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Alcohol

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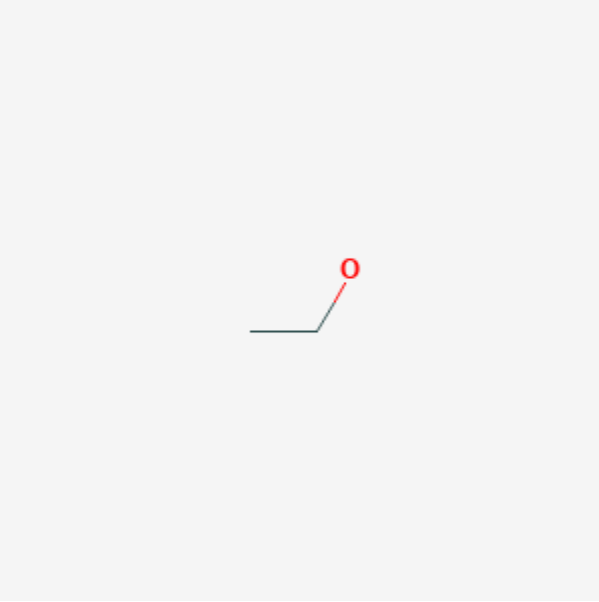

Drug Levels and Effects

Summary of Use during Lactation

The effects of maternal alcohol (ethanol) ingestion during lactation are complex and depend on the pattern of maternal drinking. Alcohol decreases milk production, with 5 drinks or more decreasing milk letdown and disrupting nursing until maternal alcohol levels decrease. Beer may increase serum prolactin levels during nursing because of polysaccharides from barley and hops. After ingestion of nonalcoholic beer, the antioxidant capacity of milk is increased, but alcohol levels in milk are negligible. Women with a family history of alcoholism have a blunted prolactin response following breast stimulation and tend to breastfeed more frequently to compensate.

Breastmilk alcohol levels closely parallel blood alcohol levels. The highest alcohol levels in milk occur 30 to 60 minutes after an alcoholic beverage, but food delays the time of peak milk alcohol levels. Nursing after 1 or 2 drinks (including beer) can decrease the infant's milk intake by 20 to 23% and cause infant agitation and poor

sleep patterns. The long-term effects of daily use of alcohol on the infant are unclear. Some evidence indicates that infant growth and motor function may be negatively affected by 1 drink or more daily, but other studies have not confirmed these findings. Heavy maternal use may cause excessive sedation, fluid retention, and hormone imbalances in breastfed infants.

Casual use of alcohol (such as 1 glass of wine or beer per day) is unlikely to cause either short- or long-term problems in the nursing infant,[1] especially if the mother waits 2 to 2.5 hours per drink before nursing, and does not appear to affect breastfeeding duration. Daily heavy use of alcohol (more than 2 drinks daily) may affect infants negatively and appears to decrease the length of time that mothers breastfeed their infants. Nursing or pumping within 1 hour before ingesting alcohol may slightly reduce the subsequent amounts of alcohol in breastmilk.

Drug Levels

The alcohol (absolute ethanol) content of various drinks are as follows: 12 fluid ounces of beer (4.5%) = 12.6 g; 4 fluid ounces of table wine (12%) = 11.2 g; 1 fluid ounce of whiskey (100 proof) = 11.7 g. Blood alcohol is often reported as a percent; a concentration of 1 grams/L of alcohol is equivalent to 0.1%.

Maternal Levels. Five nursing mothers drank 0.4 grams/kg of alcohol as vodka (about 2 drinks for a 60 kg woman) over 1 minute after a standard breakfast and followed the drink with 80 mL of water. Blood and milk samples were collected over the next 3 hours. Eight additional women who were not breastfeeding followed the same protocol. Blood and milk alcohol levels had a later peak in lactating women (48 minutes) than in the nonlactating women (31 minutes). The bioavailability of alcohol in the lactating women was 74% of bioavailability in the nonlactating women; peak blood alcohol concentrations were numerically lower, but not statistically different from the nonlactating women. Milk alcohol levels closely paralleled blood alcohol levels with an average peak level of 0.44 grams/L, falling to about 0.35 grams/L at 90 minutes and about 0.09 grams/L at 3 hours after the dose.[2]

Twelve women between 4 and 41 weeks postpartum drank a 0.6 grams/kg of alcohol (about 3 drinks for a 60 kg woman) as a 15% solution over 5 minutes on an empty stomach. Blood and milk samples were obtained every 30 minutes for 2 hours. Alcohol concentrations in milk closely paralleled blood concentrations with the highest concentration averaging 1.05 grams/L at 1 hour after the dose. By 2 hours, the alcohol concentration in milk was 0.7 grams/L. Acetaldehyde, the major metabolite of alcohol, was undetectable in milk (assay limit not stated), but was detectable in maternal blood.[3]

