Effects of Third Trimester Consumption of Eggs High in Docosahexaenoic Acid on Docosahexaenoic Acid Status and Pregnancy

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Worldwide, maternal intakes of docosahexaenoic acid (DHA) are highly variable; however, few studies have looked at the effect of variable DHA intake on DHA in maternal and infant blood. We postulated that eggs from chickens fed DHA-rich microalgae (DHA Gold™, OmegaTech, Inc., Boulder, CO) would be accepted as a food source of DHA and increase levels of this fatty acid in blood lipids of mothers and infants. The primary aim of this study was to compare maternal third trimester DHA status and infant DHA status among women who: (i) were randomly assigned to consume up to one dozen regular eggs, each containing about 28 mg DHA, per week (regular egg); (ii) were randomly assigned to consume up to one dozen eggs from chickens fed a diet containing the dried microalgae, each containing approximately 135 mg DHA, per week (high-DHA egg); or (iii) routinely consumed few if any eggs (low egg). Secondary aims of the study were: (i) to determine the usual DHA intakes from eggs by women who delivered in our hospital, and (ii) to obtain data about pregnancy outcomes that might be relevant to safety and efficacy of the high-DHA eggs.

Methods. Pregnant women who were 24–28 wk postmenstrual age without diabetes, organ disease, or pre-eclampsia were asked to consent to the study. Blood samples (pre-study) were obtained, and the women were asked about frequency of food intake. Women who ate eggs were randomly assigned to regular or high-DHA eggs; women who ate few eggs were grouped without being randomized. The two egg groups were given one dozen eggs per week and instructed to eat as many of the eggs as they could. Egg intakes were recorded from written records and double-checked biweekly by telephone interviews.

Poststudy maternal bloods were taken at delivery. After delivery, cord bloods were obtained, the placentas and infants weighed, and infants' lengths and head circumferences measured. Plasma and red blood cells (RBC) were separated by centrifugation, and total lipids from each were extracted and separated into lipid classes by thin-layer chromatography. Plasma and RBC total phospholipids and plasma triglycerides were recovered from the plates, transmethylated with boron trifluoride–methanol, and the resulting fatty acid methyl esters analyzed by capillary gas–liquid chromatography (SP-2560, 100 m × 0.25 mm).

Results. Fifty-three women completed the study (16 low egg, 19 regular egg, 18 high-DHA egg). The respective mean pre-study DHA intakes from eggs for these groups were 5.4, 16.0, and 19.6 mg/day. The mean study DHA intakes from eggs for the same groups were 16.2, 51.2, and 205.2 mg/d based on weekly egg intakes of 2.7, 8.8, and 10.1 for 12.9, 12.6, and 12.8 wk of study, respectively.

In the control groups (low egg and regular egg), DHA decreased in each lipid class during the study while it increased in comparable lipids of the high-DHA egg group. The difference between groups did not reach statistical significance because of variable egg intakes within groups. However, regression analysis showed a significant positive relationship between study DHA intake and DHA in plasma and RBC lipids of women and infants at delivery.

The study did not have adequate power to detect an effect of high-DHA eggs on pregnancy outcome; however, several favorable outcomes were suggested. Despite the variability in number of eggs consumed, the high-DHA egg group had fewer low-birth-weight (<2500 g) (0% vs. 13 and 26%) and preterm (<37 gestation) (6% vs. 25 and 26%) infants than women from the low-egg and regular-egg groups, respectively. They also had larger placentas (760 g vs. 658 and 663 g), even after preterm infants were excluded (762 g vs. 665 and 710 g). A higher proportion of women in the control and comparison groups compared to the high-DHA group also had surgical delivery and received antibiotics in hospital. Three women in the regular-egg group but none in the high-DHA group or low-egg group developed gestational diabetes after enrollment.

Summary. High-DHA eggs appear to be a practical way to increase maternal DHA status. The data suggest that high-DHA eggs could decrease the incidence of preterm and low-birth-weight births, and this could be tested in a study with more statistical power. The neurodevelopment of infants from women fed low- and high-DHA eggs could also provide helpful information.

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Abbreviations: DHA, docosahexaenoic acid; RBC, red blood cell.