Nutrition and Perinatal Mental Health: The Importance of Maternal Diet for Mother and Child's Mental Health

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May 15, 2024

SAMHSA
Substance Abuse and Mental Health Services Administration

Mountain Plains (HHS Region 8)
MHTTC Mental Health Technology Transfer Center Network
Funded by Substance Abuse and Mental Health Services Administration

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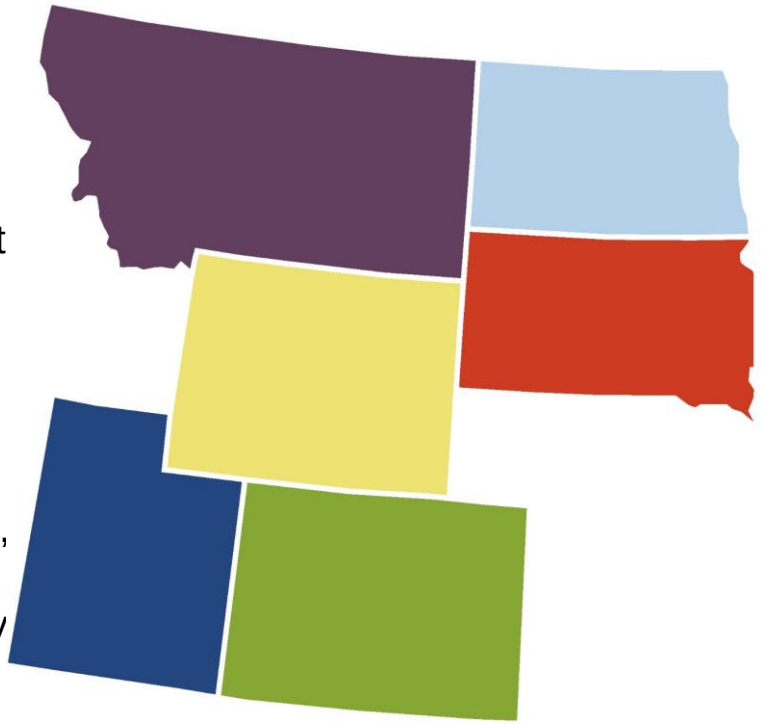
The Mountain Plains Mental Health Technology Transfer Center

The Mountain Plains Mental Health Technology Transfer Center (Mountain Plains MHTTC) provides training and technical assistance to individuals who serve persons with mental health concerns throughout Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming).

We belong to the Technology Transfer Center (TTC) Network, a national network of training and technical assistance centers serving the needs of mental health, substance use and prevention providers. The work of the TTC Network is under a cooperative agreement by the Substance Abuse and Mental Health Service Administration (SAMHSA).



Land Acknowledgement Statement

Today, the University of North Dakota rests on the ancestral lands of the Pembina and Red Lake Bands of Ojibwe and the Dakota Oyate - presently existing as composite parts of the Red Lake, Turtle Mountain, White Earth Bands, and the Dakota Tribes of Minnesota and North Dakota. We acknowledge the people who resided here for generations and recognize that the spirit of the Ojibwe and Oyate people permeates this land. As a university community, we will continue to build upon our relations with the First Nations of the State of North Dakota - the Mandan, Hidatsa, and Arikara Nation, Sisseton-Wahpeton Oyate Nation, Spirit Lake Nation, Standing Rock Sioux Tribe, and Turtle Mountain Band of Chippewa Indians.

The MHTTC Network uses affirming, respectful and recovery-oriented language in all activities. That language is:

- Strengths-based and hopeful
- Inviting to individuals participating in their own journeys
- Person-first and free of labels
- Non-judgmental and avoiding assumptions
- Inclusive and accepting of diverse cultures, genders, perspectives, and experiences
- Respectful, clear and understandable
- Healing-centered and trauma-responsive
- Consistent with our actions, policies, and products

Adapted from: https://mhcc.org.au/wp-content/uploads/2019/08/Recovery-Oriented-Language-Guide_2019ed_v1_20190809-Web.pdf

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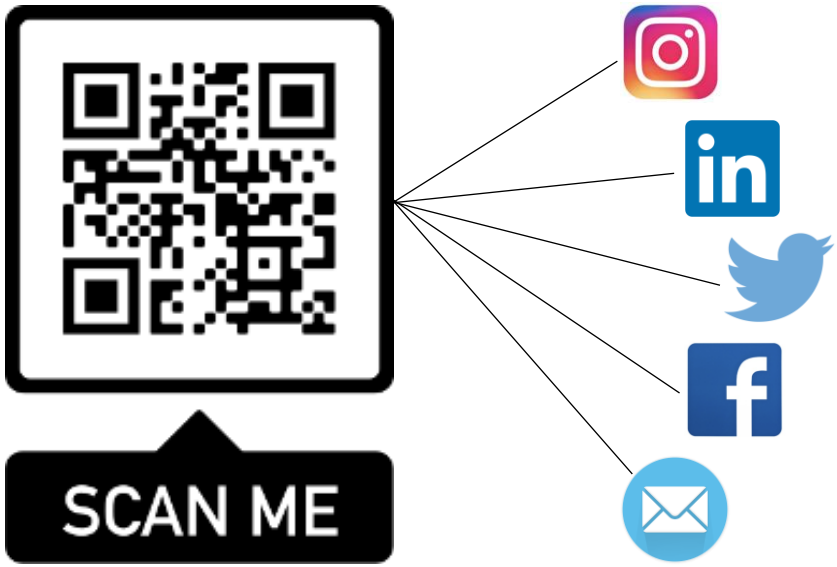

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Nathaniel "Thanny" Johnson, PhD

University of North Dakota

Wednesday May 15th, 2024

The Perinatal Period

- No consensus of exactly what the perinatal period is, but it must include **birth**:
  - World Health Organization (WHO): 22 weeks gestation to 1 week postpartum
  - The American Academy of Pediatrics (AAP): Pregnancy (i.e., 0 weeks gestation) to 4 weeks postpartum
  - Garcia and Yim (2017): Pregnancy (i.e., 0 weeks gestation) to 1 year postpartum

Micronutrient Needs During Pregnancy and Lactation

Table 2
Recommended daily dietary allowances for pregnant and lactating women

Nutrient	Nonpregnant	Pregnant[a]	Lactation[a]
Vitamin A (μg/d)	700	770	1300
Vitamin D (μg/d)	5	15	15
Vitamin E (mg/d)	15	15	19
Vitamin K (μg/d)	90	90	90
Folate (μg/d)	400	600	500
Niacin (mg/d)	14	18	17
Riboflavin (mg/d)	1.1	1.4	1.6
Thiamine (mg/d)	1.1	1.4	1.4
Vitamin B_6 (mg/d)	1.3	1.9	2
Vitamin B_{12} (μg/d)	2.4	2.6	2.8
Vitamin C (mg/d)	75	85	120
Calcium (mg/d)	1000	1000	1000
Iron (mg/d)	18	27	9
Phosphorus (mg/d)	700	700	700
Selenium (μg/d)	55	60	70
Zinc (mg/d)	8	11	12

[a] Applies to women older than 18 years old.

