
The Effects of Human Breastmilk and Feeding on Diabetes

Presented to *Welcome Baby* by
Carmen Rezak, DNP, MJ, RN, WHCNP
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CEO, Perinatal Advisory Council
(PAC/LAC)



I have no conflicts to declare.

Objectives

- 1. Name several ways to optimize support for breastfeeding and the diabetic mother.
 - 2. What are some of the beneficial effects of breastfeeding for lactating mothers, newborn, infants, and children?
 - 3. What are the recommendations from the AAP and ACOG for breastfeeding the infant for the first 6 months, to one year?
 - 4. Name some myths or misconceptions about diabetes and breastfeeding that can be corrected?
 - 5. Breastfeeding and diabetes long and short-term impact on mothers and their infants?
 - 6. What are some red flags to look for when assessing the diabetic mother and her infant with breastfeeding?
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Breast is Best

- Principal nutritional source for neonates and infants
 - Protects infants against obesity and type 2 diabetes – the longer duration of breastfeeding, the less risk of developing type 2 DM
 - Lactating women exhibit lower blood glucose and insulin concentrations compared to non lactating
 - Diabetes mellitus (DM) is a chronic metabolic and microvascular disease that affects all the body systems and all ages from intrauterine life to late adulthood
 - Breast/chest feeding protects against infant mortality and diseases
 - Also protects against obesity and insulin resistance
 - Breast milk composition changes in mothers with gestational diabetes – from colostrum to late stages of lactation
 - Colostrum provides different antibodies
 - Breastfeeding can reduce fasting insulin and insulin resistance in infancy, childhood, and adulthood
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Introduction – Optimizing Support for Breastfeeding

You as healthcare providers/health coaches are uniquely positioned to enable women to achieve their infant feeding goals and ensure all women receive optimal breast/chest feeding support especially with a premature infant

Helping women to breast/chest feed is a public health priority because interruption of lactation is associated with adverse health outcomes for the birthing person, especially a diabetic mother and her child

Health care providers have a key role in providing assessments, education, encouragement, support, and advocacy

Education – healthcare providers should maintain skills to support the lactating mother and provide education and encouragement; engaging and educating fathers and significant others, family support

Accurate and consistent information on the benefits of breastfeeding and human milk, and encouragement are critical to mothers making an informed infant feeding choice and free from coercion, pressure or undue influence; provide community resources – WIC, La Leche, BFLA, IBCLCs

Support the woman's decision – most vaccinations and medications are safe during breastfeeding and refer to evidence-based resources such as [Lactmed](#) online or [Medications and Mother's Milk](#) by Thomas Hale

Beneficial Effects to Neonate

Helps development of the immature gut

Immunological, nutritional, and neurodevelopmental benefits for preterm neonates

Decreases incidence of necrotizing enterocolitis (NEC) preterm babies

Prevents development of post-natal hypoglycemia in infants of diabetic mothers (IDMs)

Beneficial Effects for Infants and Children

1. Decreases infant mortality and protects against SIDS
2. Crucial for infant eyesight, speech, jaw and mouth development
3. Increases intelligence by 2-3 points
4. Promotes healthy weight gain; reduces BMI and risk of later obesity
5. Reduces diarrhea and respiratory infections
6. Protects against common allergic diseases ; *e.g.*, eczema, allergic rhinitis, asthma, and food
7. Protects against Celiac disease
8. Decreases incidence of inflammatory bowel disease *e.g.*, Crohn's and Ulcerative colitis
9. Reduces risk of type II DM by 24% to 32% and to a lesser degree, type I DM
10. Decreases risk of childhood leukemia by 14-20%

Elbeltagi, R. et al (2023). Cardiometabolic effects of breastfeeding on diabetes.

Beneficial Effects on Lactating Mothers

1. Helps in rapid involution of the gravid uterus to return to pre-gravid size
 2. Decreases the risk of postpartum bleeding
 3. Increases maternal-infant bonding
 4. Significantly reduces postpartum depression in the first few months
 5. Helps in weight loss
 6. Significantly reduces the risk of ovarian cancer, especially the most lethal high-grade serous subtype
 7. Reduces breast, endometrial, and thyroid cancer risk
 8. Reduces risk of developing type 2 diabetes
 9. Decreases risk of HTN, hypercholesteremia, and CAD
 10. Decreases risk of osteoporosis and arthritis
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Few Contraindications to Breastfeeding

