the different nutritional problems affecting their populations. Instituto de Nutricion de Centro America y Panama (INCAP) therefore embarked on research to determine what solutions could be given to the problem. The staff recognized, then, that the

permanent and most logical solution to the problem was an overall improvement in agricultural production, as well as economic and social development, to make accessible to all people in the Central American countries an adequate, well-balanced diet, which would supply sufficient sources of vitamin A.

However, it was also considered that this solution was a long-term one, and, in view of the seriousness of the vitamin A-deficiency situation, other measures should be taken that would promise more immediate benefit. After analyzing different alternatives to the problem, it appeared that the approach of food fortification with vitamin A was a reasonable solution. A series of analyses of alternatives was started to judge the potential of different foods to serve as possible vehicles for the addition of vitamin A.

Staple foods, such as corn and beans, are not suitable vehicles, because they are usually grown at home and are also processed at home; *i.e.*, there is no central location where vitamin A can be added. Wheat was also considered as a potential vehicle, but the data indicated that wheat flour reached a sector of the population existing on a higher socio-economic level, and that the population suffering most from vitamin-A deficiency did not consume flour, or consumed insufficient amounts of it. In addition, all foods such as margarine, milk and similar fat-containing foods were discarded, because, again, these foods do not reach the population requiring additional vitamin A.

This process of analyzing potential food vehicles for vitamin A finally led to the consideration that white sugar was the most promising carrier for the vitamin. When initially trying to determine if, from a technical point of view, it would be possible to mix vitamin A with sugar, the first technical contact was made with the research personnel of Hoffman-La Roche through a conversation with Dr. S. H. Rubin. He considered that cooperation between Hoffman-La Roche and INCAP would be possible and favorable to determine the best form of vitamin A that could be made commercially available and suitable for the fortification of sugar.

A series of samples were tested, all of which belonged to the family of water-dispersible vitamin A's. Adequate preliminary results were obtained by mixing sugar with one of the Hoffman-La Roche products, namely palmitate 250SD, which was already in production and had been designed for the fortification of wheat flour. The results of this initial laboratory testing were very promising, but not definitive. There remained the problem of the segregation of the sugar-vitamin mixture. The initial

experiment mixing produced a homogenous mixture, but, in the process of storage and transportation, the vitamin A tended to segregate from the sugar, which naturally produced different vitamin concentration zones according to the level in the container.

The Hoffman-La Roche and INCAP team then tried to develop a premix that would insure non-segregation, or physical stability of the vitamin-sugar mixture. Technical assistance was obtained from both the Nutley, New Jersey, and Basle, Switzerland laboratories of Hoffman-La Roche. The premix, with proper characteristics, was developed in a relatively short time. It contained 50,000 International Units (IU) of vitamin A per gram, and this was tested at the industrial level to demonstrate that it was practical and appropriate for producing uniformly fortified sugar.

In relation to the development of an industrial process for this addition, your author would like to emphasize the direct cooperation of the private sector of the sugar industry in Guatemala, particularly the cooperation of one of the sugar manufacturers, Robert C. Dorion, of El Salto, S.A., and the chief engineer of that factory, Eusebio Portela. They devoted extensive time to the testing of the process in the sugar manufacturing plant, working until there was satisfaction, through many trials: that a sugar containing the appropriate amount of vitamin A could be produced; that it was stable, both physically and chemically; and that the final sugar, fortified with vitamin A, did not have any detectable change in color, flavor or any other physical or organoleptic characteristics that would make it an undesirable food for the people.

