

---

From the Pediatric Department, State University,  
59 Oestersingel, Groningen, The Netherlands

---

## Nutritional Status as an Important Factor in the Health Status of the Adult

by

J.H.P. JONXIS

### Abstract

*Malnutrition in the first year of life may cause permanent damage to the individual. There may be a permanent retardation in growth if the malnutrition is a serious one and the food intake is severely insufficient over a longer period. Specially when malnutrition occurs in the first months after birth, it may cause damage to the central nervous system.*

*As long as the breast-fed child gets enough breast milk, it is unlikely that serious problems arise. The decline in feeding in many developing countries is a serious problem, especially because the alternatives for human milk are not always available, owing to economic factors. In the countries of the Western world there exists just the opposite problem; owing to partial over-nutrition abnormalities in fat metabolism may occur, which may influence the health of the individual later on in life.*

\*) Invited Paper at the Third National Indonesian Paediatric Congress, Surabaya 1-6 July, 1974.

Received 4th. August 1974.

Since the great infectious diseases, which in the first decennia of this century still determined to a great extent the health conditions of a population do not play a role anymore in western countries, it is possible to estimate the influence of nutrition of the child on the health condition of the adult more exactly. But it still remains difficult to collect precise data, as the nutrition of every population and also that of the young child, is changing continuously.

The present adults have in many cases been fed in their infancy, 30-40 years ago, very much differently from the children of today. The reason for the increasing interest in nutrition is found in the fact that, in spite of the enormous progress in medical treatment, the health condition in western society, is not a very good one. The average life span of a male tends to become shorter again. The number of people dying of heart and coronary diseases is increasing. Naturally, one wonders about the cause of this; nutrition in infancy may be one of the causes of the arteriosclerosis in the relatively young adult male.

It is known, that nutrition influences growth. If the growing individual is malnourished, his growth rate decreases. An important phenomenon, that was studied for the first time by McCance and Widdowson, may be noticed, namely the fact that the somewhat older experimental animal catches up its growth if it gets

enough food after being starved for some time. If the malnourishment takes place during intra-uterine life, or soon after birth, however, the growth retardation cannot be corrected when later on enough food is available.

This phenomenon is an indication, that malnutrition at an early age has a much more severe effect than malnutrition during a somewhat later phase of development. In those phases of growth in which the number of cells in the body increases rapidly and cell differentiation is still in progress (for the human being the period before and shortly after birth), a lack of nutrients will have greater permanent consequences than later on.

In the human being the development of brain tissue is very rapid in the last months before birth. At the age of two years the growth of the human central nervous system is completed for the greater part, while most other organs are still developing. In some cases, for instance in muscle tissue, this growth is, however, mainly based on enlargement of the cell, and not on an increase of the number of cells. When by a lack of one or more nutrients in a certain critical phase of development the normal cell division and differentiation has been arrested, this may have a permanent effect on the development of the individual. As this development takes place in a strict time schedule, a later abundant quantity

and quality of nutrients cannot restore the damage by delayed cell division and differentiation.

We are well informed about the influence of nutrition in utero on the development of the child. It often occurs that identical twins are born of whom as a result of the peculiarities of the placental circulation one is much better nourished than the other.

Likely, both children grow up healthy; the child with the lowest birthweight will however never catch up with the more fortunate twin.

In 1944 - 1945 the circumstances in the Netherlands were thus, that the nutritional condition of the population, at least in the western part of the country, was very bad during a rather short period of about 8 months. Now it is interesting, that the children who were born in the last months before the liberation at the end of the starvation period, had a lower birth weight than children who were born before and after this period in the same population. The difference was about 240 grams, the normal birthweight about 3700 grams. Also important is that already 4 months after the liberation the birthweight had normalised itself again. The influence of the mother's nutrition on the child's birthweight is most marked in the last months of pregnancy. We can assume that severe malnutrition of the child before birth and in the first year of life may have a per-

manent influence on the development of the later individual. This is of special importance for many nonwestern countries, in which the nutrition of mother and child is often not optimal. Especially when breast feeding is supplemented with a nutrition that is poor in proteins and rich in carbohydrates (banana, rice) the risk of protein malnutrition is high, the protein percentage of human milk being low.

While in the western world a lack of iron, fluor and vitamin D are more or less likely to occur, in many tropical areas a lack of protein, vitamin B and in some countries of iodide in the food are frequently found. The main risk in the western world for the infant born a terme with a normal birthweight is not malnutrition, but partial over-nourishment. The use of fat, both in quantity and quality, is a main problem in the western world. Overnutrition with carbohydrates (starch and saccharose) is closely linked with the problem of fat overnutrition. At the moment of birth the human being has already a fairly large quantity of fat tissue. After birth the number of fat cells still increases, but the possibility of producing new fat cells decreases gradually and is very limited in the adult, if still present at all.

