

Growth and body composition of preterm infants: influence of nutrient fortification of mother's milk in hospital and breastfeeding post-hospital discharge

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We examined the influence of multi-nutrient fortification of mother's milk (MM + MNF) compared to supplementation with calcium and phosphorus (MM + CaGP) alone in hospital (in a randomized trial), and of breastfeeding (post-MM) compared to formula feeding (post-FF) after hospital discharge with a descriptive analysis of growth and body composition to 1 y corrected age in preterm infants. Anthropometry, nutrient intakes and whole body bone mineral content, lean and fat mass were determined at four time points in the first year after term corrected age. Body composition was determined with dual energy X-ray absorptiometry. MM + MNF compared to MM + CaGP for preterm infants in the early neonatal period did not appear to influence growth or body composition in the first year. Growth in post-MM and post-FF groups was within the normal range of growth references derived from term infants fed mother's milk. Post-MM infants had lower whole body bone mineral content (132.3 ± 10.4 g) at 6 months corrected age when compared to post-FF infants (159.4 ± 14.1 g) and greater percent fat mass to 12 months corrected age. These differences may result from the lower calcium, phosphorus and protein intakes in post-MM compared to post-FF infants. Our findings demonstrate that dietary practices after hospital discharge likely have a greater impact on body composition in prematurely born infants than dietary practices in hospital. Whether the observed differences in body composition between breastfed and formula-fed preterm infants have any long-term consequences requires further investigation. □ *Body composition, mother's milk, multi-nutrient supplementation, preterm infants*

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Providing mother's milk to preterm infants has been associated with better neurodevelopmental outcomes (1, 2). Mother's milk, however, is not considered adequate to meet all of the preterm infants' nutrient requirements in early neonatal life (3). Supplementation of mother's milk with calcium and phosphorus salts, powdered or liquid fortifiers or preterm formula is, therefore, common practice in many neonatal intensive care units. The use of multi-nutrient fortifiers added to mother's milk rather than supplementation with calcium and phosphorus alone has allowed preterm infants fed mother's milk to achieve intrauterine growth rates (4–6). Investigations to determine whether multi-nutrient fortification of mother's milk improves bone mineral mass during the early neonatal period, as measured in a single bone, have been inconclusive (7–10). We recently demonstrated that preterm infants fed mother's milk with a multi-nutrient fortifier (MNF), or calcium and phosphorus alone, in the form of calcium glycerophosphate (CaGP), resulted in a whole body BMC at term corrected age, as measured by dual energy X-ray absorptiometry (DXA), in the low normal range of healthy term infants at birth (6).

The beneficial effects derived from multi-nutrient fortification of mother's milk in hospital on growth and bone mineral mass after discharge from hospital has received little attention in the literature. While nutrient supplementation of mother's milk in hospital is standard practice, supplementation of mother's milk (with the exception of iron and vitamins) is usually discontinued when breastfeeding is established. No information is available on whole body bone, lean and fat mass in the first year, measured with appropriate techniques such as DXA, in preterm infants who are fed mother's milk for a prolonged period of time after hospital discharge.

This report describes long-term outcomes of whole body BMC, lean and fat mass and body size in preterm infants fed mother's milk, who participated in a randomized controlled trial receiving either a multi-nutrient fortifier or calcium and phosphorus alone in the early neonatal period. Because about one-third of these preterm infants continued to be breastfed to 6 months corrected age, we performed a *post hoc* analysis to evaluate the influence of post-hospital discharge breastfeeding on these long-term outcomes of growth and body composition.

Subjects and methods

Diet groups pre-hospital discharge

We studied 37 preterm infants who participated in a randomized controlled trial, which has been described elsewhere (6). Briefly, preterm infants whose mothers chose to provide breast milk were allocated, by block randomization, to receive either a new multi-nutrient fortifier (MM + MNF) ($n = 12$, birthweight: 1.4 ± 0.2 kg, post-menstrual age: 29.9 ± 1.9 weeks) (produced, to our design specification, by Wyeth-Ayerst, Canada) or calcium and phosphorus alone, providing approximately $3 \text{ mmol kg}^{-1} \text{ d}^{-1}$ of calcium and phosphorus, in the form of CaGP (MM + CaGP) ($n = 13$, birthweight: 1.3 ± 0.2 kg, post-menstrual age: 30.1 ± 1.5 weeks) ($\text{C}_3\text{H}_7\text{CaO}_6\text{P}$, Paul Lohmann Chemicals, Emmerthal, Germany). MNF added 3.7 g protein; 34.7 g carbohydrate; 15.2 mmol calcium; 14.1 mmol phosphorus; and 4730 IU vitamin D per litre of mother's milk. Infants whose parent(s) elected to formula feed served as a comparison group (PTF) ($n = 12$, birthweight: 1.2 ± 0.2 kg, post-menstrual age 29.7 ± 1.7 weeks). The formula-fed infants received Preemie SMA (Wyeth-Ayerst, Canada).