Eight nursing mothers with infants ranging in age from 6 weeks to 2 years 9 months rapidly drank from 0.46 to 1.5 grams/kg of alcohol after a small meal. The time of peak alcohol concentrations varied from 1 to 2.5 hours after the initial ingestion of alcohol; however, some of the women drank their alcoholic beverage over a 1 hour period. Both fore- and hindmilk levels closely paralleled blood alcohol concentrations.[4]

Twelve nursing mothers with infants 25 to 216 days of age drank 0.3 grams/kg of alcohol (about 1.5 drinks for a 60 kg woman) in orange juice over 15 minutes in the morning. Prior food intake was not controlled. Milk samples were collected over 3 hours. The average peak level of alcohol in milk was 0.32 grams/L at 1 hours after the end of alcohol ingestion. Milk alcohol concentrations were 0.2 grams/L at 2 hours and 0.05 grams/L at 3 hours after the end of alcohol ingestion. Using the volume of milk taken by the infant at the one nearest nursing time, the authors estimated that a breastfed infant would receive between 0.5 to 3.3% of the mothers weight-adjusted dosage.[5]

Two groups of Mexican mothers were studied after receiving an average of either 0.21 or 0.4 grams/kg of alcohol as pulque after breakfast. Blood and milk samples were taken at 60, 90 and 120 minutes after pulque ingestion. They were exclusively breastfeeding their infants who were 3 to 21 months of age. Milk alcohol concentrations

paralleled blood alcohol, with the highest milk levels at the first measurement at 60 minutes after ingestion. The group of mothers who consumed higher doses of alcohol eliminated it more slowly from blood and milk.[6]

A dose of 0.3 grams/kg of alcohol (about 1.5 drinks for a 60 kg woman) was administered over 15 minutes to 23 Chinese nursing mothers in a chicken-based soup following a cereal snack. Samples of blood and milk were taken during the following 135 minutes. The time of peak milk alcohol levels varied among women between 20 and 40 minutes after the dose. Milk alcohol levels were similar to blood levels, but fell slightly more slowly. At 135 minutes after soup ingestion, the average breastmilk alcohol concentration was 9.05 mg/dL. The authors estimated that milk alcohol levels returned to 0 at about 175 minutes after ingestion.[7][8]

A study compared alcohol pharmacokinetics in 20 lactating women to that in 9 formula-feeding women and 15 nulliparous women. Women were tested twice, once fasting and once after a standard breakfast. Subjects received 0.4 grams/kg of alcohol (about 2 drinks for a 60 kg woman) in 2 doses 5 minutes apart, an hour after the meal on the fed days. Blood alcohol was estimated from breath alcohol levels over a 205 minute period. The average bioavailability of alcohol in the lactating women was 82% of bioavailability in the nonlactating women; peak blood alcohol concentrations in the lactating women were lower than in the nonlactating women, especially than the nulliparous women. Postpartum women, both lactating and nonlactating, felt sedated by the alcohol for a shorter period of time than nulliparous women.[9]

A nomogram was developed using pharmacokinetic principles to estimate the duration of alcohol in milk. The time to eliminate a standard drink of about 12 g of alcohol varied with the weight of the woman. For a 54 kg (120 lb) woman, 2.5 hours after finishing the drink is required to eliminate the alcohol from her milk. For a 68 kg (150 lb) woman 2.25 hours is required; for an 82 kg (180 lb) woman, 2 hours is required. For each additional drink consumed, the same number of hours should pass. For example, a 68 kg woman consuming 4 drinks should wait 9 hours before resuming breastfeeding to ensure that the infant does not receive any alcohol.[10] A study of 10 women of varying weights who consumed 16 fluid ounces of table wine found general agreement between their results and this nomogram.[11]

Sixteen lactating women who were 3 to 5 months postpartum pumped milk either 1 hour before or 0.6 hours after ingesting 0.4 grams/kg of ethanol. Blood alcohol concentrations were measured several times between 0.4 and 3.4 hours after alcohol ingestion. Each woman underwent this test on 2 occasions, once fasting and once after a meal. Eating before alcohol ingestion reduced and delayed the peak blood alcohol concentrations, and reduced the total alcohol absorption and elimination rate. Pumping before alcohol ingestion caused similar effects, but of a smaller magnitude, and the two effects were additive or synergistic.[12] Milk alcohol concentrations were not measured, but likely paralleled the blood concentrations closely.