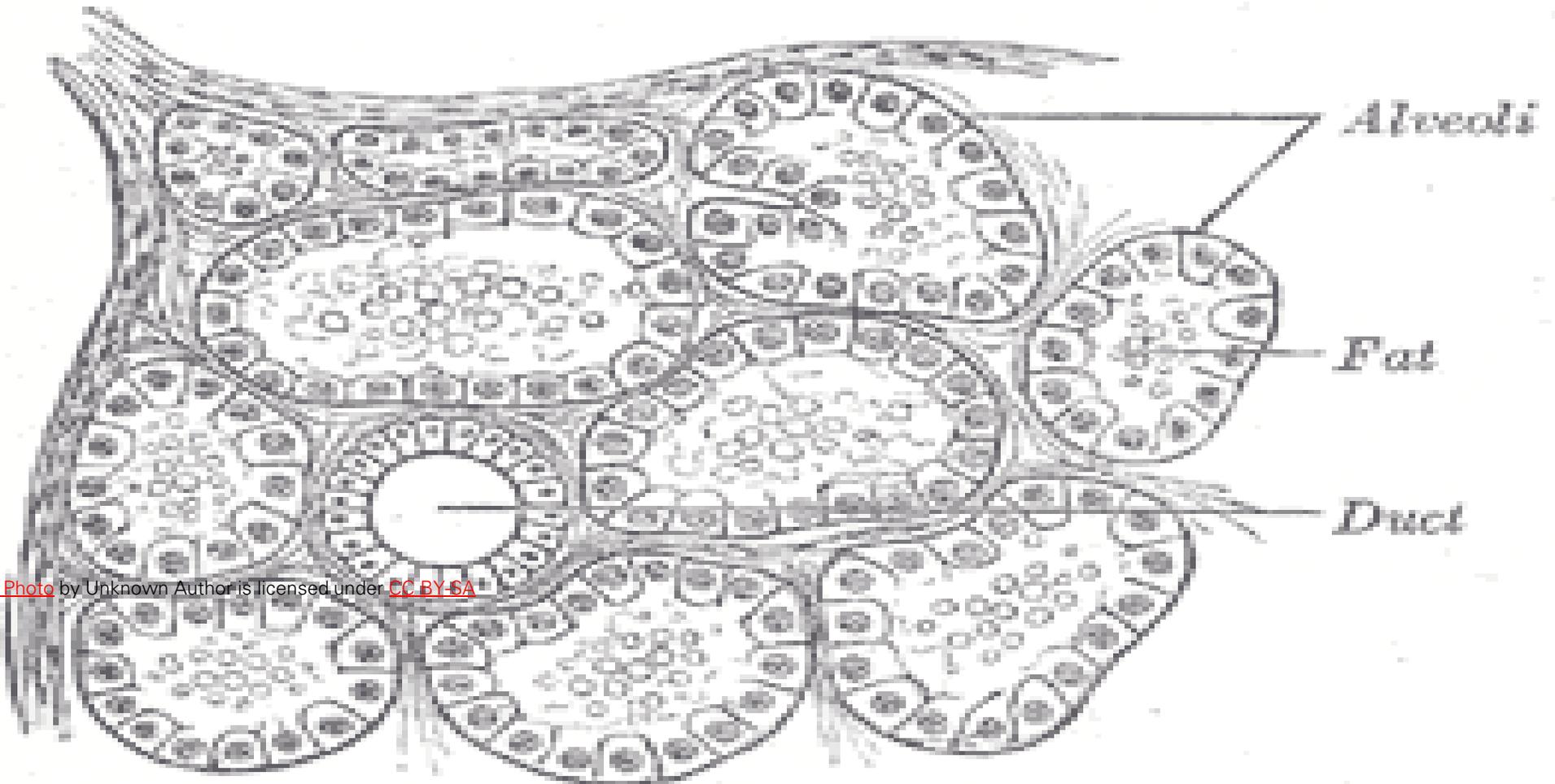
- Infant with Galactosemia
 - HIV though there are now new updated recommendations – per AAP HIV-positive mothers with undetectable viral load can now safely breastfeed their infants;
 - Previously, HIV-positive women were not encouraged to breastfeed, limiting their choices on how to care for and feed their infants; change aligns with new evidence-based literature and promotes equity in health care by offering HIV-positive mothers the same breastfeeding opportunities as those without the virus (AAP and Clinical Advisory, 2023)
 - Human T-cell lymphotropic virus type I or type II
 - Untreated TB, varicella, active herpes simplex virus lesions on the nipple
 - Substance use disorder – women on medically indicated drugs or treatment on stable doses of methadone or buprenorphine and not using illicit drugs and have no other contraindications should be encouraged to breastfeed
 - Insufficient data to evaluate cannabis use and lactation and is discouraged and need screening and counseling on medicinal and recreational use of marijuana
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AAP and ACOG Breastfeeding Recommendations

