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FEEDING THE PREMATURE BABY*

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Until about 25 years ago the feeding of premature babies was a problem largely delegated to or appropriated by the nursing staff and strange and mysterious rites were observed in the process. There are no records to show how the babies fared under these circumstances but the acceptance by the obstetricians of paediatric help and the infiltration into maternity circles of nurses with paediatric training has improved the infants' prospects of survival. Progress has been slow but is based on facts, many of which are not generally known, and it is important that wider dissemination of some of these should be promoted. A few additional facts can be added to those which are already accepted. A meeting of large numbers of the medical profession, such as this, provides an opportunity for discussion of some of these points.

Prematurity is, of course, no rarity. Table I shows the incidence as stated by various writers. Salber *et al.*[1] gave figures of 4 - 18% in different racial groups in South Africa.

The observations for Cape Town (1955) are shown in Table II. Approximately three-quarters of the premature babies will be born alive and will have to be cared for. If the probable numbers for the city are calculated, it appears

TABLE I. INCIDENCE OF PREMATURITY

Levine[2]	(1950) 5%
Dunham[3]	(1955) 7%
Paterson and McCreary[4]	(1956) 6%
Salber[1]	(1953) — (4·2 - 18·3)
Cape Town Teaching Hospitals†	(1955) 8·4% (6·5 - 10·4)

† Total estimated figures (Cape Town) 8% of 16,000 = 1,300 annually.

TABLE II. PREMATURITY IN HOSPITALS OF CAPE TOWN OBSTETRIC TEACHING HOSPITALS GROUP, 1955

	Total births	*Prematures*		*Total as %*	*Race*
		live born	*still-born*		
Peninsula Mat. Hosp.	3,261	147	64	6·5	Col. and Afr.‡
New Somerset Hosp.	2,398	196	54	10·4	Col. and Afr.
St. Monica's Hosp.	1,353	112	26	10·2	Col. and Afr.
Mowbray Mat. Hosp.	1,031	71	9	8·0	White
Totals	8,043	526	153	8·4	
			679		

‡ Col. = Cape Coloured. Afr. = Bantu

that about 1,300 (8·4% of 16,000 births) are born each year, of which at least 1,000 will be live born, and since there is nothing like enough hospital accommodation a very large number must be cared for in the relatively few other establishments which undertake such work, or in their own homes.

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It is unfortunate that the general conception of adequate premature care visualizes a hospital, incubators, oxygen, special heating, etc. The main difficulty envisaged is that concerned with feeding. But there is really no necessity for such alarms, and my purpose is to show that a simple routine will yield excellent results if reasonable care is taken in the maintenance of body heat and in the prevention of infection.

Basically, a premature baby does not differ materially in the matter of feeding from any other infant. It needs fluid and all the usual constituents of any other infant's food. But feeding schedules which have been used in the past vary between gross deprivation of the baby in the early stages and attempts to fill it as full as a sausage later on. This is irrational, and investigation has shown that a more scientific basis for the feeding of prematures can be found. The minimum fluid requirement has been fairly accurately defined and the probable caloric needs are known approximately. Other details are in the process of being elucidated.

Gordon[5] showed that a fluid intake of 74 ml./kg./day (33·6 ml./lb.) produced a negative water balance while an intake of anything from 124 to 167 ml./kg./day (56 - 76 ml./lb.) resulted in a positive balance which did not increase proportionally to the intake. Translated into working practice this means that 2 oz./lb./day will be enough to allow of a positive water balance and a little less than that is probably allowable but risky. It also means that there is no need to exceed this amount unless the infant shows some sign of water deprivation or its environment is being maintained at a high temperature. No advantage need be expected from a materially higher intake of fluid *per se*. On the other hand, if the stipulated amount is given from the commencement of feeding and the first two 'feeds' are water or 5% glucose, the so-called 'physiological' loss of weight will be minimized or avoided. This is to the baby's advantage since a 4-oz. loss of weight is equivalent to an extra week in the region of dangerously low weights.

The caloric requirement has been generally estimated at 55/lb./day but other assessments have been as high as 70/lb./day. Obviously, with breast milk, which will supply 20 calories per oz., it is going to be impossible to supply even the lesser figure of 55 cals. in a volume of 2 oz. and some sort of compromise must be sought. Any form of cow's milk will supply still fewer calories. From this difficulty has evolved a vast literature on the type of food which should be given and which will be compatible with the premature baby's digestive capacity. A compromise of some sort is indicated.