Ethical approval was obtained from the Research Advisory Committees at both the Children's Hospital of the Hamilton Health Sciences Corporation and St Joseph's Hospital, where the research was conducted. Informed and written consent was obtained from the parent(s).

Diet groups post-hospital discharge

Feeding practices after hospital discharge were by parental choice. Of 25 infants receiving mother's milk in hospital with either MNF or CaGP, 10 infants (5 from each group) discontinued breastfeeding after hospital discharge and before reaching term-corrected age. Once receiving exclusive standard formula feeding, these infants were designated as the post-FF group (Fig. 1). In MM + MNF, breastfeeding continued in seven infants at term age, four infants at 3 months corrected age and 4 infants at 6 months corrected age. In MM + CaGP breastfeeding continued in eight infants at term age, six infants at 3 months corrected age and 3 infants at 6 months corrected age. These infants from MM + MNF and MM + CaGP groups were combined and were designated as the post-MM group. Breastfeeding in post-MM was defined as receiving over 60% of enteral intake as breast milk. The seven infants who were fed mother's milk to 6 months corrected age were followed to 12 months corrected age and thus remained in the post-MM group. After hospital discharge all preterm infants received approximately 400 IU supplemental vitamin D and when breastfed or receiving no iron-fortified formula, supplemental iron was provided at approximately 10 mg daily to 6 months corrected age.

Growth and body composition measurements

After hospital discharge, infants returned for follow-up

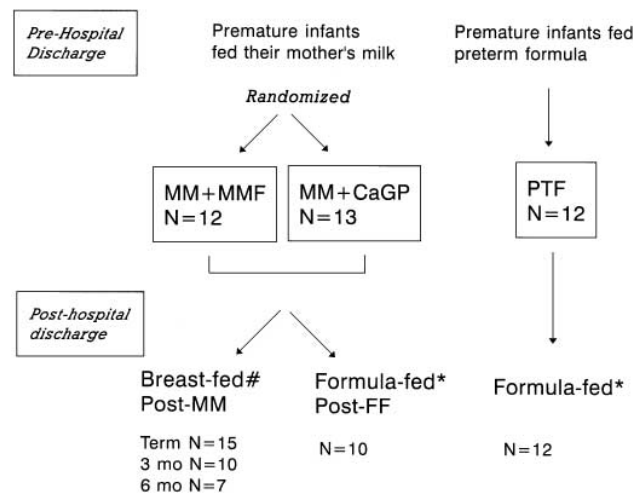


Fig. 1. Overview of assignment of preterm infants to diet groups specified. # Breastfeeding was defined as receiving over 60% of milk intake as breast milk. *Infant in post-FF and PTF received standard term formulas after hospital discharge.

visits at the Children's Hospital of the Hamilton Health Sciences Corporation at term age and at 3, 6 and 12 months corrected age. During these follow-up visits growth was measured by weight, length and head circumference as previously described (6). Whole body BMC and lean and fat mass were measured using DXA (Hologic QDR1000W^R, Hologic Inc, Waltham, MA, USA) at each visit. The DXA scans were performed while the infants were sleeping (without sedation) wrapped in a blanket wearing only a diaper while being scanned. The individual scans were analysed using the Pediatric Whole Body Software version 5.63 (Hologic Inc.). If a good scan could not be obtained, parents were asked to return for a second scan; however, it was not possible to obtain scans from all infants at all follow-up visits.

Nutrient intake

After each visit parents were asked to keep a 5-d food intake record of their infants. If infants were breastfed, parents were given a scale (Sartorius, Goettingen, Germany) to test-weigh their infant before and after breastfeeding to measure breast milk intake. Food intake records were analysed using Nutrient Analysis Software (Nutrient Analysis Programme, E. Warwick, PEI, Canada).

