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Retention of Nitrogen, Fat, and Calories in Infants of Low Birth Weight on Conventional and High-volume Feeds

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Summary

Two balance studies were performed on each of five infants of low birth weight. About 230 ml/kg/day of S.M.A. S26 milk was given during one study and 180 ml/kg/day during the other. The proportion of nitrogen, fat, and calories retained was similar in the two studies, suggesting that the larger weight gains on the high-volume feeds were due to growth rather than retention of water or excessive deposition of fat.

Introduction

Large gains in weight have been reported in infants of low birth weight receiving higher than conventional volumes of milk (Valman *et al.*, 1972). Such gains could be owing to excessive salt and water retention or excessive fat deposition. We report here the results of balance studies on infants of low birth weight given both high-intake and low-intake feeds.

Patients and Methods

Five infants weighing between 1,100 g and 1,500 g at birth were studied (table I). The gestational age as assessed clinically (Dubowitz *et al.*, 1970) agreed with that calculated from the mother's last menstrual period. Two metabolic balance studies were performed on each infant, one on 230 ml/kg/day of S.M.A. S26 milk and the other on 180 ml/kg/day. Each volume was given for at least five days and collections of stool and urine were made on the final three days. Infants were weighed on scales weighing to 10 grammes.

The balance studies were performed using disposable napkins and Rayon liners as described elsewhere (Valman and Aikens, 1974). The total energy content of the excreta was determined by ballistic bomb calorimetry and the nitrogen content by Kjeldahl digestion and steam distillation. Faecal fat was estimated by the method of Van der Kamer (1958).

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TABLE I—*Clinical Results in Five Infants of Low Birth Weight*

Case No.	Gestational Age (Weeks)	Birth Weight (g)	Birth Weight Centile	Balance Study No.	Age at Start of Study (Days)	Weight at Start of Study (g)
1	32	1,460	10	1	12	1,480
				2	18	1,620
2	32	1,160	<10	3	21	1,320
				4	26	1,440
3	33	1,500	<10	5	26	1,950
				6	33	2,200
4	28	1,100	50	7	47	1,900
				8	52	2,110
5	29	1,130	25	9	30	1,500
				10	41	1,960
				11	47	2,180

The study was approved by the hospital ethical committee and informed consent was obtained from each mother.

Results

The percentage of the intake of nitrogen, fat, and calories which was retained was similar in the studies performed during the high and low intakes (tables II-IV). The retention of nitrogen is expressed as absolute amounts in the diagram.

TABLE II—*Results of Nitrogen Balance Studies in Five Infants of Low Birth Weight*

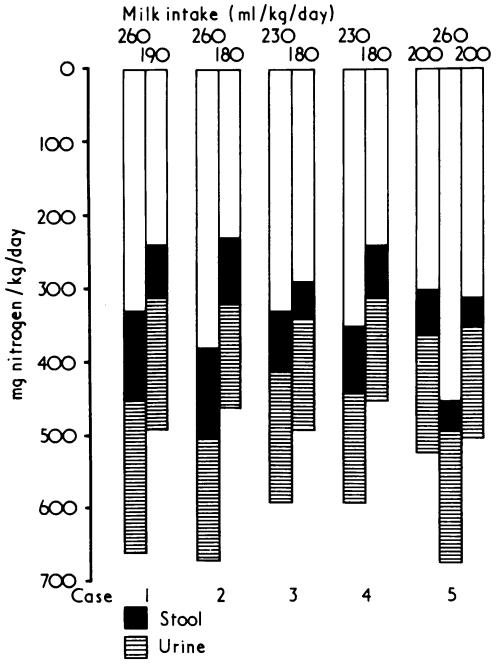
Case No.	Balance Study No.	Approximate Milk Intake (ml/kg/day)	Nitrogen (g/3 days) Intake	Stool	Urine	Retention (%)
1	1	260	2·918	0·531	0·926	50
	2	190	2·371	0·350	0·893	48
2	3	260	2·647	0·493	0·670	56
	4	180	1·970	0·370	0·593	51
3	5	230	3·423	0·466	1·029	56
	6	180	3·20	0·340	0·994	58
4	7	230	3·360	0·517	0·842	60
	8	180	2·877	0·409	0·890	55
5	9	200	2·351	0·254	0·724	58
	10	260	3·955	0·261	1·077	66
	11	200	3·285	0·267	0·972	62

TABLE III—*Results of Fat Balance Studies in Five Infants of Low Birth Weight*

Case No.	Balance Study No.	Fat (g/day) Intake	Stool	Retention (%)
1	1	13·8	3·28	76
	2	11·2	2·06	81
2	3	12·5	3·6	71
	4	9·3	3·5	62
3	5	16·5	2·22	87
	6	14·8	1·26	92
4	7	16·2	2·93	82
	8	13·6	1·74	87
5	9	10·8	1·2	89
	10	18·1	1·9	90
	11	15·8	0·7	96

TABLE IV—*Results of Calorie Balance Studies in Five Infants of Low Birth Weight*

Case No.	Balance Study No.	Kilocalories/3 days			
		Intake	Stool	Urine	Retention (%)
1	1	804	116	34	81
	2	653	72	27	85
2	3	729	128	34	78
	4	543	86	21	80
3	5	896	126	34	82
	6	800	66	32	88
4	7	880	168	48	76
	8	738	155	42	73
5	9	585	70	42	81
	10	983	88	30	88
	11	854	41	44	90



Retention of nitrogen in five infants on high-intake and low-intake feeds.

The percentage of the intake retained was similar in two low-intake studies separated by a high-intake study.

There was an enhanced weight gain during the high-intake periods compared with the low-intake periods except in cases 1 and 2 (table V).

TABLE V—*Milk Intake and Weight Gains in Five Infants of Low Birth Weight*

Case No.	Balance Study No.	Milk Intake (ml/3 days)	No. of Feeds /24 hours	Weight Gain During Balance	
				g/day	g/kg/day
1	1	1,152	Drip	37	25
	2	936	Drip	40	24
2	3	1,045	Drip	20	15
	4	778	Drip	23	16
3	5	1,379	12	41	20
	6	1,231	12	25	11
4	7	1,354	12	51	26
	8	1,136	8	33	16
5	9	900	12	30	20
	10	1,512	12	53	27
	11	1,314	12	40	18

Discussion

A similar percentage—and therefore a larger amount—of nitrogen, fat, and calories was retained by infants on high compared with conventional intakes. This suggests that increased intake is associated with increased growth.

The retention of nitrogen varied widely between individuals (table II) but the use of an infant as his own control allowed data to be interpreted from a small number of patients.

The fat retention was directly related to the intake (table III), and similar findings up to an intake of 9 g/kg/day were noted by Williams *et al.* (1970) in full-term infants.

The third balance study in case 5 showed a similar retention of nitrogen to that in the first balance, which suggests that it is valid to compare the percentage retention on different intakes in the patients who had two balance studies.

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