- Exclusive breastfeeding for the first 6 months
 - When adding complementary feeds at 6 months and beyond continue breastmilk feedings
 - Breastfeed until at least one year and beyond
 - Reduce proportion of breastfed newborns who receive formula supplementation in the first two days of life
 - Increase employers who provide lactation accommodation at work
 - Limit pacifier use for the first month until breast milk supply is established (pacifier use is indicated for pain control with procedures and in the NICU) reduces risk of SIDS
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Myths and Misconceptions – Barrier to Breastfeeding

- Colostrum is not enough and not good – contains high protein, Vit A, leukocytes, lactoferrin and lysozyme, low fat and lactose, mild laxative effect which helps clear the gut, clears bilirubin from the gut and helps to prevent jaundice
 - Small breasts do not produce sufficient amount of breastmilk – not the size but the milk producing alveoli, developing a good supply of milk via breast stimulation (supply and on-demand to ensure adequate milk production; Prolactin, is a hormone, that helps build and maintain the breast milk supply, rises with suckling and higher at night
 - Breast milk is dilute and not nourishing – mature breast milk consists of foremilk (early in a feed) is bluish-grey, watery, provides plenty of water, protein, and lactose and hind milk (later in a feed) which is whiter and provides extra fat for satiety
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Myths and Misconceptions continued

If infant has diarrhea stop breastfeeding – no just the opposite

Breastfeeding is a reliable form of birth control – if breastfeeding is exclusive without any supplement day and night during the first 6 months ovulation is inhibited and menstruation does not resume, risk for pregnancy is < 2% BUT most women are not consistent in this manner and can get pregnant

Formula is as good as breast milk – there are > 100 different nutrients, hormones, enzymes, and disease-fighting compounds in human milk and though formula provides a nutritional balanced food it cannot compete with the many benefits of human breast milk

Breastfeeding is painful – it should not be painful but may have nipple tenderness at the first 2 weeks; need to assess the latch and attach to ensure it is correct; pain is a symptom of being incorrect and mothers need assistance to see what is the issue

Breastfeeding requires a special or bland diet - eat a healthy, balanced diet with plenty of fluids; may restrict caffeine, spicy, some raw foods or gassy foods, acidic, and chocolate; depends on the mother and response from the infant

Irritable infant behavior is due to low milk supply or hunger – teach baby behavior and what it means



3 days

5 days

6 days

25 days



Body doesn't generate sufficient insulin for glucose regulation



Insufficient insulin secretion for blood glucose regulation



Body is not able to produce insulin for glucose regulation during pregnancy

- Symptoms**
- Always hungry
 - Unexpected weight loss
 - Numb or tingling hands/feet
 - Frequent urination
 - Sexual disorder
 - Extreme fatigue
 - Always thirsty

- Complications**
- Wounds heal slowly
 - Peripheral neuropath
 - Cerebrovascular disease
 - Diabetic Nephropathy
 - Coronary heart disease
 - Eye damage

Treating Diabetes During Pregnancy and Effects on Lactation

- Women with any form of diabetes during pregnancy have more problems with lactation than women without diabetes.
 - Lactation onset occurs later in patients with type 1 and gestational diabetes mellitus than in women without diabetes, with a greater delay in mothers with poor glucose control
 - Good glycemic control enhances maternal serum and milk prolactin concentrations and decreases the delay in the establishment of lactation in patients with insulin-dependent diabetes.
 - Mothers with type I diabetes discontinue nursing at a higher rate during the first week postpartum
 - Other factors that have been identified as causes of shorter duration of breastfeeding among type I diabetes patients are more frequent cesarean sections and earlier delivery than in nondiabetic mothers
 - In women with type 2 diabetes, obesity can be a contributing factor to breastfeeding difficulties
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Obesity and Breastfeeding

- Obesity creates a pro-inflammatory, insulin-resistant environment
 - Hinders successful breastfeeding for mothers with type 2 diabetes by disrupting key metabolic and hormonal processes
 - This leads to delayed milk production, lower milk supply, and potential complications for both mother and baby
 - Reduced prolactin sensitivity: Obese women have been shown to have a diminished prolactin response to suckling. While their prolactin levels may be higher, the mammary glands of mothers with obesity and diabetes have reduced sensitivity to this milk-producing hormone
 - Insulin resistance: associated with both type 2 diabetes and obesity is a major contributor to lactation problems
 - Insulin plays a direct and essential role in the development of mammary glands during pregnancy and in triggering milk production after birth. Resistance to insulin signaling can interfere with the synthesis of lactose and fatty acids, reducing milk volume and content
 - Delayed milk production (lactogenesis)
 - The hormonal and metabolic dysregulation caused by obesity and diabetes can postpone the onset of significant milk production, a process called lactogenesis II
 - The transition from colostrum to mature milk is slower, which can cause infants to have difficulty gaining weight and may prompt early supplementation with formula
 - Poor blood sugar control exacerbates this delay, while good glycemic control can help normalize milk production timing.
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Nurses' Health Study

- Study was conducted in 1976 and again in 1989 and published in 2005
- Retrospective study collected in 1980s and 1990s
- Finding - longer breastfeeding duration was associated with a decrease risk of type 2 Diabetes
- Women who lactated for 4 months or more had a 25% reduction in risk of type 2 DM and exclusive lactation was associated with a 35%-40% reduction in diabetes risk
- Findings were inconclusive among women with a history of GDM
- Prospective, population-based studies that control for intrauterine and postnatal exposures are needed
- Prospective studies are also needed on IDM to examine the effects of breastfeeding on infant growth and development of overweight in childhood controlling for multiple factors

Gunderson, E. P. (2008).

