

# Alcohol Consumption During Lactation and Child Neurodevelopment

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# Question 8

- *What is the relationship between alcohol consumption during lactation and infant developmental milestones, including neurocognitive development?*



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# Alcohol Elimination and Infant Dose

- Alcohol known to enter breast milk in approximately same concentrations as in maternal blood
- Peak concentration about 1 hour after ingestion on an empty stomach
- Can be delayed if alcohol consumed with a meal
- Lactation appears to affect maternal alcohol absorption (bioavailability 20-25% lower in lactating vs non-lactating women)
- Milk levels closely parallel maternal blood levels
- Quantity consumed, maternal body weight, also affect elimination time

■ *Anderson PO, Breastfeeding Medicine (2018) 13:315-17*



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# Alcohol Elimination and Infant Dose

- Estimated that nursing child receives 5-6% of the weight-adjusted maternal dose if the child is fed at the time of maximum alcohol concentration in maternal blood following intake of about 1.8-3.6 units
- Estimated blood alcohol level in a 6 kg infant consuming 150 mL of milk over 6 feedings would be about 0.005%
- Suggestion to minimize infant exposure: wait 2-2.5 hours per drink before breastfeeding or pumping
  - *Haastrup MB et al, Basic and Clinical Pharmacology and Toxicology, (2014) 114:168-73*



# Questions 7 and 8

*Biology of  
the Neonate*

## Original Paper

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Biol Neonate 2001;80:219–222

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## Alcohol and Breast Feeding: Calculation of Time to Zero Level in Milk

Elaine Ho Alexis Collantes Bhushan M. Kapur Myla Moretti Gideon Koren

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**Table 2.** Alcohol and breast feeding: time (h:min) until the zero level in milk is reached for women at different body weights

| Maternal weight |     | Drinks |      |      |       |       |       |       |       |       |       |       |       |
|-----------------|-----|--------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| kg              | lb  | 1      | 2    | 3    | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    |
| 40.8            | 90  | 2:50   | 5:40 | 8:30 | 11:20 | 14:10 | 17:00 | 19:51 | 22:41 |       |       |       |       |
| 43.1            | 95  | 2:46   | 5:32 | 8:19 | 11:05 | 13:52 | 16:38 | 19:25 | 22:11 |       |       |       |       |
| 45.4            | 100 | 2:42   | 5:25 | 8:08 | 10:51 | 13:34 | 16:17 | 19:00 | 21:43 |       |       |       |       |
| 47.6            | 105 | 2:39   | 5:19 | 7:58 | 10:38 | 13:18 | 15:57 | 18:37 | 21:16 | 23:56 |       |       |       |
| 49.9            | 110 | 2:36   | 5:12 | 7:49 | 10:25 | 13:01 | 15:38 | 18:14 | 20:50 | 23:27 |       |       |       |
| 52.2            | 115 | 2:33   | 5:06 | 7:39 | 10:12 | 12:46 | 15:19 | 17:52 | 20:25 | 22:59 |       |       |       |
| 54.4            | 120 | 2:30   | 5:00 | 7:30 | 10:00 | 12:31 | 15:01 | 17:31 | 20:01 | 22:32 |       |       |       |
| 56.7            | 125 | 2:27   | 4:54 | 7:22 | 9:49  | 12:16 | 14:44 | 17:11 | 19:38 | 22:06 |       |       |       |
| 59.0            | 130 | 2:24   | 4:49 | 7:13 | 9:38  | 12:03 | 14:27 | 16:52 | 19:16 | 21:41 |       |       |       |
| 61.2            | 135 | 2:21   | 4:43 | 7:05 | 9:27  | 11:49 | 14:11 | 16:33 | 18:55 | 21:17 | 23:39 |       |       |
| 63.5            | 140 | 2:19   | 4:38 | 6:58 | 9:17  | 11:37 | 13:56 | 16:15 | 18:35 | 20:54 | 23:14 |       |       |
| 65.8            | 145 | 2:16   | 4:33 | 6:50 | 9:07  | 11:24 | 13:41 | 15:58 | 18:15 | 20:32 | 22:49 |       |       |
| 68.0            | 150 | 2:14   | 4:29 | 6:43 | 8:58  | 11:12 | 13:27 | 15:41 | 17:56 | 20:10 | 22:25 |       |       |
| 70.3            | 155 | 2:12   | 4:24 | 6:36 | 8:48  | 11:01 | 13:13 | 15:25 | 17:37 | 19:49 | 22:02 |       |       |
| 72.6            | 160 | 2:10   | 4:20 | 6:30 | 8:40  | 10:50 | 13:00 | 15:10 | 17:20 | 19:30 | 21:40 | 23:50 |       |
| 74.8            | 165 | 2:07   | 4:15 | 6:23 | 8:31  | 10:39 | 12:47 | 14:54 | 17:02 | 19:10 | 21:18 | 23:26 |       |
| 77.1            | 170 | 2:05   | 4:11 | 6:17 | 8:23  | 10:28 | 12:34 | 14:40 | 16:46 | 18:51 | 20:57 | 23:03 |       |
| 79.3            | 175 | 2:03   | 4:07 | 6:11 | 8:14  | 10:18 | 12:22 | 14:26 | 16:29 | 18:33 | 20:37 | 22:40 |       |
| 81.6            | 180 | 2:01   | 4:03 | 6:05 | 8:07  | 10:08 | 12:10 | 14:12 | 16:14 | 18:15 | 20:17 | 22:19 |       |
| 83.9            | 185 | 1:59   | 3:59 | 5:59 | 7:59  | 9:59  | 11:59 | 13:59 | 15:59 | 17:58 | 19:58 | 21:58 | 23:58 |
| 86.2            | 190 | 1:58   | 3:56 | 5:54 | 7:52  | 9:50  | 11:48 | 13:46 | 15:44 | 17:42 | 19:40 | 21:38 | 23:36 |
| 88.5            | 195 | 1:56   | 3:52 | 5:48 | 7:44  | 9:41  | 11:37 | 13:33 | 15:29 | 17:26 | 19:22 | 21:18 | 23:14 |
| 90.7            | 200 | 1:54   | 3:49 | 5:43 | 7:38  | 9:32  | 11:27 | 13:21 | 15:16 | 17:10 | 19:05 | 20:59 | 22:54 |
| 93.0            | 205 | 1:52   | 3:45 | 5:38 | 7:31  | 9:24  | 11:17 | 13:09 | 15:02 | 16:55 | 18:48 | 20:41 | 22:34 |
| 95.3            | 210 | 1:51   | 3:42 | 5:33 | 7:24  | 9:16  | 11:07 | 12:58 | 14:49 | 16:41 | 18:32 | 20:23 | 22:14 |