Kominiarek, M. A., & Rajan, P. (2016). Nutrition Recommendations in Pregnancy and Lactation. *Medical Clinics of North America*, *100*(6), 1199–1215. https://doi.org/10.1016/j.mcna.2016.06.004

Nutrients of Concern

- The following are nutrients of concern for pregnant women according to the American College of Obstetricians and Gynecologists:
  - Folic acid (B9)
  - Iron
  - Calcium
  - Vitamin D
  - Choline
  - Omega-3 fatty acids
  - B vitamin complex
  - Vitamin C

https://www.acog.org/womens-health/about-acog

Food Agency

- **Food agency** is the ability to produce **healthy meals**
  - Nutrition knowledge – needed to make healthy food choices
    - Improved by nutrition classes or lessons
  - Cooking ability and knowledge – needed to prepare food
    - Affected by physical health
    - Improved by cooking classes or lessons
  - Equipment – needed to prepare food
  - Food Security – access to and ability to afford healthy food

Trubek, A. B., Carabello, M., Morgan, C., & Lahne, J. (2017). Empowered to cook: The crucial role of 'food agency' in making meals. *Appetite*, *116*, 297–305. https://doi.org/10.1016/j.appet.2017.05.017

Food Insecurity & Security

- **Food security is one's ability to access and afford *healthy* food**
- **Food insecurity (FI) is limited or uncertain ability to access or afford *healthy* food**

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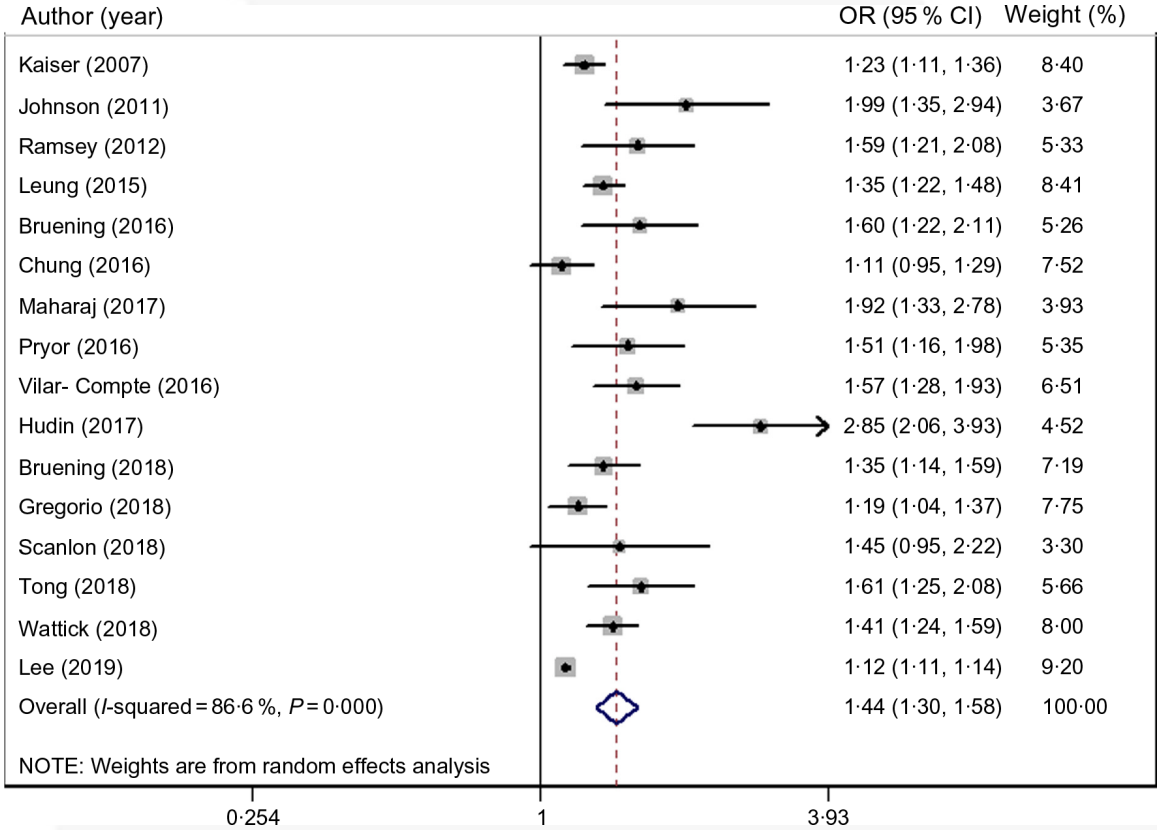
Food Security & Mental Health

- Data from 372,143 people across 19 studies and 10 countries:
- Those with FI were **44% more likely** to have **depression**



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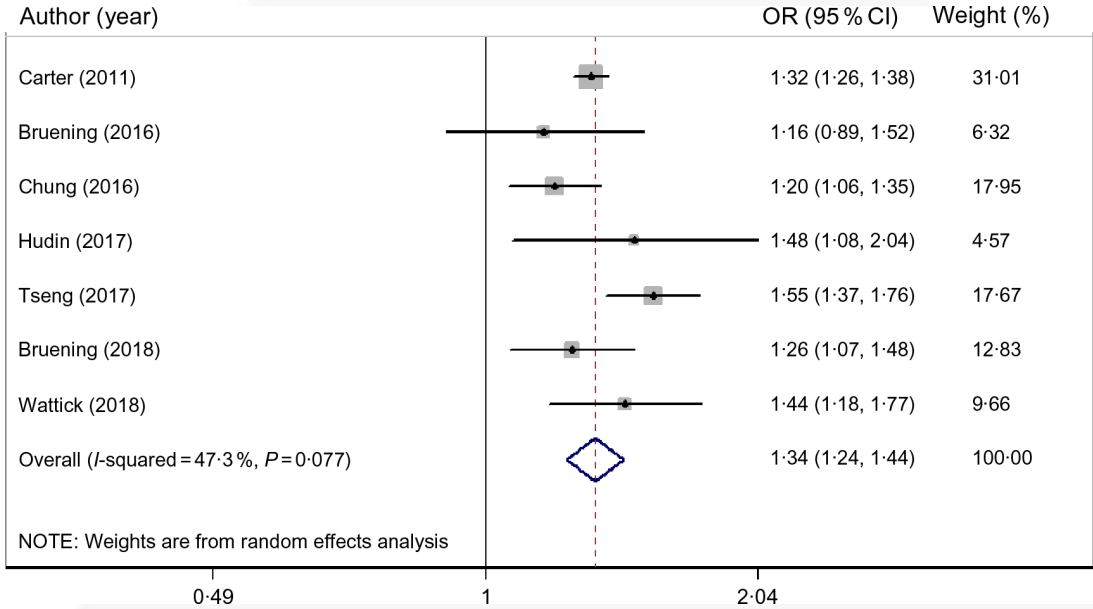
Food Security & Mental Health

- Data from 372,143 people across 19 studies and 10 countries:
- Those with FI were **44% more likely** to have **depression**
- Those with FI were **34% more likely** to report **stress**



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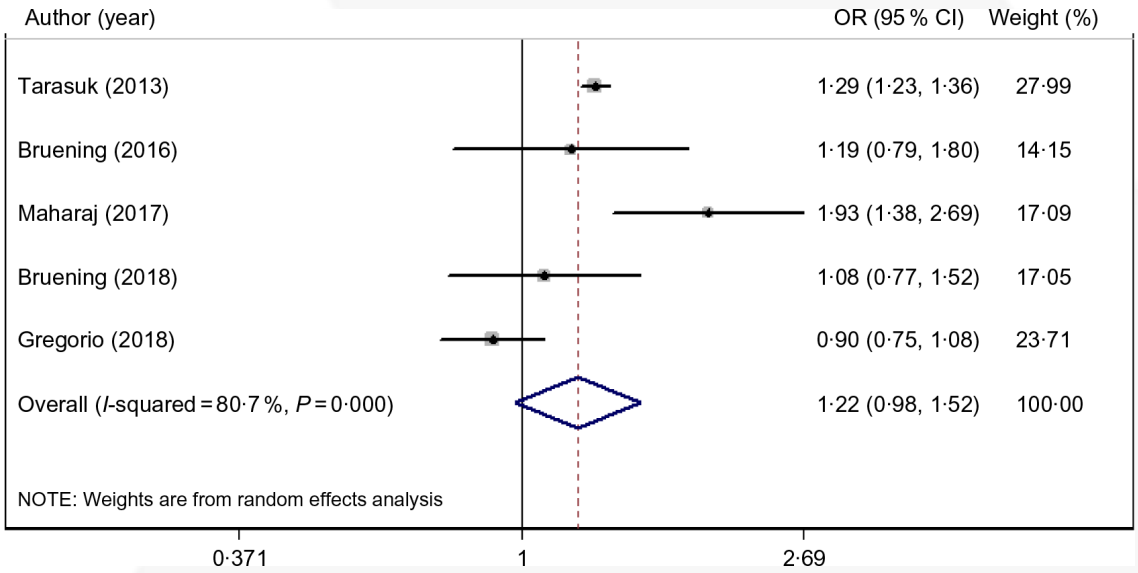
Food Security & Mental Health

