MEDICAL PRACTICE

*Contemporary Themes***Infant feeding practices: a cause for concern**

J H TRIPP, D E M FRANCIS, J A KNIGHT, J T HARRIES

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Cases of infants with life-threatening nutritional deficiencies due to certain strict vegetarian or macrobiotic diets have recently been reported.¹⁻⁷ It has been suggested that in some instances this should be regarded as a form of child abuse.¹ We have recently come across infants who have been severely ill as a result of similar nutritionally inadequate diets. During the past 12 months nine have presented to the Hospital for Sick Children, Great Ormond Street, and six to the Queen Elizabeth Hospital for Children, Hackney Road. In these cases the parents, not themselves on exotic diets, have used alternative "milks" for infant feeding in good faith on the basis of publications or on the recommendation of those providing professional advice. We wish to draw attention to the practice of lay, professional, or commercial recommendations of what may often be inappropriate infant feeds. Most mothers interested in vegetarian and other cult diets are keen to breast-feed their infants, and it is only when this is not possible that other feeds are used.

Relatively minor problems may arise when infants are inappropriately given supplements to their basic milk feeds or when they are on mixed diets. For example, the frequent use of Complan as an addition to infant feeds has resulted in at least two referrals to this hospital of infants with uraemia, later found to be due to excessive protein intake. The manu-

facturers of this product have now clearly labelled it as unsuitable for use in infancy except under medical supervision.

When, however, an inappropriate food is used as a complete diet, rather than a supplement for young infants, who are wholly bottlefed, serious problems may arise. Public interest in "natural," "health," and vegetarian foods is increasing and is not confined to those of particular religious persuasions or cults. There is an awareness among lay men and women of the importance of cows' milk in the aetiology of eczema,⁸ gastrointestinal disorders associated with failure to thrive,⁹ hypernatraemic dehydration,¹⁰ and cot death.¹¹ Advice to parents about alternatives to cows' milk products when the infant is not breast-fed are widespread in the press¹² and in material published by the Vegan Society,¹³ by other interested societies,¹⁴ and by manufacturers.¹⁵ We are particularly concerned that recommendations relating to the use of goats' milk issued by various goat clubs^{14 16} and of Plamil, a soya-based "milk" product, should be brought to the attention of doctors and nurses.

Goats' milk

In a leaflet entitled *The Allergic Child—a Goats' Milk Diet*¹⁶ attention is appropriately drawn to the possibility that cows' milk in the diet may exacerbate eczema, and an alternative diet using goats' milk is recommended. Under the heading "The First Months" the following is advised: "Tiny babies and sick ones—half strength goats' milk; quickly on to UNDILUTED goats' milk (which requires no boiling or pasteurisation *if it comes from a reliable source*)."

Reference to the table shows that full strength goats' milk has a high solute load similar to that of fresh cows' milk and a protein content greater than unmodified cows' milk while dilution to half-strength would inevitably result in deficiency of many nutrients and of energy. It has been suggested elsewhere¹⁷ that for use as an infant feed goats' milk should be diluted to three-quarters strength and sugar (0.75 oz per pint,

Hospital for Sick Children, Great Ormond Street, London WC1N 3JH

J H TRIPP, MD, MRCP, senior registrar
D E M FRANCIS, SRD, group chief dietitian

Zoological Society of London, Regent's Park, London

J A KNIGHT, B VET MED, MRCVS, veterinary officer

Institute of Child Health and Hospital for Sick Children, London

T HARRIES, MD, FRCP, reader in paediatrics and consultant physician

3.5 g/100 ml) added to overcome these problems. Folic acid, B₁₂, and a standard A, D, and C vitamin supplement are also needed.

Although, as suggested by the Goat Society,¹⁴ there may be little risk of contracting tuberculosis from goats' milk, both mammalian and avian strains of the disease have been recorded in goats^{18, 19} with an outbreak in a British herd.²⁰ *Brucella abortus* has also been reported both as a natural and experimental infection of goats. Both organisms can readily be excreted in the milk of infected animals for long periods even from sub-clinical cases.

Perhaps of more importance, however, is mastitis, which is commonly subclinical and hence undetected by the herdsman. This is one of the main reasons for the continued pasteurisation of milk from tuberculin-tested and brucella accredited cows. The most common organisms include *Staphylococcus aureus*, *Pasteurella haemolytica*, *Corynebacterium pyogenes*, and *Mycoplasma agalactia*.²¹ Less commonly found are *Streptococcus* spp with other likely pathogens including *Escherichia coli*, *Klebsiella* spp, and *Pseudomonas aeruginosa*. Even in a modern and well-maintained milking parlour other possibilities of bacterial contamination exist: milk "straight from the animal" is often contaminated by bovine faecal material and is exposed to contamination by human pathogens from dairy staff and handlers.