Metabolic Effects of Breastfeeding

- Initiates a metabolic shift from pregnancy to postpartum with alteration of resource allocation from the caloric storage stage to the milk production phase
- Lipid transport facilitation to the mammary gland to help with milk synthesis
- Early, high intensity breastfeeding might help endocrine balance to shift from insulin resistant state to insulin sensitive state
- Lactation may protect against long-term cardiometabolic health consequences
- Breastfeeding induces improved glucose utilization through reduced insulin production, enhanced insulin sensitivity and decreased Beta-cell proliferation
- Therefore, lactating women have better glucose and lipid metabolism, lower fasting and postprandial blood glucose, low insulin levels and more insulin sensitivity than non-lactating women especially in the first 4 months postpartum
- Lactation reduces risk of obesity, metabolic syndrome, cardiovascular disease, type 2 DM during mid to late life especially if breastfeed 6 months or longer; duration makes a difference

Changes in Breast Milk Composition with Diabetes

Breast milk is biologically active, continuously dynamic fluid that differs from woman to woman and one stage to another

It is affected by factors such as preterm labor, maternal diet, metabolic disorders, and diseases

A birthing person with gestational DM has a 15-24 hr. delay in lactogenesis II (initiation of lactation) markers such as citrate, lactose and total nitrogen to reach levels similar to healthy women

This delay in breastmilk initiation with GDM could be related to low levels of circulating human placental lactogen in the latter stages of pregnancy

Study found significant delay in timing of the lactose increase in the colostrum in lactating women with type I or GMD, accompanied by a reduced milk volume in the first three postpartum days

Women with type I DM also have impaired mammary gland lipid metabolism and high glucose and sodium contents in mature milk – altered composition

Medication Use During Breastfeeding

Most meds are safe for use

Inappropriate advice can lead to women discontinuing breastfeeding or switch to formula feedings unnecessarily

Counseling re: medication use during lactation should address the risks of drug exposure through breast milk and the risks of interrupting lactation

Insulin

- Insulin is a normal component of human milk
- Milk insulin concentrations averaged almost double the maternal fasting serum insulin in one study at 2 weeks postpartum and were a third higher at 4 months postpartum, implying active transport of insulin into milk.
- Exogenous insulin is used in both type 1 and type 2 diabetes and has been detected in human milk
- Insulin is not absorbed by the infant, but may have beneficial local activity in the gastrointestinal tract
- Breastfeeding appears to improve postpartum glucose tolerance in mothers with gestational diabetes and reduce the insulin requirement of patients with type I diabetes if they are breastfeeding
- The cause is thought to be the use of glucose in milk synthesis; the decrease in insulin requirement is quite variable among studies; close monitoring of glucose is important in the postpartum period in nursing mothers using insulin

Achong N, et al. (2018)

Sulfonylureas

- Older drugs have fallen out of favor in the treatment of type 2 diabetes because they can cause hypoglycemia and weight gain
 - The advantage for nursing mothers is that information exists on the excretion into breast milk for two of the currently used second-generation agents, and some infant safety information is available; best information is available for glyburide
 - Among 11 women taking glyburide 5 or 10 mg/day, glyburide was undetectable in milk at several times after the dose. Likewise, two women taking glipizide also had undetectable levels in milk
 - Checking infant's blood glucose is advisable
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Metformin

- Metformin is the drug of choice for initial treatment of type 2 diabetes for most patients.
 - Data from well-conducted studies indicate that metformin levels in milk are low and infants would receive 0.5% of their weight adjusted dose
 - the dose in milk is low metformin is sometimes detectable in low levels in the serum of breastfed infants
 - timing of breastfeeding with respect to the drug administration times is of little benefit. One sizeable prospective study found no adverse effects in breastfed infants whose mothers were taking metformin for polycystic ovary syndrome. Although it does not lower plasma glucose, metformin should be used with caution while nursing newborns and premature infants; no adverse effects on the blood glucose of nursing infants
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Short and Long-Term Implications of The Diabetic mother on Her Offspring