- Data from 372,143 people across 19 studies and 10 countries:
- Those with FI were **44% more likely** to have **depression**
- Those with FI were **34% more likely** to report **stress**
- **FI was not associated with anxiety**



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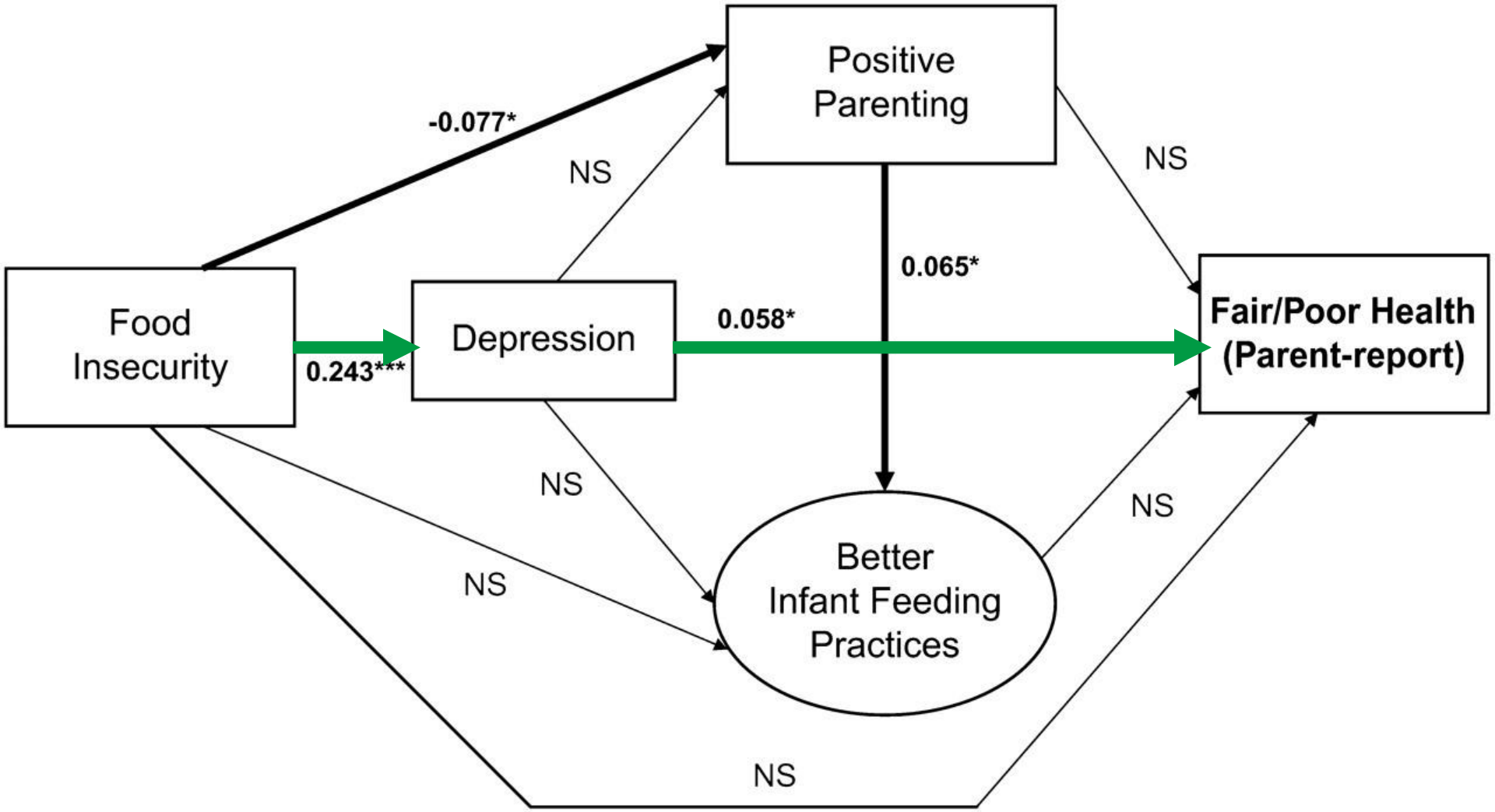
Food Insecurity, Depression, & Child's Health



Bronte-Tinkew, J., Zaslow, M., Capps, R., Horowitz, A., & McNamara, M. (2007). Food insecurity works through depression, parenting, and infant feeding to influence overweight and health in toddlers. *The Journal of nutrition*, *137*(9), 2160-2165.

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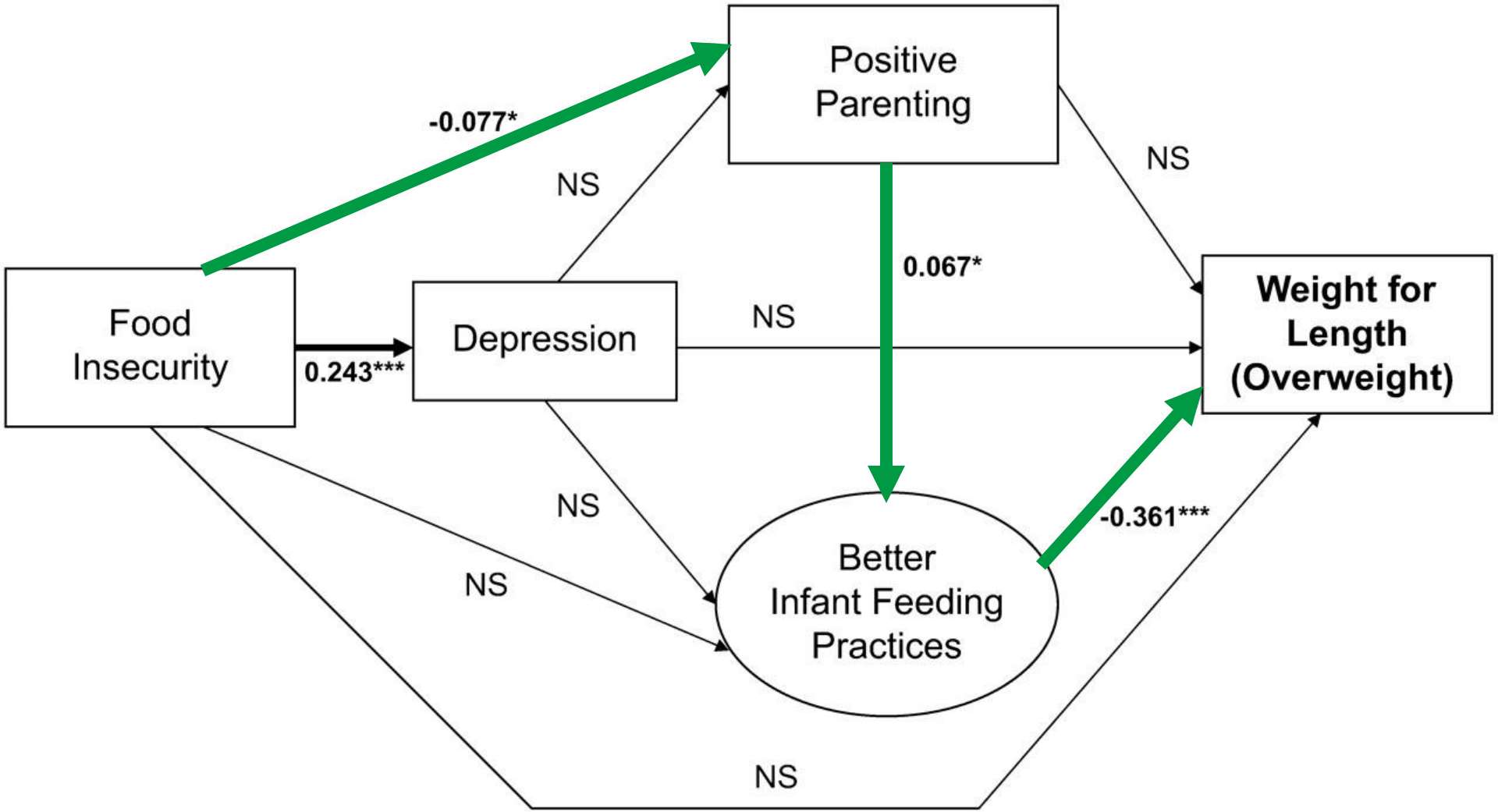
Food Insecurity Affects Families

