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Dr. Zlotkin: We started talking about epidemiology, went on to understanding physiology and impact, and ended I think very appropriately with looking at how we can deal with this issue. So we have appropriately gone full circle. For the last few minutes there is really nothing specific prepared. I thought I would ask the audience if they had any questions for any of the speakers, I think this would be the time to do that. Depending on the number of questions I thought it might be an interesting way to close by offering each of the speakers a final word. It is always difficult to write your thoughts before you have heard the other people speak. If anyone has the desire to make a couple of final comments, we are the experts in our individual areas and you have a willing audience here. Are there any questions for any of the speakers of the last 3 days?

Dr. Specker: A question that has been going through my mind is whether it would be useful to have people directly address the vulnerability of the breast-fed baby. In the course of the 3-day workshop any number of times we have talked about the importance of breast-feeding but there are real issues about the micronutrient status of the breast-fed baby under certain conditions, and it seems as though it has been articulated in bits and pieces but not necessarily as a synthesis of what is known about that.

Dr. Zlotkin: I actually think that it is a very interesting question. Not a simple question to answer without giving it a lot of thought because like most things certainly breast milk is a complex biological fluid which has complex immunologic properties, important and complex social properties in terms of bonding, and complex and important nutritional properties. If we think of the nutritional properties it is a nutritionally complete food, with the possible exceptions of vitamin D if you happen to live in Canada or Mongolia, with the possible exceptions of iron if you happen to be born prematurely or born to a mother with poor iron status. It is an important topic but not a topic without controversy and emotion. I think that the general statement that we have to live with is a WHO statement. Whether we agree or disagree with it, we have to live with it because at least in the short-term we can't change it. I think that we should in fact plan around the boundaries in terms of our attitude toward the developing world. We have to live with the statement that breast milk is recommended exclusively for the first 6 months. We all know that this recommendation is not followed and many of us may feel that there are problems with this but despite how we feel as an organization we have to live within these boundaries. I asked Dr. Lönnerdal why is mammalian milk such a poor source of iron and the answer is not perfectly straightforward. Dr. Lönnerdal, do you want to comment on that?

Dr. Lönnerdal: I can only reiterate what I said that it is remarkable that anemic women in southern India have identical iron content in their milk as Finnish women

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taking 120 mg of supplemental iron/day. That means that the body has invented a very delicate mechanism in order to regulate this very tightly and to me it seems to be the reason. So it may not be that iron is too low, there are other things that we should be more concerned about. Since I have been given the opportunity I would like to go back to a discussion I had with Dr. Bhutta during the break. One of the things we have discussed very little here is education. Whatever we do should come with proper education. They have done a study just having education as an intervention without micronutrients and had a very significant effect on micronutrient status, which I think is highly relevant for discussion. When it comes to breast-feeding, we can take the example that many cultures have discarded colostrum for a long time. Everybody knows that this is disadvantageous for the newborn child. The only way to overcome that is education and say that there are very valuable components in colostrum. A similar thing could be done about exclusive breast-feeding. I don't think that the problem is that breast milk is of poor quality, the problem is early weaning at 1 or 2 months, but this is still a relatively recent development. Take farmers for example, they would never put a newborn cow on a straw diet. Similarly we are all mammals and there is a certain time when we should most likely be on milk. That message has not been carried out and education can do a lot of good. That doesn't negate any of the other things we are talking about, but education should come integrated with all these things rather than just dietary interventions.

Dr. Neufeld: I agree completely with that, and in practice the message of breast-feeding until 6 months is completely meaningless unless the patient is told how to do that, unless very concrete advice is given on what happens if there are physiological problems, what happens when the mother goes back to work. Perhaps some companies need to develop an effective low-cost breast pump which could be very useful to women in developing countries. Right now anything that is actually worthwhile tends to be very costly and people don't have access to that. There is a whole series of things that could be brought into education and practical solutions that we just don't do and without that, 6 months is just some number that the scientists have come up with, it is not real to the world. But with some concrete recommendations it could be.

Mr. Parvanta: I agree completely in the concept, the issue, the importance of education. I would like to just mention one specific point related to that: we need to involve professionals who know how to develop an education method or messages in a good way, especially behavioral scientists and communication specialist because often we target the wrong audience. Often women are not the ones who decide what the baby should eat, in many societies grandmothers decide or the mother may not immediately have the say. So education is important, but beyond education we have really to consider the audience to receive that education in order to make the kind of societal changes that need to take place. There are examples of successes of these kinds relating to infant feeding practices.

Dr. Castillo-Durán: I think that in research there are many international collaborative efforts. Many of the results come from privileged groups in collaborative efforts, but when we cross from research to intervention I think we must sometimes separately analyze in different ways in countries. The poorer people may need different strategies and not extrapolation from one to the other kinds of groups. Some approaches that I showed in my presentation tried to divide into different kinds of countries. Maybe the conclusions for the 2 or 3 varying groups could be different for the interventions and not extrapolated from the solution for the very underprivileged group to the more developed countries.