- Robust evidence that an hyperglycemic intrauterine environment is responsible not only for significant short-term morbidity in the fetus and the neonate but also for an increased risk of developing diabetes
 - The risk is higher in pregestational diabetes
 - Poorly managed gestational diabetes (GDM) may have similar consequences. Although a relatively clear picture of the pathogenesis of the fetal and neonatal complications of maternal diabetes and of their fetus – cardiac, macrosomia, increased stillbirth
 - the rate of GDM is sharply increasing in association with the pandemic of obesity and of type 2 diabetes, risks of obesity,
 - the metabolic syndrome, type 2 diabetes and impaired insulin sensitivity and secretion in offspring of mothers with GDM are two- to eightfold those in offspring of mothers without GDM.
 - Infants of women with diabetes in pregnancy are at risk of developing hypoglycemia and other morbidities in the neonatal period. They also have an increased risk of developing diabetes themselves, and of being overweight later in life.
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Long-Term Implications

Converging clinical and experimental data suggest that the offspring of diabetic mothers is further exposed to an increased risk of developing diabetes as well as other chronic, noncommunicable diseases at adulthood, with potential trans-generational effects involved in the pandemic

Maternal glucose tolerance often normalizes shortly after pregnancy, women with GDM have a substantially increased risk of developing type 2 diabetes later in life.

Studies have reported that women are more than seven times as likely to develop diabetes after GDM, and that approximately 50% of mothers with GDM will develop diabetes within 10 years, making GDM one of the strongest predictors of type 2 diabetes.

In women with previous GDM, development of type 2 diabetes can be prevented or delayed by lifestyle intervention and/or medical treatment. Systematic follow-up programs would be ideal to prevent progression of GDM to diabetes,

Long-Term Risks

- Some congenital anomalies, such as congenital heart disease, carry long-term risks and requirements for specialist monitoring and interventions
 - Some perinatal complications, such as hypoxia–ischemia, result in long-term disability
 - Most birth injuries secondary to macrosomia resolve spontaneously in the neonatal period, others such as some cases of Erbs palsy may persist into childhood and beyond and require specialist treatment
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Assessment

Table 1: Interpretation of Christi Breastfeeding Assessment Scale.

	0	1	2	Score	Risk
Latch-on	No latch on achieved	Latch on after repeated attempts	Eagerly grasped breast to latch on	0-2	High risk
Length of time before latch-on and suckle	Over 10 min	4-6 min	0-3 min	3-6	Moderate risk
<small>This Photo by Unknown Author is licensed under CC BY</small> Suckling	Did not suckle	Suckled but needed encouragement	Suckle rhythmically with lips flanged	7-10	Low risk
Audible swallowing	None	Only if stimulated	Over 48 hours: frequent		
Mom's evaluation	Not pleased	Some what pleased	Pleased		

The following steps can help your baby to latch well:

1. Hold your baby close with their nose level with your nipple.
 2. Let your baby's head tip back so their top lip brushes against your nipple - this should help them open their mouth wide.
 3. When your baby's mouth is wide open, bring them to your breast.
 4. Aim your nipple to the roof of their mouth.
 5. When they attach, your nipple and most of the areola (the area around your nipple) should be deep in your baby's mouth.
 6. When your baby is attached properly, their chin will be pressed into your breast.
 7. Your baby's nose should be clear for easy breathing. Ideally, the nose should be at a tilt when attached correctly.
 8. Newborns are nose breathers. If they cannot breathe freely, they will come off the breast.
 9. In the correct position, your baby will be able to suck, swallow and breathe comfortably.
 10. If your baby's nose appears to be blocked, move their bottom closer to you. This will create a head tilt and free up their nose.
 11. The deeper the attachment the more comfortable you will feel and the better your baby will feed.
 12. More of your areola will be visible above their top lip than below their bottom lip.
 13. Their cheeks will appear fuller.
 14. They'll suck quickly at first, followed by longer sucks.
 15. You will hear them swallowing.
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Position and Attachment

- Positioning and attachment are the terms used to describe how to hold your baby at your breast so they can feed. Attachment is also sometimes known as 'latching on'.
- Correct positioning and attachment is the most important thing for successful breastfeeding. When your baby is well positioned and attached, they will find it easier to feed well.