- **“It’s *depressing* because I’m okay with my kids going to sleep with a full stomach, or at least a satisfied stomach that they can go to sleep. But it’s uncomfortable for me to wake up and my stomach’s touching my back. …‘Cause now I’m upset ‘cause there’s nothing to eat here.”**
  - Joanna in Minneapolis

Knowles, M., Rabinowich, J., Ettinger de Cuba, S., Cutts, D. B., & Chilton, M. (2016). “Do you wanna breathe or eat?”: parent perspectives on child health consequences of food insecurity, trade-offs, and toxic stress. *Maternal and child health journal*, *20*, 25-32.

Food Insecurity, Positive Parenting, & Better Feeding Practices



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Blood Sugar & Stress

- ≈70 mg/dL
  - ▼ Insulin
  - ▲ glucagon
  - ▲ **epinephrine**
  - ▲ Growth Hormone
- ≈55 mg/dL
  - ▼ Cognition
  - ▲ **Cortisol**

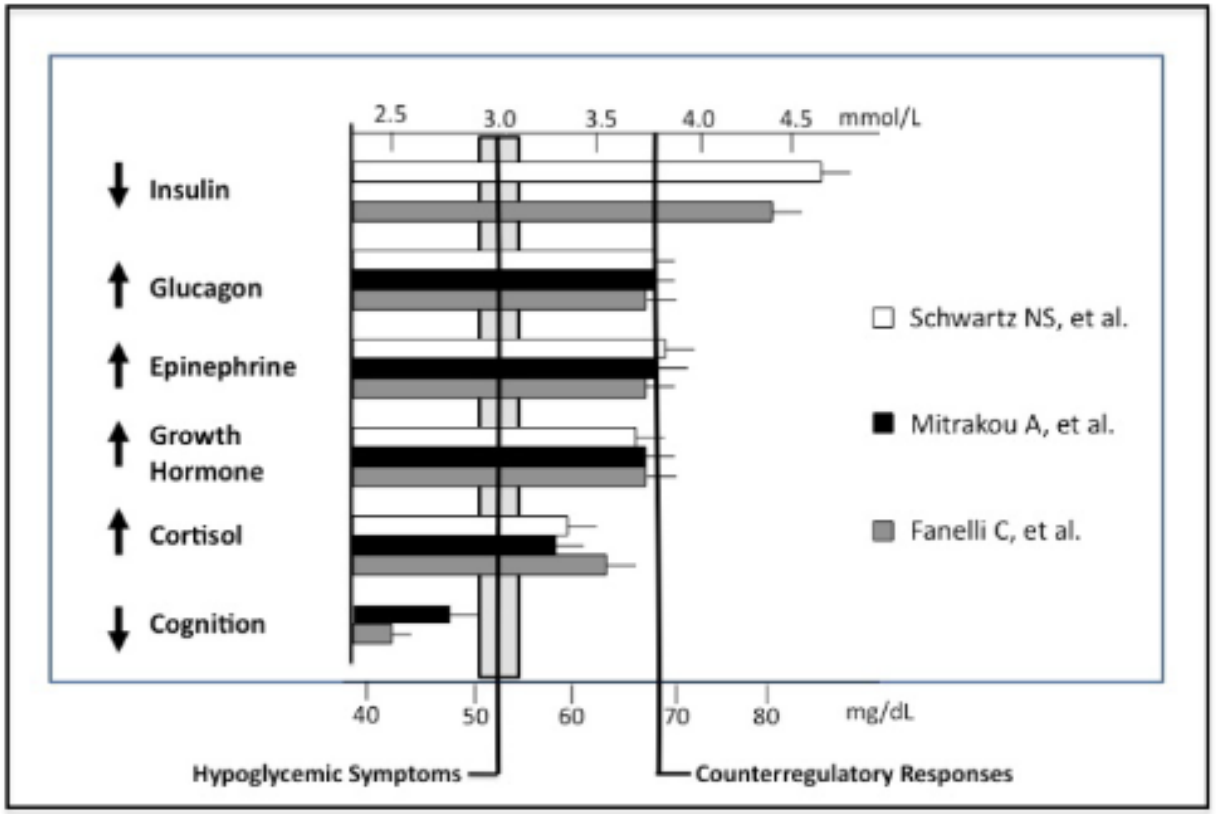


Figure 1.
Glycemic thresholds for physiological responses to hypoglycemia. Adapted from Cryer PE. Hypoglycemia. Pathophysiology, Diagnosis and Treatment. New York: Oxford University Press, 1997, pp. 184, with permission from the author and publisher.

Sprague, J. E., & Arbeláez, A. M. (2013). Glucose Counterregulatory Responses to Hypoglycemia. *Pediatric Endocrinology*, *9*(1), 463–475.

Cortisol & The Body

- Increased **cortisol** results in:
  - **Muscle loss**
  - **Increased body fat**
  - **Decreased bone mineral density**

