Effect of Light Exposure During Pumping and Holder Pasteurization on Vitamin Concentrations in Human Milk

Hope Lima[1,2], Kenneth Vogel[1], Daniela Hampel[3], Montana Wagner-Gillespie[1], April Fogleman[1]

[1]Department of Human Nutrition, Winthrop University; [2]Food, Bioprocessing, and Nutrition Sciences, North Carolina State University, Raleigh, NC, [3]Department of Nutrition, University of California Davis, Davis, CA

Donor human milk is a necessary secondary feeding option when mother's own milk is unavailable. To ensure safety for premature and medically fragile infants, milk banks pasteurize donated milk. During pumping, storage, and pasteurization, all milk is exposed to light. Currently, milk banks do not regulate light exposure. Riboflavin, thiamine, and vitamin A are vitamins that are highly light labile. In this study, we aim to determine if light exposure during pumping, storage, and pasteurization in a milk bank setting causes degradation of vitamins in human milk. Thirteen eligible participants donated four milk samples each: 2 light-exposed (E) and 2 light-protected (P) samples. One E and one P sample from each participant were kept raw (R), while one E and one P sample from each participant were subjected to 3 hours of daytime light and Holder pasteurization (H). Subsequently, all samples were analyzed for fat, protein, carbohydrates, riboflavin, thiamine, retinol, γ-tocopherol, α-tocopherol, and β-carotene content. Protein and fat were similar between treatment groups ($p < 0.05$). Carbohydrate content was significantly lower ($p < 0.05$) in PH samples, but was still in the range expected based on current literature (range of 6.2-7.2%). Thiamine content was significantly ($p < 0.05$) impacted by light exposure and heat exposure; however, concentrations were within the range expected based on current literature (0.23 – 0.26 mg/L). Retinol, α-tocopherol, and β-carotene were not impacted by the level of light exposure utilized in this study ($p < 0.05$). γ-tocopherol concentrations were significantly reduced in raw samples when exposed to light; however, concentrations were still in the range expected based on the literature (2.8 - 3.5 mg/L). Total riboflavin was significantly ($p < 0.05$) impacted by light exposure in both raw and pasteurized samples (62.1 µg/L and 73.7 µg/L, respectively) when compared to light protected raw samples (99.68 µg/L). Riboflavin concentrations may be reduced to levels of concern after exposure to light at any point. Additional research is needed to determine if an infant receiving exclusively pumped raw or pasteurized human milk needs additional dietary riboflavin. Our results indicate that protecting human milk samples from light exposure during pumping, home storage, and transport to a donor human milk bank may help retain the riboflavin present in human milk. Additionally, milk may have higher concentrations of riboflavin if protected from light exposure during the pasteurization process.