We therefore regard the advice that goats' milk "requires no boiling or pasteurisation if it comes from a reliable source" as a dangerous recommendation in relation to infant feeding. The British Goat Society have recently agreed to recommend boiling or appropriate heat treatment when the milk is to be used for infant feeds (Soothill, J F, personal communication). Although this would further reduce the amounts of folic acid and other heat labile vitamins (table) however, vitamin supplements are not among the additions to the milk recommended in these publications by goat clubs.^{14, 16}

Plamil

Plamil is a soya-based milk that is recommended without qualification for infant feeding by the Vegan Society. In a leaflet entitled *Is Cow Milk Good Food* admirable emphasis is laid on the advisability of breast-feeding infants. We applaud the sentiments expressed in the following: "There is only one substance that has developed with the purpose of nourishing human beings—human breast milk. It should be our most highly prized food and its composition our surest guide in determining our nutritional needs. Probably the greatest crime nutrition-wise of the past decades has been the increasing use of substitutes." In the same leaflet, however, Plamil is recommended as being much better than cows' milk for the few babies who cannot have their mother's milk. Similarly, in a recently published answer by a doctor to a parent's inquiry,¹² Plamil was again recommended as an alternative to cows' milk despite the fact that the parents had expressed concern about maintaining adequate nutrition and vitamin intake.

The table shows the paucity of information that is generally available for this product. The figures given are derived from the product label; information¹⁵ published by and correspondence with the manufacturers; and our own analyses. Where information is available it is apparent that this product does not compare favourably with human milk for several important constituents. We would especially draw attention to the inadequate calcium (recently increased by the manufacturers after correspondence with one of us) and low vitamin D content. These factors may have been a contributory cause of severe rickets in a child.⁷ There is virtually no potassium in Plamil, and we have recently admitted an infant with a plasma potassium concentration of 1.3 mmol/l and other evidence of gross depletion of body potassium who had been fed entirely on Plamil on professional advice. In the absence of adequate information it is impossible to suggest appropriate supplements that might render this feed acceptable for infant nutrition, and its use cannot therefore be recommended at present.

Composition of average human milk and of some other milks expressed as per 100 ml of feed (reconstituted where necessary)

	Human milk ⁽¹⁾	Premium (Cow and Gate)	Prosobee ⁽²⁾ (Mead Johnson)	Goats' milk ⁽¹⁾	Plamil ⁽³⁾ (Plant Milk Ltd)
Protein g	1.3	1.8	2.6	3.3	2.1
Carbohydrate g	7.2	6.9	6.8	4.6	6.5
Fat g	4.1	3.3	3.4	4.5	2.3
Energy kCal	69	63	68	71	55
	289	264	284	296	230
Renal solute load (mOsmol) ⁽⁴⁾	10.1	12.9	17.3	24.8	10.5
Sodium mg	14	22.5	42.3	40	33.7 ⁽⁵⁾
Potassium mg	58	60	74	180	2.6 ⁽⁵⁾
Calcium mg	34	55	79	130	11.7 ⁽⁵⁾
Phosphorus mg	14	40	53	110	*
Magnesium mg	3	4.5	7.4	20	0.62 ⁽⁵⁾
Zinc mg	0.28	0.3	0.5	0.30	0.12 ⁽⁵⁾
Copper mg	0.04	0.04	0.06	0.05 ⁽⁵⁾	0.03
Iron mg	0.07	0.65	1.3	0.04	0.29 ⁽⁵⁾
Vitamin					
A µg	60	79	51	40	88
D µg	0.81 ⁽⁷⁾	1.1	1.1	0.06	0.6
C mg†	3.7	5	5.3	1.5	*
Thiamine B ₁ mg†	0.02	0.07	0.06	0.04	*
Riboflavin B ₂ mg	0.03	0.10	0.06	0.15	0.21
Niacin B ₃ mg	0.22	0.85	0.8	0.19	*
Pyridoxine B ₆ mg†	0.01	0.08	0.04	0.04	*
B ₁₂ µg†	trace	0.11	0.2	trace	0.12
Folic acid µg†	5.0	3.5	10.6	1.0	*
Vitamin E mg†	0.34	1.0	1.1	*	*
Pantothenic acid mg	0.25	0.25	0.3	0.34	*
Biotin µg	0.7	3.1	5.3	2.0	*

(1) McCance and Widdowson, *Composition of Foods*. London, HMSO, 1978.

(2) Company data, normal dilution.

(3) Dilution as recommended for infants: one in three + ½ oz sugar per ½ pint.

(4) Calculated by formula of Ziegler and Fomon.²³

(5) Based on analysis of ashed specimen at the Hospital for Sick Children, London.

(6) Analysis of new sample showed 22 mg/100 ml and recent information from manufacturers suggests an increase to 28 mg/100 ml. NB The can label, unchanged, reads 10 mg/100 ml.

(7) Includes water-soluble vitamin D sulphate.²⁴

* No figure available.

† Losses occur on boiling or pasteurisation.