There are 2 ways to attach your baby:

- baby-led approach
 - mother-led approach
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Components of Safe Positioning

- Infant's face can be seen
 - Infant's head in the sniffing position
 - Infant's nose and mouth are not covered
 - Infants neck is straight
 - Infants shoulder and chest face mother
 - Legs are flexed
 - Back is covered and supported
 - If formula feeding then same positioning mother gazing in infant's eyes, pace feeding, DO NOT PROP BOTTLES
-

Things That Can Affect Milk Supply

- Poor attachment and positioning.
 - Not feeding your baby often enough.
 - Drinking [alcohol](#) and [smoking while breastfeeding](#) – these can both interfere with your milk production.
 - Previous breast surgery, particularly if your nipples have been moved.
 - Having to spend time away from your baby after the birth – for example, because they were premature.
 - Illness in you or your baby.
 - Giving your baby bottles of formula before breastfeeding is well established
 - Using nipple shields – although this may be helpful and necessary to feed your baby with damaged nipples and is preferable to stopping feeding
 - Some medicines, including dopamine, ergotamine and pyridoxine
 - Anxiety, stress or depression
 - Your baby having a [tongue tie](#) that restricts the movement of their tongue.
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How to Tell if the Infant is Getting Enough Breastmilk

- Feed on both breasts anywhere from 5 – 40 minutes
- Feed on-demand at least 8-12 times/24 hours and at least once in the night
- Baby latches well, audible swallows, is alert, seems content, calm, relaxed, color normal not yellow
- Breastfeeding is comfortable no soreness after the first few days
- Appropriate wet and dirty diapers
- Infant slowly gaining weight, not losing weight after the first two days

If infant is irritable, gets on and off the breast frequently, not interested in feeding, short feeds, sleepy, skin yellow, decreased output then consult healthcare provider, IBCLC