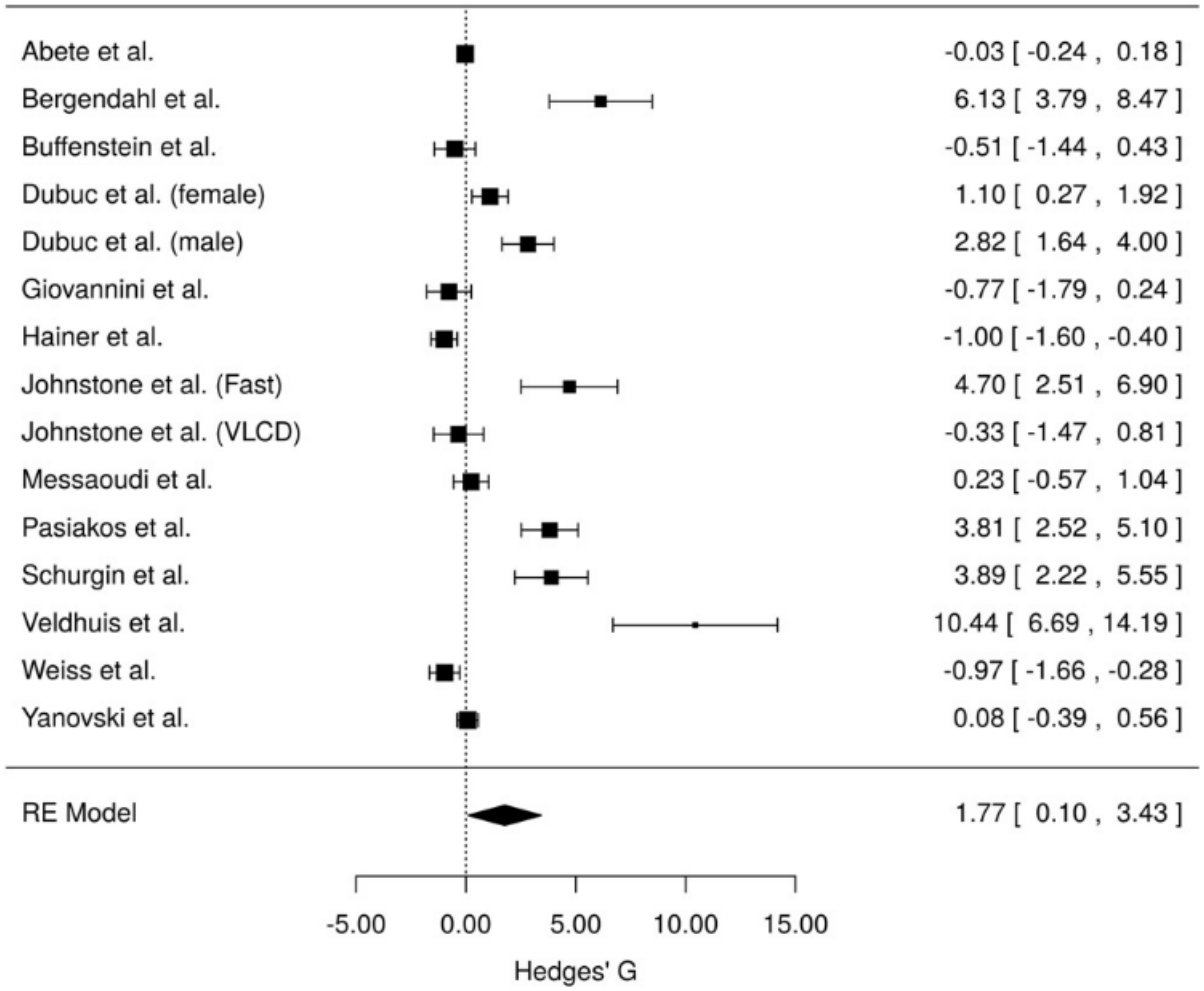
Table 1 Body composition in the elderly, GH deficiency, and hypercortisolism

	Total body fat	Visceral fat	Fat-free mass	BMD
Aging				
Adults >55 years[a]	↑↑↑[3]	↑↑↑↑↑[3]	↓[3] ↓↓[8]	↓[8,9]
Adults >55 years[b] post-GH Rx	↓[2,6,13,29,30]	↓[6]	↑[2,13,29,30]	↑[13]
GHD				
Adult GHD[c]	↑[14,18]	↑↑[20,21]	↓[14]	↓[16]
Adult GHD[d] post-GH Rx	↓[6,19,40]	↓↓[19,20]	↑[6,19,40]	↑[50,51]
Hypercortisolism				
Cushing's[e]	↑↑[101]	↑↑↑↑↑[99]	↓[100]	↓[100]
Cushing's[f] post-op	↓[111]	↓↓[110]	↑[110]	↑↑↑[100] ↑↑[101]

Nass, R., & Thorner, M. O. (2002). Impact of the GH-cortisol ratio on the age-dependent changes in body composition. *Growth Hormone and IGF Research*, *12*(3), 147–161. https://doi.org/10.1016/S1096-6374(02)00022-9

Energy Restriction & Cortisol

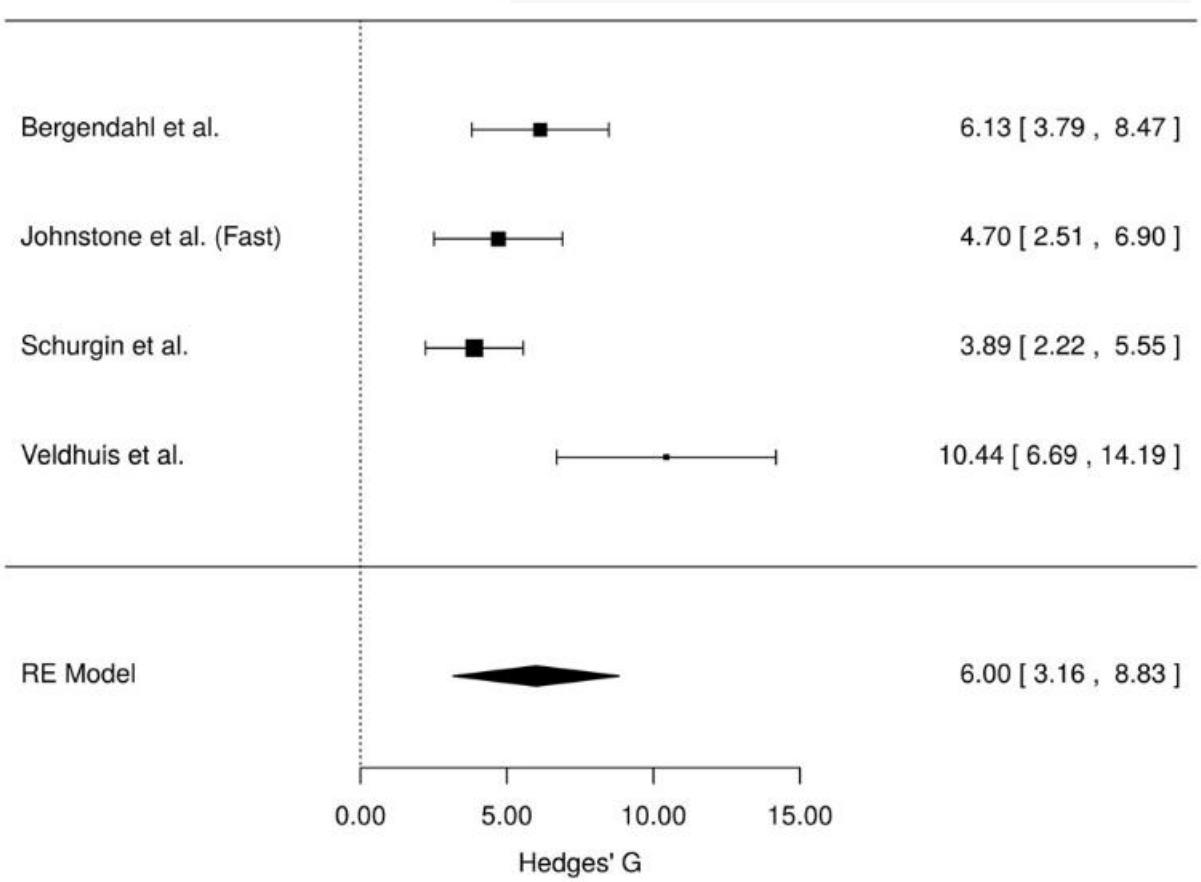
- Any form of **energy restriction** increases **cortisol**



Y. Nakamura, B. R. Walker, and T. Ikuta, "Systematic review and meta-analysis reveals acutely elevated plasma cortisol following fasting but not less severe calorie restriction," *Stress*, vol. 19, no. 2, pp. 151–157, 2016.

Fasting & Cortisol

- Any form of **energy restriction** increases **cortisol**
- **Fasting** when in energy restriction **greatly increases cortisol**



Y. Nakamura, B. R. Walker, and T. Ikuta, "Systematic review and meta-analysis reveals acutely elevated plasma cortisol following fasting but not less severe calorie restriction," *Stress*, vol. 19, no. 2, pp. 151–157, 2016.