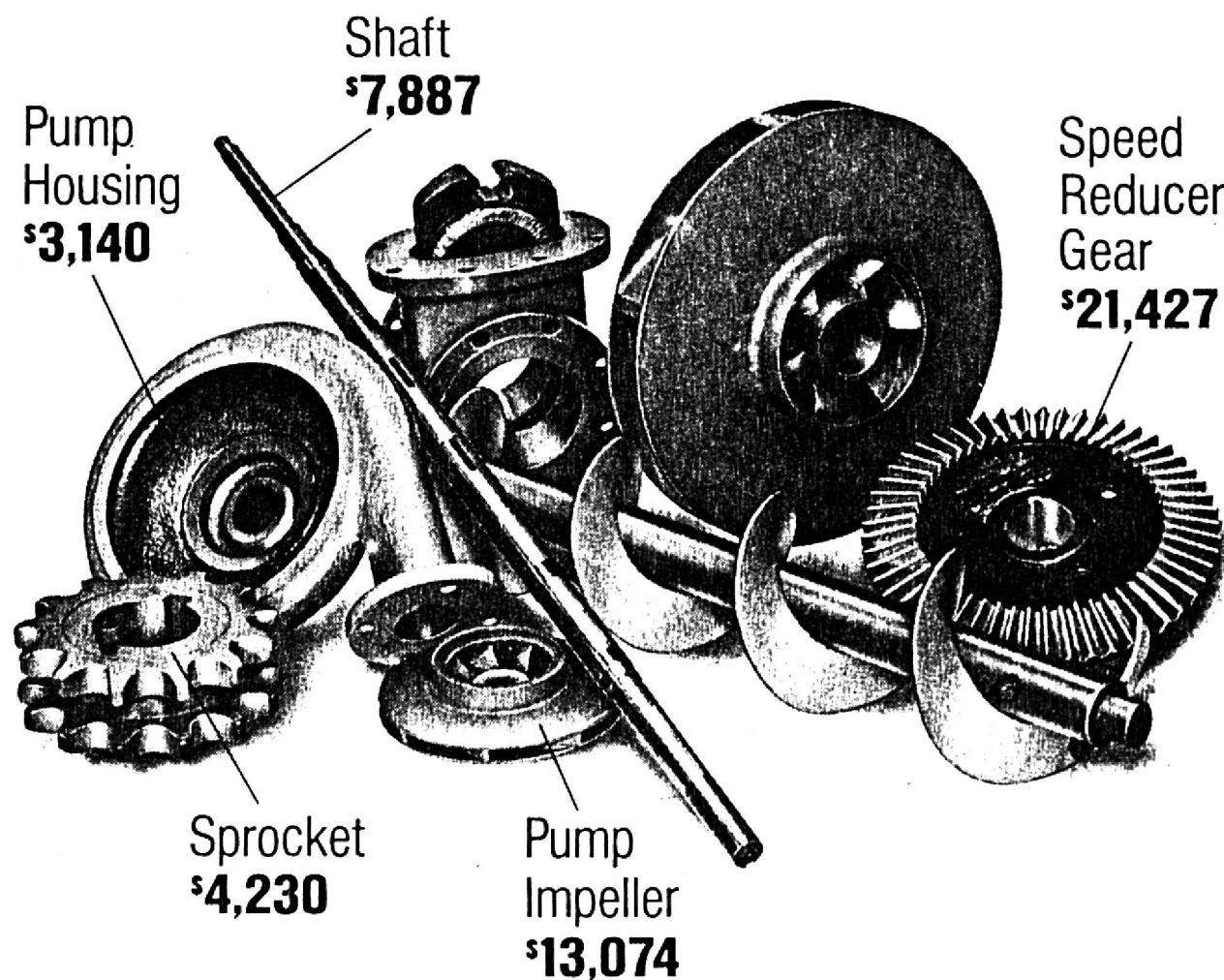
Once this was done, INCAP was ready to propose the process, and to make it become a program at the national level in those countries where it was known, by previous data, that there was a serious problem of vitamin A deficiency. The lesson that can be drawn from this presentation, up to this point, which your author would like to emphasize very strongly, is that the fruitful cooperation obtained from three important sectors made it much simpler and faster to arrive at a logical, practical process to fortify sugar with vitamin A. The cooperation of the vitamin A manufacturer, Hoffman-La Roche, together with the sugar manufacturer El Salto, S.A., and INCAP, represents forces that, combined, made it feasible to reach the goal in a shorter time.

After this process was proposed to the government, there came another phase in the whole program, namely its implementation at the national level. It was believed from the beginning that the best way to have an extensive and con-

tinuous national program would be to convince the various governments to pass a law that would make vitamin A fortification obligatory. Therefore, initial contacts were made with the governments, and the plans were discussed with them. There was a good initial reception at the various Ministries of Health. Government personnel also shared the idea that it would be necessary to pass a law similar to the iodization of salt bill, which had been passed previously in several Central American countries.

This phase gave rise to perhaps the greatest frustration in the project. Immediately after the proposal to fortify sugar with vitamin A was announced and, hence, made public, a definite, clear opposition to the idea began to develop, which reached important proportions. This opposition came principally from a group of sugar manufacturers who claimed not to be in agreement with the idea; this group had not taken part in the development of the process in the initial phases.

(continued on page 40)



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it is difficult to analyze the real reasons for this opposition. It may have been partly due to the fact it was proposed that the costs of fortification should be absorbed by the sugar manufacturers, *per se*. This was principally based on precedent. Wherever and whenever in the past there had been an enrichment or fortification program for foods produced at the industrial level, it had been the manufacturers of those foods who absorbed the cost of the enrichment or fortification.

