Research and Professional Briefs

Low Docosahexaenoic Acid in the Diet and Milk of Women in New Mexico

ROBERT H. GLEW, PhD; ROSEMARY S. WOLD, MS, RD; JOSEPH H. HERBEIN, PhD; WENDY A. WARK, MS; MARY A. MARTINEZ, MS, RD; DOROTHY JOAN VANDERJAGT, PhD

ABSTRACT

Because docosahexaenoic acid (DHA) is critical for the development of the nervous system, especially during the first year of life, the content of DHA in human milk is important for the well-being of exclusively breastfed infants. The aim of this study was to determine the fatty acid composition, including DHA, of the breast milk fat and serum phospholipids of women in New Mexico, and to correlate these data with dietary fatty acid content. Samples of blood and breast milk, 3-day diet records, and information on dietary supplement use were obtained from 29 women. Eligible subjects were nonsmokers, aged 18 to 40 years, lactating for 1 to 6 months, and not pregnant, taking immunosuppressive drugs, or diagnosed with diabetes. The mean fat content of the breast milk was 3.37±2.34 g/dL. The percentage of DHA in the milk fat was very low (0.11%) relative to international norms (0.2% to 0.4%) and could be explained by the women's low intake of DHA (33 to 58 mg/day). These data can be explained by the fact that the subjects were not taking DHA supplements or consuming foods that are good sources of DHA. Correlations were found between the percentages of DHA in the serum phospholipids and milk fat. The findings underscore the need for educating lactating women about food sources of DHA. Educational opportunities could occur in conjunction with other education postdelivery or during postnatal clinic visits.
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R. H. Glew is a professor and D. J. VanderJagt is a research associate professor, Department of Biochemistry and Molecular Biology, and R. S. Wold is nutrition research manager, General Clinical Research Center, University of New Mexico, Albuquerque. J. H. Herbein is a professor, and W. A. Wark is a laboratory specialist, Department of Dairy Science, Virginia Polytechnical Institute and State University, Blacksburg. M. A. Martinez is a member of the faculty, Department of Nutrition, Central New Mexico Community College, Albuquerque; at the time of the study, she was a senior research nutritionist, General Clinical Research Center, University of New Mexico, Albuquerque.

Address correspondence to: Dorothy Joan VanderJagt, PhD, Research Associate Professor, Department of Biochemistry and Molecular Biology, University of New Mexico School of Medicine, MSC08 4670, University of New Mexico, Albuquerque, NM 87131. E-mail: dvanderjagt@salud.unm.edu

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The amounts of various fatty acids in the triacylglycerol fraction of human milk are critical to the overall growth and development of newborns, especially during the first year of life (1-10). Triacylglycerol is the major energy source in breast milk and provides nursing infants with the two essential fatty acids, linoleic acid and α-linolenic acid, and polyunsaturated fatty acids such as arachidonic acid and docosahexaenoic acid (DHA) that are critical for the development of the central nervous system.

The amounts and kinds of fatty acids a lactating woman consumes are strong determinants of the fatty acid composition of the milk fat she produces. In terms of public health significance, it is useful to point out that a lactating woman can enhance the content of the two essential fatty acids and DHA in her milk by increasing her intake of these fatty acids (11-13).

Whereas the literature contains several reports of the fatty acid composition of the milk of women in the United States (11,14), there are few studies of the content of fatty acids in the milk of women in the Southwest and the relations between the diets of these women and the fatty acid composition of the milk fat they produce. Several reports have revealed that from the fatty acid standpoint, the milk of women in certain parts of the United States may fall short of international standards (15). In light of the fact that the lower breast milk DHA concentrations have been found in populations with low marine-food consumption, women in certain geographic areas of the United States, including those in New Mexico, may not consume adequate amounts of DHA.

In New Mexico, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) has seen an increase in the initiation of breastfeeding by their participants from 47% in 1990 to 67% in 2001 (16). Because DHA-rich seafoods such as salmon and tuna are not routine components of the diet of most of the inhabitants of New Mexico (17,18), it is hypothesized that lactating women in New Mexico may produce a milk fat that contains proportions of DHA that are suboptimal for infants who receive a substantial portion of their nutrition from breast milk.

The purpose of this study was to assess the nutrient quality of breast milk in lactating women in New Mexico.

Specifically, we investigated the proportions and actual amounts of the different fatty acids in the milk fat and correlated these results with the fatty acid content of their diets and the fatty acid composition of their serum phospholipids.