Food Security & Cortisol

Table 2. Bivariate correlations between socioeconomic risk and child cortisol, by age group

2a. 12-month-old Infants	HCC	AUCg	Slope	Bedtime SCC
Income-to-needs ratio	−.28*	−.17	.02	−.27*
Parent education	−.25*	.03	−.27*	−.22
Parent occupational prestige	−.28*	−.06	−.15	−.20
Household chaos	.21	.36**	−.02	.28*
Neighborhood risk	.30**	.12	−.05	.12
Food insecurity	.25*	.25*	−.16	.13
Parent HCC	.34**	.44***	−.21	.31**
2b. 3.5-year-old children	**HCC**	**AUCg**	**Slope**	**Bedtime SCC**
Income-to-needs ratio	−.18	−.18	−.04	−.25*
Parent education	−.42***	−.13	−.10	−.31**
Parent Occupational Prestige	−.35**	−.05	−.17	−.22
Household chaos	.13	.17	.13	.32**
Neighborhood Risk	.03	−.07	.01	.07
Food insecurity	.33**	.08	.29*	.20
Parent HCC	.58***	.07	.29*	.26*

Note: *$p < .05$, **$p < .01$ ***$p < .001$.
AUCg = area under the curve with respect to ground; HCC = hair cortisol concentration; SCC = salivary cortisol concentration

Tarullo, A. R., Tuladhar, C. T., Kao, K., Drury, E. B., & Meyer, J. (2020). Cortisol and socioeconomic status in early childhood: A multidimensional assessment. *Development and Psychopathology*, *32*(5), 1876-1887.

Food Insecurity: Infants & Toddlers

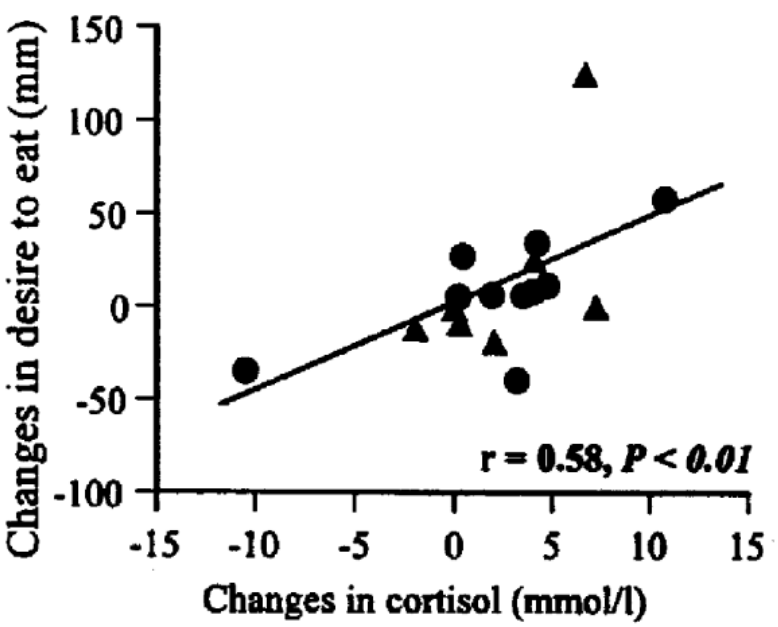
- **Food insecurity (FI) is limited or uncertain ability to access or afford *healthy* food**
- FI Children ≤36 months were **31% more likely** to be **hospitalized** (Cook, 2004)
- FI Children ≤36 months were **17% more likely** to have **iron deficiency anemia** (Moradi, 2018)
- FI Children were **61% more likely** be **overweight** (Bronte-Tinkew, 2007)
- FI Children ≤60 months were **14% more likely** to have **stunted growth** (Moradi, 2019)

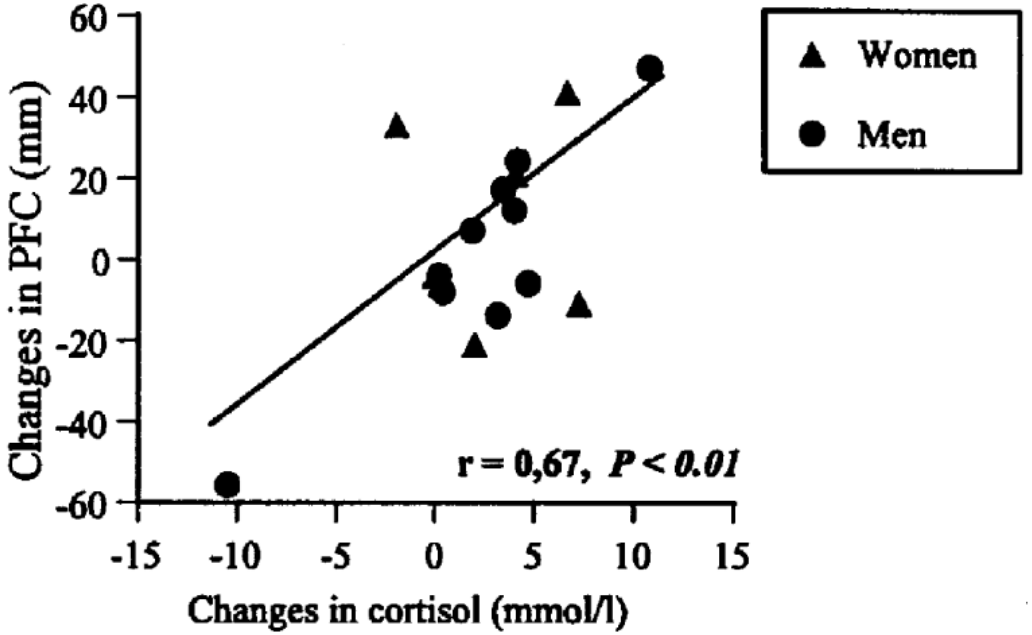
Food Insecurity: Children & Adolescents

- **Food insecurity is associated with poor mental health:**
  - Children and adolescents who have “low food security” are **26%** and **33% more likely** to have a **mental disorder** with **impairment** (Burke, 2016)
  - Children and adolescents who have “*very* low food security” are **2.55** and **3.44 *times*** more likely to have a **mental disorder** with ***severe* impairment** (Burke, 2016)
- **Food insecurity is associated with poor physical health:**
  - Food insecurity is related to **20% increased odds** of **stunted growth** in children (Moradi, 2019)
  - Food insecurity is related to **34% increased odds** of being **underweight** in children (Moradi, 2019)
  - Food insecurity is related to **81% increased odds** of being **overweight** in children (Kaur, 2015)

Cortisol & Hunger

- **Greater cortisol** is also related to **increased hunger**





- **Food insecurity (FI) is limited or uncertain ability to access or afford *healthy* food**

Doucet, E., Imbeault, P., St-Pierre, S., Âras, A., Âge, M., Richard, D., & Tremblay, A. (2000). Appetite after weight loss by energy restriction and a low-fat diet±exercise follow-up. *International Journal of Obesity*, *24*, 906–914. www.nature.com/ijo

