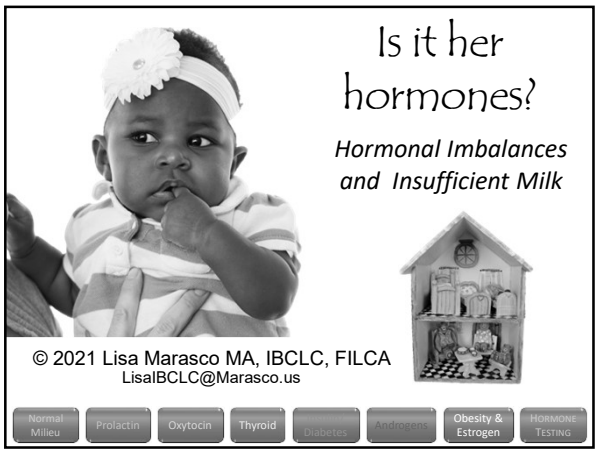
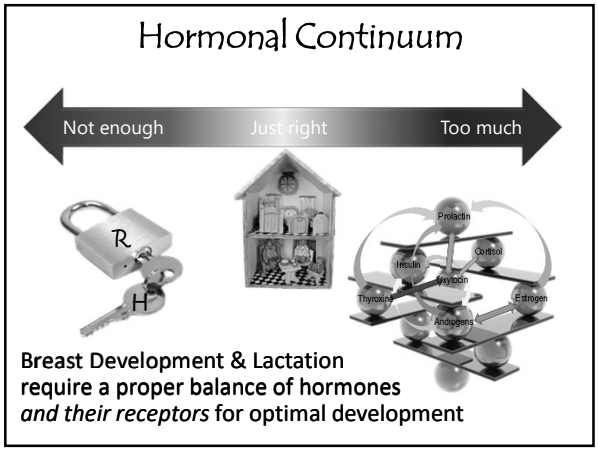
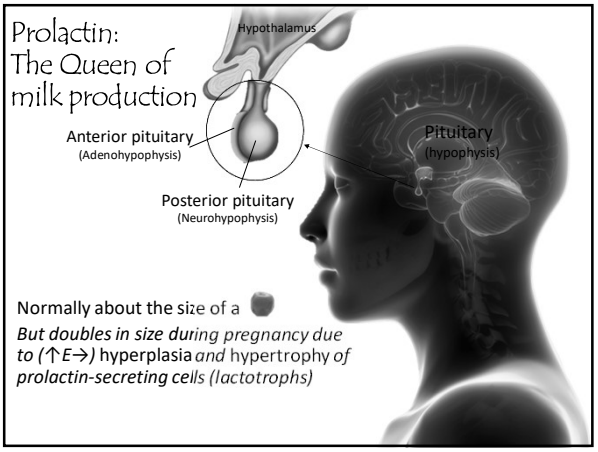
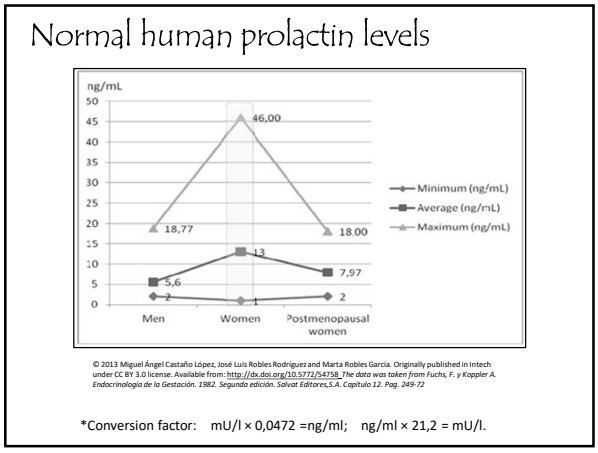
Hormones

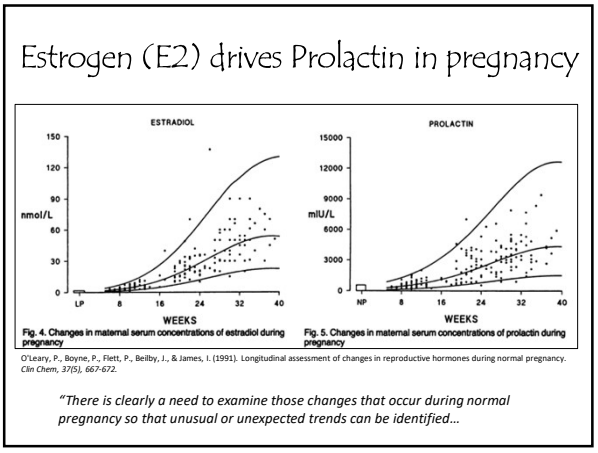


I receive royalties for *Making More Milk*
No other disclosures of financial or conflicting interests to make.



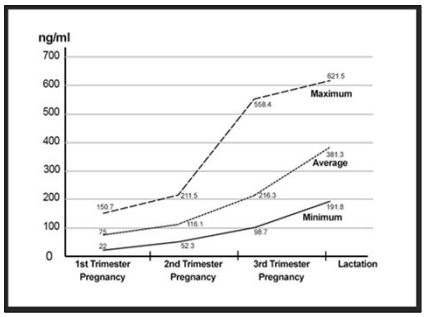






Hormones

Pregnancy Prolactin range



What happens in pregnancy if prolactin is low/suppressed?

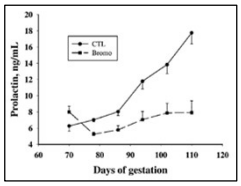


Figure 1. Prolactin concentrations in the blood of gilts (young primip pig) receiving an empty capsule (CTL) or 10 mg bromocriptine (Bromo) thrice daily from d 70 to 110 of gestation

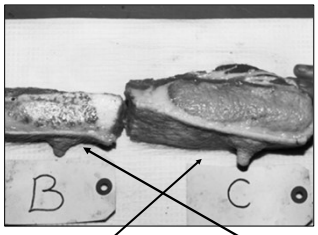


Figure 4. Transversal cut from the mammary gland of gilts receiving an empty capsule (C, placebo) or 10mg of bromocriptine (B) thrive daily from d 70 to 110* of gestation

Farmer, C., Sorensen, M. T., & Petitclerc, D. (2000). Inhibition of prolactin in the last trimester of gestation decreases mammary gland development in gilts. *J Anim Sci, 78(5), 1303-1309.*

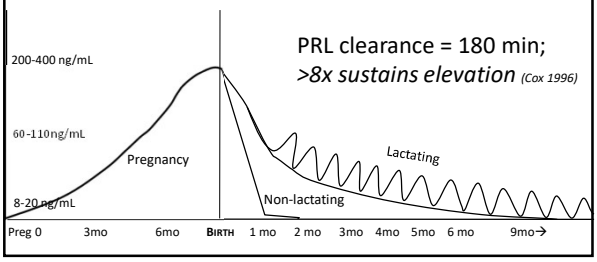
Prolactin through the reproductive cycle

Baseline a product of *surges*

Driven by estrogen during pregnancy

Influenced by *frequency* & *quality* of stimulation

PRL clearance = 180 min; *>8x sustains elevation* *(Cox 1996)*



Timing of initiation matters!