METHODS

Subjects

From June 2005 to January 2006, 429 new mothers were screened for eligibility for the study; 196 were eligible and were contacted; however, 167 of these were no longer breastfeeding, could not be reached, or were not interested in participating in the study; 29 completed the study. The socioeconomic status (SES) of the subjects was assessed by financial class based on Medicaid eligibility. Subjects were determined to be lower SES if they were Medicaid eligible or of higher SES if they had private health insurance or coverage through an employer.

Twenty-nine women between ages 18 and 40 years who had been lactating for 1 to 6 months were recruited into the study while they visited the breastfeeding center, the neonatal intensive care unit, or the mother–baby unit at the University of New Mexico Hospital in Albuquerque. The exclusion criteria were maternal use of tobacco, use of immunosuppressive drugs, pregnancy, and diabetes mellitus. The study was approved by the Human Research Review Committee of the University of New Mexico Health Sciences Center and signed informed consent was obtained from each subject. Compliance with Health Insurance Portability and Accountability Act guidelines was maintained. Participants' biological samples, height and weight measurements, and dietary data collection were completed at the outpatient clinic at the University of New Mexico General Clinical Research Center from June 2005 through January 2006.

Collection of Biological Specimens

Milk was collected after 30 days postgestation to ensure that mature milk was fully established (19). Milk and blood were collected by a registered nurse between 7 AM and 10:30 AM following an overnight fast. Using a manual pump and adhering to the recommendation of Neville (19), the first 3 mL of milk were collected and discarded. The next 10 to 15 mL of milk were collected into a sterile plastic cup with the aid of a Medela Harmony Breastpump (Medela, Inc, McHenry, IL) and aliquoted into 2-mL cryovials. Ten milliliters of blood was collected from each participant's arm at the antecubital fossa into clean, dry vacutainers and allowed to clot at room temperature for 45 minutes. After centrifugation at 8,000×g for 8 minutes, the serum fraction was aliquoted into 2-mL cryovials. The milk and blood sera were stored at −70°C before analysis.

Diet Records

Participants in the study completed a single written diet record of all food and drinks consumed in the 3 days before giving blood and milk samples (20). Participants were provided a standardized form along with written and verbal instructions on how to keep the record. Subjects met with a registered dietitian (RD) who confirmed each item on the food record.

Participants recorded amounts of foods consumed in standard household measurements, such as cups, tablespoons, and ounces. When necessary, quantities of food were checked by the RD using Nasco Lifeform three-dimensional food models (Nasco Food Models, Modesto, CA). Information about brand names of foods and fats and oils used in cooking was also collected. The 3-day diet records were coded and analyzed by RDs using Food Intake Analysis System (versions 3.99, 1999, and Millennium 1.0, 2005, The University of Texas School of Public Health, Houston, TX). This nutrient analysis software program utilizes the 1994-1996, 1998 US Department of Agriculture Continuing Survey of Food Intakes by Individuals Nutrient Data Base. The output has information on 52 nutrients (19 fatty acids, including linolenic, linoleic, and arachidonic acids as well as DHA). Coding for all dietary records was reviewed by an RD to ensure accuracy. Averages of nutrients across the 3-day period were compiled from each participant's diet records.

Dietary Supplement Records

During the clinic visit, the participants presented containers of all dietary supplements they were currently taking. The label information was recorded onto a standardized form by an RD and the participants were questioned regarding frequency of use. Sources of nonvitamin, nonmineral supplements in functional foods were not included in the data collection because these products are not classified as dietary supplements (21). RDs compiled the dietary supplement information into a spreadsheet that was reviewed by an RD to ensure accuracy.

Body Mass Index (BMI), Height, and Weight

Participant height and weight was measured twice by an RD using the method described by Gordon and colleagues (22). Participants were weighed to the nearest 0.1 kg on a platform scale (Detecto, Webb City, MO); height was measured to the nearest 0.1 cm using a wall-mounted stadiometer (Holtain Ltd, London, UK). BMI was calculated as kg/m^2.

Patient Education and Follow-Up

After data collection, an RD counseled participants about increasing fish consumption in accordance with US Environmental Protection Agency guidelines (23), and also counseled them regarding overall general diet quality. Each participant was sent a letter outlining general study results and overall recommendations.

Fatty Acid Analysis

Frozen milk was thawed and gently mixed to provide a uniform sample. Dry matter content was determined by drying 0.5 g milk in a forced-air oven at 60°C for 24 hours. An aliquot (2 mL) of each sample was weighed in a 50-mL extraction tube before lipid extraction using chloroform/methanol (2:1, volume:volume). The extracted lipid residue was weighed after drying at 45°C under a stream of nitrogen. The total phospholipid component of serum was