An infant that builds a considerable fat layer, will have more fat cells than a person who did not have an excessive fat layer in this youth. The-

before, in a person who was thin at first and gained weight later, this increase of weight is achieved with a relatively restricted number of fat cells, which have more or less a maximal size. On the other hand, the individual who has formed a too great number of fat cells in infancy, has a greater capacity to store fat later on. And if this person has once lost weight, that is, if his fat cells have given up a great part of the stored fat, he has what I should like to call, a great number of "hungry" fat cells. He will be more liable to accumulate fat once more and to increase in weight on a somewhat more liberal food-intake than the person who became fat at a more advanced age.

As we know that an overweight is a disadvantage for an individual who is getting older, we may assume that a diet on which a young child accumulates extra subcutaneous fat, will be harmful during adult life. The fat layer of the overweight baby needs not to be formed only by abundant use of fat. For the nutrition that is rich in sugars and flours can promote also fat deposits.

The fat composition of infant nutrition has different aspects. Mother's milk is relatively rich in fat which contains a rather high percentage of unsaturated fatty acids. Infant nutrition based on cow's milk has a divergent fatty acid composition: it contains more fatty acids with long saturated chains, C16, C18. Babies whose nourishment contains cow's

milk have markedly higher blood cholesterol levels than children mainly fed on mother's milk during the first half year of life. When we give the child an infant formula in which butter fat is replaced by vegetable oils, rich in unsaturated fatty acids, C 18-2, we find blood cholesterol values which are not higher than that of the child fed on mother's milk, or even somewhat lower. When we keep these children on a diet with vegetable oils, rich in unsaturated fatty acids, the blood cholesterol percentage is found to be lower than in children who are on a diet of fatty acids with long saturated chains (butter fat).

In view of the relation that exists during later life between arterio-sclerotic vascular abnormalities and the blood cholesterol level, it is not unlikely that the nature of the fat that is used in the first year of life is a factor in the development of arterio sclerosis in adult life. We shall only be certain about this when larger groups of children, whose dietary fat in infancy had been vegetable fat, for instance maize oil, have reached adulthood, and we have got an insight into the degree of arterio-sclerotic vascular abnormalities in this group.

Diets, which are rich in unsaturated fatty acids, make high demands on the vitamin E supply of the individual. Fortunately, many vegetable oils (maize oil, sunflower seed oil, soy oil) have high vitamin E valu-

es, while they are also rich in the essential fatty acid, linoleic acid. One has to take into account, that there exists an inborn error, which is rather frequent in many populations, in which at an early age the total lipid and cholesterol percentages of the blood tend to rise markedly. Carriers of this hereditary error tend to get arteriosclerotic vascular diseases at relatively early age. For this group, which already at an early age can be localized in our population by screening, a suitable diet, poor in saturated fatty acids, eventually saccharose, and relatively rich in unsaturated fatty acids and vitamin E, is important.

Which practical conclusions can be drawn from the previous discussion? Firstly, that the healthy baby should not be overfed, while vegetable oils, rich in poly-unsaturated fatty acids, should be preferred to butter fat.

So far about the influence of the nutrition of the young child on the later state of health in the western population. The situation is different in many areas outside Europe. There, the child is often already born of a malnourished mother, while it moreover is exposed to total or partial malnutrition in infancy. Mortality is high in these children. The children that stay alive and grow up, will never gain the length they are genetically capable of. In the last ten years much attention was paid to the ques-

tion: to what extent severe malnutrition in utero and protein malnutrition in the first year of life threaten the normal development of the central nervous system. It has been found that in the severely malnourished child, the development of the central nervous system may be permanently retarded. This was demonstrated both by microscopic and enzymologic research. This damage cannot or hardly be compensated during the next phase of development. It is very difficult to find out to which extent these disturbances influence later behaviour and learning achievements. Malnourished children mostly grow up under the least optimal circumstances and their behaviour and learning achievements depend on environmental factors.

The Rotterdam children who were born at the end of the hunger winter 1944-1945 and had a low birthweight, show no signs of retardation in mental development. Their mothers were however, not chronically malnourished, and in most children the diet was, although in calories insufficient, not too unbalanced.

It is known that a reasonably high percentage of the children who are born in the western world with a considerably low birthweight, due to extra-uterine malnutrition, show mental retardation later on. Other children from this group, however, developed normally. In our present opinion, the nutrition of these children,

even in the recent past, was often not optimal. According to our recent views we exposed them to moderately caloric malnutrition in the critical first weeks of life. Our feeding techniques have improved considerably, and we now give 150 cal. per kg. body weight daily instead of 100 cal.

We shall have to wait until these dysmature infants, who have got these high caloric diets, go to school before we will be able to detect small abnormalities in intellectual development. We shall only in five or six years be able to judge the question: is our view on the nutrition of this

group better than in the past? It is very important to study the mental development of the dysmature child, that of the in utero malnourished child, especially about the connection between nutrition and mental development. It can give us a better insight on the large problems about infant nutrition in tropical countries. We hope that we can help our colleagues there with useful information. However, it is already clear now that adequate breast-feeding is still the best nutrition for the child, and that the food of the child after weaning should contain more protein than human milk contains.