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Food Insecurity: Pregnancy

		General health	Physical performance	Role limitation due to physical reasons	Role limitations due to emotional reasons	Physical pain	Social performance	Perceived Mental health	fatigue	Total QoL
Household food insecurity status	Food secure (*n* = 221)	70.3 (15.4)	73.4 (24.6)	67.9 (41.3)	76.2 (39.3)	66.2 (22.1)	81.3 (19.1)	70.6 (16.6)	66.4 (16.6)	71.5 (16.2)
	Mild food insecure (*n* = 86)	65.9 (14.7)	69.8 (26)	50.3 (44)	68.6 (40.4)	66.1 (26.9)	75 (19.8)	68 (17.84)	64.7 (19.9)	66.1 (16.7)
	Moderate food insecure (*n* = 37)	57.3 (17.9)	68.1 (21.7)	55.4 (40.5)	61.3 (45.5)	60.6 (19.7)	67.6 (18.5)	58.6 (20.4)	55.7 (22.7)	60.6 (16.8)
	Sever food insecure (*n* = 50)	57.6 (20.1)	60.1 (29)	49 (45.2)	51.3 (47.7)	60.3 (25)	63.5 (25.6)	59.4 (22.4)	55.2 (19)	57.1 (2.5)
One-way ANOVA	F	13.17	3.95	5.31	5.65	1.37	13.65	8.60	7.50	12.28
	p-value	< 0.001	0.009	0.001	0.001	0.25	< 0.001	< 0.001	< 0.001	< 0.001

- **Decreased quality of life** across all domains, but physical pain

Moafi, F., Kazemi, F., Samiei Siboni, F., & Alimoradi, Z. (2018). The relationship between food security and quality of life among pregnant women. *BMC Pregnancy and Childbirth*, *18*(1). https://doi.org/10.1186/s12884-018-1947-2

Food Insecurity: Pregnancy

- **Decreased quality of life** across all domains including mental health, but not physical pain (Moafi, 2018)
- Food insecurity is related to:
  - **53% increased odds** of **obesity** (Nguyen, 2024)
  - **64% increased odds of pregnancy complications** (Hoseini, 2018)
    - Gestational hypertension = 24%
    - Preeclampsia = 388%
    - Gestational anemia = 24%
    - Gestational diabetes = 63%

The Dutch Hunger Winter

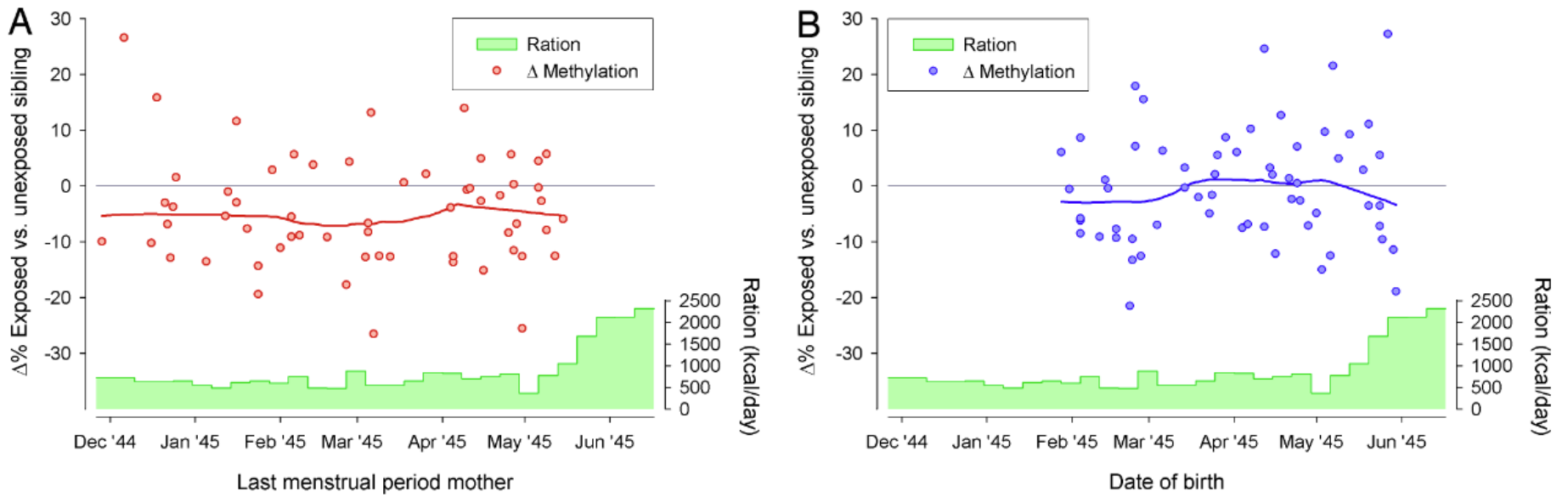

Fig. 1. Difference in *IGF2* DMR methylation between individuals prenatally exposed to famine and their same-sex sibling. (*A*) Periconceptional exposure: Difference in methylation according to the mother's last menstrual period (a common estimate of conception) before conception of the famine-exposed individual. (*B*) Exposure late in gestation: Difference in methylation according to the date of birth of the famine-exposed individual. To describe the difference in methylation according to estimated conception and birth dates, a lowess curve (red or blue) is drawn. The average distributed rations (in kcal/day) between December 1944 and June 1945 are depicted in green.

- Winter of 1944-1945 in Nazi Occupied Netherlands
- Dutch people subsiding on ≈800 Calories per day

Heijmans, B. T., Tobi, E. W., Stein, A. D., Putter, H., Blauw, G. J., Susser, E. S., ... & Lumey, L. H. (2008). Persistent epigenetic differences associated with prenatal exposure to famine in humans. *Proceedings of the National Academy of Sciences*, *105*(44), 17046-17049.

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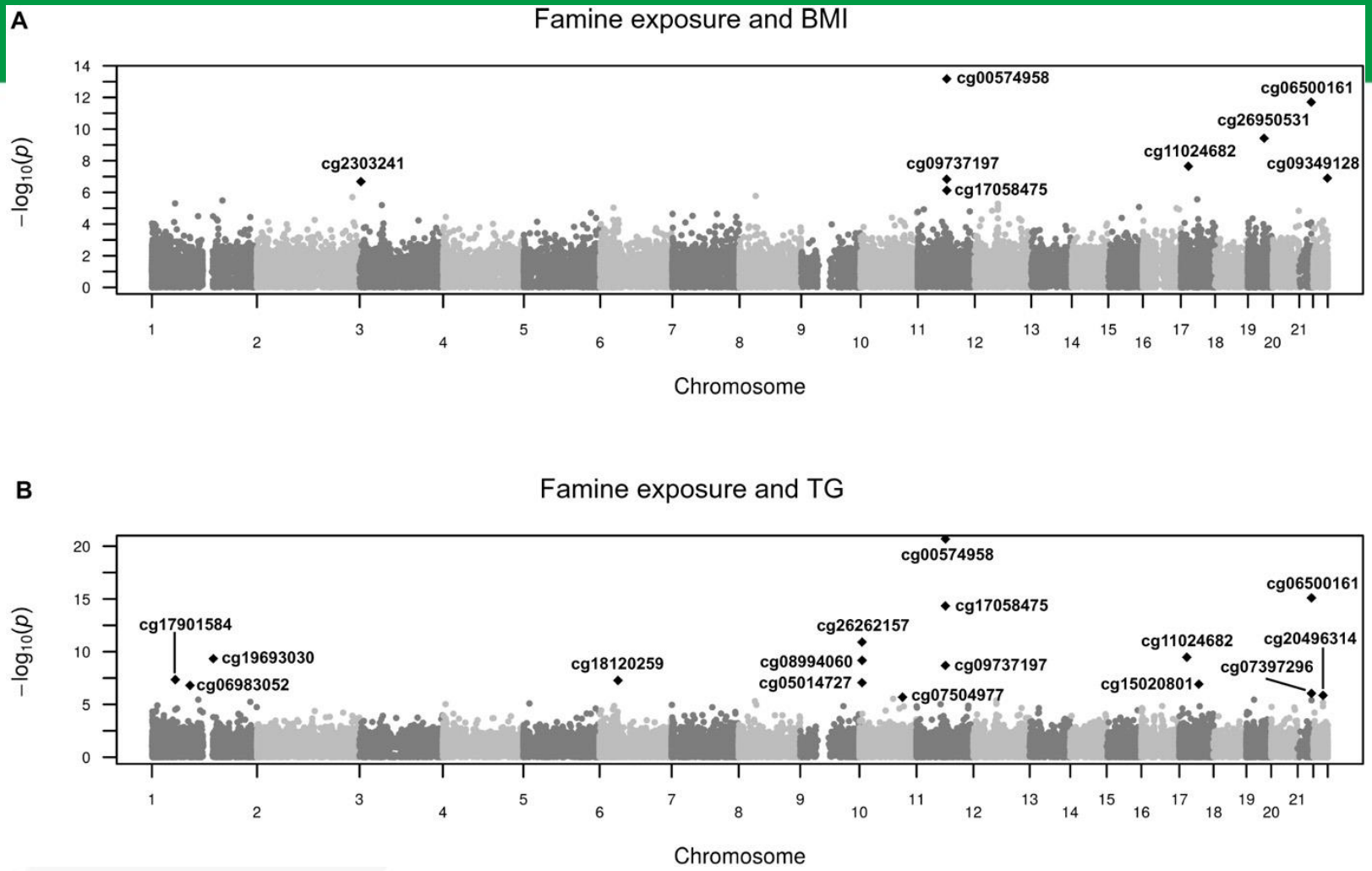
The Dutch Hunger Winter



