Tissue Distribution of Lutein in Neonatal Sprague -Dawley Rats Reared by Mothers Consuming a Normal- or a High Fat Diet

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Objectives: Lutein, the most abundant carotenoid in the eye and brain of infants, is critical for their visual and cognitive development. Lutein cannot be synthesized *de novo* and newborns must obtain it from breast milk or infant formula. Due to its lipophilic nature, a high adiposity may affect the tissue distribution of lutein and compromise its availability in key organs by increasing its storage in fatty tissues. The aim of the present study was to assess the distribution of lutein in neonatal rats reared by mothers consuming a normal- or a high fat diet.

Methods: Pregnant Sprague-Dawley rats were randomized to a normal fat diet (NFD, 25% kcal from fat) or a high fat diet (HFD, 50% kcal from fat) both with 0.3% of lutein during their gestation and lactation. At postnatal day 6 (P6) and P11, rat pups (n = 7/group/time) were euthanized. Blood, liver, stomach, small intestine, eye, brain, spleen, kidney, lung, visceral white adipose tissue (WAT), brown adipose tissue (BAT), and subcutaneous white adipose tissue (SWAT) were collected. The concentration of lutein in the serum, milk separated from stomach, and all the other tissues were measured by UPLC with a photodiode array detector.

Results: No significant difference in maternal lutein intake was found between the NFD and the HFD group. At both P6 and P11, a significantly ($P < 0.05$) lower lutein concentration was noted in the milk samples separated from the stomach of HFD pups compared to that in NFD pups. At P6, HFD pups showed a significantly higher lutein concentration in the serum, spleen, lung, and WAT than the NFD group and a significantly lower concentration in the liver. At P11, the HFD group exhibited a significantly lower lutein concentration in the brain, eye, and BAT, but a significantly higher concentration in the WAT.

Conclusions: Neonatal rats reared by mothers fed an HFD received a lower level of lutein in milk and exhibited different tissue distribution compared to pups in dams consuming an NFD. At P11, the HFD group had a significantly lower lutein concentration in the organs where lutein plays a critical role, i.e., eye and brain, accompanied with a higher concentration in the adipose tissue. The present study was the first to provide evidence that maternal HFD consumption affected or even potentially compromised the availability of lutein to its target organs in neonatal offspring.

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