Fifteen women drank 1.5 L of nonalcoholic beer (0.42% alcohol by volume) over about 1 hour. Breastmilk samples were obtained at the completion of alcohol ingestion, plus 1 and 3 hours later. Two women had detectable levels of alcohol in their breastmilk at the termination of drinking (0.0021 and <0.001 grams/L). All other samples had undetectable (<0.0006 grams/L) levels of alcohol. The authors concluded that drinking nonalcoholic beer by a nursing mother is unlikely to affect their breastfed infant.[13]

Infant Levels. A computer simulation of breastfed infant serum alcohol levels after maternal ingestion of 250 mL of wine estimated resulting blood alcohol concentrations of 0.0033% in newborn infants and 0.0038% in 3-month-old infants.[14]

Another group estimated that if a woman ingested 4 standard drinks at once and breastfed her infant, the infant would attain a blood alcohol concentration of 0.049 g/L (0.0049%).[1]

Effects in Breastfed Infants

A nursing mother was drinking large amounts of quinine wine, wine, champagne, beer and liquors. Her infant had been gaining 30 g of weight daily until he weighed nearly 6 kg at 5 weeks of age. The infant had been restless and sleepless for several days when he suffered from violent fits and tonic-clonic seizures that required medical treatment. After he was taken off the mother's breast and began to be nursed by a wet nurse, his weight quickly dropped by 200 g in 3 days and fell into a pattern of calm sleep.[15]

A similar case of chronic heavy alcohol use by a nursing mother resulted in pseudo-Cushing syndrome in her 4-month-old breastfed infant. The infant had a bloated appearance, excessive wight gain and diminished length for age. The mother reported drinking 50 cans of beer weekly and "generous" amounts of other alcoholic beverages to increase her milk supply. The infant's symptoms resolved and growth pattern returned to normal after her mother stopped consuming alcohol.[16]

A series of 23 cases of severe thrombocytopenia and bleeding were reported among 21- to 60-day old breastfed infants of Chinese women in Singapore over a 5-year period. None of the infants had received prophylactic vitamin K at birth and all of their mothers had been taking alcohol tonics after each meal beginning at 7 to 10 days after delivery which was a common practice among only the Chinese in the mixed ethnic population delivering at the hospital. Most of the infants had also been receiving 5 to 15 mL daily of "gripe water" which had an alcohol content of about 5%. The authors attributed these cases to the lack of prophylactic vitamin K (which was common practice at the time) and increased clotting factor degradation caused by alcohol.[17]

A woman who drank 750 mL of port wine in 24 hours noticed that her breastfed 8-day-old had a deep unarousable sleep, snoring, pain insensitivity, inability to suck, excessive perspiration and a feeble pulse. These symptoms were attributed to the very young age of the infant and the large amount of alcohol consumed.[18]

In a series of studies, investigators measured the effect of maternal alcohol use on their breastfed infants. In one study, 12 nursing mothers with infants 25 to 216 days of age drank 0.3 grams/kg of alcohol (about 1.5 drinks for a 60 kg woman) in orange juice over 15 minutes in the morning. On a separate occasion, they drank an equal volume of orange juice.[5] In another study, 12 nursing mothers nursing infants with a median age of 150 days drank 0.3 grams/kg of alcohol as beer or the same volume of nonalcoholic beer on a separate occasion.[19] In a third study, 12 nursing mothers with infants averaging 3.1 months of age drank 0.3 grams/kg of alcohol in orange juice over 15 minutes in the morning. On a separate occasion, they drank an equal volume of orange juice In both studies, infants who drank milk that contained alcohol consumed 20 to 23% less milk during the 3- or 4-hour testing session, even though the time spent at the breast and number of sucks was unchanged. Mothers could perceive no difference in milk production or nursing behavior in their infants. Infants sucked more vigorously on a bottle containing their mothers' milk spiked with alcohol than on mothers' milk alone.[20] In a study in which infants were weighed by the mothers before and after each feeding for the next 16 hours (20 hours total), infants increased the number of nursings during the period of 8 to 12 hours after the alcohol intake such that the total amount of milk consumed during the 20-hour period did not differ between the alcohol and non-alcohol days.[21]