Mr. Parvanta: I would like to take the opportunity to come back to Dr. Guesry. At CDC we would like to get some feedback on how best we can engage the industry globally and also in relation to what you said with regard to political will. You are

absolutely right, there is a lack of political will. In a different food fortification effort that Dr. Venkatesh referred to, the flour fortification initiative which is headed by MI and CDC and other partners, the idea was that we would engage the flour industry, the flour and grain industry around the world to take on the cause as something that is their responsibility and something good for them to do. In 12 months we have really moved very far, and they have taken on major responsibilities. But one of things that is important is the political will. Our contacts at the government level of countries is through the ministries of health, so that is where our leverage is and that is where we can influence political decisions. Industry on the other hand has other contacts within the government or the public sector. So my question is how do you think we as public agencies should engage the commercial baby food industry in various parts of the world to help them to take on the cause in a more global way, and to let them take on some responsibility coming from their side of the equation rather from our side of the equation alone?

Dr. Guesry: I think we have already covered this issue earlier today when we spoke about the Codex Alimentarius Recommendation which is a guideline for the whole world industry for infant products: breast milk substitutes, follow-up formula, growing up milk, and baby cereals, and these recommendations are very clear and there are norms for food fortification. But I understand that these recommendations from the Codex Alimentarius are not mandatory in every country. By the way in Europe it has been translated into mandatory recommendations by the European Committee of Nutrition, so in Europe there is no other choice than to put on the market products which are enriched. Although I am not so much in favor of imposing things, I suspect that it would probably be faster and more efficient to contact the ministers of health to recommend implementing this Codex Alimentarius Recommendation in their own countries. That would be quite fast and efficient.

Dr. Horton: I would like to take a somewhat different tack on Dr. Specker's initial question, the difference between the short run and the long run and the quick fix and the underlying solution. The problems with breast milk for babies with very low birth weight born to mothers with very low iron stores to start with brings up the problem of the quick fix. To some degree micronutrient fortification is a medium term quick fix for us being able to do longer-term things with the quality and the variety of the diet, and the baby of less than 6 months shows us the problem of a quick fix. I think a long-run fix on that is you have to do something with the status of women and the nutritional status of women, and there is no quick fix for that. This is something Dr. Lozoff and I were separately discussing as we pondered on Dr. Bloehm's very interesting presentation which was both encouraging and discouraging. On the one hand he said all these health interventions that Indonesia has been undertaking, all these projects the non-governmental organizations have been undertaking, didn't do much in the face of enormous economic disruption and negative economic growth. My view is that it is not possible to do that in a context where people's real incomes declined by 40% and we should not expect micronutrient fortification to be able to succeed in the face of that. On the other hand we should not give up either. Perhaps there are things that can be done with these more limited programs. The thing that is encouraging about micronutrients, that is less encouraging about macronutrients (energy and protein), is you can do things, there is a possibility to achieve the millennium goals, but I think it would be much harder to achieve millennium goals that are described in the nature of stunting and underweight for children.

Dr. Parampalli Maiya: We are not supposed to give multivitamin drops to babies born in hospital. So supplementations including vitamins and these micronutrients are drawn if these babies continue to be exclusively breast-fed for 6 months. I heard from the different presentations that subclinical micronutrient deficiencies do occur before

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the age of 6 months. So when we withdraw this supplementation from these babies are we going to have trouble with these babies? My second question is, I heard that vitamin D deficiency does occur before the age of 6 months if the mothers are vegetarian and they exclusively breast-feed their babies. Vegetarianism is very common in our country and I feel that such exclusively breast-fed babies should be given vitamin D supplementation also. The third thing is, this morning we touched upon oral rehydration and zinc fortification. It is very well known now that a lot of zinc is lost in diarrheal stools. Probably this is one of those things which could go through the pharmaceutical industries without going through the politicians, supplementing or fortifying the oral rehydration solutions with zinc.

Dr. Abrams: I think the first question was, is there any consistency between the rules for the baby from the hospital and current guidelines to give vitamin D supplementation in infants, and as I understand nothing should be given in the newborn nursery other than breast milk. But the American Academy of Pediatrics recommendations don't suggest that vitamin D needs to be given before 2 months of age because there is really not much need in any of these circumstances before that. Now I could imagine that there could be a small conflict between a hospital that is really trying to admit 2- or 3-month-old babies and trying to keep breast-feeding going. We are talking about supplements, not vitamin drops, and I can tell you that although there is some opposition to the vitamin D recommendation in general, it is not that strong.

Dr. Specker: As far as the vegetarian mother is concerned I don't think the vitamin D requirements are any higher and, as long as the infant and mother are outside, they are going to be getting the all the vitamin D that is necessary. The reason for the high rate of vitamin D deficiency among some vegetarian mothers has also to do with the clothing customs of certain vegetarian groups and their lack of sunlight exposure. There should be no reason why the vitamin D requirements are any greater in vegetarians than non-vegetarians.

Dr. Pettifor: I think there is some evidence that low-calcium diets, seen often in vegetarian diets, may in fact increase the catabolism of vitamin D. There were some studies done looking at the effect of low calcium diets on the turnover of 25-hydroxyvitamin D and vitamin D itself [1]. It reduces the half life of 25-hydroxyvitamin D from about 17 or 21 to about 10 days, when an individual is put on a low-calcium diet. So there is some evidence.