If the premature infant is provided with 2½ oz./lb./day of a feed which has a calorie value of roughly 20 cals./oz. both its fluid and caloric requirements will be catered for, not in an ideal way but in such a manner that the doctor in charge can have an easy mind on these matters. The child will be liable neither to the dangers of underhydration nor to those of overfilling and regurgitation. The nurse or junior hospital officer can be supplied with a standard list of feeds suited to

different premature weights and can proceed without further guidance. If the child does not thrive on this regime the fault is not likely to be a dietetic one and attention can be concentrated on the possibilities of acquired or congenital disease.

The best type of food to be used is another matter. Breast milk has been severely criticised because of its low protein and low mineral content. Full-cream cow's milk has not met with general approval because of the difficulties which premature babies have with the digestion of its casein and fat and also because of the large amounts of phosphate which it contains. It has been suggested that a mixture of human and cow's milk, or one of human milk reinforced by casein, or special casein digests, or an amino-acid mixture is an improvement (Magnussen[6]). All such combinations may be readily available in hospitals in big cities but are not likely to be obtainable at short notice elsewhere.

My own experience does not make me enthusiastic over any of these complicated feeds, and the risk of mistakes in their preparation for the baby does nothing to advance their claims. It has been shown that, used in the above regime, any one of the following 4 feeds in pure form, viz. (1) breast milk, (2) full-cream evaporated milk, (3) a dried half-cream milk with added sugar, and (4) a so-called humanized milk,