Data analysis

In order to determine the influence of post-hospital nutrition only comparisons between post-MM and post-FF were performed using the Student's *t*-test or Mann-Whitney *U*-test if data were not normally distributed. A *p* value of 0.05 was used to judge significance for outcome measurements between groups.

Table 1. Body size, whole body BMC and percent lean and fat mass at term, 3, 6 and 12 months corrected age of preterm infants fed MM + MNF, MM + CaGP and PTF prior to hospital discharge^a.

Outcome	MM + MNF	MM + CaGP	PTF
Term			
Weight (kg)	3.3 ± 0.3	3.2 ± 0.4	3.5 ± 0.4
Length (cm)	49.6 ± 1.3	48.4 ± 1.8	49.4 ± 2.3
Head circumference (cm)	36.3 ± 1.4	36.2 ± 1.0	36.6 ± 1.1
DXA scans	<i>n</i> = 11	<i>n</i> = 13	<i>n</i> = 11
Whole body BMC (g)	58.0 ± 5.8	55.3 ± 1.8	60.0 ± 10.5
Lean mass (%)	77.3 ± 4.6	76.4 ± 6.7	78.8 ± 5.4
Fat mass (%)	21.9 ± 2.5	22.2 ± 3.4	19.6 ± 5.4
3 months			
Weight (kg)	5.6 ± 0.6	5.7 ± 0.5	5.8 ± 0.7
Length (cm)	59.8 ± 2.0	60.5 ± 3.1	60.5 ± 2.7
Head circumference (cm)	41.1 ± 1.1	41.5 ± 0.7	41.5 ± 1.7
DXA scans	<i>n</i> = 7	<i>n</i> = 10	<i>n</i> = 8
Whole body BMC (g)	113.5 ± 20.9	106.1 ± 13.6	119.0 ± 28.0
Lean mass (%)	66.5 ± 7.8	69.8 ± 4.6	63.4 ± 22.4
Fat mass (%)	31.9 ± 7.8	28.6 ± 4.7	25.5 ± 8.8
6 months			
Weight (kg)	7.0 ± 0.7	7.1 ± 0.7	7.4 ± 1.1
Length (cm)	66.3 ± 2.5	66.5 ± 2.7	66.4 ± 2.9
Head circumference (cm)	44.3 ± 1.0	44.1 ± 1.3	44.0 ± 1.5
DXA scans	<i>n</i> = 9	<i>n</i> = 9	<i>n</i> = 8
Whole body BMC (g)	146.2 ± 19.4	155.2 ± 19.9	163.2 ± 31.5
Lean mass (%)	70.2 ± 5.7	69.8 ± 3.7	69.5 ± 8.3
Fat mass (%)	27.7 ± 5.7	28.1 ± 3.7	28.4 ± 8.1
12 months			
Weight (kg)	9.0 ± 0.9	9.0 ± 0.9	9.6 ± 1.4
Length (cm)	74.9 ± 3.7	75.9 ± 2.5	76.0 ± 2.8
Head circumference (cm)	46.9 ± 3.9	46.8 ± 1.3	46.6 ± 2.0
DXA scans	<i>n</i> = 7	<i>n</i> = 9	<i>n</i> = 6
Whole body BMC (g)	209.9 ± 27.1	223.0 ± 29.2	243.9 ± 40.6
Lean mass (%)	74.0 ± 5.0	73.3 ± 4.7	73.8 ± 5.6
Fat mass (%)	23.6 ± 5.0	24.3 ± 4.7	23.9 ± 5.6

^aMean ± SD.

Results

Outcomes related to pre-hospital discharge nutrition

A trend could be observed that body size and BMC were greater in infants fed PTF compared to infants fed MM + MNF in hospital with body size and BMC in MM + CaGP being intermediary. Two infants in MM + MNF continued to receive breast milk (albeit <60% of total milk intake) up to 11 months corrected age, which may explain that infants in MM + MNF attained a somewhat lower BMC and length at 12 months corrected age (Table 1).