In studies that measured infant sleep, infants slept more frequently for shorter periods of time during the 3.5 to 4 hours after alcohol intake, whether it was after mothers drank 0.3 grams/kg of alcohol before breastfeeding or infants were given their mothers' milk spiked with an amount of alcohol (32 mg/100 mL) equivalent to that at 1 hour after maternal ingestion of 0.3 grams/kg of alcohol.[5][22][23] After ingesting the alcohol-containing milk after maternal consumption of 0.3 grams/kg of alcohol, 14 infants from 4 to 11 weeks of age infants were observed for 1 hour after milk ingestion. Their behavioral state changed more frequently, they slept less, cried more and startled more than after consuming milk without alcohol. Mother-infant interactions were more conflictive after alcohol intake which may partially explain increased infant arousal after maternal and infant alcohol ingestion.[24] A study that monitored the infants during the 24-hour period after maternal alcohol

ingestion revealed that the infants compensated by spending more time in active (rapid eye movement) sleep from 3.5 hours to 24 hours with no further alcohol intake.[23]

Long-term effects of alcohol ingestion during breastfeeding were studied in 2 separate populations by one group of investigators. In the first study, alcohol intake of more than 1 drink daily during nursing produced a measurable decrease in motor function development, but not mental development at 1 year of age.[25] A later follow-up study found no decrements in performance of 18-month-old infants who were breastfed by mothers who consumed alcohol.[26]

Studies have examined the effects of ingestion of pulque, an alcohol-containing drink made from agave cactus, in rural Mexican mothers. Most of the women had ingested pulque daily during pregnancy and lactation. One study found no effects on weight or length growth velocity among the 32 infants at 3 and 6 months of age whose mothers ingested an average of about 30 g of alcohol daily compared to the infants of 62 infants who did not drink pulque.[27] Another study compared the growth of 40 infants whose mothers ingested pulque during pregnancy and lactation and 18 whose mothers did not. Mothers who consumed pulque ingested an average of 16.3 g daily. The infants whose mothers ingested pulque regularly had poorer growth between 1 and 57 months and smaller size at 57 months.[28]

A retrospective study of 222 inner city women reported only as an abstract found that 1-year-old breastfed infants scored higher on language skills and motor development and had fewer hearing problems than nonbreastfed infants. Alcohol use by the mothers did not decrease the beneficial effects of breastfeeding.[29]

A subgroup analysis of a large cohort study in Norway found that the infants of mothers who drank alcohol during breastfeeding had no greater risk of asthma, allergy or lower respiratory infections at 36 months of age than infants of mothers who did not drink.[30]

A study of low socioeconomic status women in South Africa evaluated development of their children at 7 years of age. Infants were grouped by whether their mothers drank alcohol during pregnancy and breastfeeding, breastfeeding only, or who abstained during breastfeeding, according to their mothers' recall at the time of the study. Compared to the infants whose mothers reported no drinking during breastfeeding (n = 64), those whose mothers reported drinking during breastfeeding only (n = 21) had lower verbal IQ, and were lower on growth charts.[31]

Ileus with abdominal distension was reported in two Chinese infants, one 19 days and two 3 weeks of age. All laboratory tests were normal. Their mothers had been eating "chicken wine" (chicken cooked in Chinese rice wine), which is a postpartum custom in Chinese culture. Two infants had measurable alcohol in their blood. One had an alcohol level of 4.3 mmol/L (198 mg/L or 0.02%), 30 hours after admission and the other had a level of 4.3 mmol/L, 15 hours after admission. In the third infant, alcohol was not measured. The authors concluded that the ileus was caused by alcohol intoxication in the infants.[32][33]

A prospective cohort study in Australia evaluated breastfed infants at 8 weeks and 12 months of age. Their mothers' alcohol use was tracked. Most mother's alcohol use was considered to be moderate and drinking was almost always timed to minimize the amount of alcohol in breastmilk. Infants' social, mental and motor development were examined with the Ages and Stages questionnaires. The infants of mothers who used alcohol postpartum had no greater risk of adverse outcomes up to 12 months of age than the infants of mothers who were alcohol abstainers.[34]

A large, nested case-control study from a prospective cohort study in Australia compared infants who had been breastfed by mothers who drank alcohol during lactation to those whose mothers did not drink alcohol. The authors found that greater or riskier maternal alcohol intake determined by a maternal questionnaire was associated with decreased nonverbal reasoning at 6 to 7 years in a dose-dependent manner. This correlation was

not found in children at 8 to 11 years of age. The frequency and quantity of milk consumed by infants and the timing of alcohol consumption in relation to breastfeeding were not known.[35]

A search was performed of the shared database of all U.S. poison control centers for the time period of 2001 to 2017 for calls regarding medications and breastfeeding. Of 2319 calls in which an infant was exposed to a substance via breastmilk, 7 were classified as resulting in a major adverse effect, and one of these involved alcohol. A 16-day-old infant was exposed to alcohol and unspecified benzodiazepines in breastmilk. The infant was admitted to the intensive care unit for cardiac and respiratory arrest. The dosages and extent of breastfeeding were not reported and the infant survived.[36]

