



Research Review:  
Infants of Diabetic Mothers-  
What Exists and Is Upcoming

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Categories of Diabetes

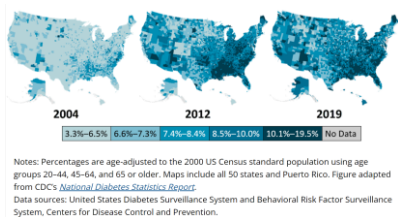
- Type 1 Diabetes
- Type 2 Diabetes
- Gestational Diabetes

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County-Level Distribution of Diagnosed Diabetes Prevalence among US Adults ≥20 years



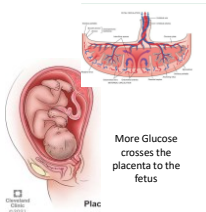
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How does Maternal Diabetes affect the Fetus and Neonate?

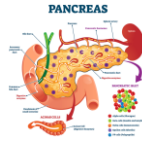
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Maternal hyperglycemia

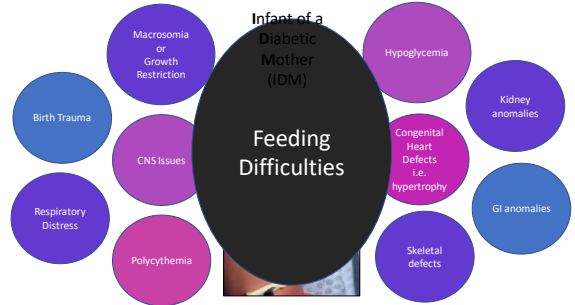


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Fetus has higher glucoses levels and increased insulin production

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Why do IDMs have difficulty with oral feeding?

"They are just immature"

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Abnormal State Maintenance

INFANT STATES



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Infant Behavior

Dimensions	Examples	Score Ranges	Optimal
Response	Stimulation to light, sound, and tactile touch	0-8	8
Orientation	Looking at inanimate objects and infant face and turning to inanimate sounds and inanimate voices	0-8	8
Range of state	Extent to which infants were in sleep and wake states	0-8	mid range
Motor processes	Smoothness, accuracy, and angle (arc) of movements	0-8	mid range
Autonomic stability	Color changes and transiency	0-8	0
Regulation of state	A neonate's ability to raise, maintain, and resolve self	0-8	8
Reflex	Elicited responses, such as sucking, functioning	0-20	0

	IDM infants demonstrated...
Yogman et al. 1986	Lower orientation, motor and autonomic stability, and social interaction
Silverman et al. 1991	Performed poorly on motor, state, and physiologic stress response items. Correlated with diabetes severity
Pressler et al. 1999	Low muscle tone and decreased response to engagement, poor reflex functioning, drowsy state, appeared to improve over time
Botet et al. 1996	No difference to healthy controls when mothers had well-controlled DM

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IMMATURE SUCKING PATTERNS IN INFANTS OF MOTHERS WITH DIABETES

RUBEN BIKORER, MD, ADI RACHWANI, MD, CATHY HARRISMAN, MD, MICHAEL SCHIMMEL, MD, MICHAEL KAPLAN, MD, CHB, AND BARBARA MEDOFF-COOPER, PhD

	Insulin	Diet	Control
Number	14	31	55
Gestational age (weeks)	38.6 ± .9*	39.1 ± 1.2†	39.8 ± 1.0
Birth weight (Kg)	3.47 ± .46	3.44 ± .41	3.47 ± .44
Sex (M/F)	8/6	18/13	29/26
Plm Dextransrose (mg/dL)	50 ± 12	46 ± 12	NA
Hypoglycemia (N and %)	3 (19%)	9 (29%)	NA
Cesarean Section (N and %)	6 (37%)	6 (19%)	9 (17%)
1-minute Aggar scores	9 (8-9)	9 (8-9)	9 (9)
5-minute Aggar scores	9 (9)	9 (9)	9 (9)

Sucking Variable	Insulin	Diet	Control
Number of sucks	115 ± 65*	152 ± 71	157 ± 73
Number of bursts	14.5 ± 6.5†	18.3 ± 6.6	19.7 ± 7.9
Number of sucks per burst	9.8 ± 11.4	9.5 ± 8.1	9.9 ± 12
Suck Width (sec)	38 ± 08	37 ± 08	38 ± 08
Interburst Width (sec)	11.5 ± 7.5	8.7 ± 4.6	8.6 ± 4.2
Maximum pressure (mm Hg)	70 ± 39	61 ± 27	69 ± 40