Dr. Specker: But I would argue that those mothers would have to be marginally vitamin D-deficient.

Dr. Pettifor: I think the issue is that an individual may be marginally vitamin D-deficient for instance in an urban environment, particularly an Indian environment for instance where clothing is fairly extensive, where houses are very close together, the mothers don't get out very often, they may well be marginally vitamin D-deficient. On top of that there is a low-calcium diet that is associated with vegetarianism, then vitamin D deficiency may well be precipitated. So I think what one must do in individual countries is to assess the vitamin D status of mothers to discover whether or not there is a need for vitamin D supplementation during pregnancy or during lactation in fact. It may not be necessary and obviously each country will be different, so to take the American Academy of Pediatrics recommendation and say that is a global international policy, is probably inappropriate. We haven't answered the third question which was related to the need for zinc in oral rehydration fluid. Was that the issue? Vitamin A, was it?

Dr. Guesry: It was zinc but also vitamin A.

Dr. Pettifor: Would somebody like to answer this question: why isn't vitamin A and/or zinc put into an oral rehydration solution? Now the comment that was made this morning was that the duration of time that oral rehydration is given is short and therefore the effect would be marginal. I don't know what the effect on cost would be.

Dr. Barclay: There are studies showing that administration of zinc during acute diarrhea does shorten the duration of diarrhea [2].

Dr. Castillo-Durán: There is evidence that supplementation during acute diarrhea decreases the duration and the risk of complications due to diarrhea, but in relation to the zinc content of oral rehydration solution, I don't know if we can use the amount needed to increase the zinc status because the amount that the children drink would be greater. Most the children drink about 500–700 ml/day during 2 or 3 days, and it is difficult to increase the amount to increase zinc status.

Dr. Ribeiro: The experience with using oral rehydration solution for any other additional purpose besides prevention and/or dehydration treatment has not been successful. The possibility of misunderstanding is quite high. In the past, the addition of some caloric content to the oral rehydration solution led mothers to keep using the oral rehydration solution as a food later on. So I don't think it is a good idea to put zinc into oral rehydration solutions.

Mr. Parvanta: On the same issue of vitamin D and a follow-up from Dr. Pettifor's comment about using US-based recommendations or Canadian-based Academy of Pediatrics recommendations and adapting those to the other settings. Dr. Specker, in your presentation you mentioned that the American Academy of Pediatrics made a recommendation about infants not being exposed to sunlight. Could you explain what that exactly means?

Dr. Specker: The American Academy of Pediatrics is going along with dermatologists who do not recommend sunlight for infants. That is why the meeting of the CDC was called because if you can make adequate vitamin D through sunlight exposure then vitamin D should not necessarily be a problem, but the American Academy of Dermatologists recommends no sunlight exposure for infants.

Dr. Abrams: The American Academy of Pediatrics agreed with the American Academy of Dermatology that children should have effective sun block when they are out in the sun.

Dr. Specker: Because of those recommendations they are now saying you cannot depend upon sunlight exposure in infants for vitamin D synthesis. We can't encourage sunlight exposure for production of vitamin D, but at the same time turn around and say they shouldn't be exposed, so that is the reason for the change in the recommendation.

Mr. Parvanta: So to follow-up what would your advice be to other countries vis-à-vis that recommendation?

Dr. Specker: I think moderation is great.

Mr. Parvanta: Basically you are suggesting that not everybody adopt that type of recommendation.

Dr. Specker: I personally would not recommend that.

Mr. Parvanta: I think it is dangerous in dark-skinned individuals. In those individuals skin cancer is not that common.

Mr. Specker: I think 10 min of sunlight exposure a day in even a fair-skinned infant does not represent a significant cancer risk. But the dermatologists may disagree with that. My concern actually with that recommendation is not just so much with vitamin D, but if parents are now told that children should have minimal exposure to sunlight, what is that going to do to obesity rates? It is also a big issue because in all of our studies on factors affecting physical activity in children, one of the biggest predictors is time outside, and now there are recommendations that children should not go outside, and I am not so sure that it is a healthy recommendation.

Dr. Zlotkin: I would like to thank the Nestlé Company. They gave Dr. Pettifor and I absolute carte blanche in inviting whom we wanted into this meeting; we had absolute carte blanche in determining what the program would be, and what they did was the hard part of making it all happen. So on your behalf I would like to thank the Nestlé Company for giving us the opportunity to get together and have a free and open discussion about what I think is an interesting and important topic. Thank you.

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References

- 1 Clements MR, Johnson L, Fraser DR: A new mechanism for induced vitamin D deficiency in calcium deprivation. *Nature* 1987;325:62–65.
- 2 Bhutta ZA, Bird SM, Black RE, et al: Therapeutic effects of oral zinc in acute and persistent diarrhea in children in developing countries: Pooled analysis of randomized controlled trials. *Am J Clin Nutr* 2000;72:1516–1522.