Time is calculated from the beginning of drinking. Assumptions made: alcohol metabolism is constant at 15 mg/dl; height of the women is 162.56 cm (5 feet, 4 inches). 1 drink = 340 g (12 oz) of 5% beer or 141.75 g (5 oz) of 11% wine or 42.53 g (1.5 oz) of 40% liquor.

Example 1: for a 40.8-kg (90-lb) woman who consumed 3 drinks in 1 h, it would take 8 h 30 min for there to be no alcohol in her breast milk, but for a 95.3-kg (210-lb) woman drinking the same amount, it would take 5 h 33 min.

Example 2: for a 63.5-kg (140-lb) woman drinking 4 beers starting at 8.00 p.m., there would be a zero level of alcohol in her breast milk 9 h 17 min later (i.e. at 5.17 a.m.).

# Data on Infant and Child Neurodevelopment

- Four prospective studies on infant and toddler development 8 weeks to 18 months
- Four analyses of longer-term neurodevelopment from one longitudinal study in Australia; one additional retrospective study from South Africa



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# Mental and Motor Development

Vol. 321 No. 7

MATERNAL ALCOHOL USE DURING BREAST-FEEDING — LITTLE ET AL.

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## MATERNAL ALCOHOL USE DURING BREAST-FEEDING AND INFANT MENTAL AND MOTOR DEVELOPMENT AT ONE YEAR

RUTH E. LITTLE, Sc.D., KEVIN W. ANDERSON, B.Sc., CYNTHIA H. ERVIN, Ph.D.,  
BONNIE WORTHINGTON-ROBERTS, Ph.D., AND STERLING K. CLARREN, M.D.

**Abstract** The detrimental effects of maternal drinking during pregnancy on fetal health have been documented. The consequences for infants of maternal drinking during breast-feeding are unknown, but research in animals suggests that the infant could be affected by exposure to alcohol through the mother's milk. In a study of 400 infants born to members of a health maintenance organization, we investigated the relation of the mother's use of alcohol during breast-feeding to the infant's development at one year of age.

Mental development, as measured by the Bayley Mental Development Index (MDI), was unrelated to maternal drinking during breast-feeding. However, motor development, as measured by the Psychomotor Development Index (PDI), was significantly lower in infants exposed regularly to alcohol in breast milk (after alcohol exposure during gestation was controlled for), with a dose-

response relation ( $P$  for linear trend, 0.006). The infants of breast-feeding mothers who had at least one drink daily had a mean PDI score of 98, whereas the infants exposed to less alcohol in breast milk had a mean PDI score of 103 (95 percent confidence interval for the difference of the two means, 1.2 to 9.8). The effect was more pronounced when mothers who supplemented breast-feeding with formula were excluded from the analysis. The association persisted even after we controlled for more than 100 potentially confounding variables, including smoking and other drug use during pregnancy and in the postpartum period.