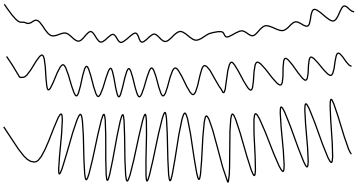
Nedkova 1995 (Bulgarian)

Studied effect of early initiation on PRL in 90 women: All newly delivered mothers had serum PRL level over 100ng/ml, *author accepted as minimum threshold*

Initiation of breastfeeding	Prolactin on Day 4*
< 6 hrs post-delivery	164
@ 6-12 hrs post- delivery	124
@ 72 hrs post-delivery (c-sections)	29

**Feeding frequency unknown, likely q4hrs*

Amplitude matters



"Good lactators gave a prolactin response 236% above baseline after nursing whereas poor lactators showed a blunted or flat response"- Ostrom, 1990

Other risk factors

Cranial Radiotherapy (CRT) tx at young age

→ Anterior pituitary problems- GH, PRL

Prolactin declines further over time

Theory: GH influences prolactin secretion directly OR indirectly through IGF-1

High lactation failure rate

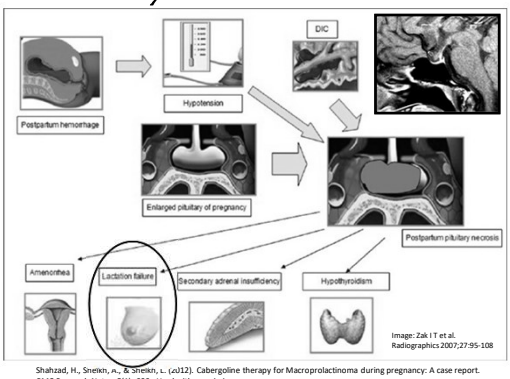
Follin: 6 of 7; Johnston: 10 of 12

Johnston, K., Vowels, M., Carroll, S., Neville, K., & Cohn, R. (2008). Failure to lactate: a possible late effect of cranial radiation. *Pediatr Blood Cancer, 50(3), 721-722.*

Follin, C., Link, K., Wiebe, T., Moell, C., Bjork, J., & Erfurth, E. M. (2013). Prolactin insufficiency but normal thyroid hormone levels after cranial radiotherapy in long-term survivors of childhood leukaemia. *Clin Endocrinol (Oxf), 79(1), 71-78.*

Hormones

Sheehan's Syndrome



Shahzad, H., Sneikn, A., & Sneikn, L. (2012). Cabergoline therapy for Macroprolactinoma during pregnancy: A case report. *BMC Research Notes, 5(1), 606. Used with permission.*

What about Hyperprolactinemia?

- **Often treated w/ PRL inhibitors, radiation or surgery**
- **Hx of galactorrhea is no guarantee of good lactation**
- **Sporadic information**

Cheng, W., & Zhang, Z. (1996). [Management of pituitary adenoma in pregnancy]. *Zhonghua Fu Chan Ke Za Zhi, 31(9), 537-539.* ***75% breastfed***

http://www.women-health-info.com/33-Hyperprolactinemia-Lactation.html

Case study of three women

Case I: Treated w/bromocriptine prior to pregnancy; levels rose normally then extra high (~600ng), headache @ 39 wks for 6 hrs.

Case 2: Treated with CRT (Cobalt Radiation Therapy); Twins

Case 3: Tumor removed surgically. Twin pregnancy.

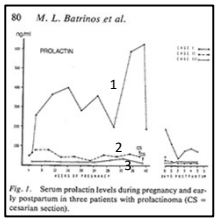


Fig. 1. Serum prolactin levels during pregnancy and early postpartum in three patients with prolactinoma (CS = cesarian section).

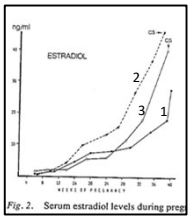


Fig. 2. Serum estradiol levels during preg

Batrinos, M. L., Panitsa-Faflia, C., Anapliotou, M., & Pitoulis, S. (1981). Prolactin and placental hormone levels during pregnancy in prolactinomas. *Int J Fertil, 26(2), 77-85.*

Case study of three women

Table I. *Prolactin (PRL) and estradiol (E_2) levels in the three patients with prolactinomas before and after termination of pregnancy*

	Before pregnancy Prolactin (PRL) ng/ml		Delivery		Amniotic fluid		Umbilical cord		Suckling	
			PRL ng/ml	E_2 pg/ml	PRL ng/ml	E_2 pg/ml	PRL ngml	E_2 pg/ml	Before PRL ng/ml	After PRL ng/ml
Case I	Before treatment 200–250	After bromocriptine 40–60	182	28,000	610	17,000	262	25,000	75	88
Case II	92–>200	After irradiation 22–57	47.5	46,000	a) 650 b) 625	31,000 13,600	a) 375 b) 210	15,000 8,300	12.5	12.5
Case III		After excision of adenoma 7.5–10	14.5	40,000	a) 650 b) 600	19,000 20,000	a) 170 b) 190	13,000 18,000	18.5	15

None were able to breastfeed…

Batrinos, M. L., Panitsa-Faflia, C., Anapliotou, M., & Pitoulis, S. (1981). Prolactin and placental hormone levels during pregnancy in prolactinomas. *Int J Fertil, 26(2), 77-85.*

Prolactin Problems: A New Insight

Iwama Case Study

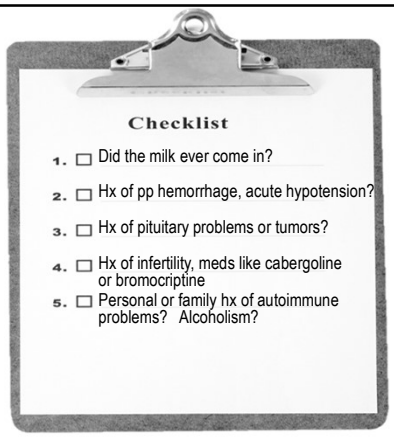
Discovered auto-antibodies that *specifically targeted prolactin-secreting cells*

√√ DeBellis 2013 also involved antibodies to GH and PRL

Developed full supply for duration of recombinant hPRL study

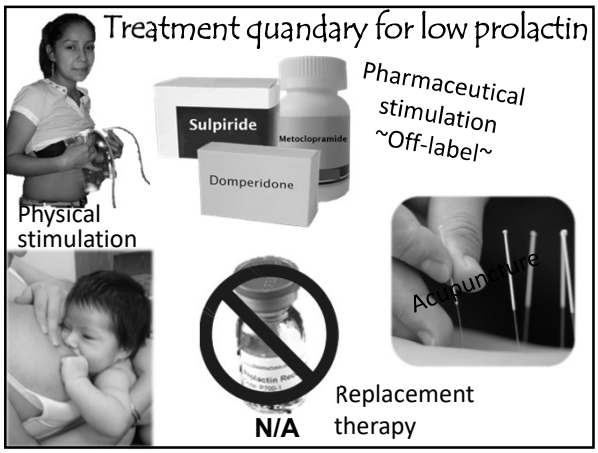
Iwama, S., Welt, C. K., Romero, C. J., Radovick, S., & Caturegli, P. (2013). Isolated prolactin deficiency associated with serum autoantibodies against prolactin-secreting cells. *J Clin Endocrinol Metab, 98(10), 3920-3925. doi: 10.1210/jc.2013-2411*

Screening for prolactin problems



Hormones

Treatment quandary for low prolactin



Measuring prolactin

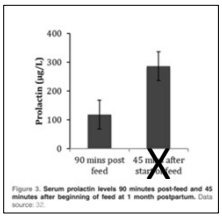


Figure 3. Serum prolactin levels 90 minutes post-feed and 45 minutes after beginning of feed at 1 month postpartum. Data source: 33.