The mean nutrient intakes for all diet groups met or exceeded the current recommendations for the post-hospital discharge period except for protein and energy (at 3 and 6 months), particularly in the MM + MNF and MM + CaGP groups where some infants were receiving mother's milk after hospital discharge (Table 2). There were no significant differences as determined by ANOVA in the time of introduction of solids between MM + MNF, MM + CaGP and PTF (3.5 ± 1.1, 3.7 ± 1.0 and 2.9 ± 1.1 months, respectively).

Outcomes related to post-hospital discharge nutrition

Weight and length in all infants were within the normal range of WHO reference standards generated from breastfed infants born at term (11) (Fig. 2). Whole body BMC in post-MM was significantly lower at 6 months corrected age, when compared to post-FF (Table 3). The increase in total BMC between 3 and 6 months corrected age was less ($p < 0.05$) in post-MM infants (1.4 g/week) compared to post-FF infants (3.9 g/week). When whole body BMC was adjusted for body size (weight, length and lean mass) BMC remained lower in post-MM compared to post-FF (Table 3). Post-MM infants demonstrated a significantly greater percent fat mass at 3, 6 and 12 months corrected age when compared to post-FF (Fig. 3).

Intakes of protein, calcium and phosphorus for the post-MM infants were generally lower than for the post-FF infants, and below the current recommendations for the post-hospital discharge period (Table 4). No differences were present between post-MM and post-FF (3.7 ± 1.0 vs 3.7 ± 1.2 months, respectively) in the introduction of solids.

Table 2. Nutrient intakes at term, 3, 6 and 12 months corrected age for preterm infants fed MM + MNF, MM + CaGP and PTF prior to hospital discharge^a.

Nutrient intakes ^b	MM + MNF	MM + CaGP	PTF
Term			
Protein (g kg ⁻¹ d ⁻¹)	2.0 ± 0.5	2.7 ± 0.6	2.9 ± 0.5
Energy (kcal kg ⁻¹ d ⁻¹)	114 ± 13	136 ± 14	133 ± 25
Calcium (mmol kg ⁻¹ d ⁻¹)	1.6 ± 0.4	1.9 ± 0.4	2.1 ± 0.4
[mmol d ⁻¹]	[5.2 ± 1.5]	[6.2 ± 1.2]	[7.1 ± 1.4]
Phosphorus (mmol kg ⁻¹ d ⁻¹)	1.1 ± 0.5	1.5 ± 0.5	1.8 ± 0.3
[mmol d ⁻¹]	[3.7 ± 1.8]	[4.7 ± 1.5]	[6.4 ± 1.0]
3 months			
Protein (g kg ⁻¹ d ⁻¹)	2.0 ± 0.8	2.1 ± 1.0	2.4 ± 0.5
Energy (kcal kg ⁻¹ d ⁻¹)	89 ± 21	103 ± 38	107 ± 17
Calcium (mmol kg ⁻¹ d ⁻¹)	1.7 ± 0.8	1.7 ± 0.7	1.9 ± 0.4
[mmol d ⁻¹]	[9.4 ± 4.1]	[9.3 ± 3.3]	[10.8 ± 2.6]
Phosphorus (mmol kg ⁻¹ d ⁻¹)	1.5 ± 0.9	1.4 ± 0.8	1.8 ± 0.4
[mmol d ⁻¹]	[8.1 ± 4.4]	[7.7 ± 3.6]	[10.0 ± 2.8]
6 months			
Protein (g kg ⁻¹ d ⁻¹)	1.9 ± 0.5	2.3 ± 0.6	2.1 ± 0.4
Energy (kcal kg ⁻¹ d ⁻¹)	85 ± 19	97 ± 27	90 ± 12
Calcium (mmol kg ⁻¹ d ⁻¹)	2.0 ± 0.7	2.0 ± 0.7	1.9 ± 0.5
[mmol d ⁻¹]	[13.7 ± 5.1]	[13.9 ± 3.2]	[13.8 ± 5.2]
Phosphorus (mmol kg ⁻¹ d ⁻¹)	2.0 ± 0.7	2.0 ± 0.7	2.0 ± 0.7
[mmol d ⁻¹]	[14.1 ± 5.8]	[13.9 ± 3.2]	[14.7 ± 6.6]
12 months			
Protein (g kg ⁻¹ d ⁻¹)	4.5 ± 1.1	3.5 ± 0.8	5.2 ± 0.5
Energy (kcal kg ⁻¹ d ⁻¹)	123 ± 32	110 ± 18	131 ± 29
Calcium (mmol kg ⁻¹ d ⁻¹)	4.0 ± 2.1	2.7 ± 1.1	4.0 ± 0.7
[mmol d ⁻¹]	[37.0 ± 19.4]	[23.4 ± 11.4]	[37.0 ± 6.8]
Phosphorus (mmol kg ⁻¹ d ⁻¹)	4.9 ± 2.3	3.2 ± 1.4	4.7 ± 0.8
[mmol d ⁻¹]	[45.1 ± 21.1]	[28.0 ± 13.9]	[44.4 ± 9.2]