We conclude that ethanol ingested through breast milk has a slight but significant detrimental effect on motor development, but not mental development, in breast-fed infants. (N Engl J Med 1989; 321:425-30.)



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# Limitations

- 2 drinks a day associated with 7.5 point deficit ( $\sim 1/2$  SD) – is that clinically meaningful?
- Bayley Scales of Infant Development an imprecise measure at 12 months
- Sample primarily white, well-educated, middle class
- Difficult to measure mixed feeding



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# Replication Study

## Alcohol, Breastfeeding, and Development at 18 Months

Ruth E. Little, ScD\*; Kate Northstone, MSc‡; Jean Golding, PhD, ScD‡; and the ALSPAC Study Team‡

**ABSTRACT.** *Objective.* We aimed to replicate a previous study of 1-year-olds that reported a deficit in motor development associated with moderate alcohol use during lactation, using a different but comparable population.

*Methodology.* The mental development of 915 18-month-old toddlers from a random sample of a longitudinal population-based study in the United Kingdom was measured using the Griffiths Developmental Scales. Frequent self-administered questionnaires during and after pregnancy provided maternal data. The dose of alcohol available to the lactating infant was obtained by multiplying the alcohol intake of the mother by the proportion of breast milk in the infant's diet. We compared this dose with the Griffiths Scales of Mental Development, taking into account potentially confounding variables.

*Result.* Three of the Griffiths scales increased slightly but significantly with increasing infant alcohol exposure; there was no association in the remaining 2 or average of the scales.

*Discussion.* We were unable to replicate the earlier deficit in motor skills associated with lactation alcohol use. One reason may be that the dose of alcohol reaching the lactating infant is small, and tests of infants and toddlers have limited ability to pick up small effects. Studies of older children may resolve the question of the safety of drinking while nursing. *Pediatrics* 2002;109(5). URL: <http://www.pediatrics.org/cgi/content/full/109/5/e72>; alcohol, lactation, child development.



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# Limitations

- Fewer high infant alcohol exposures than in the original study
- Griffiths Scales although widely used as measure of general development, similar to Bayley, may be an imprecise measure at 18 months



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# Screening for Milestones

- Triple B Pregnancy Cohort Study Australia 2009-2013; history of breastfeeding and alcohol use captured at 8 week and 12-month post-partum interviews
- Infant social, mental and motor development assessed using Ages and Stages Questionnaires at 8 weeks and 12 months and Ages and Stages Questionnaire Social Emotional at 12 months
- Sample size 402 at 8 weeks, 191 at 12 months
- No significant differences between those who reported alcohol and those who did not except on Personal-Social Interactions at 12 months, where infants of alcohol-consuming mothers were reported to have fewer concerns
  - *Tay RY and Wilson J et al, Drug and Alcohol Review (2017); 36:667-76*



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# School Age Children

- Growing Up in Australia Study
- 5,107 infants recruited in 2004 and assessed every two years
- Modified AUDIT-C questions used to assess maternal alcohol consumption
- Increased or riskier alcohol consumption associated with reductions in Matrix Reasoning scores but not other measures at age 6-7 years in children who had been breastfed but not in children who had never been breastfed
- Reductions not sustained at 10-11 year assessment timepoint
  - *Gibson L, et al, Pediatrics (2018); 142:e20174266*



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# School Age Children

- Growing Up in Australia Study Pediatric Quality of Life Inventory Generic Core Scales (physical, emotional, social functioning)
- Parent completed up to 12 years of age
- No associations with poorer quality of life were found maternal alcohol consumption among breastfed infants
  - *Gibson L and Porter M BMC Research Notes (2020); 13:232*



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# School Age Children

- Growing Up in Australia Study assessed academic achievement using national standard school evaluations
- Dose dependent association between increased and riskier maternal alcohol consumption while breastfeeding with small reductions in literacy, numeracy, writing, spelling and grammar punctuation scores at Grade 3, and spelling at Grade 5
- No associations found in children who had never been breastfed
  - *Gibson L and Porter M Nutrients (2020); 12:829*



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# School Age Children

- Growing Up in Australia Study assessed ADHD and Autism Spectrum Disorders diagnoses at 6-7 or 10-11 years
- No associations found with maternal alcohol consumption while breastfeeding
  - *Gibson L and Porter M Journal of Autism and Developmental Disorders (2022); 52:1223-34*