For Basal/Baseline level:
After 2-3 hours no stimulation

For Surge:
10-15 min after *end* of nursing/pumping

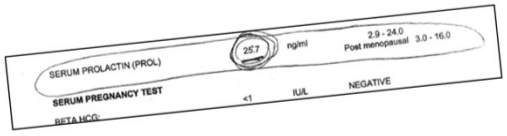
Boss, M., Gardner, H., & Hartmann, P. (2018). Normal Human Lactation: closing the gap. *F1000Research, 7((F1000 Faculty Rev)), 801.*

Prolactin Problems

Laboratory Measuring issues:

-Labs have no reference ranges for lactation!

-Must factor in frequency of feeding/pumping



Prolactin Reference

Approximate Prolactin Levels for Exclusively Breastfeeding				
Stage	Baseline		Level after Suckling	
	ng/mL	mIU/l	ng/mL	mIU/l
Female menstrual life	2-20	42-425		
Third trimester of pregnancy	100-550	2128-11700		
Term pregnancy	200–600	4255-12766		
First 10 days postpartum	200	4255	400	8510
1 month	100-140	2128-2978	260-310	5532-6596
2 months	100-140	2128-2978	195-240	4149-5106
4 months	60-80	1277-1702	120-155	2553-3298
6 months	50-65	1063-1383	80-100	1702-2128
7 months–1 year	30–40	638-851	45–80	957-1702

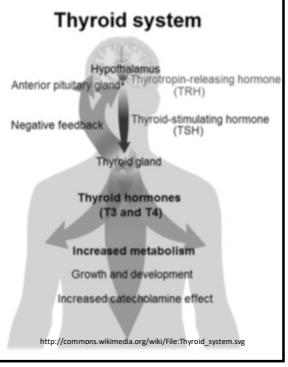
Thyroid Hormones

- ✓ Influences breast tissue via prolactin & GH

T3 = triiodothyronine

T4 = thyroxine

TSH = Thyroid-stimulating hormone Indicator of thyroid function

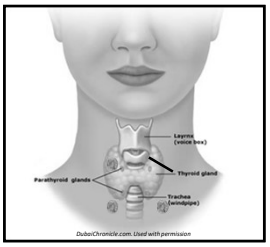


http://commons.wikimedia.org/wiki/File:Thyroid_system.svg

Thyroid Dysfunction

Can be primary, secondary, overt, subclinical, autoimmune

Onset can be prior to preg, during preg, post-delivery, or even later



DubaiChronicle.com. Used with permission

Can also occur in conjunction with other conditions such as PCOS

Incidence much higher in women

Hormones

Hypothyroidism

High TSH verified by low T3/T4

Sx may include weight gain, cold, fatigue, hair loss

Hashimoto's is most common version, autoimmune

Reproductive Endocrinologist perspective

RE preferred TSH range for preconception is .5-2.5, with 1.0 as ideal

2018 proposed range .3-3.5 for general & fertility (Moncayo 2017)

Controversial- still not settled

Hypothyroidism in Pregnancy

Uncontrolled hypothyroidism can cause
→ anemia
→ pregnancy induced hypertension
→ postpartum hemorrhage

Risk factors for delayed Lact 2

Rat studies: Less mammary tissue development

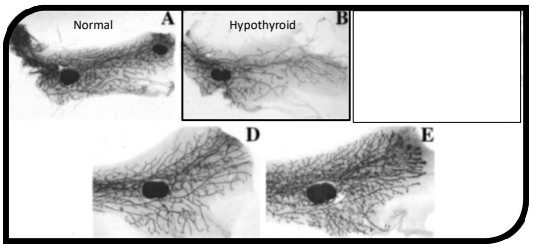


Fig. 3. The effects of thyroid hormones and progesterone (P) on tertiary branching. Whole mounts of mammary glands from mice are presented. (A) 3-month-oldC3Hmouse; (B) 3-month-old hypothyroid C3H mouse, after treatment with propylthiouracil for 5 weeks; (C) 3-month-old hyperthyroid C3H mouse, treated with thyroxine for 5 weeks; (D) 39-day-old BALB/c mouse (reproduced by permission of the Society for Endocrinology; 58); (E) 39-day-old intact BALB/c mouse treated with P for 15 days (reproduced by permission of the Society for Endocrinology; 58).

Hovey, R. C., Trott, J. F., & Vonderhaar, B. K. (2002). Establishing a framework for the functional mammary gland: from endocrinology to morphology. *J Mammary Gland Biol Neoplasia, 7(1), 17-38.*

Rat studies: Hypothyroid

Hypothyroid rats have smaller litters and longer gestations

- Triglycerides ↓ (less milk fat)
- Less milk-making tissue in pregnancy
- Reduced pp circulating OT→
- Impaired Milk Ejection
- Poorer lactation

-Hapon 2003, 2005

- Disrupted prolactin signaling
- Reduced milk production
- Premature mammary involution

-Campo Verde Arbocco 2017

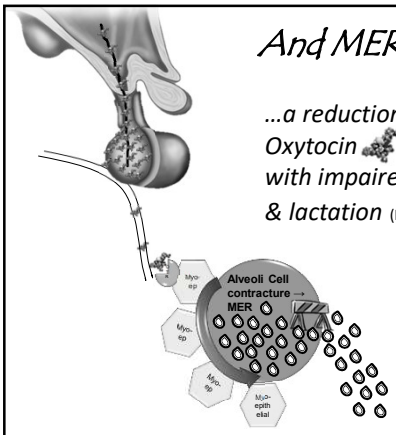
Lower fat milk

Hapon 2005, 2007: Impaired mammary output of triglycerides… resulting in "low milk quality"

HealthPages.org Used with permission.

Hapon et al. (2005). Effects of hypothyroidism on mammary and liver lipid metabolism in virgin and late-pregnant rats. *J Lipid Res*
Hapon et al. (2007). Reduction of mammary and liver lipogenesis and alteration of milk composition during lactation in rats by hypothyroidism.

