

# CHOLINE CONTENT OF MOTHERS' MILK IN ECUADOR AND BOSTON

*To the Editor:* We have found that the free choline concentration of human milk varies during postnatal development and is sometimes markedly depressed in samples from women thought to be ingesting a choline-deficient diet.

Choline is a precursor in the biosyntheses of phospholipids<sup>1</sup> and of the neurotransmitter acetylcholine.<sup>2,3</sup> In animals, ingestion of a diet deficient in choline results in hepatic, renal, growth, and memory disorders.<sup>4</sup> Neonates must ingest choline-containing foods like milk in order to maintain blood choline concentrations at high levels<sup>5</sup>; these levels may be needed to supply adequate choline to rapidly growing tissues. For these reasons, we were interested in measuring the amounts of choline available to infants ingesting human milk.

Milk from Boston women was compared with milk from women living in two communities in highland Ecuador (Table 1). These Ecuadorean women live in villages approximately 100 km north of Quito. The incidence of intellectual impairment and short stature among their offspring is high, and the maize-based diet of many villagers appears to be low in choline content.

Milk from Boston women had the highest free choline levels three to five days post partum; mature milk (more than 30 days post partum) had choline concentrations of 100 to 350 nmol per milliliter. Lecithin and sphingomyelin also served as sources of choline. Mature milk from 21 Ecuadorean women had much lower free choline contents (4 to 84 nmol per milliliter). The remainder of the Ecuadorean women (34 subjects) had choline concentrations similar to

**Table 1. Free Choline Content of Milk Samples Obtained from Ecuadorean and American Women.\***

MILK CHOLINE  μM	PERCENTAGE OF POPULATION WITHIN GIVEN RANGE	
	ECUADOR (N = 55)	UNITED STATES (N = 11)
0-100	40	0
100-200	27	27
200-300	27	18
>300	6	55

those seen in milk from Boston women. Lecithin and sphingomyelin content was the same in Ecuador and Boston.

No studies have determined the actual choline requirements of neonates, nor do we know whether lecithin and sphingomyelin can be digested by neonates to yield free choline. More information about the effects of maternal diet on the quality of breast milk is clearly needed. In view of the high incidence of abnormalities in intellectual development and growth in children from these villages in Ecuador, we believe that the low choline concentrations we found in milk may have important consequences for the neonate.

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\*Milk samples were collected by manual expression at midday, after feeding the infant. All donors had been lactating for more than 30 days. Samples were placed on ice and frozen as soon as possible. Free choline, lecithin, and sphingomyelin were determined with radioenzymatic assays.<sup>5</sup>