

## Discussion

PROFESSOR G. C. ARNEIL: Does Dr Crawford have any evidence on the modern low-solute milks, such as SMA 26, Osterfeed or Cow and Gate Premium?

DR M. A. CRAWFORD: We've studied children who have been fed on low-solute SMA but the data that I showed you related to a conventional cow's milk formula. If you remove the cow's milk fat and substitute a vegetable oil, you are providing linoleic acid but none of the longer chain derivatives present in the cow's milk. These are present at about an eighth of the concentration of human milk. So by replacing the cow's milk fat by a vegetable oil you are simplifying the whole picture in favour of linoleic acid alone, and we are not happy about that.

DR E. JEPSON: What other sources are there of the essential fatty acids for a child after weaning?

DR CRAWFORD: It very much depends what the mother feeds the child on. Green vegetable purées provide  $\alpha$ -linolenic acid, liver and fish are rich in the long-chain polyunsaturated derivatives, the oils used for cooking provide linoleic acid, as do the cereal foods. One point I would like to make is that some manufacturers use the label 'made with vegetable oils' which is inadequate because it could be coconut oil, or it could, indeed be hydrogenated vegetable oil, in which case you would not be providing essential fatty acids.

DR W. F. J. CUTHBERTSON: Am I to understand from Dr Crawford that the C18  $\omega$ 3, and the C20 polyunsaturated fatty acids are essential fatty acids in the sense that they must be supplied in the diet as well as what we have grown up to believe to be the essential fatty acids linoleic and linolenic?

DR CRAWFORD: No, I don't think C20s are but I think the complexity of their bio-synthesis has been overlooked. The studies of Hassam in our laboratory, and Brenner in the Argentine and Sprecher in the States all demonstrate that linoleic acid is not equivalent to arachidonic and it takes about thirty molecules of linoleic acid to produce one of arachidonic. So I was really looking at it the other way round. What I was saying was that if you omit the small percentages of arachidonic acid and docosahexaenoic acid from the calculations you are making a much bigger mistake than would appear from their small proportions.

DR CUTHBERTSON: Do I understand, that Dr Crawford is retracting and he will now accept the view that linoleic acid is a sufficient essential fatty acid and all that needs revision is the quantities which are required? Is that a true statement?

DR CRAWFORD: No, I'm not retracting what I have not said. In membranes throughout the whole of the human body, both families of essential fatty acids are present; the ratio of linoleic to  $\alpha$ -linolenic acid in the human fetus (where you can analyse the whole thing) is roughly of the order of between four and five to one in favour of linoleic acid. Now, all work has been mostly done on linoleic acid and we know much less about  $\alpha$ -linolenic acid, so I would leave the question open about the essential fatty

acid requirements of  $\alpha$ -linolenic acid. I would not say that it is not required; also, any consideration of EFA requirement needs to take the long chain polyunsaturated fatty acids into account because of (a) their higher biological activity and (b) the rate limitations imposed on their biosynthesis by the desaturase.

PROFESSOR R. M. LAUER: I was impressed by the demonstration that you showed of the differential rate of growth of the brain versus the arterial wall, with the brain being almost full-sized by 2 years. Do you think there is anything in what you know that would relate to the nutritional requirements as far as saturated or unsaturated fats and total cholesterol intake during that very critical period?

DR CRAWFORD: You are specifically referring to saturated fats and cholesterol? Yes, we really don't know enough to answer that question. I am personally schizophrenic about it, because of course human milk contains cholesterol, which is required for the arterial and every other membrane in the body; I am just not 100% certain whether it is right to feed babies on diets which have no cholesterol in them. There is an opposite view, i.e. if you feed cholesterol during this early stage you encourage the mechanisms for suppressing endogenous cholesterol synthesis; if you don't, you encourage endogenous synthesis. The only thing I would add is that during this early period of growth and development there is a high demand for energy and of course the best source of energy is fat and that human milk has got a lot of fat in it. In fact, it has got more fat really than anything else, on a percent energy basis.

PROFESSOR LAUER: Are there any animal experimental data that would say that myelination or abilities for rats to go through a maze would be better if they were fed more saturated fat?

DR CRAWFORD: The converse evidence is available. Clausen and Moller of the Neurochemistry Institute in Copenhagen demonstrated that if you put rats on diets deficient in essential fatty acids they became susceptible to the encephalytogenic protein which attacks the myelin. There is also evidence that feeding pregnant rats on EFA-deficient diets induces learning defects, and these learning defects were permanent despite later reconstitution of the diet. I don't know of any experiments in which the effects of saturated fat have been studied in this context.

PROFESSOR J. H. DE HAAS: I am very impressed with what you have told us, Dr Crawford, but I have not understood your suggestion that the fatty acid composition of breast milk in African mothers and European mothers is more or less the same. At what age of the infant were these samples taken? My other question is, you spoke only about fatty acids, assuming that the composition of fatty acids is more or less the same in African and European mothers; why did you not mention the many acid deficiencies of breast milk of African mothers? I am not so familiar with African as with Asian mothers and you did not mention even if the fatty acid composition is

similar. So many other deficiencies exist that I think it would be worthwhile to mention them.

DR CRAWFORD: You are absolutely right. We have done a study on the changes of composition in mothers throughout nine months' lactation. The data I presented were from mothers at about 4–6 weeks after birth and they were from well-nourished mothers. We have also studied

mothers at later periods of lactation in Africa when growth rate was failing in the baby (rather like the Indian situation) and the most profound effect was not on the milk protein or sugar but on the milk fat; it was the milk fat which was low in the situations where maternal nutrition is apparently inadequate to support lactation.