"FEEDING THE LOW BIRTH WEIGHT BABY.
DEVELOPMENTS IN THE LAST DECADE"

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The ESPGAN report "Nutrition and feeding of preterm infants" was published in 1987. (1) In 1992 "Nutritional needs of the preterm infant" was published (2)

This paper reviews some of the changes which occurred between 1987 and 1992, and since 1992. Many contributions to this conference include these developments as well as "cutting edge research". Particular attention is given to conditionally essential nutrients.

Conditionally essential nutrients

Various substances are not essential nutrients because they can be synthesized from simpler substances. However, the processes of synthesis may find it difficult to meet the demand for these substances at times e.g. during periods of rapid cell turnover as in normal growth, or gut disease. At these times there is a greater reliance on the substances already preformed in the diet to meet demands. These substances are therefore regarded as 'conditionally essential nutrients' ie in certain conditions they must be provided by the diet. Taurine and nucleotides are discussed in further detail.

Taurine

Taurine in infant formulas
Circumstantial evidence collected in the 1970’s led eventually to the addition of taurine to infant formulas. It was present in breast milk, plasma and urinary taurine concentrations in formula fed children were much below values in breast fed children,(3) babies preferentially conjugated duodenal bile acids with taurine if present in the diet rather than with glycine (4), and kittens receiving a taurine free diet went blind (an intriguing observation since kittens unlike puppies and humans are unable to switch conjugation of bile acids from taurine to glycine.(5)
Further evidence accrued in the 1980’s. Changes in retinal histology were also described in primates not receiving taurine.(6) Children receiving long term parenteral nutrition with taurine free amino acid solutions had changes in their electroretinograms and visually evoked responses.(7) Fat absorption was improved by taurine supplementation in cystic fibrosis (8) and in 1 study of preterm babies(9) but not in another one.(10) Taurine was added in the 1980’s at first to formulas for preterm babies and later to formulas for term babies as well.

Metabolism and function
Chesney et al (11) have recently reviewed the role of taurine in infant nutrition and only references not included in that review are given below. Taurine is formed from methionine and cysteine via the transulphuration pathway. The pathway is variably effective in the newborn so taurine may be a conditionally essential nutrient partly relying on a dietary supply as well as endogenous production to achieve physiologically active levels in the newborn. Taurine has many functions eg in the intestine, cardiovascular system, (12) kidney, retina, cochlea (13) and brain. Within the central nervous system it functions as a neurotransmitter, a ‘neuroprotective factor’, (14) an osmolyte, a neurotrophic agent during fetal development (15) and is related to both retinal and auditory function. Various studies have related taurine to the hippocampus where its release in response to other stresses may be protective.(16)

Nucleotides

Structure
A nucleotide consists of a base plus a sugar plus 1, 2 or 3 phosphates. The sugar is either ribose or deoxyribose. which are pentose The base is either a purine (a 2 ring structure e.g. adenine); or a pyrimidine. (a single ring structure eg cytosine).

Function
Nucleotides are parts of DNA and RNA, important in the functions of tissues with rapid turnover (eg gut, immune system), and are regulators of metabolic functions such as energy transfer, the electron chain, and synthesis of large molecules.

Sources
Sources of nucleotides in a baby are those (a) already present in the diet (b) manufactured from various amino acids (c) scavenged as the molecules are liberated from cells. Although nucleotides can be synthesised from simpler substances, if demands are great there is a greater reliance on the nucleotides in the diet to meet demands ie they are ‘conditionally essential nutrients’.

Diet.
Mature breast milk contains around 10mg/litre, more if that present in the cells in the milk is included. Cows milk contains much less, the chemical composition is different, and they may be degraded by heat treatment. Therefore many infant formulas contain little nucleotide. Some have nucleotides added during manufacture up to about 8mg/litre. Infants receiving nucleotides either from breast milk or a supplemented formula need to rely less on the salvage pathway and less on new synthesis from amino acids to meet their requirements. In weaning foods nucleotides are also provided by fish, poultry and meat Milk products and vegetables provide little, but certain peas and pulses provide some.
Nucleotides in infant formulas
There are many studies of the effects of nucleotides in vitro and in vivo in animals, on the gut, immune function, the liver, metabolism and the brain.

There are fewer studies in human babies and some have been criticized. However, there is evidence that dietary nucleotides enhance the growth of light for gestational age babies, and also lead to fewer episodes of diarrhoea. Some immunological functions in babies’ blood are improved and antibody responses to diphtheria and haemophilus influenzae immunisations are greater. There are also changes in measures of lipid metabolism.

Views vary on whether nucleotides must be added to infant formulas. Some argue that since they are present in human milk and may have positive effects they should also be added to formulas. Others are more cautious. They suggest that more basic and clinical research studies are needed to critically assess the potential benefits and the appropriate level of nucleotide supplementation.

Further work is necessary to refine the exact composition and quantity of nucleotide mixtures to be added, and to determine clinical efficacy and safety in further clinical trials.

Reviews
The proceedings of 2 major symposia were published in 1994.(17,18) and there are 4 recent reviews (19-22).

Other conditionally essential nutrients
Many other substances may be conditionally essential in the newborn eg tyrosine, arginine, glutamine, choline, inositol, long chain polyunsaturated fatty acids and possibly lactose.

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