

Complementary Feeding with Cow's Milk Alters Sleeping Metabolic Rate in Breast-Fed Infants

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Introduction

SMR = sleeping metabolic rate (during certain period of sleep)

MOEE = minimal observable energy expenditure (mean energy expenditure during lowest 5 min of sleeping metabolic rate)

BMR = basal metabolic rate

SMR is dependent on gender, age, weight, and mode of feeding

- higher SMR in formula-fed vs. breast-fed
- formula-fed: shorter duration of REM sleep, longer percentage of time in non-REM; formula's tend to have a higher protein content and contributes more to TEF

Rationale

Purpose: Observe the influence of socioeconomic status on components of energy expenditure (MOEE) in breast fed infants

- BCM group: breast and cow's milk
- BM group: just breast milk

Would energy metabolism be influenced by the difference in feeding pattern?

Hypothesis: In line with differences in SMR and MOEE between breast- and formula-fed infants found by others, MOEE would be higher in BCM than in BM infants.

Methods

- Took place in Pelotas, Brazil - 77 infants
- Cross-sectional study to assess food intake, growth, total energy expenditure, SMR, MOEE in 8 month old breast fed infants
 - each measurement period was 3 weeks for each infant
- Used food questionnaire to classify babies into two groups
- SMR - measured by respirometry (Deltarac) for oxygen consumption, carbon dioxide production, and respiratory quotient
 - done around the time the infants would sleep
- MOEE - assessed as the mean of the 5 consecutive lowest 1-min values for energy expenditure
- Measured breast milk intake, H₂O turnover (urine samples collected), body composition (FFMI, FMI), intake of complementary foods, TEF

Results

- 35 infants classified as BM, 27 infants as BCM
- Breast milk intake higher in BM than BCM
 - BCM group: 18 had cow's milk, 3 formula, 5 cow's and formula
- the difference in protein intake between BM and BCM infants was 6.6 g/d (higher values for the BCM infants).

TABLE 2

Food and nutrient intake of BM and BCM infants¹

	BM (n = 32)	BCM (n = 26)	P-value
Breast milk volume, mL/d	761 ± 231	464 ± 352	0.001
Cow's milk volume, mL/d	25 ± 60	232 ± 227	0.001
Intake of yoghurt, g/d	24 ± 49	33 ± 58	0.490
Age until which EBF, ² mo	3.0 ± 1.9	2.3 ± 2.0	0.169
Energy intake, kJ/d	3160 ± 800	3127 ± 741	0.878
Energy from breast milk, %	69 ± 22	42 ± 32	0.001
Energy from cow's milk, %	1.6 ± 4.0	18 ± 20	0.001
Energy from solids, %	29 ± 21	38 ± 22	0.133
Protein intake, g/d	17.1 ± 5.7	23.7 ± 9.5	0.002
Fat intake, g/d	34.7 ± 9.6	29.8 ± 10.3	0.065
Carbohydrate intake, g/d	104.9 ± 32.6	104.8 ± 25.3	0.986
Food quotient	0.86 ± 0.02	0.87 ± 0.02	0.077

¹ Values are means ± SD.

² EBF, exclusively breast-fed, i.e., receiving nothing but breast milk, not even water.

TABLE 3

Components of energy expenditure of BM and BCM infants¹

Metabolic component	BM (n = 35)	BCM (n = 27)	P-value
MOEE			
kJ/d	1672 (1607–1736)	1858 (1785–1932)	0.001
kJ/(kg · d)	201 (192–211)	216 (205–227)	0.041
kJ/(kg FFM · d)	284 (270–298)	309 (293–324)	0.020
kJ/(kg ^{0.347} · d)	801 (772–829)	876 (846–911)	0.001
SMR			
kJ/d	1908 (1846–1971)	2045 (1974–2116)	0.005
kJ/(kg · d)	230 (220–239)	238 (227–249)	0.263
kJ/(kg FFM · d)	325 (311–340)	339 (323–355)	0.198
kJ/(kg ^{0.313} · d)	982 (953–1011)	1041 (1007–1074)	0.001
TEE²			
kJ/d	2315 (2094–2536)	2537 (2290–2784)	0.186
kJ/(kg · d)	285 (257–313)	294 (262–325)	0.688
kJ/(kg FFM · d)	390 (350–430)	421 (377–466)	0.290
kJ/(kg ^{0.192} · d)	1547 (1402–1692)	1674 (1512–1836)	0.247
AEE²			
kJ/d	634 (401–867)	679 (419–940)	0.795
kJ/(kg · d)	82.6 (54.5–110)	79.3 (47.8–111)	0.875
kJ/(kg FFM · d)	106 (66.9–146)	113 (69.4–156)	0.827

¹ Values are means (95% CI).

² Values are adjusted for ethnicity.

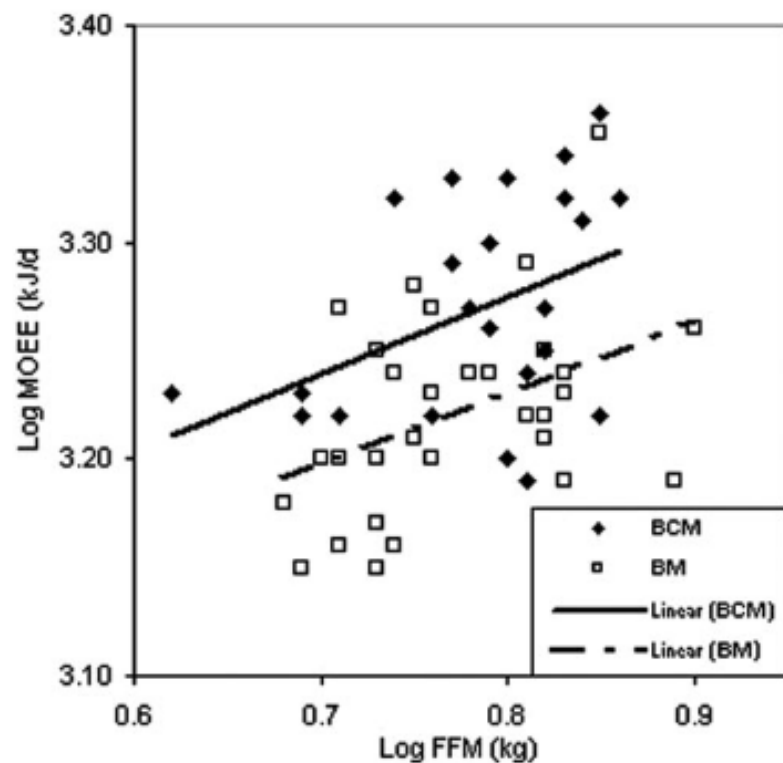


FIGURE 1 Association of log FFM and log MOEE by feeding pattern in infants fed breast milk as the exclusive source (BM) and in those also given cow's milk (BCM). For BM infants: $\log \text{MOEE (kJ/d)} = 2.952 + 0.350 \times \log \text{FFM (kg)}$; for BCM infants: $\log \text{MOEE (kJ/d)} = 3.005 + 0.336 \times \log \text{FFM (kg)}$.

Discussion/Conclusion

- Energy metabolism increased if infants were fed cow's milk
- The socioeconomic status of mothers (working or not) did not differ between the two feeding groups - did not bias results
- Conclusion: complementary feeding with cow's milk appears to increase MOEE and SMR in breast-fed infants
 - higher protein intake in the BCM group
 - bioactive factor in cow's milk responsible for higher SMR
 - higher FMI BCM infants suggests that consumption of cow's milk has an effect on body composition as well
 - → relation to the development of obesity later in life

Questions?

