

Brain sialic acid concentration: comparison of breast-fed vs formula-fed infants

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Neural tissues contain large amounts of sialic acid (SA) bound to gangliosides and glycoproteins. In animal models, levels of SA in brain gangliosides and glycoproteins are influenced by nutritional intake and correlate with learning ability (1). The aim of our study was to compare the SA concentration in brain frontal cortex of breast-fed and formula-fed infants who died of sudden infant death syndrome.

Twenty-five frontal cortex samples were collected as part of a previous study on long chain fatty acids in brain cortex. Twelve infants were breast-fed, 9 formula-fed and the rest unknown. The mean age at death of breast-fed and formula-fed infants was 11 and 13 wks respectively. Gangliosides were extracted, isolated and purified according to published methods. Ganglioside-bound, protein-bound and free SA were determined using HPLC (2).

There was a significant positive correlation between protein-bound SA and age at death ($P = 0.02$), but not for ganglioside-bound SA ($P = 0.24$). Ganglioside-bound SA was 8% higher in males while protein-bound SA was 5% higher in females, although neither reached statistical significance. On average, breast-fed infants were about 2 wks younger than formula-fed infants and all of the latter were male. We therefore used a multi-variate general linear model for the components of SA (ganglioside-bound, protein-bound and free) adjusting for type of feed and sex, with age at death as a covariate. The overall differences of feeding methods were significant ($P = 0.024$). Ganglioside-bound, protein-bound and total SA were significantly higher in breast-fed infants ($P = 0.013$, 0.01 and 0.005 respectively) (Figure).

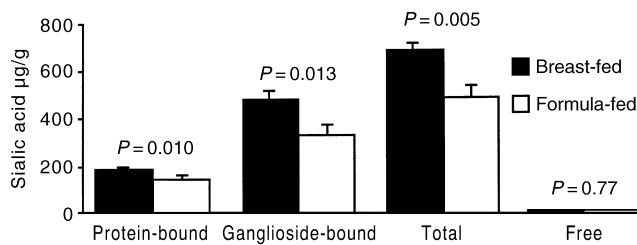


Figure. Sialic acid concentration in brain cortex (adjusted for age and sex) of breast-fed vs formula-fed SIDS infants.

These findings provide objective evidence of differences in brain development in breast-fed vs formula-fed infants. The higher concentration of ganglioside-bound, protein-bound & total SA in frontal cortex in the breast-fed group may explain the known neurological and intellectual advantages of breast-feeding.

1. Morgan BL, Winick M. Effects of administration of N-acetylneuraminic acid (NANA) on brain NANA content and behavior. *J Nutr* 1980; 110: 416–424.