Hormones



And MER problems

…a reduction in circulating Oxytocin postpartum with impaired milk ejection & lactation (Hapon 2003, 2005)

Hyperthyroidism- too much hormone

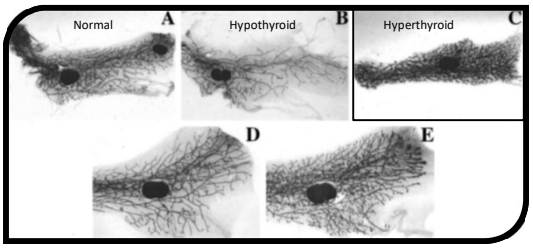
Low TSH verified by elevated T3/T4

- Grave's disease most common
- Common sx include weight loss, fast heart beat, sleep problems, nervousness, frequent BMs
- Previously thought not to affect lactation

Hyperthyroidism

Sx often improve during pregnancy, but more severe HT can cause pregnancy complications such as fetal growth restriction, pre-eclampsia, preterm labor.

Impact on mammary development



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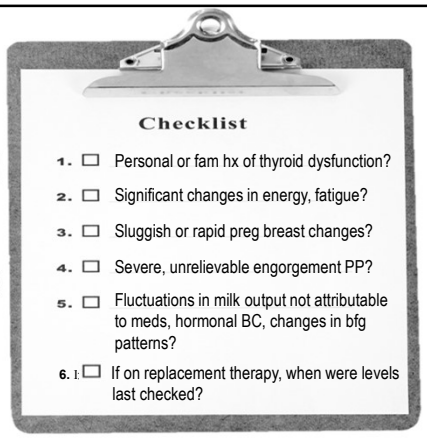
Rat studies: Hyperthyroid

Hy*per*thyroid rats have larger litters with earlier and *prolonged* labors.

Rat studies showed good mammary growth and evidence of milk production *but poor or complete lactation failure* depending on the degree of hyperT → poor oxytocin release & milk ejection (Varas 2002)

New rat studies show "advanced" prepartum surge in PRL and blunted PRL response to suckling (Pennacchio 2017)

Screening for thyroid problems



Strategy for Thyroid & Supply: the First Step

Replacement hormone is first line of treatment for hypoT-related supply problems…

The dessicated thyroid extract debate

Reducing thyroxine is the first line of defense for hyperT- related milk supply problems

Beware of over- or under-treatment postpartum

American Thyroid Assoc weighs in (2017)

Recommendation 74:

As maternal hypothyroidism can adversely impact lactation, *women experiencing poor lactation without other identified causes should have TSH measured to assess for thyroid dysfunction.*

Recommendation 75:

Given its adverse impact on milk production and letdown, *subclinical and overt hypothyroidism should be treated in lactating women seeking to breastfeed.*

American Thyroid Assoc weighs in (2017)

Recommendation 76:

The impact of maternal hyperthyroidism upon lactation is not well understood. Therefore, *no recommendation to treat maternal hyperthyroidism on the grounds of improving lactation can be made at this time.* ***(No recommendation, Insufficient Evidence)***

Available online!

https://www.liebertpub.com/doi/pdfplus/10.1089/thy.2016.0457

Secondary help for thyroid-related problems

Oxytocin nasal spray?

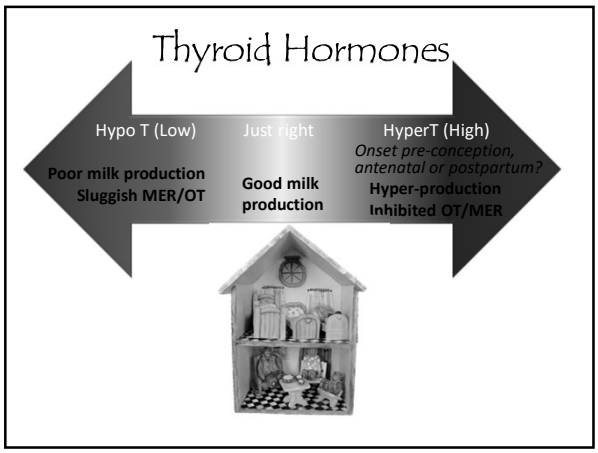
If MER a problem, could exogenously provide the oxytocin needed while waiting for hormone correction to normalize oxytocin release

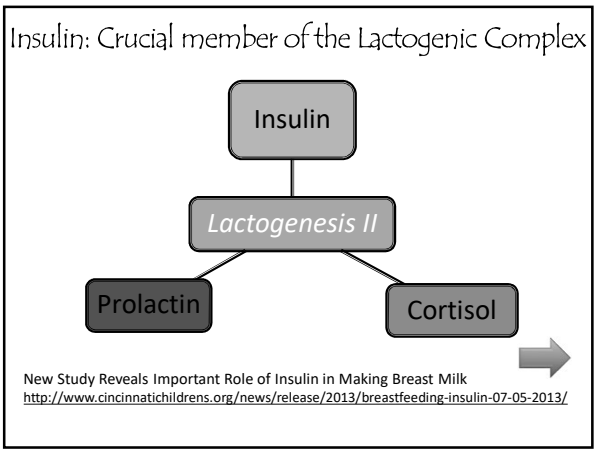
Be aware of thyroid affective herbs

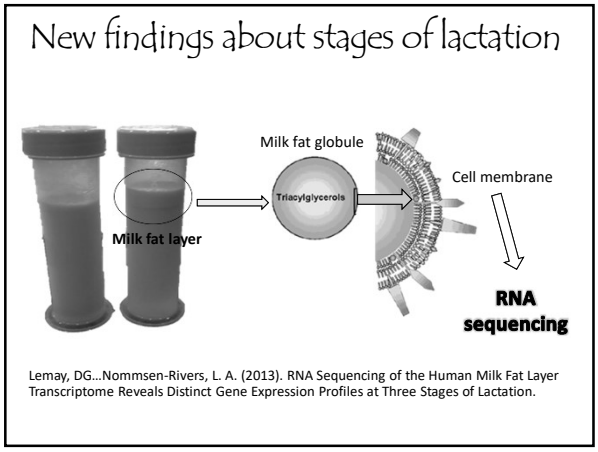
Ashwagandha- stimulates T3
Chickweed- supportive
Dandelion- supportive
Milk thistle- improves T4→T3
Nettle- supportive/balancing
Vervain- supportive
Red clover- increased total & free T3 in ewes
Fenugreek- *Reduced T3 in mice & rats*
Malunggay- *tested for use with hyperthyroidism*

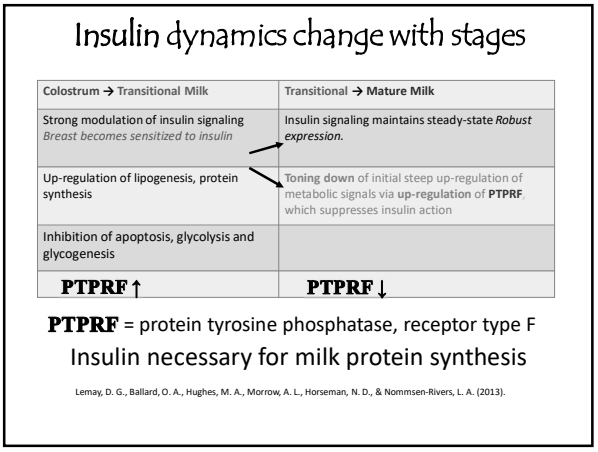
Yarnell 2006; Tahiliani 2003; Panda 1999;