WIC How you can tell your baby is getting enough

- https://youtu.be/rYXj3wa_7uo?si=RZ9gzzhEN2p9-B9x

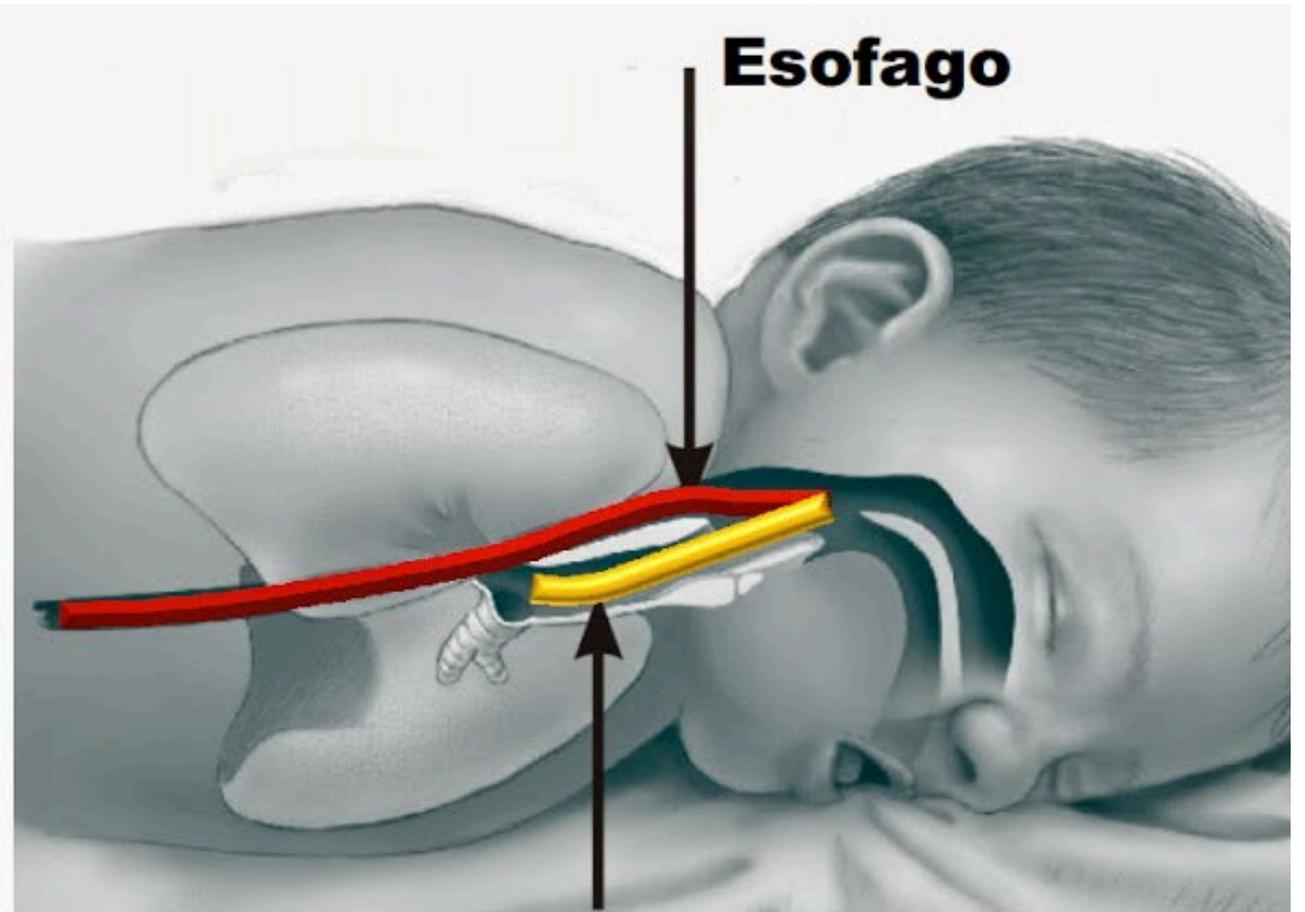
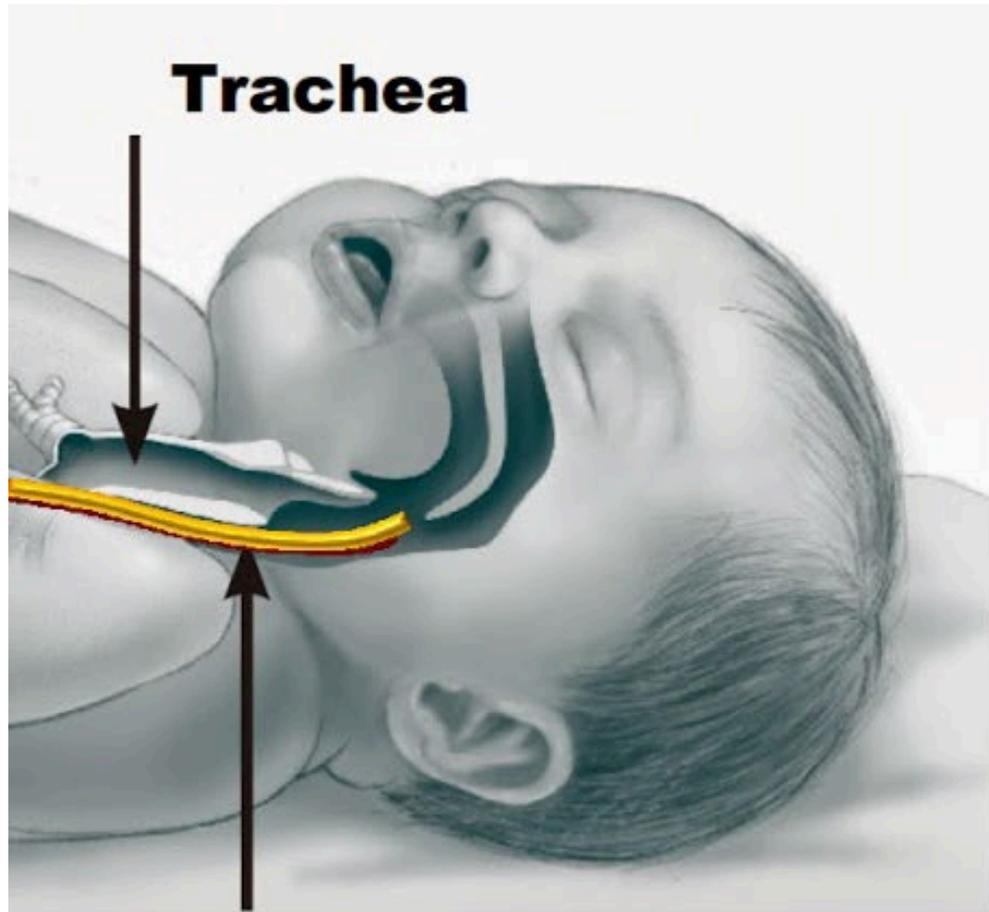
SIDS and SUIDS

No vomit risk – always position babies on their back

If your baby vomits or spits up while sleeping on their back, it will go back down their esophagus.

The esophagus is a long muscular tube that connects the throat with the stomach. It is underneath the trachea (windpipe). If your baby sleeps on their back it means gravity brings vomit back down to their stomach.