Effects on Lactation and Breastmilk

Studies in mothers who were 2 to 8 days postpartum found that acute doses of alcohol infused intravenously reduced the oxytocin-mediated milk ejection reflex following infant sucking. The effect could be overridden by administration of exogenous oxytocin, indicating that alcohol inhibits oxytocin release, not its effect on the breast.[37] Alcohol doses of 0.5 to 0.99 grams/kg reduced oxytocin response to infants sucking by 18%; doses of 1 to 1.49 grams/kg reduced the response by 62%; and doses from 1.5 to 1.99 grams/kg reduced the response by 80%. Alcohol also increased the time for letdown to occur after nipple stimulation, from 29 seconds to 64 seconds with doses of 1 to 1.49 grams/kg and from 38 seconds to 331 seconds with doses of 1.5 to 1.99 grams/kg.[38] Other investigators found that drinking 100 mL of whiskey containing a total of 50 mL of absolute alcohol (about 4 drinks in a 60 kg woman) abolished the rise in serum oxytocin in response to breast stimulation with a breast pump in 16 nonpregnant, nonlactating women. Pretreatment with naloxone blunted alcohol's inhibitory effect on oxytocin release.[39]

Acute alcohol ingestion can either increase, decrease or have no effect on serum prolactin in nonpregnant, nonlactating women.[40][41][42]

Drinking 100 mL of whiskey containing a total of 50 mL of absolute alcohol lessened the increase in serum prolactin in response to breast stimulation with a breast pump in 11 nonpregnant, nonlactating women. Serum prolactin rose by 71% over baseline 20 minutes after stimulation without alcohol and only by 25% after alcohol consumption. Pretreatment with naloxone blunted alcohol's inhibitory effect, with the combination resulting in a 46% rise in serum prolactin over baseline.[43] It is not clear how these finding apply to lactating women.

A study on 28 lactating women who were 2 to 5 months postpartum found that the normal rise in serum prolactin was enhanced when alcohol in a dose of 0.4 grams/kg was taken 35 minutes before breast stimulation with a breast pump. In subjects with a first-degree relative with a history of alcoholism, the increase in serum prolactin was blunted in magnitude, rapidity, and duration both with and without prior alcohol consumption.[44]

Nursing mothers who ingested a 0.3 grams/kg dose of alcohol produced an average of 9.3% less milk 2 hours after the alcohol intake using a breast pump than they did when a nonalcoholic beverage was taken. The caloric content and composition of milk were not different during the two test periods.[45]

A 1-year long survey of 587 new mothers in Australia found that women who drank more than 2 standard drinks (10 grams or 12.5 mL of absolute alcohol) daily were twice as likely to discontinue breastfeeding by 6 months postpartum than mothers who reported use below this amount.[46]

Beer specifically has a reputation for increasing milk supply. A small crossover study found that ingestion of 1 liter of beer containing 6% alcohol by 11 nonpregnant, nonlactating women increased serum prolactin by nearly 2.5-fold 30 minutes after ingestion, but sparkling water with an equivalent amount of alcohol did not.[47] In another study, 7 nonpregnant, nonlactating women were given 800 mL of beer. Six drank beer containing 4.5% alcohol and 1 woman drank nonalcoholic beer. Their average peak serum prolactin increased to 2.4 times the

baseline value between 60 and 105 minutes after ingestion. The one woman who drank nonalcoholic beer had an equivalent prolactin response. Pretreatment with naloxone had no effect on the prolactin response.[48] Studies in animals indicate that a polysaccharide found in barley and malt is apparently responsible for the increase in prolactin after beer ingestion.[49][50]

The interaction between alcohol ingestion and breast pumping was investigated in a double-blind crossover study of 13 lactating women who were exclusively nursing 2- to 5-month-old infants. Compared to placebo, ingestion of 0.4 grams/kg of alcohol increased serum prolactin during the ascending phase of blood alcohol concentrations. Pumping milk from the breasts during the ascending phase of blood alcohol enhanced the prolactin response, but pumping during the descending phase of blood alcohol blunted the prolactin increase. Milk production was lower after alcohol ingestion, but unrelated to serum prolactin or alcohol blood concentrations.[51]