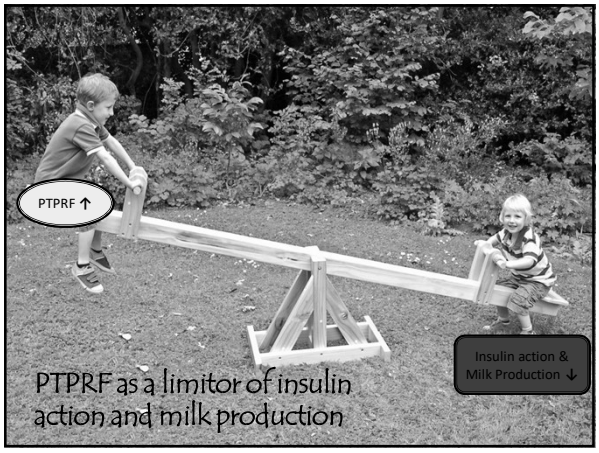
Hormones







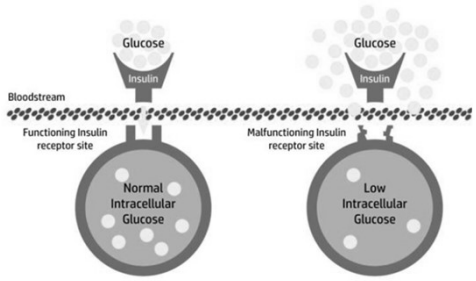




Hormones

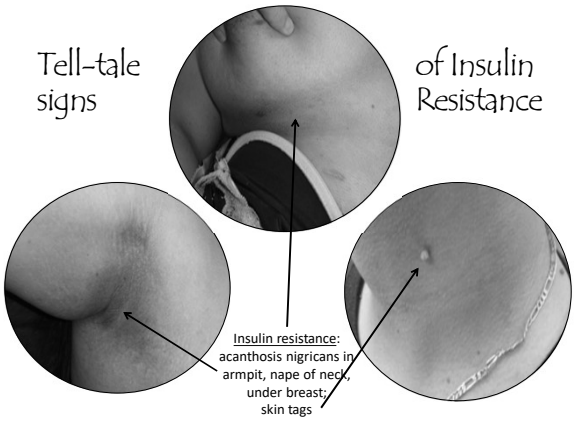
Type 2 & Gestational Diabetes

Normal insulin metabolism	Insulin Resistance



→ Compensatory *hyperinsulinemia*

Tell-tale signs of Insulin Resistance



How IR can affect production

Markers	Mature Group 1	Mature Group 2
Median onset of notably fuller breasts	34 hrs	74 hrs
Insulin secretion	Above median	Below median
Insulin sensitivity	Above median	Below median
Expression of PTPRF	_baseline_	Significantly higher than Group 1 (over-expressed)
Milk Production	Engorgement peaked day 4-5, then down regulated to demand	All reported difficulty with milk supply at either day 4 or pp week 4-6 interviews

Lemay, D. G., Ballard, O. A., Hughes, M. A., Morrow, A. L., Horseman, N. D., & Nommsen-Rivers, L. A. (2013). RNA Sequencing of the Human Milk Fat Layer Transcriptome Reveals Distinct Gene Expression Profiles at Three Stages of Lactation. *PLoS One, 8(7).*

CONCLUDING HYPOTHESIS: *"Women with decreased insulin sensitivity will experience a more sluggish increase in milk output in response to infant demand as a result of PTPRF over-expression in the mammary gland"*

Insulin Resistance And low milk production

48 mothers 1-8wks pp w/low supply

- **33** had signs of IR → BMI ~37 → Milk production median **216** [158-332]
- **15** non-IR → BMI ~25 → Milk production median **377** [294-598]

"Additional deficit associated w/ IR"

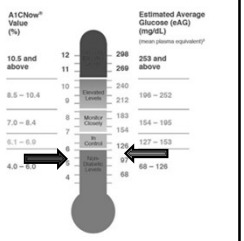
Nommsen-Rivers, et al. (2017). Milk Production in Mothers with and without Signs of Insulin Resistance. *The FASEB Journal*

Glover (2017). *Impact of metabolic dysfunction on breastfeeding outcomes in GDM*

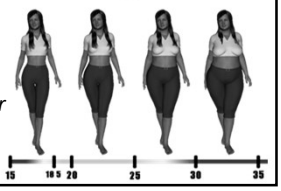
Table. Associations between metabolic markers and breastfeeding duration in GDM *Risk of reporting not breastfeeding as long as desired*

Metabolic marker tertiles	Time to weaning MV-adj HR (95% CI)	Wald chi square p value	Undesired weaning, N (%)	M-H Chi Square p
Fasting glucose, mg/dL		.04		.04
<93	1.0 (ref)		5 (21.7)	
93-101	.77 (.33-1.83)		6 (23.1)	
>101	1.84 (1.11-3.06)		12 (48.0)	
Hemoglobin A1c		.01		NS
<5.3	1.0 (ref)		5 (21.7)	
5.3-5.6	1.45 (0.87-2.41)		10 (38.5)	
> 5.6	2.51 (1.36-4.60)		10 (34.5)	
Body Mass Index, kg/m2		<.01		<.01
<34	1.0 (ref)		6 (20.7)	
34-40.6	1.22 (.77-1.94)		6 (21.4)	
>40.6	2.21 (1.24-3.94)		14 (56.0)	
Subscapular skin fold, mm		<.0001		.04
<28.3	1.0 (ref)		6 (21.4)	
28.3-33.0	3.66 (2.62-5.11)		10 (34.5)	
>33.0	2.82 (1.57-5.06)		10 (40.0)	

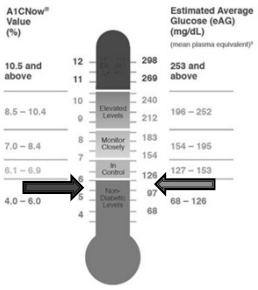
NS = not significant



A1C, BMI, OGTT & subscapular were associated w/ shorter duration of lactation



Confirmed by Verd 2016



Compared women with *normal* 1-hr glucose challenge tests (<7.8 mmol/L) with those who had *elevated* 1-hr test (≥ 7.8mmol/L but <10.6 mmol/L) but clinical indices below threshold for GDM diagnosis

Results: *Mildly impaired women abandoned exclusive breastfeeding sooner than non-impaired:* OR 1.65