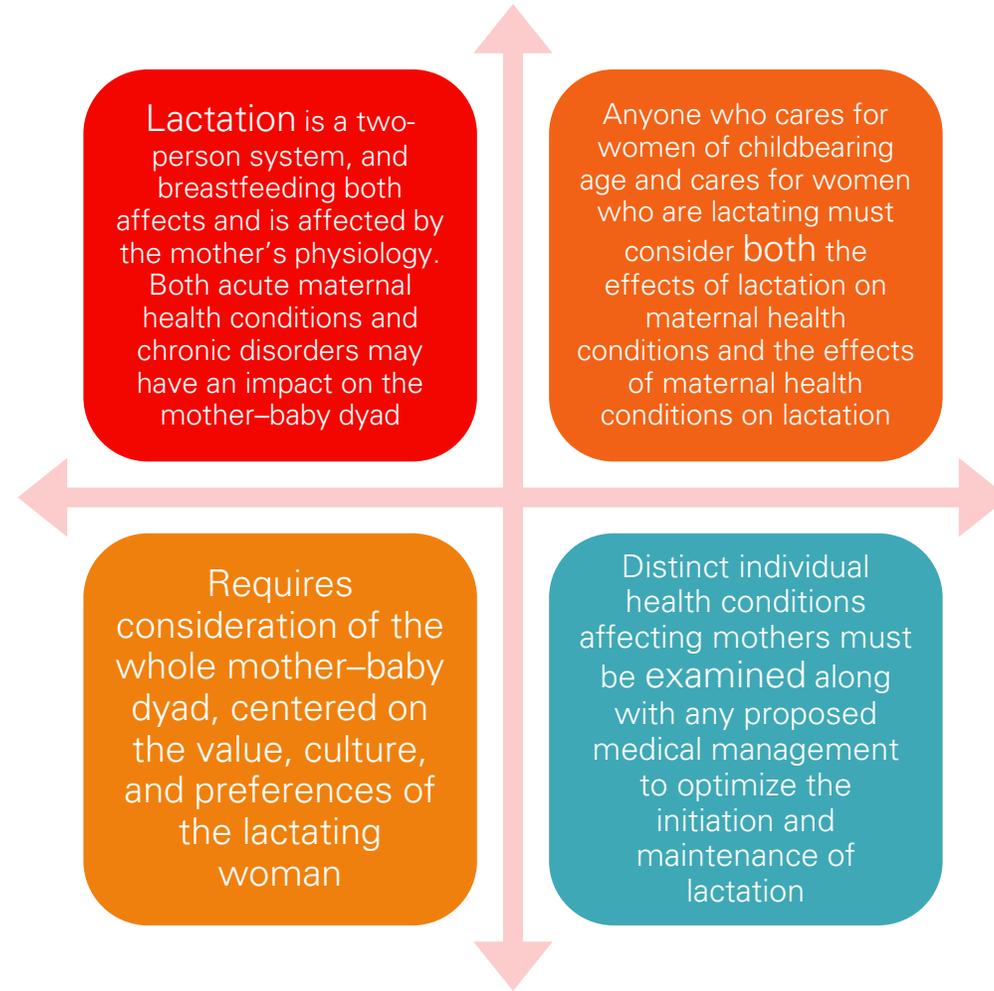
When babies are sleeping on their tummy, vomit will pool at the opening of their trachea. This makes it more likely your baby could choke.



Differences in Short- and Long-term Health in Offspring who are Breastfed vs Those Who are Formula-Fed

- Feeding an infant breast milk, whether exclusively or partially, is associated with a significantly lower risk of Sudden Infant Death Syndrome (SIDS) compared to formula feeding
 - Reducing the risk by approximately 50%
 - Attributed to several factors including: immunologic benefits of breast milk, the potential for more easily aroused sleep states in breastfed infants, and the "organizing" effect breastfeeding may have on a baby's developing systems (can help organize the baby's sleep/wake cycles and overall physiological development)
 - Lower incidence of infection
 - The longer a baby is breastfed, particularly exclusively, the greater the protective effect against SIDS
 - Safe sleep environment - no smoking, do not place infant couch or armchairs, room sharing NO bed-sharing, position supine only, do not fall asleep while feeding
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Red Flags with Lactating Diabetic Mother and Infant



Recommendation

- As providers and coaches every effort should be made to support and encourage breastfeeding especially with a GDM or current mother with DM
 - Despite the obstacles exclusive breastfeeding should be encouraged for the first 6 months and supplemented for two years as the goal and when possible
 - Provide education on technique, frequency, feeding cues, feeding on demand, nutrition for the mother and hydration, how to overcome obstacles and community resources
 - Mental health assessment for PMADS is important and referrals for counseling as needed
 - Incorporate the partner, dad, family in the education and understanding to support the mother and know the benefits for mother and baby, especially with DM
 - Understand educate to the protective factors of breastfeeding against obesity, insulin resistance, GDM, cardiovascular diseases
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BREASTFEEDING TIPS FOR MOTHERS WITH DIABETES

Breastfeed as soon as you can after delivery.

Get lots of skin-to-skin contact with your baby and nurse several times a day in the beginning.

Stay relaxed, and be patient while your milk comes in.

Have a snack before or during nursing.



Breastfeeding with Diabetes

- Prioritize early and frequent nursing
 - Practice skin-to-skin contact
 - Stay hydrated
 - Monitor blood sugar levels closely
 - Keep snacks and fast-acting sugars readily available to treat potential low blood sugars (hypoglycemia)
 - Eat an extra 500 calories daily to support milk production
 - Consult your healthcare team about medication adjustments, potential infections
 - Get personalized support from a registered dietitian or lactation consultant
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Thank you!

Carmen Rezak
crezak@paclac.org
626.806.6674



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