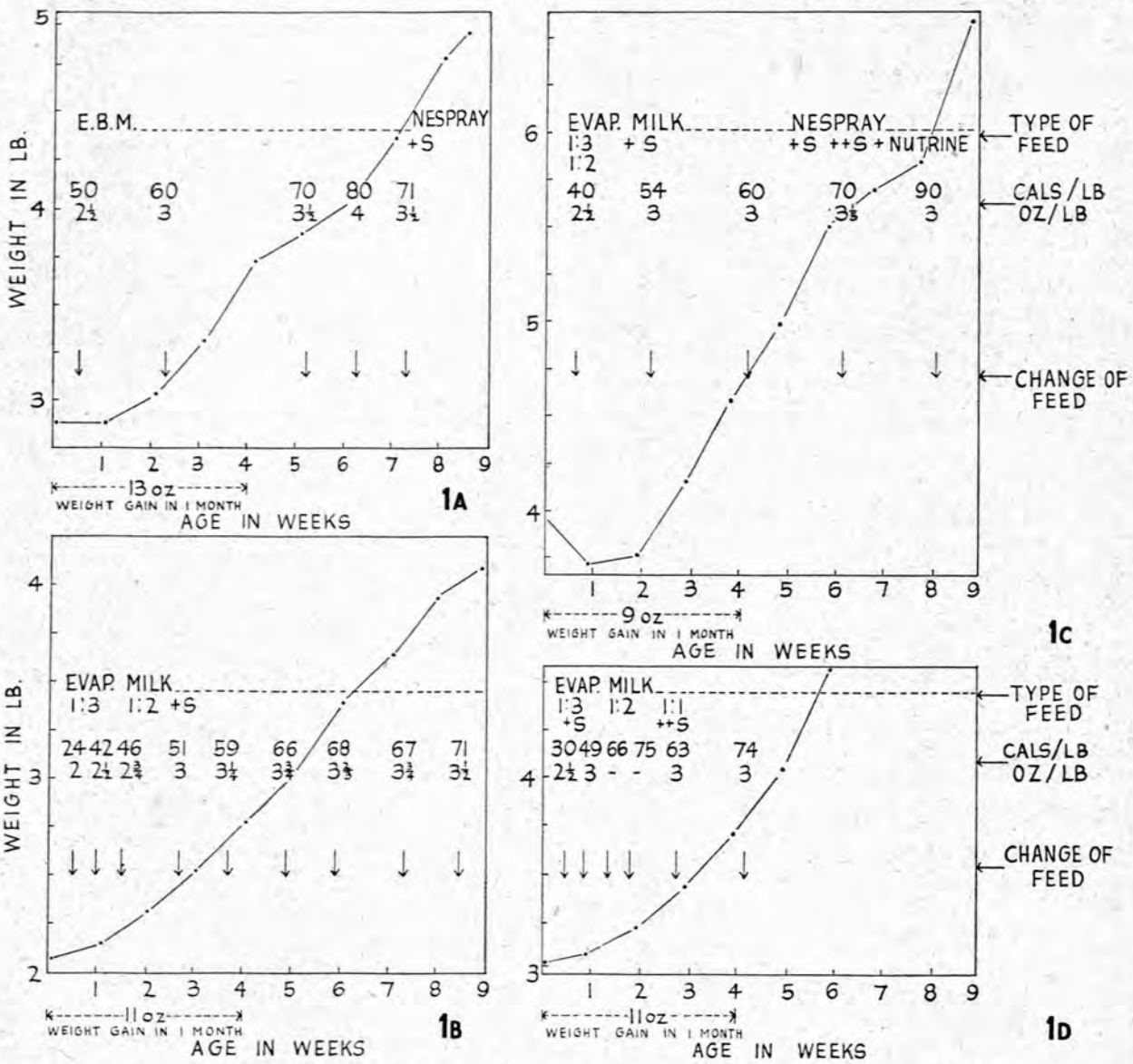

Fig. 1. Feeding of premature babies. E.B.M.=expressed breast milk. Cals./lb.=calories for lb. body-weight. +S=one-quarter teaspoonful of sugar per feed. ++S=one-half-teaspoonful of sugar per feed.

(A) K., born 26 March 1958. Peninsula Maternity Hospital.
(B) Buy., born 6 April 1959. Red Cross War Memorial Children's Hospital.
(C) Bul., born 14 April 1959. Red Cross War Memorial Children's Hospital.
(D) P., born 28 June 1959. Red Cross War Memorial Children's Hospital.

produces a weight curve which cannot be differentiated from that produced by any of the other three (Ford[7]). But with any of them it is impossible to obtain the suggested optimum caloric content in the allowable volume of fluid, i.e. 2½ oz./lb./day. Therefore, if this optimum is adhered to a caloric addition without increase in volume is needed. This should not be considered before the end of the first week of life but, when desired, it can be arranged for by adding about 1 g. of one of the commercial preparations of casein digest (casein-carbohydrate powder) per oz. of breast milk, or 1 g. of sugar per oz. of evaporated milk. This raises the calorie value to 23/oz., and the 2½ oz./lb./day will supply 58 cals. per lb. of body weight, a modest increase over the stipulated minimum requirement of 55 cals./lb./day mentioned above.

There is another way of getting over the deficiency in calories, but it is unwise to use it until after the end of the first week of life and then unless the baby is showing that a feed of 2½ oz./lb./day is well within its capacity and powers of digestion. This method is to give 3 oz./lb./day, in full knowledge that the child does not normally require this amount of fluid and will discard a large proportion of it in the urine. If the reinforced feeds are used the baby will be receiving 69 calories/lb. body-weight. The calories supplied at different times in the development of a few babies are shown in Fig. 1 (A, B, C and D).