Twenty-three Taiwanese nursing mothers received a chicken-based soup following a cereal snack twice during the first 15 days postpartum. On one occasion the soup contained a dose of 0.3 grams/kg of alcohol (about 1.5 drinks for a 60 kg woman) and on the other occasion the soup was alcohol free. The time for the first drops of milk to be ejected after breast stimulation with a pump was longer (4.4 vs 2.9 seconds) after the alcohol-containing soup than with the nonalcoholic soup. In addition, the triacylglycerol (14.8 vs 12.3 mg/dL) and lactate (0.8 vs 0.6 mg/dL) content of breastmilk were greater at 135 minutes after ingesting the alcohol-containing soup than the nonalcoholic soup.[8]

A study compared the prolactin response of 7 non-alcohol-dependent women with a family history of alcoholism to 21 women with no family history of alcoholism. Participants were given a dose of 0.4 grams/kg of alcohol or placebo in a crossover fashion on 2 days. A breast pump was used to collect breastmilk beginning 35 minutes after ingesting the test solution. Blood samples were collected for prolactin before and at various times after beverage consumption. The women with a family history of alcoholism had reduced serum prolactin responses to breast stimulation whether or not they had consumed alcohol. They tended to nurse their infants more frequently than the other mothers, apparently as a method of compensation.[42]

Nursing mothers whose diets were supplemented with 660 mL daily of nonalcoholic beer had increases in the antioxidant capacity of their plasma and breastmilk. The coenzyme Q10 content of milk was higher at day 30 in the supplemented mothers. No change in oxidant markers was found in their infants' urine.[52]

A prospective cohort study in Australia evaluated breastfed infants at 8 weeks and 12 months of age. Most mother's alcohol use was considered to be moderate at 14 or fewer drinks per week. Alcohol use did not adversely affect the duration of breastfeeding.[34]

A study of first-time mothers in a Brazilian Baby Friendly hospital found that mothers who used alcohol during pregnancy had an increased risk of delayed lactogenesis II.[53]

References

1. Haastrup MB, Pottegard A, Damkier P. Alcohol and breastfeeding. Basic Clin Pharmacol Toxicol. 2014;114:168–73. PubMed PMID: 24118767.
2. da-Silva VA, Malheiros LR, Moraes-Santos AR, et al. Ethanol pharmacokinetics in lactating women. Braz J Med Biol Res. 1993;26:1097–103. PubMed PMID: 8312842.
3. Kesaniemi YA. Ethanol and acetaldehyde in the milk and peripheral blood of lactating women after ethanol administration. J Obstet Gynaecol Br Commonw. 1974;81:84–6. PubMed PMID: 4818321.
4. Lawton ME. Alcohol in breast milk. Aust N Z J Obstet Gynaecol. 1985;25:71–3. PubMed PMID: 3862407.
5. Mennella JA, Beauchamp GK. The transfer of alcohol to human milk. Effects on flavor and the infant's behavior. N Engl J Med. 1991;325:981–5. PubMed PMID: 1886634.