Another reason could have been that these commercial-industrial people were not equipped with sufficient information, or pretended not to be, to understand the value or the significance of the fortification of sugar with vitamin A. Therefore, a very extensive publicity campaign was started to *educate*, not only those people in the sugar industry who opposed the program, but also the public themselves, to make the public become a pressure group in favor of the program. In this particular instance, the Guatemalan press and the Costa Rican press played a rather important and decisive role. The number of articles, press interviews and editorials that were published throughout a period of about two years reached over 150, and most of

them were in definite support of the fortification program, and emphasized that the measure would benefit the people, from the point of view of their nutrition.

When the law was proposed to the governments by INCAP, it was considered by the Ministries of Health, and, once approved, went on to be signed by the president, and, finally, to Congress for discussion and final disposal. At this point in Guatemala, the strong opposition from the sugar manufacturers played a very significant negative role. They developed a campaign, unknown to INCAP at the time, which convinced a large number of representatives in Congress that the program was not beneficial, and that Guatemala was not ready to implement the process.

The result was that, the first time the proposed law was submitted to Congress for discussion, it was rejected. This was perhaps the "lowest" point in the project, since the proponents were temporarily discouraged. They did not rest, however, but started a heavier campaign to convince those most directly involved, *i.e.*, important people in the medical sector, Congressional representatives and people in the government and industry. A few months later, after extensive campaigning, the

law was again submitted to Congress, with slight modifications. This time, it was approved, and Guatemala had a law for the fortification of sugar with vitamin A. One month earlier, however, the Costa Rican government had been the first in the world to sign a law of fortification of sugar with vitamin A.

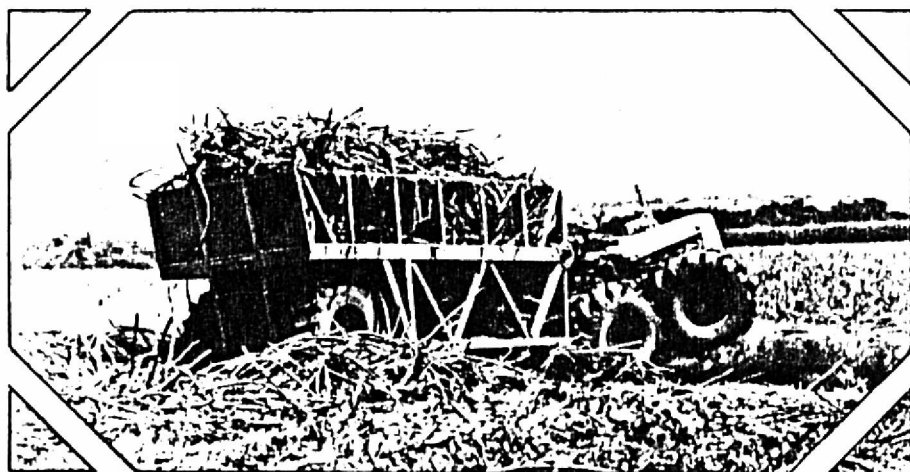
One of the factors that determined the rapid approval of the law the second time was the cooperation with INCAP of a group of professionals directed by the president of the Committee of the Blind and Deaf of Guatemala, Mrs. Elisa Molina de Stahl. She is a politically strong and very determined professional woman who was convinced of the benefits that the program would bring to the Guatemalan people in preventing vitamin A deficiency and, possibly, blindness due to it. These joint forces helped to make the law and the fortification program better understood and accepted by many, instead of only a few. At the present time, two more countries in Central America have laws making the program compulsory, Panama and Honduras. Costa Rica, Guatemala and Panama are already adding vitamin A to their sugar; Honduras will begin in the very near future.

Your author would like to summarize the important factors contributing to the successful implementation of the process at the national level: the close cooperation and support of professional groups, *i.e.*, medical, pediatric and biochemical; and the fact that scientists from INCAP got out of their laboratories to engage in, in essence, a political role, by getting in direct contact with political people to present their program in simple terms, and, especially, to explain the significance of the problem of vitamin A deficiency and all its undesirable consequences. This type of action took about one and one-half years of devoting extensive time to those contacts and discussions with key people in government and in the private sector.

These efforts developed into a three-member party enterprise integrated by INCAP, as the scientific and technical resource, along with the government, responsible for the policy decision, and with the private sugar industry sector directly in charge of carrying out the fortification in their factories and absorbing the cost.

A program for the evaluation of the fortification of sugar with vitamin A is now being carried out. This includes the evaluation of the delivery system and the evaluation of the biological effectiveness of the program. When this evaluation is finished, the team will know to what extent this intervention has modified the indicators that reflected a serious problem of vitamin A deficiency.

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