Hormones

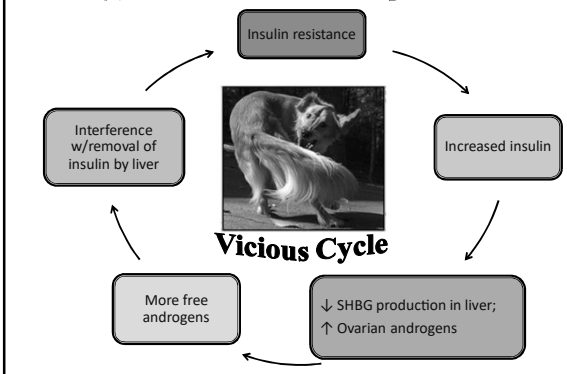
Pregnancy complications/GDM

	Any Bfg Rate	Duration: Full Bfg	Duration: Any Bfg
Healthy = 527	86%	17 wks	
GDM all = 257	75%	9 wks	
GDM-Diet		12 wks	20 wks
GDM Insulin		4 wks	10 wks
GDM + BMI <30	80%		17 wks
GDM + BMI >30	65%		12 wks

Conclusions: *Mothers with GDM, especially those with insulin-dependent gestational diabetes, and obese mothers breastfed their children significantly less and for a shorter duration than healthy mothers.*

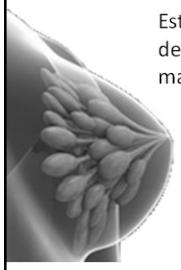
Breastfeeding in women with gestational diabetes Hummel, S., Hummel, M., Knopff, A., Bonifacio, E., & Ziegler, A. G. (2008).

The HyperInsulinemia-Androgen connection

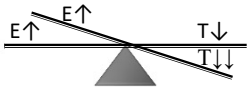


Schuring et al. Androgens and Insulin- Two Key Players in Polycystic Ovary Syndrome. *Gyn Geb Rundsch* 2008; 48:9-15.
Carlsen, S. M., & Vanky, E. (2010). Metformin influence on hormone levels at birth, in PCOS mothers and their newborns. *Hum Reprod, 25(3), 786-90.*

Androgens vs estrogens in the breast



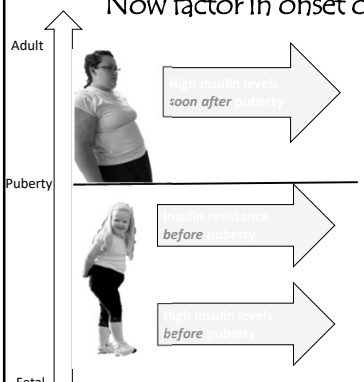
Estrogen stimulates development of mammary tissue



Androgens slow growth of mammary tissue (possibly by ↓ERα)

Labrie F. Dehydroepiandrosterone, androgens and the mammary gland. Gynecology Endocrinology 2006; 22(3):118-30.

Now factor in onset of heaviness



May *reduce* breast size & lactational capacity via androgens

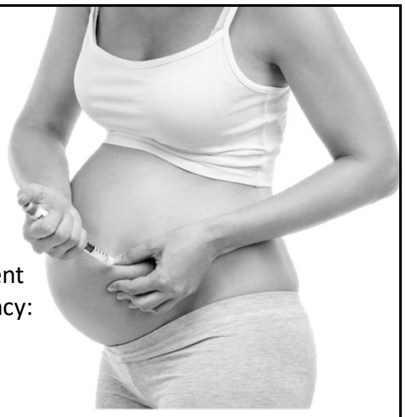
Can *decrease* overall glandular tissue inside (IGT)

Can *increase* breast *size* (hypertrophy)

Thanks to R. Craig, MD

Cassar-Uhl, D., & Liberatos, P. (2017). *Influence of adolescent and pre-pregnancy maternal weight status on lactation capability. Paper presented at the APHA 2017 Annual Meeting & Expo (Nov. 4-Nov. 8).*

GDM Lactation Risks



Insulin treatment during pregnancy: AOR 3.11

Matias et al. (2014). Maternal prepregnancy obesity and insulin treatment during pregnancy are independently associated with delayed lactogenesis in women with recent gestational diabetes mellitus.

Speaking of insulin… *Herskin 2015*

Diabetes type	Any bfg discharge	Full bfg discharge	Any bfg 4 mo	Full bfg 4 mo
Type 1	93%	72%	61%	49%
Type 2 (pregestational)	86%	45%	34%	23%

STANDARD PRACTICE:

- Insulin-controlled during pregnancy
- Infants automatically given mother's milk or Nutramigen by cup or NG tube starting after first bfd/within 2 hrs & q3hrs first 24 hrs

Herskin et al. (2015). Low prevalence of long-term breastfeeding among women with type 2 diabetes. *J Matern Fetal Neonatal Med, 1-6.*

Lee, S., & Kelleher, S. (2016). Biological underpinnings of breastfeeding challenges: the role of genetics, diet, and environment on lactation physiology. *Am J Physiol Endocrinol Metab, 311(2), E405-422.*

Hormones

Implications!

"Women with GDM who are on insulin therapy have a delay in the onset of lactation, which suggests that insulin treatment may have adverse effects on milk production or composition in humans."

– Lee and Kelleher 2016

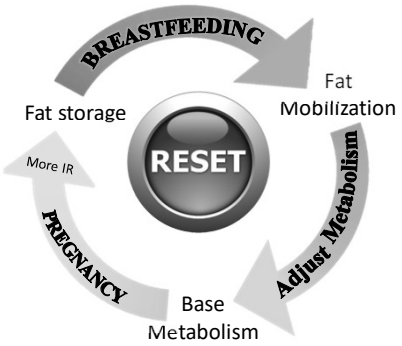
Immature sucking patterns

		# sucks/ 5 min	Number of bursts	Interburst width (sec)
Term infants born to moms w/ GDM N=47 vs Controls	Insulin-managed N=16	115 +/- 65	14.5 +/- 6.5	11.5 +/- 7.5
	Diet controlled N= 31	152 +/- 71	18.3 +/- 6.6	8.7+/- 4.6
	Controls N=55	157 +/- 73	19.7 +/- 7.9	8.6+/- 4.2

Bromiker et al. (2006). Immature sucking patterns in infants of mothers with diabetes. *The Journal of pediatrics, 149(5), 640-643.*

Breastfeeding is important: Reset theory

Stuebe & Rich-Edward 2009



Level 1
Level 2

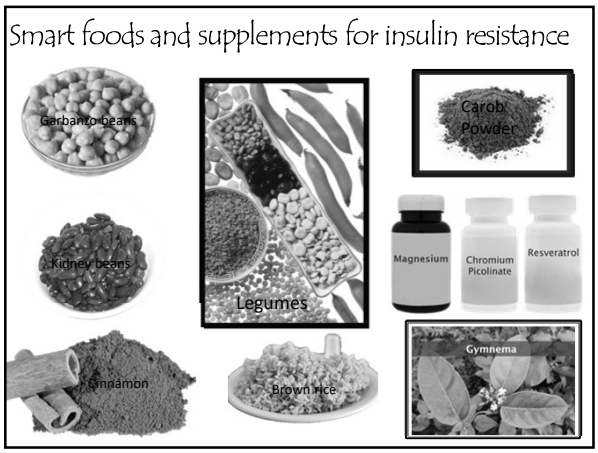
Weight loss, diet changes, supplements, medications