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# School Age Children

- Retrospective study of first grade children Western Cape, South Africa
- Compared offspring of mothers who reported postpartum alcohol use and breastfed to those who reported no postpartum alcohol use and breastfed – n = 1,047
- Controlling for prenatal alcohol use, those exposed to alcohol in the postpartum period had lower verbal IQ scores
  - *May PA et al Reprod Toxicol (2016); 63:13-21*



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# Limitations

- No specific measures of alcohol quantity/frequency in the breastfeeding period
- Control for pregnancy exposure difficult to entangle from postnatal exposure



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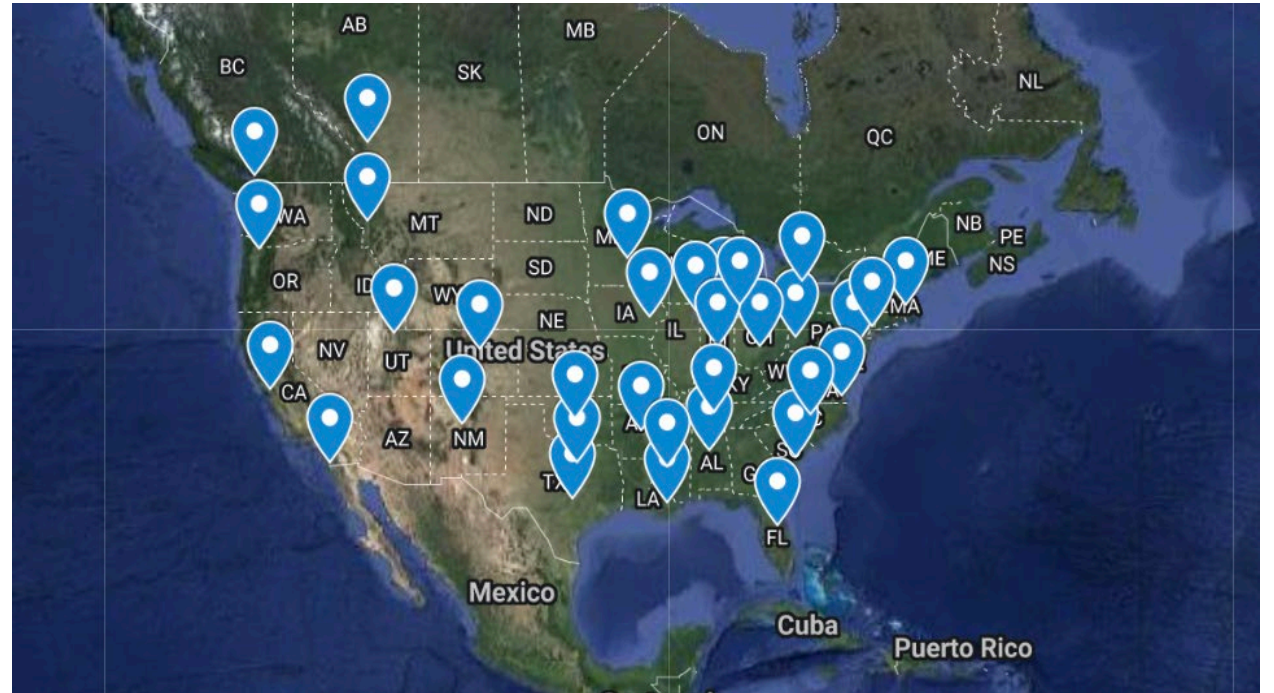
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# Need for Better Information - Donor Milk Banks as an Example

- Human Milk Banking Association of North America (HMBANA) has 33 members serving 1,500 hospitals – dispensed ~10,000,000 ounces of milk in 2023
- However, not enough supply with growing need



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# Donor Milk Banks

- HMBANA sets standards for milk donations that can and cannot be accepted
- Maternal alcohol consumption criteria eliminate a large number of potential donors (if donor discloses alcohol consumption accurately)
- Unknown if donor milk supply is affected by donors who do not disclose accurately



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# Donor Milk Banks: Current Criteria for Alcohol

- Donors who report daily use of alcohol are deferred
- For donors who consume alcohol occasionally, a deferral period of six hours following consumption of one serving of alcohol and 12 hours following consumption of more than one serving is required.
- For milk expressed prior to contact with milk bank, donor alcohol use of no more than one serving a week may be accepted at the discretion of the milk bank when the consumption to milk expression interval is less than the required waiting period or unknown
- Leads to a high proportion of potential donors becoming ineligible due to unknown potential risks to the donor milk recipient infant