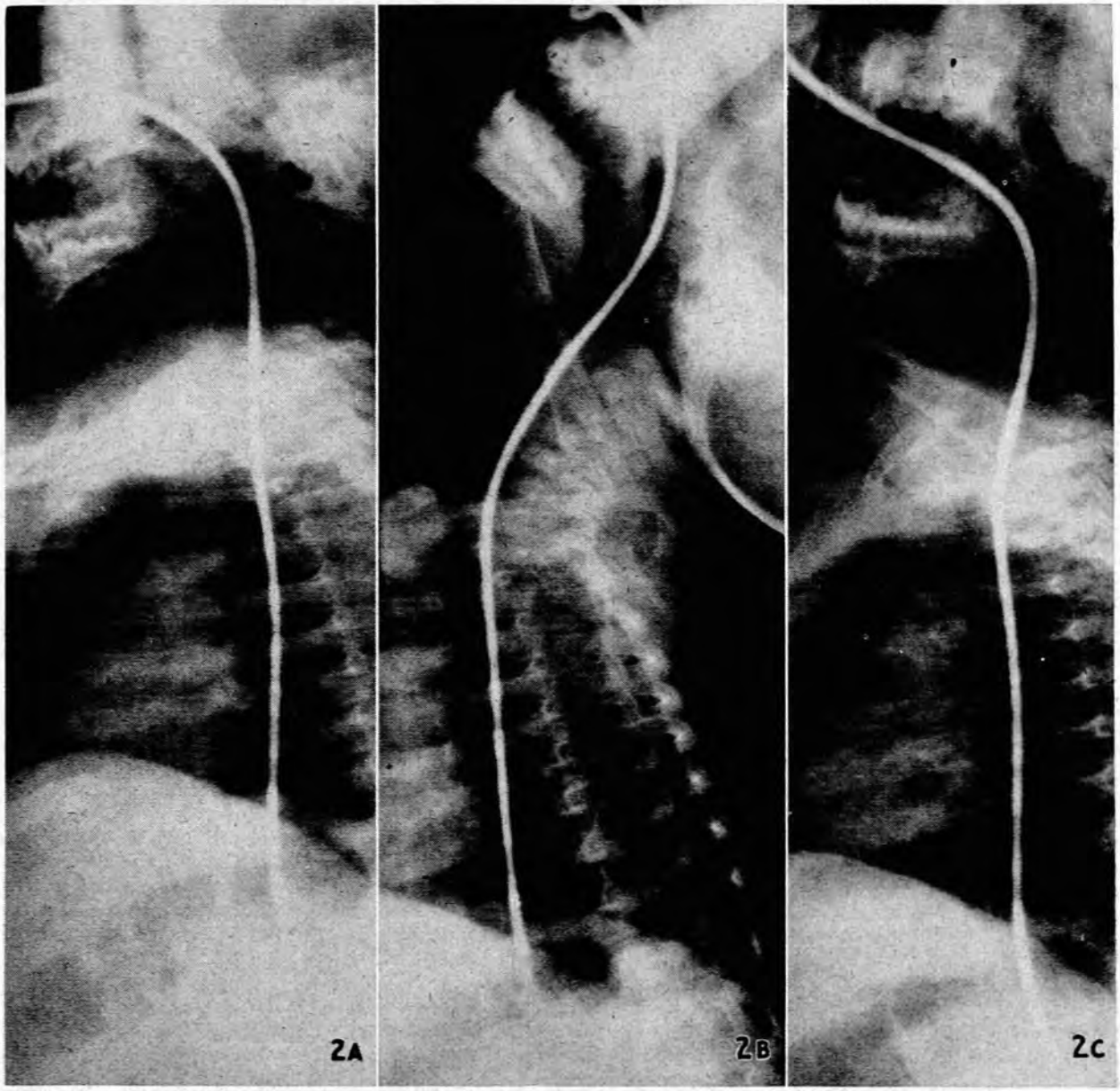

Fig. 2. Gavage tube. Length: tip of xyphoid to suprasternal notch × 2, plus 1 inch.

A. Nasal tube. Head upright. Distance mark at margin of nostril.
B. Nasal tube. Neck in full extension.
C. Oral tube. Head upright. Distance mark at gum margin.

The analytical details of the suggested feeds are shown in the following table and diagram (Fig. 3).

SUITABLE FEEDS FOR PREMATURE BABIES

	Total content of 3 oz. in g.			
	Prot.	*Carb.*	*Fat*	*Cals.*
3 oz./lb./d. breast milk + 'digest'*	2·7	8·7	3	70
3 oz./lb./d. evap. milk + sugar†	3	7·8	3	68

* 'digest' added: one quarter teaspoonful (approx. 1 g.) per oz.
† sugar added: one quarter teaspoonful (approx. 1 g.) per oz.