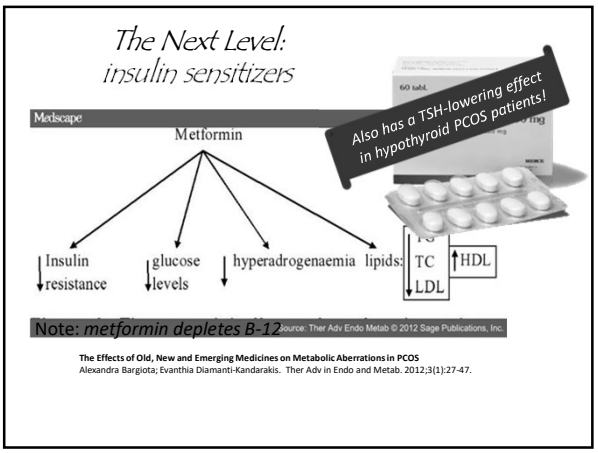
Most importantly…

Early frequent feeds to bring the milk in faster
Targeted prenatal-postnatal education reduced drop off

Chertok, I. R., & Sherby, E. (2016). Breastfeeding Self-efficacy of Women With and Without Gestational Diabetes.
Stuebe et al. (2016). A Cluster Randomized Trial of Tailored Breastfeeding Support for Women with GDM

Hormones





MALMS: Metformin to Augment Low Milk Production

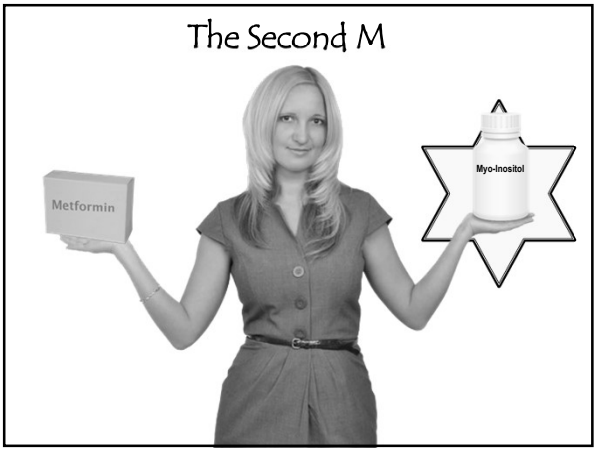
Nommsen-Rivers 2019

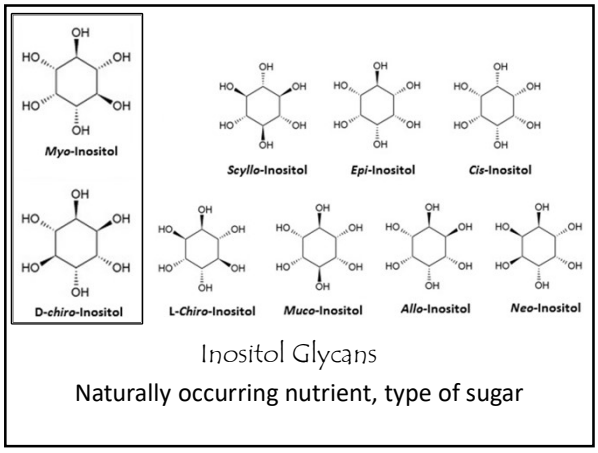
Participants:
- 15 Mothers 1-8 weeks post birth, low supply, signs of IR
- Median

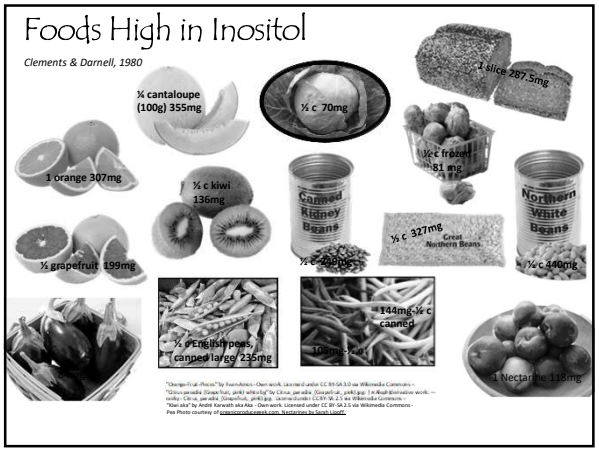
Arms: (28 day treatment)
- Standard Care + Metformin, titrated 750mg to 2000mg
- Standard Care + Placebo

Results (peaked @ 14d)	**Max change in milk output mls/24 hrs**
Placebo n=5	-58 (-62 to -1)
Metformin ALL n=10	+8 (-23 to 33)
Metformin- 14-28 days (completers, n=8)	+22

"Strong negative association between signs of insulin resistance and baseline milk output"







Hormones

Larner 2010

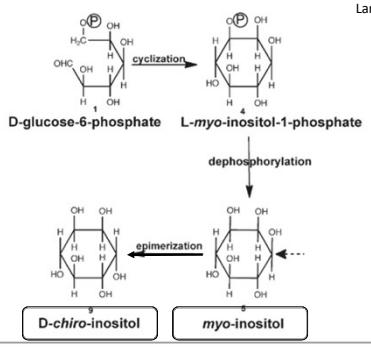


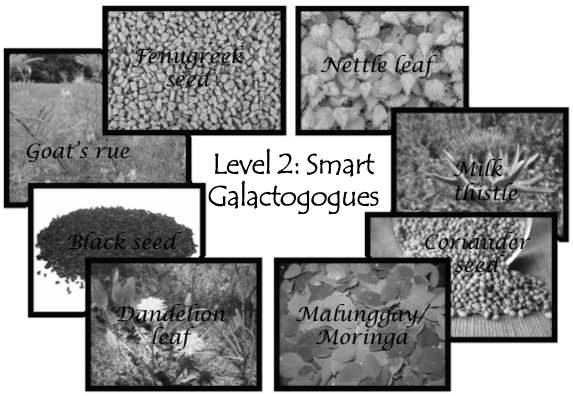
Figure 5. Conversion of D-glucose-6-phosphate to myo-inositol-1-phosphate by cyclization. Myo-inositol-1-phosphate is then dephosphorylated to myo-inositol, which then is converted by epimerization of the C3 hydroxyl (dashed left arrow) to DCI.

