Lactation after Normal Pregnancy is Not Associated with Blood Glucose Fluctuations

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Introduction
Breastfeeding is the preferred method of feeding infants up to 12 months of age (1). Breastfed infants experience fewer and less severe infections and may be protected against future disease development (2). Mothers who breastfeed potentially experience accelerated weight loss (3), a lower risk of breast and ovarian cancer (3), and a lower risk of type 2 diabetes mellitus compared to mothers who do not breastfeed (4).

Breastfeeding is recommended for all women, including those with gestational (5) or pregestational diabetes (6). However, data suggest that diabetic women may experience hypoglycemia during breastfeeding; subsequently, they have been advised to eat before or during breastfeeding in order to avoid hypoglycemia (6). Because data on blood glucose fluctuations in normoglycemic women are limited, we tested the hypothesis that lactation in healthy normoglycemic women will not cause significant blood glucose fluctuations.

Research Design and Methods
Women were recruited randomly from the Pregnancy Program at Brigham and Women’s Hospital (BWH). The BWH Human Research Committee approved the study protocol and all women provided informed written consent prior to participation. Healthy women were included if they were 18-40 years of age; 6 weeks-6 months postpartum; free of a history of gestational or pregestational diabetes; and breastfeeding with no more than 1 bottle/day supplementation. Women were excluded if they had an abnormal 1-hour glucose challenge test during pregnancy (5); were taking medications known to influence blood glucose; were nursing more than one infant; or were incapable of using the continuous glucose monitoring system (CGMS®).

Participants presented to the General Clinical Research Center (GCRC) where height and weight were measured and their pregnancy history was reviewed. A study physician inserted the CGMS® according to manufacturer directions and provided participants with instructions regarding CGMS® maintenance and Accu-chek™ fingerstick blood glucose monitoring (FBGM) for CGMS® calibration.

Participants wore the CGMS® for 48 hours and documented initiation of infant suckling or breast pump use, food intake, FBGM (at least 4 times daily), hypoglycemic symptoms, exercise, and sleep. In addition, participants marked these events using CGMS® controls. After 48 hours, participants returned to the GCRC and had blood drawn fasting for glucose, insulin, and glycosylated hemoglobin. The physician collected the documentation, removed the CGMS®, and downloaded the CGMS® data.

Blood samples were iced and centrifuged at 4°C/2000 RPM for 15 minutes. Plasma was frozen at -70 ºC until assays were performed. Serum glucose was measured by the glucose oxidase method (Beckman glucose analyzer, Fullerton, CA). Serum insulin was assayed by Chemiluminescence (Beckman Chemiluminescence-new protocol, Chaska, MN). Hemoglobin A1c was measured by high-performance liquid chromatography (Tosoh Bioscience, Inc., San Francisco, CA).

In order to optimize data accuracy, by allowing for CGMS® acclimation, blood glucoses obtained during the second 24-hour CGMS® period were analyzed. The first lactation episode free of food or caloric beverage intake for 60 minutes both before and after lactation initiation was identified and data were analyzed using SAS version 9.1 (SAS Institute Inc., Cary, NC). Analysis of variance (ANOVA) was used to compare the glucoses obtained before and after lactation. Paired t-tests were used to compare 1) the
mean area under the curve for glucose (AUCg) before lactation to the mean AUCg after lactation; and 2) the mean glucose before to the mean glucose after lactation. Data are expressed as the mean ± standard deviation (SD) and a p-value < 0.05 was considered statistically significant.

Results
The nine women studied were 33 ± 4 years of age and 20.3 ± 7.3 weeks postpartum. They had BMI 24.4 ± 5.3 kg/m², fasting glucose 82 ± 8 mg/dl, insulin 1.99 ± 0.90 μU/ml, and HgbA1c 5.5 ± 0.3%. The CGMS® data revealed no significant fluctuations in glucose obtained at 5-minute intervals during the pre-lactation period (p=0.23; Figure 1). Similarly, there were no significant fluctuations among the glucose obtained during the period after lactation (p=0.09). The mean glucose before lactation did not differ significantly compared to the mean glucose after lactation (95 ± 14 vs. 96 ± 15 mg/dl; p = 0.93). The mean AUCg before lactation did not differ significantly compared to the mean AUCg after lactation (376.9 ± 53.3 vs. 382.8 ± 56.9 mg·hr/dl; p=0.34).

Conclusions
We observed no significant glucose changes during the period before or after lactation in women who had pregnancies uncomplicated by pregestational or gestational diabetes mellitus. Moreover, these healthy women did not have differences in the mean glucose obtained pre-lactation compared to post-lactation nor did they manifest hypoglycemia in response to lactation.

Our data extend the current literature on blood glucose response to lactation by examining healthy women. Data in Type 1 diabetic women have revealed that breastfeeding lowered blood glucose concentrations and made achieving metabolic control more difficult (6). Studies have demonstrated that women with gestational diabetes benefit from lactation, manifesting improved glucose metabolism with a two-fold increase in subsequent T2DM among non-lactating women (7). However, to our knowledge there are no published data employing CGMS® to characterize glucose fluctuations in healthy lactating women.

Our main study limitation is sample size. However, although only nine women were studied, each had CGMS® data providing blood glucose sampling every 5 minutes both before and after lactation to understand blood glucose characteristics during this period. Additionally, the validity of our selected blood glucose analysis periods before and after lactation was dependent on participant reliability in documenting food intake.

In conclusion, we observed no significant blood glucose fluctuations in response to lactation among healthy women with a normoglycemic pregnancy history. Therefore, these women do not need to increase caloric intake specifically before or during lactation to prevent hypoglycemia. This is noteworthy because limiting postpartum caloric intake will facilitate the loss of excess pregnancy weight, thereby reducing the risk of developing obesity. Nonetheless, women should be aware of recommendations during breastfeeding regarding healthy caloric intake (8). Moreover, further studies of glucose fluctuations during lactation in larger numbers of normoglycemic and diabetic women are warranted.

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References

Figure 1. Blood glucose levels (mg/dl) collected every 5 minutes during the 60 minutes before and after the start of lactation (Time =0) for each of the nine participants in the study.