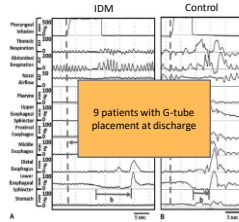
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### Pilot Study of Pharyngoesophageal Dysmotility Mechanisms in Dysphagic Infants of Diabetic Mothers

Manish B. Mallikar, MD, MPH<sup>1</sup> · Sreekanth K. Viswanathan, MD, MS<sup>2,3</sup> · Sudarshan R. Jadcherla, MD<sup>2,3</sup>  
Am J Perinatol 2019;36:1237-1242.

20 dysphagic IDMs and 10 control patients

- Longer lower esophageal nadir duration
- Longer time to esophageal peristalsis
- Lower frequency of deglutination apnea
- Longer esophageal sphincter relaxation

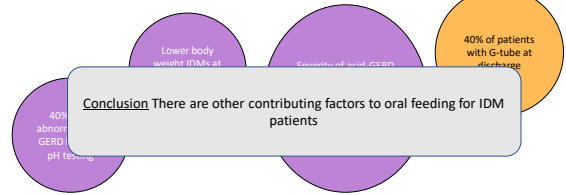


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### Diagnostic utility of impedance-pH monitoring in infants of diabetic mothers with oral feeding difficulties

Sreekanth Viswanathan<sup>1,2</sup> · Sahithee Batchu<sup>1</sup> · Erika Osborn<sup>2,3</sup> · Sudarshan Jadcherla<sup>2,3</sup>

51 Infants of Diabetic Mothers in the NICU



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### Breastfeeding

- Women with diabetes are **less likely** to exclusively breastfeed their babies
- Women with GDM who breastfeed are more likely to have improved insulin sensitivity postpartum and thereafter and **reduce the risk of obesity and developing T2DM**
- **Children** of women with DM who breastfeed have **reduced BMI** in childhood and **decreased prevalence of T2DM**

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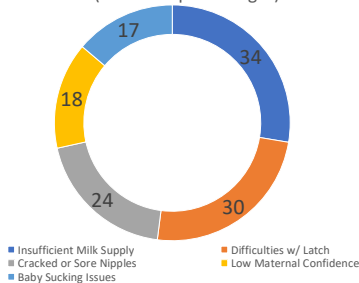
### Breastfeeding

- Women with DM are less likely to exclusively breastfeed and more likely to have early formula supplementation (within 2 days after birth)
- Women with any type of DM are more likely to experience delayed milk production
- Multiple barriers secondary to complications for mother and infant from diabetes during pregnancy



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### Most Commonly Reported Problems (shown as percentages)



(Morrison et al 2015)

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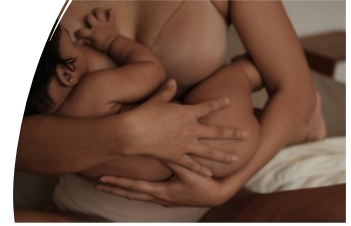
### How Can We Support?

- Stuebe et al 2016- Nutrition, Exercise and coping Skills Training (NEST) intervention
- Consider prenatal expression of breastmilk starting at 36 weeks of pregnancy



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## Quick Case Study



### Baby E

- Mom with Type 1 DM, well-controlled
- Born at 37 weeks, mild hypoglycemia; Observed for 24 hours; No NICU stay required
- Poor weight gain
- Diagnosed with tongue tie from pediatrician and chiropractor
- Sleepy for feeds, poor arousal/state

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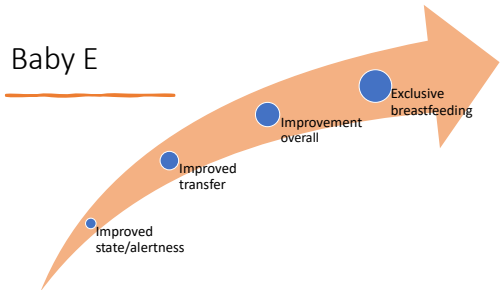


### Baby E

- Feed the baby
- Protect the supply
- Protect the relationship

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### Baby E



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## Future Directions

- More research on behavior and feeding patterns of infants of diabetic mother
- Consideration for alternative feeding methods (i.e. home nasogastric feeds)
- Long term follow-up on growth and development
- Address behavior and feeding complications during prenatal period



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