Larner 2010

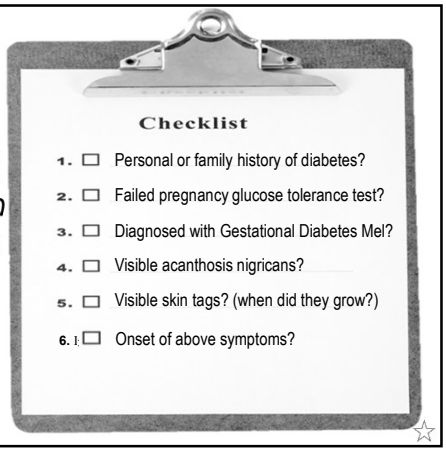
Groups	Myo/chiro
Control	2.5
Type II diabetes patients	20.4
Nondiabetic relatives of type II diabetic patients	13.2
Type 1 diabetes patients	13.6

Insulin resistance is frequently associated with imbalance of Myo-I to D-chiro-I

⟶ *Caused by impaired conversion and/or increased urinary clearance of D-chiro-I*



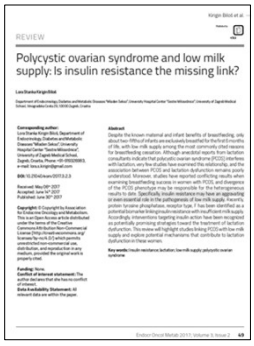
Screening for Insulin problems



What about PCOS?

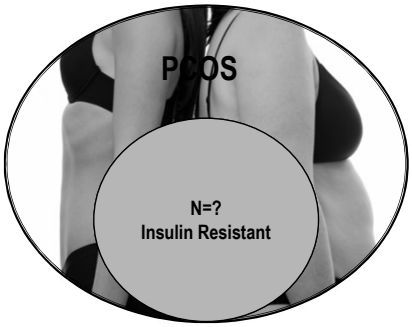

Insights in Practice

Polycystic Ovary Syndrome: A Connection to Insufficient Milk Supply?


REVIEW

Polycystic ovarian syndrome and low milk supply: Is insulin resistance the missing link?

Hormones



Riddle & Nommsen-Rivers 2016:
"PCOS as a risk factor for insufficient lactation may be limited to the subset of women with postpartum glucose intolerance"

McGuire, E., & Rowan, M. (2015). PCOS, breast hypoplasia and low milk supply: A case study. *Breastfeeding Review, 23(3), 29-32.*

Case Study

-Measured output via infant transfer = 52mls/day

-Did *not* respond to domperidone @ 30 or 60mg

-Clinical indications of insulin resistance

Metformin: Transfer *increased 69%* to 88mls/day

Hypertension: fallout from metabolic issues

PIH is associated with delayed lactogenesis (Salahudeen 2013)

Mothers with gestational hypertension have more difficulties maintaining exclusive breastfeeding and shorter duration after 6 mos (Strapasson 2018)

Women with hypertensive disease of pregnancy bfd significantly less often, esp. w/HELLP (Leeners, 2005)

Impact may be multifactorial

Variable clinical presentations… May include both primary (preeclampsia disease course itself) and secondary factors (magnesium sulfate therapy, delayed at-breast feeding due to maternal-infant separation) etiologies. *Demirci 2018*

Placental impact

Multiple effects on placental function

Placenta affects mammary growth

Hypertensive rats had reduced PTHrP, impaired mammary development, ↓ milk delivery

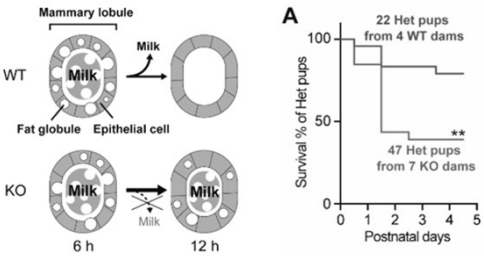
Naharet al. (2013). Placental changes in pregnancy induced hypertension.

Goswami et al. (2012). Excessive placental calcification observed in PIH patients and its relation to fetal outcome.

Majumdar, et al. (2005). A Study of Placenta In Normal and Hypertensive Pregnancies. *Journal of the Anatomical Society of India, 54(2), 7-12.*

Wlodek, et al. (2003). Impaired mammary function and parathyroid hormone-related protein during lactation in growth-restricted spontaneously hypertensive rats.

Pre-eclampsia & Oxytocin



Elevated homocysteine – risk factor for pre-eclampsia
Impaired *contraction response* to oxytocin, possibly due to decreased OT receptor expression in the mammary gland

Akahoshi et al. (2019). Preeclampsia-Like Features and Partial Lactation Failure in Mice Lacking Cystathionine gamma-Lyase-An Animal Model of Cystathioninuria.

Hormones

And what about magnesium treatment?

CLUE:
MgSO4 *relaxes smooth muscle*, leads to *increased OT requirements* for uterine toning during c-section (Hasanein 2015)

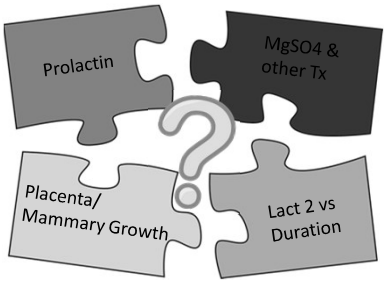
- ✓ Mothers who took it 4wks or longer before delivery were less likely to be discharged fully bfg (Anderson 2017; Drugs that suppress lactation, Part 1)
- ✓ Postpartum tx assoc w/impaired MER, delayed Lact 2, infant lethargy (& greater wt loss)

Pre-eclampsia & Prolactin

PREGNANCY	20-23 weeks	24-27 weeks	28-31 weeks	32-35 weeks	36-39 weeks	40-42 weeks
Normotensive N=121	92ng/mL 29-172	128ng/mL 49-266	149ng/mL 69-440	225ng/mL 70-566	205ng/mL 65-584	229ng/mL 64-496
Pre-eclampsia				155ng/mL 27-465	183ng/mL 47-414	178ng/mL 63-326
Essential (primary) hypertension			169ng/mL 50-375	180ng/mL 85-444	171ng/mL 52-420	149ng/mL 104-219

Yuen, B. H., Cannon, W., Woolley, S., & Charles, E. (1978). Maternal plasma and amniotic fluid prolactin levels in normal and hypertensive pregnancy.

Research needed



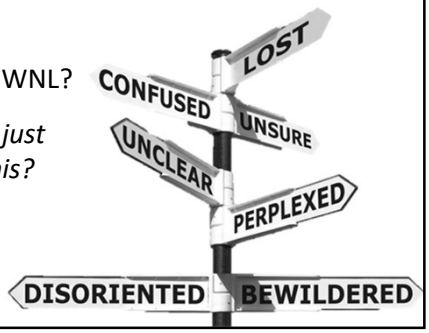
To look at all factors simultaneously to determine most likely contributors to bfg problems… with an eye to tx

Hormone testing: The Next Step?

Remember: *We Know Not Because We Ask Not*

Is it really WNL?

Or did we just assume this?



How do I know what is normal?

- Look at lab ranges
- Is this a hormone that is affected by pregnancy or lactation?
- Develop your expert contact network

Your Role in Interpreting the Results

Look for obvious abnormalities

Explain to mother the *possible* implications if significant

Discuss mother's options *based on what you know*

Write summary of concerns to HCP

Possible phone call to explain or expedite action