^aMean ± SD.^bRecommended intakes for preterm infants 1 y following discharge from hospital are; for protein: 2.2 g kg⁻¹ d⁻¹; for energy: 100–120 kcal kg⁻¹ d⁻¹; for calcium 6.3–9.4 mmol d⁻¹; and for phosphorus 3.4–8.8 mmol d⁻¹ (12).

Discussion

Dietary practices, in this case the feeding of mother's milk compared to formula, in prematurely born infants after hospital discharge have a greater impact on their body composition than nutritional interventions in hospital. This observation is in agreement with findings of earlier studies (4, 13, 14). Bishop et al. (14) demonstrated that at 3 months corrected age, the diet after hospital discharge was the only clinical factor that was related to radial BMC. Likewise, a nutrient enriched formula fed to premature infants after hospital discharge resulted in improved growth to 9 months corrected age (15–17).

The lower whole body BMC observed in premature infants fed mother's milk compared to formula is not consistent with observations in term born infants where single site measures of BMC in the radius or humerus revealed no differences between breast and formula-fed groups to 1 y of age (18, 19). But the inconsistency may relate to measures using the single photon absorptiometry technique of a single bone site which may not be representative of whole body bone mass. Recently, Specker et al. (20) demonstrated that total whole body BMC was lower in

term born infants fed mother's milk compared to formula to 6 months of age.

In premature infants, lower bone mass was observed in a single bone in infants fed mother's milk compared to formula at 4 months and 1 y corrected age (13, 15). However, catch-up in radial BMC was demonstrated in a small group of human milk-fed preterm infants before they reached 2 y corrected age (13). In our study, the lower BMC at 6 months corrected age in post-MM was not simply a reflection of the slightly smaller body size, since the differences between post-MM and post-FF remained when BMC was adjusted for body weight or length. The lower calcium and phosphorus intakes in post-MM infants likely contributed to the reduced BMC. Whether the lower whole body BMC in the post-MM infants is of clinical significance in the long term is open to conjecture. Bishop et al. (21) found that intake of human milk in preterm infants was positively associated with a greater radial BMC at 5 y of age and suggested that either low bone mineral content in early infancy programmes bones to be conservative with bone mineral or that growth factors in mother's milk may stimulate later bone mass accretion.

The finding of higher percent body fat in preterm infants fed mother's milk compared to formula was consistent with