6. Argote-Espinosa RM, Flores-Huerta S, Hernandez-Montes H, Villalpando-Hernandez S. [Plasma clearance of ethanol and its excretion in the milk of rural women who consume pulque]. Rev Investig Clin. 1992;44:31-6.. PubMed PMID: 1523347.
7. Chien YC, Liu JF, Huang YJ, et al. Alcohol levels in Chinese lactating mothers after consumption of alcoholic diet during postpartum "doing-the-month" ritual. Alcohol. 2005;37:143–50. PubMed PMID: 16713502.
8. Chien YC, Huang YJ, Hsu CS, Chao JC, Liu JF. Maternal lactation characteristics after consumption of an alcoholic soup during the postpartum 'doing-the-month' ritual. Public Health Nutr. 2009;12:382–8. PubMed PMID: 18426631.
9. Pepino MY, Steinmeyer AL, Mennella JA. Lactational state modifies alcohol pharmacokinetics in women. Alcohol Clin Exp Res. 2007;31:909–18. PubMed PMID: 17433009.
10. Ho E, Collantes A, Kapur BM, et al. Alcohol and breast feeding: calculation of time to zero level in milk. Biol Neonate. 2001;80:219–22. PubMed PMID: 11585986.
11. Palmquist M, Grainger D, Frazier L, et al. Elimination of alcohol from breast milk: Establishing guidelines for resumption of breast-feeding after alcohol consumption. Fertil Steril. 2005;84 Suppl 1:S415. Abstract.
12. Pepino M, Mennella J. Effects of breast pumping on the pharmacokinetics and pharmacodynamics of ethanol during lactation. Clin Pharmacol Ther. 2008;84:710–4. PubMed PMID: 18596681.
13. Schneider C, Thierauf A, Kempf J, Auwarter V. Ethanol concentration in breastmilk after the consumption of non-alcoholic beer. Breastfeed Med. 2013;8:291–3. PubMed PMID: 23484672.
14. Mielke H, Gundert-Remy U, Partosch F, Stahlmann R. Alcohol concentrations in breastfed babies - physiologically based modelling as a decision aid. Naunyn-Schmiedebergs Arch Pharmacol. 2012;385 (Suppl 1):59. Abstract. doi: 10.1007/s00210-01-0.
15. Budin P. Lecture VI. In, The nursling: the feeding and hygiene of premature and full-term infants. London. Caxton Publishing Company. 1907;85-101.
16. Binkiewicz A, Robinson MJ, Senior B. Pseudo-Cushing syndrome caused by alcohol in breast milk. J Pediatr. 1978;93:965–7. PubMed PMID: 722441.
17. Hoh TK. Severe hypoprothrombinaemic bleeding in the breast fed young infants. Singapore Med J. 1969;10:43–9. PubMed PMID: 5803560.
18. Bisdom W. Alcohol and nicotine poisoning in nurslings. JAMA. 1937;109:178. Abstract.
19. Mennella JA, Beauchamp GK. Beer, breast feeding, and folklore. Dev Psychobiol. 1993;26:459–66. PubMed PMID: 8293892.
20. Mennella JA. Infants' suckling responses to the flavor of alcohol in mothers' milk. Alcohol Clin Exp Res. 1997;21:581–5. PubMed PMID: 9194908.
21. Mennella JA. Regulation of milk intake after exposure to alcohol in mothers' milk. Alcohol Clin Exp Res. 2001;25:590–3. PubMed PMID: 11329500.
22. Mennella JA, Gerrish CJ. Effects of exposure to alcohol in mother's milk on infant sleep. Pediatrics. 1998;101:E2. PubMed PMID: 9565435.
23. Mennella JA, Garcia-Gomez PL. Sleep disturbances after acute exposure to alcohol in mothers' milk. Alcohol. 2001;25:153–8. PubMed PMID: 11839458.
24. Schuetze P, Das Eiden R, Chan AW. The effects of alcohol in breast milk on infant behavioral state and mother-infant feeding interactions. Infancy. 2002;3:349–63. doi: 10.1207/S15327078IN0303_4.
25. Little RE, Anderson KW, Ervin CH, et al. Maternal alcohol use during breast-feeding and infant mental and motor development at one year. N Engl J Med. 1989;321:425–30. PubMed PMID: 2761576.
26. Little RE, Northstone K, Golding J; ALSPAC Study Team. Alcohol, breastfeeding, and development at 18 months. Pediatrics. 2002;109:e72. PubMed PMID: 11986478.
27. Flores-Huerta S, Hernandez-Montes H, Argote RM, Villalpando S. Effects of ethanol consumption during pregnancy and lactation on the outcome and postnatal growth of the offspring. Ann Nutr Metab. 1992;36:121–8. PubMed PMID: 1530279.

