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# Dietary sialic acid supplementation improves learning and memory in piglets<sup>1,2,3</sup>

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**Background:** Sialic acid, a key component of both human milk oligosaccharides and neural tissues, may be a conditional nutrient during periods of rapid brain growth.

**Objective:** We tested the hypothesis that variations in the sialic acid content of a formula milk would influence early learning behavior and gene expression of enzymes involved in sialic acid metabolism in piglets.

**Design:** Piglets ( $n = 54$ ) were allocated to 1 of 4 groups fed sow milk replacer supplemented with increasing amounts of sialic acid as casein glycomacropeptide for 35 d. Learning performance and memory were assessed with the use of easy and difficult visual cues in an 8-arm radial maze. Brain ganglioside and sialoprotein concentrations and mRNA expression of 2 learning-associated genes (*ST8SIA4* and *GNE*) were measured.

**Results:** In both tests, the supplemented groups learned in significantly fewer trials than did the control group, with a dose-response relation for the difficult task ( $P = 0.018$ ) but not the easy task. In the hippocampus, significant dose-response relations were observed between amount of sialic acid supplementation and mRNA levels of *ST8SIA4* ( $P = 0.002$ ) and *GNE* ( $P = 0.004$ ), corresponding with proportionate increases in protein-bound sialic acid concentrations in the frontal cortex.

**Conclusions:** Feeding a protein-bound source of sialic acid during early development enhanced learning and increased expression of 2 genes associated with learning in developing piglets. Sialic acid in mammalian milks could play a role in cognitive development.

**Key Words:** Sialic acid supplementation • learning and memory • gene expression • brain development • piglets

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