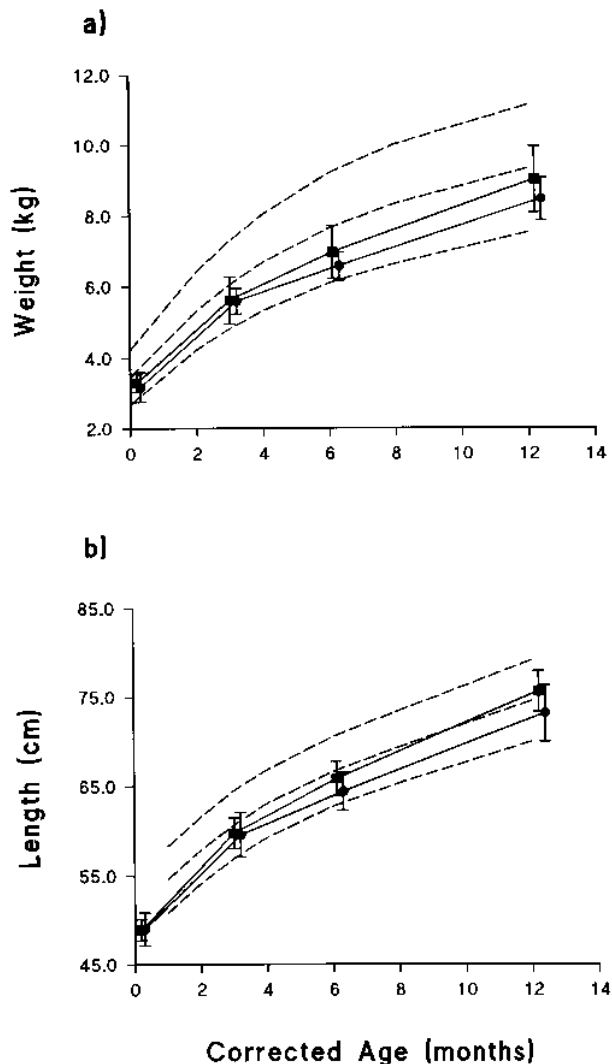


Fig. 2. Weight (a) and length (b) of preterm infants fed post-MM (●) and post-FF (■) to 1 y corrected age in comparison to growth curves derived from healthy term infants fed mother's milk. Dotted lines represent mean and 3–97 percentiles (11).

observations in term infants at 4 months of age where lean and fat mass were measured using ^{18}O dilution and total body electrical conductivity techniques (22). In contrast, Dewey et al. (23) reported lower body fatness in term infants fed mother's milk. That study, however, measured body fatness by skin-fold thickness, which assumes that subcutaneous fat is representative of internal fatness and these results may not have been an accurate reflection of whole body fat mass.

Since the ratio of protein to energy in the diet will influence body composition (24, 25), the lower protein:energy ratio of mother's milk may lead to less lean mass deposition with excess energy deposited as fat. Accordingly, the lower protein intake in the post-MM infants may be the explanation for the observed higher fat mass compared to the post-FF infants.

Table 3. Whole body BMC and BMC adjusted for body size at term, 3, 6 and 12 months corrected age in preterm infants assigned to post-MM and post-FF^a.

	Post-MM	Post-FF
Term	<i>n</i> = 15	<i>n</i> = 9
BMC (g)	57.1 ± 7.5	55.6 ± 6.2
BMC/lean mass (g/kg)	22.8 ± 3.3	20.8 ± 1.7
BMC/weight (g/kg)	17.1 ± 1.6	16.4 ± 0.7
BMC/length (cm/kg)	1.2 ± 0.1	1.1 ± 0.1
3 months	<i>n</i> = 9	<i>n</i> = 9
BMC (g)	107.2 ± 19.8	112.8 ± 15.4
BMC/lean mass (g/kg)	28.2 ± 5.7	26.6 ± 3.1
BMC/weight (g/kg)	18.1 ± 2.7	18.7 ± 0.5
BMC/length (g/cm)	1.8 ± 0.3	1.9 ± 0.2
6 months	<i>n</i> = 6	<i>n</i> = 6
BMC (g)	132.3 ± 10.5 ^b	159.4 ± 14.1
BMC/lean mass (g/kg)	28.8 ± 5.7	31.2 ± 2.7
BMC/weight (g/kg)	19.2 ± 0.7 ^b	22.2 ± 1.4
BMC/length (g/cm)	2.1 ± 0.1 ^b	2.4 ± 0.2
12 months	<i>n</i> = 6	<i>n</i> = 6
BMC (g)	202 ± 32.4	233.7 ± 21.1
BMC/lean mass (g/kg)	32.7 ± 2.5	33.1 ± 1.8
BMC/weight (g/kg)	22.7 ± 2.0	24.7 ± 1.4
BMC/length (g/cm)	2.8 ± 0.4	3.1 ± 0.3

^aMean ± SD.

^bSignificantly different from post-FF, *p* < 0.05.

Despite nutrient intakes, which did not always meet current recommendations for the post-hospital discharge period, mean weight and length attained by the post-MM infants was within the normal range of the growth centiles generated from healthy term breastfed infants (11). Term breastfed infants grow more slowly than formula-fed infants (23); the trend to slower growth in the post-MM compared to post-FF infants was not significant although a type-II error could be the explanation.