28. Backstrand JR, Goodman AH, Allen LH, Pelto GH. Pulque intake during pregnancy and lactation in rural Mexico: alcohol and child growth from 1 to 57 months. Eur J Clin Nutr. 2004;58:1626–34. PubMed PMID: 15280906.
29. Church MW, Subramanian MG, Wyllie-Fadell L et al. Maternal alcohol use and breastfeeding: II. Infant outcome at one year of age. Alcohol Clin Exp Res. 2002;26 (Suppl 5):117A. Abstract. doi: 10.1111/j.1530-0277.2002.tb05675.x.
30. Magnus MC, Deroo LA, Haberg SE, et al. Prospective study of maternal alcohol intake during pregnancy or lactation and risk of childhood asthma: The Norwegian mother and child cohort study. Alcohol Clin Exp Res. 2014;38:1002–11. PubMed PMID: 24460824.
31. May PA, Hasken JM, Blankenship J, et al. Breastfeeding and maternal alcohol use: Prevalence and effects on child outcomes and fetal alcohol spectrum disorders. Reprod Toxicol. 2016;63:13–21. PubMed PMID: 27174445.
32. Hon KL, Wong YC, Chau IK, et al. Alcohol exposure in breastfed neonates associated with Chinese chicken wine. Indian J Pediatr. 2016;83:1495–6. PubMed PMID: 27349563.
33. Hon KL, Leung AK, Cheung E, et al. An overview of exposure to ethanol-containing substances and ethanol intoxication in children based on three illustrated cases. Drugs Context. 2018;7:212512. PubMed PMID: 29344053.
34. Tay RY, Wilson J, McCormack C, et al. Alcohol consumption by breastfeeding mothers: Frequency, correlates and infant outcomes. Drug Alcohol Rev. 2017;36:667–76. PubMed PMID: 28295774.
35. Gibson L, Porter M. Drinking or smoking while breastfeeding and later cognition in children. Pediatrics. 2018;142.. PubMed PMID: 30061301.
36. Beauchamp GA, Hendrickson RG, Horowitz BZ et al. Exposures through breast milk: An analysis of exposure and information calls to U.S. poison centers, 2001-2017. Breastfeed Med. 2019.. PubMed PMID: 31211594.
37. Cobo E, Quintero CA. Milk-ejecting and antidiuretic activities under neurohypophyseal inhibition with alcohol and water overload. Am J Obstet Gynecol. 1969;105:877–87. PubMed PMID: 5348764.
38. Cobo E. Effect of different doses of ethanol on the milk-ejecting reflex in lactating women. Am J Obstet Gynecol. 1973;115:817–21. PubMed PMID: 4688584.
39. Coiro V, Alboni A, Gramellini D, et al. Inhibition by ethanol on the oxytocin response to breast stimulation in normal women and the role of endogenous opioids. Acta Endocrinol (Copenh). 1992;126:213–6. PubMed PMID: 1574949.
40. Lex BW, Ellingboe JE, Teoh SK, et al. Prolactin and cortisol levels following acute alcohol challenges in women with and without a family history of alcoholism. Alcohol. 1991;8:383–7. PubMed PMID: 1797033.
41. Sarkola T, Makisalo H, Fukunaga T, Eriksson CJ. Acute effect of alcohol on estradiol, estrone, progesterone, prolactin, cortisol, and luteinizing hormone in premenopausal women. Alcohol Clin Exp Res. 1999;23:976–82. PubMed PMID: 10397281.
42. Soyka M, Gorig E, Naber D. Serum prolactin increase induced by ethanol--a dose-dependent effect not related to stress. Psychoneuroendocrinology. 1991;16:441–6. PubMed PMID: 1805295.
43. Volpi R, Chiodera P, Gramellini D, et al. Endogenous opioid mediation of the inhibitory effect of ethanol on the prolactin response to breast stimulation in normal women. Life Sci. 1994;54:739–44. PubMed PMID: 8107524.
44. Mennella JA, Pepino MY. Breastfeeding and prolactin levels in lactating women with a family history of alcoholism. Pediatrics. 2010;125:e1162–70. PubMed PMID: 20403941.
45. Mennella JA. Short-term effects of maternal alcohol consumption on lactational performance. Alcohol Clin Exp Res. 1998;22:1389–92. PubMed PMID: 9802517.
46. Giglia RC, Binns CW, Alfonso HS, et al. The effect of alcohol intake on breastfeeding duration in Australian women. Acta Paediatr. 2008;97:624–9. PubMed PMID: 18394108.
47. De Rosa G, Corsello SM, Ruffilli MP, et al. Prolactin secretion after beer. Lancet. 1981;2:934. Letter.. PubMed PMID: 6117712.

48. Carlson HE, Wasser HL, Reidelberger RD. Beer-induced prolactin secretion: a clinical and laboratory study of the role of salsolinol. J Clin Endocrinol Metab. 1985;60:673–7. PubMed PMID: 3972968.
49. Sawagado L, Houdebine LM. Identification of the lactogenic compound present in beer. Ann Biol Clin (Paris). 1988;46:129–34. PubMed PMID: 3382062.
50. Koletzko B, Lehner F. Beer and breastfeeding. Adv Exp Med Biol. 2000;478:23–8. PubMed PMID: 11065057.
51. Mennella JA, Pepino MY. Biphasic effects of moderate drinking on prolactin during lactation. Alcohol Clin Exp Res. 2008;32:1899–908. PubMed PMID: 18715274.
52. Codoner-Franch P, Hernandez-Aguilar MT, Navarro-Ruiz A, et al. Diet supplementation during early lactation with non-alcoholic beer increases the antioxidant properties of breastmilk and decreases the oxidative damage in breastfeeding mothers. Breastfeed Med. 2013;8:164–9. PubMed PMID: 23186386.
53. Rocha BO, Machado MP, Bastos LL, et al. Risk factors for delayed onset of lactogenesis II among primiparous mothers from a Brazilian Baby-Friendly hospital. J Hum Lact. 2020;36:146–56. PubMed PMID: 30901295.

Substance Identification

Substance Name

Alcohol

CAS Registry Number

64-17-5

Drug Class

Breast Feeding

Lactation

Central Nervous System Depressants