Recommendations

While officials of the British Goat Society and the manufacturers of Plamil have provided relevant information where available, changed their recommendations, and even altered the product on the basis of medical advice, we regard the present state of affairs as unsatisfactory. There are no legislative compositional standards in Britain specifically for infant foods, although products are subject to the regulations of the Food and Drugs Act 1955, which controls the composition and labelling of condensed, dried, and skimmed milks.²⁰ It is inappropriate that nutritional deficiencies in infant feeds should be discovered for the first time by doctors after complications have arisen. We suggest that any food intended for use as an infant feed should have to be accepted by an appropriately qualified body—for example, the DHSS Committee on Medical Aspects of Food Policy—as an appropriate and nutritionally adequate feed. Until such time as these products have satisfied such a body, they should be clearly labelled as "unsuitable for use as infant feeds" as are certain skim milk preparations.²²

All those who are responsible for, or concerned with, advising parents about infant feeding should be made aware of the possible dangers inherent in the practice of using or recommending inadequately documented and possibly inappropriate "milk" substitutes. These include doctors, health visitors, and journalists. There are available, at present, infant feeds free from cows' milk constituents, such as Prosobee, which are "complete formulae" and require no supplementation (see table), and others, such as Velactin, for which the required vitamin and other supplements are clearly stated.¹⁷ These and other specialised milks are available on prescription as borderline substances to those who require them clinically. We believe that the continued widespread and indiscriminate use of foods for infants other than human milk and recognised infant feeds may lead to an increasing and iatrogenic morbidity in infancy.

We thank the staff of the department of chemical pathology for measuring mineral content and Dr P J Aggett for measuring trace metal content.

Addendum—We believe that a discussion has taken place with the manufacturers of Plamil who have agreed to alter the labelling of their product.

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In My Own Time

The rhesus story

DOUGLAS GAIRDNER

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Oscar Wilde propounds somewhere the engaging conceit that nature follows art, maintaining, for instance, that the marvellous colours of a sunset were to be seen only after Turner started to paint them in that way. By the same token, just occasionally the story of scientific research seems to follow the kind of tidy, logical stepwise progression which we more often associate with the highly contrived theme of a novel that is suitably boiled down for the *Readers Digest*. Such is the rhesus story, almost too good to be true, with its classical sequence of the disease first being defined; its cause then identified, leading on to a rational treatment, for a time available to the baby only after birth, but later extended to the baby before birth; culminating in the grand finale—the disease prevented. And, to boot, all this has indeed taken place “in my own time.”

Blood of a newborn baby

In the 1930s several groups of workers were gradually formulating the idea that among the heterogeneous group of newborn babies who developed jaundice and anaemia or both, there were three recognisable clinical pictures—icterus gravis neonatorum, hydrops fetalis, and congenital anaemia—which were all variants of a single underlying disorder, characterised by the signs of blood destruction (haemolysis) together with regeneration (erythroblastosis). Foremost among proponents of this idea were J C Hawksley and R Lightwood working in Leonard Parsons's unit in Birmingham, and K D Blackfan and L K

Diamond in Boston, USA (Diamond's name will recur more than once in this story).

So the matter rested until 1940, when K Landsteiner at the Rockefeller Institute, and A S Wiener working in a blood transfusion laboratory in Brooklyn, published a brief paper on “An agglutinable factor in human blood recognised by immune sera for rhesus blood.” An antibody raised in rabbits injected with the red cells of a rhesus monkey had been found to react with the red cells of some humans, which thus contained what was to be termed “Rh factor.” Few clinicians glancing at this paper of less than 20 lines would have recognised it as a truly seminal observation from which much was to stem. On the other hand, it is striking how, in this story, workers in blood transfusion laboratories have so often played a conspicuous part. Thus in the same year (1940) Wiener was able to relate rhesus agglutino-gen to cases of otherwise unexplained blood transfusion reactions. The crucial linking of this Rh factor with haemolytic disease of the newborn came the following year (1941), when Levine published his paper on “The role of immunisation in the pathogenesis of erythroblastosis fetalis,” which provided unequivocal evidence that most cases of haemolytic disease of the newborn were due to immunisation of a Rh-negative mother by the Rh-positive fetus. He also made the point that in transfusing an affected infant, blood from a Rh-negative donor should be used.

Fortunately, the battle of the Atlantic, then at its height, did not prevent ideas from crossing that ocean, and by 1942 Janet Gimson (Roscoe) at The Hospital for Sick Children, Great Ormond Street, was transfusing blood to a series of babies with haemolytic disease, with P L Mollison (another name that recurs more than once in this story) typing the blood from a Medical Research Council blood transfusion unit outside London. Contemporaneously, work on the genetics of the blood groups was being pursued at the Galton Laboratory, which at the outset of war had been moved from London to Cambridge. Also working in Cambridge was the brilliant geneticist R A

Rutherford Road, Cambridge CB2 2HH

DOUGLAS GAIRDNER, DM, FRCP, retired consultant paediatrician