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# Research on Exposures in Lactation

Nationwide Mommy's Milk Human Milk Research Biorepository (HMB)  
established at UC San Diego in 2014



Breastfeeding Medicine, Vol. 15, No. 3 | Clinical Research

## The Design and Mechanics of an Accessible Human Milk Research Biorepository

Gretchen Bandoli, Kerri Bertrand, Maryana Saor, and Christina D. Chambers

Published Online: 9 Mar 2020 | <https://doi.org/10.1089/bfm.2019.0277>



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# HMB Study Design

## Samples

- 50 mL milk sample up to full expression, can be repeated samples, clinic or home collection shipped overnight via FedEx on ice packs
- Samples aliquoted and stored at  $-80^{\circ}\text{C}$  at UC San Diego

## Recruitment Sources

- MotherToBaby Network (US and Canada)
- Social media; website
- Lactation consultants, Donor Milk Banks, pediatric/pharmacy referrals



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# HMB Study Design

## Clinical Data Captured

- Demographics, maternal and child health, and breastfeeding habits
- Exposure to recreational drugs, alcohol, tobacco, caffeine, and all Rx & OTC medications, supplements, herbal products, vaccines day-by-day over past 14 days
- Infant adverse reaction checklist
- Stress, anxiety, depression screening, food frequency questionnaires
- Neurobehavioral questionnaires 12-36 months; face-to-face testing for subset
- Access to medical records on an annual basis for mother and child



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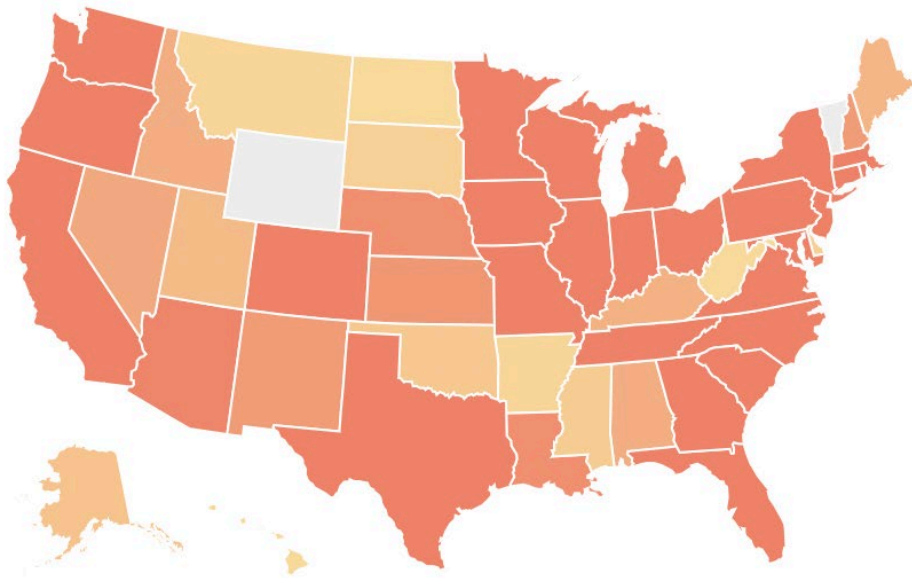
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# HMB Sample Distribution

MOTHERS DISTRIBUTION BY STATES



- 3,143 unique lactating persons enrolled in US and Canada
- 110,000 aliquots in the biorepository



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# How Common is Alcohol Use in Lactation in HMB Participants?

| Infant Age    | No Alcohol   | <2 drinks/<br>week | 2-4 drinks/<br>week | >4 drinks/<br>week | Total |
|---------------|--------------|--------------------|---------------------|--------------------|-------|
| 0-3 months    | 330          | 188                | 80                  | 86                 | 684   |
| 3.1-6 months  | 361          | 264                | 122                 | 146                | 893   |
| 6.1-12 months | 320          | 219                | 115                 | 122                | 726   |
| >12 months    | 160          | 100                | 47                  | 80                 | 387   |
| Total         | 1171 (42.7%) | 771 (28.1%)        | 364 (13.3%)         | 434 (15.8%)        | 2740  |



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# Summary

- Little support for developmental deficits in infants and toddlers associated with alcohol use by breastfeeding mothers
- Some evidence for cognitive deficits and academic performance differences in school age children that may not persist
- The limited available data lack detailed information on amount of milk consumption and actual infant alcohol dose during specified periods of time



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# Thank you!



<https://mothertobaby.org/pregnancy-studies/>



<https://MommysMilkResearch.org/>



<https://BetterBeginnings.org/>

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