We realize that our study is limited because of the small number of infants, and our analysis of the influence of post-hospital discharge nutrition on long-term outcomes was a

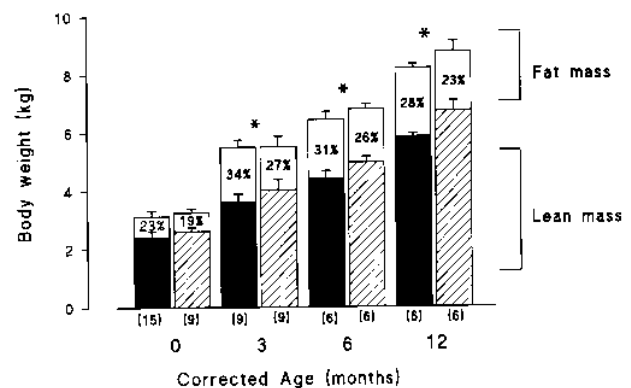


Fig. 3. Percent lean and fat mass at term, 3, 6 and 12 months corrected age in post-MM (solid bars) and post-FF (hatched bars). **p* < 0.05 post-MM vs post-FF for percent fat mass. (n) Number of infants in analysis.

Table 4. Nutrient intakes for preterm infants assigned to post-MM and post-FF post-hospital discharge^a.

Nutrient intakes ^b	Post-MM	Post-FF
Term		
Protein (g kg ⁻¹ d ⁻¹)	1.9 ± 0.4 ^c	2.9 ± 0.4
Energy (kcal kg ⁻¹ d ⁻¹)	121 ± 17	130 ± 17
Calcium (mmol kg ⁻¹ d ⁻¹)	1.4 ± 0.3 ^c	2.1 ± 0.2
[mmol d ⁻¹]	[4.6 ± 1.0]	[7.0 ± 0.5]
Phosphorus (mmol kg ⁻¹ d ⁻¹)	0.9 ± 0.2 ^c	1.8 ± 0.2
[mmol d ⁻¹]	[2.8 ± 0.7]	[5.9 ± 0.6]
3 months		
Protein (g kg ⁻¹ d ⁻¹)	1.6 ± 0.9 ^c	2.3 ± 0.8
Energy (kcal kg ⁻¹ d ⁻¹)	91 ± 22	100 ± 36
Calcium (mmol kg ⁻¹ d ⁻¹)	1.5 ± 0.9 ^c	1.9 ± 0.6
[mmol d ⁻¹]	[7.9 ± 4.2]	[10.3 ± 3.0]
Phosphorus (mmol kg ⁻¹ d ⁻¹)	1.1 ± 0.9 ^c	1.7 ± 0.6
[mmol d ⁻¹]	[5.8 ± 4.5]	[9.2 ± 3.0]
6 months		
Protein (g kg ⁻¹ d ⁻¹)	1.7 ± 0.4 ^c	2.2 ± 0.5
Energy (kcal kg ⁻¹ d ⁻¹)	80 ± 21	96 ± 24
Calcium (mmol kg ⁻¹ d ⁻¹)	1.6 ± 0.5	2.1 ± 0.7
[mmol d ⁻¹]	[10.5 ± 2.9]	[15.2 ± 4.1]
Phosphorus (mmol kg ⁻¹ d ⁻¹)	1.5 ± 0.5 ^c	2.2 ± 0.7
[mmol d ⁻¹]	[10.0 ± 3.2]	[15.6 ± 4.3]

^aMean ± SD.

^bRecommended intakes for preterm infants 1 y following discharge from hospital are; for protein: 2.2 g kg⁻¹ d⁻¹; for energy: 100–20 kcal kg⁻¹ d⁻¹; for calcium 6.3–9.4 mmol d⁻¹; and for phosphorus 3–4.8 mmol d⁻¹ (12).

^cSignificantly different from post-FF, *p* < 0.05.

post hoc analysis. Nevertheless, in the preterm infants studied, the lower BMC and greater fat mass, and a tendency to smaller body size associated with feeding of mother's milk compared to formula, parallel observations in term born infants (20, 22).

In summary, although supplementation of mother's milk with human milk fortifiers has been shown to improve short-term growth, there appears to be no benefit for long-term outcomes of growth and body composition. Post-hospital discharge nutrition seems to have a greater impact on body composition over the first year than nutrition in early neonatal life. Our study implicates an urgent need to define appropriate reference values for whole body BMC and lean and fat mass derived from term infants fed mother's milk. Availability of feeding-specific reference standards will assist in determining the long-term clinical significance, if any, of variations in body size and composition of preterm infants fed during early life.

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