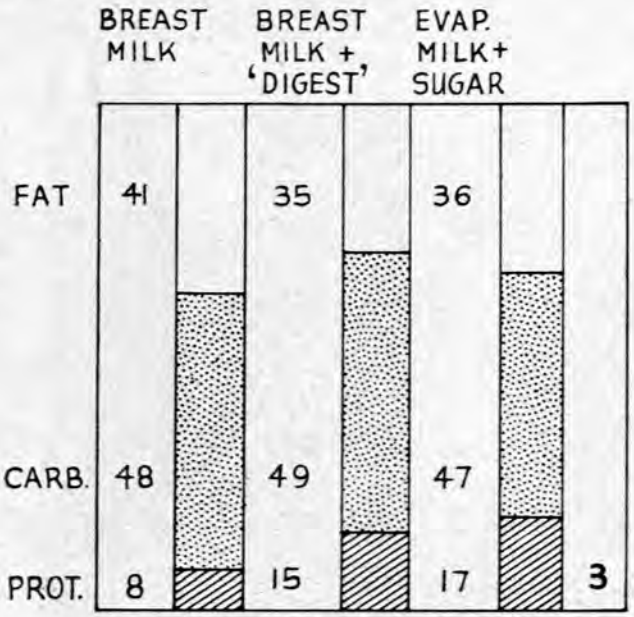

Fig. 3. Showing source of 100 calories in each of 3 food mixtures. Carb.=carbohydrate. Prot.=protein.

The schedule suggested is so simple that a general-trained nurse can master the details in a few minutes. It has now stood the test of time for about 15 years, in two hemispheres, and there is no apparent reason to make any radical change. The number of feeds to be given is laid down empirically as 8 per day for any baby under 4½ lb. birth-weight, 7 from 4½ to 5½ lb., and 5 thereafter.

The infants were tube fed, as most prematures have to be. The matter of technique in tube feeding is of some importance but there does not seem to be any authoritative statement about how far the tube should be passed. The time-honoured method (typically feminine), of measuring the tube against the child, with the tip against the substernal notch and the upper mark made at the level of the base of the nose, or after the tube has been led across from the mouth to the ear, is grossly inaccurate. The inaccuracy arises from the attempt to determine the distance between a fixed point and a moveable one. After considerable effort it became apparent that two fixed points could be used which are easily found and proportional to each individual baby. The distance between the upper edge of the manubrium sterni and the tip of the xyphoid process is a little short of half the required length. If this distance is doubled and an inch added and the mark made on the tube at that point, it will be found that, when the tube is passed nasally and the mark fixed at the margin of the nostril (or, with an oral tube, the gum margin), the tip has just passed through the diaphragm. To be quite certain that there is no danger of passing the feed into the oesophagus and, contrariwise, to avoid an excessive amount of tubing in the stomach, the manubrial-xyphoid distance should be doubled and 2 inches added. This is within the competence of any trained nurse. There is no danger of passing even a small tube unwittingly into the trachea since the small premature babies, in whom very small tubes are required, have such a small laryngeal aperture that the tube will produce immediate and considerable obstruction and distress.

The X-ray illustrations (Fig. 2—A, B and C) demonstrate the validity of this routine. The addition of 2 inches to the measurement on the chest makes sufficient allowance for movement of the head and neck during gavage. The tip of the tube can be guaranteed to be in the stomach but not too far in to permit it to act as a mechanical irritant. The plastic stomach tubes now readily available can be strapped to the baby's face and left in place for several days. In a country practice a no. 6 - 8 rubber catheter can be used until a plastic tube is obtained. There will be no great delay since, in any case, the child need not be given any fluid at all for 36 hours after birth.

The application of this technique would allow many premature babies to be cared for at home or in nursing institutions which have no special facilities for them, and avoid the risks of infection and chilling to which they are almost inevitably exposed when transport to one of the bigger centres is undertaken. The feed is easily obtained, breast milk or evaporated milk. The doctor can, if no other arrangements are possible, change the tube twice weekly, and any competent person can be quickly taught how to run in the feed at the required intervals. The baby should be propped up before the feed is started and left undisturbed for 20 minutes afterwards. It is impossible to run the feed too rapidly by gravity through a small tube and there is no need, therefore, to prescribe a minimum duration for the feeding operation. The main danger is infection, and this is the aspect which cannot be over-emphasized. The most scrupulous hygiene is essential.

SUMMARY

A simple way of feeding premature babies is outlined. It is based on a preliminary period of 36 hours in which nothing need be given. From that time a fluid intake of 2½ oz./lb./day is maintained. After one week this may be increased to 3 oz./lb./day. The inadequacy of the caloric intake with these quantities, when breast milk or evaporated cow's milk is used, may produce a rather slow gain in weight. If so, the breast milk can be reinforced with a casein—carbohydrate powder in the proportion of 1 g. per oz. and the evaporated milk with sugar in similar amount. The stomach tube should be passed to a mark made at a distance from the tip which is equal to twice the length of the sternum plus 2 inches. The mark should be fixed at the nostril or gum margin.

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