Tobi, E. W., Slieker, R. C., Luijk, R., Dekkers, K. F., Stein, A. D., Xu, K. M., ... & Heijmans, B. T. (2018). DNA methylation as a mediator of the association between prenatal adversity and risk factors for metabolic disease in adulthood. *Science advances*, *4*(1), eaao4364

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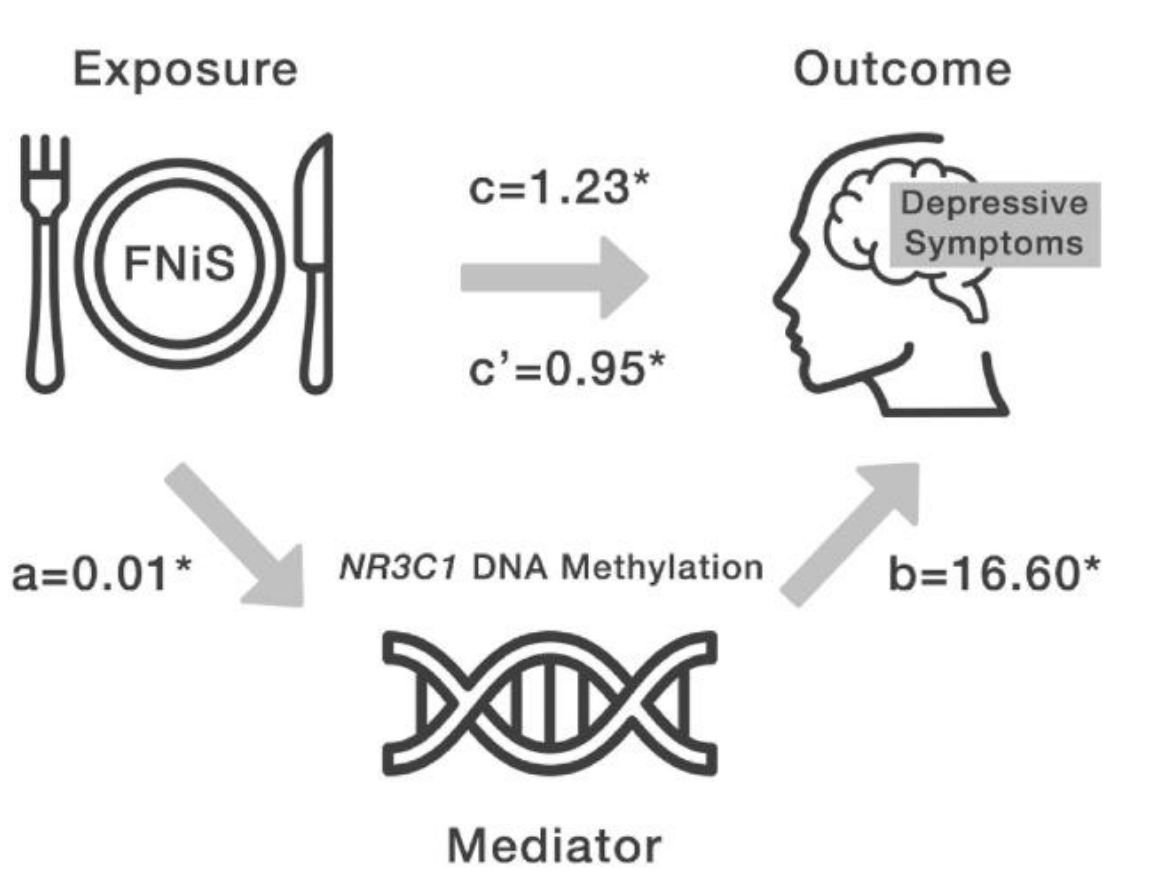
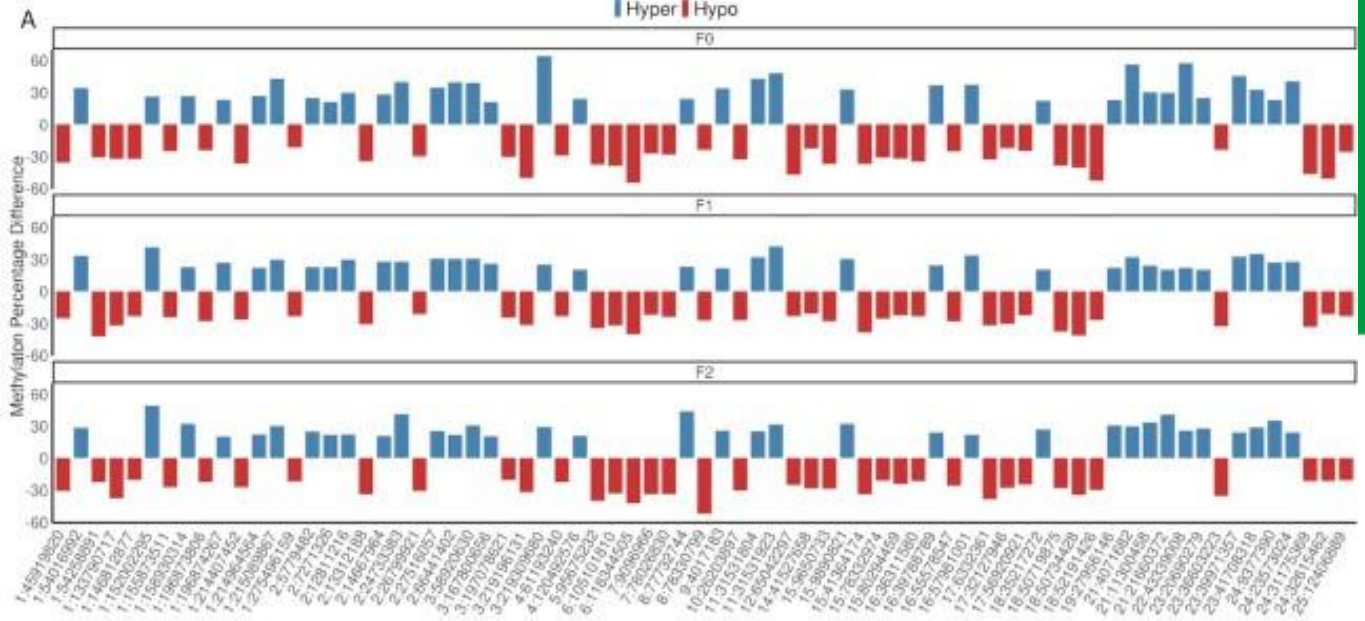
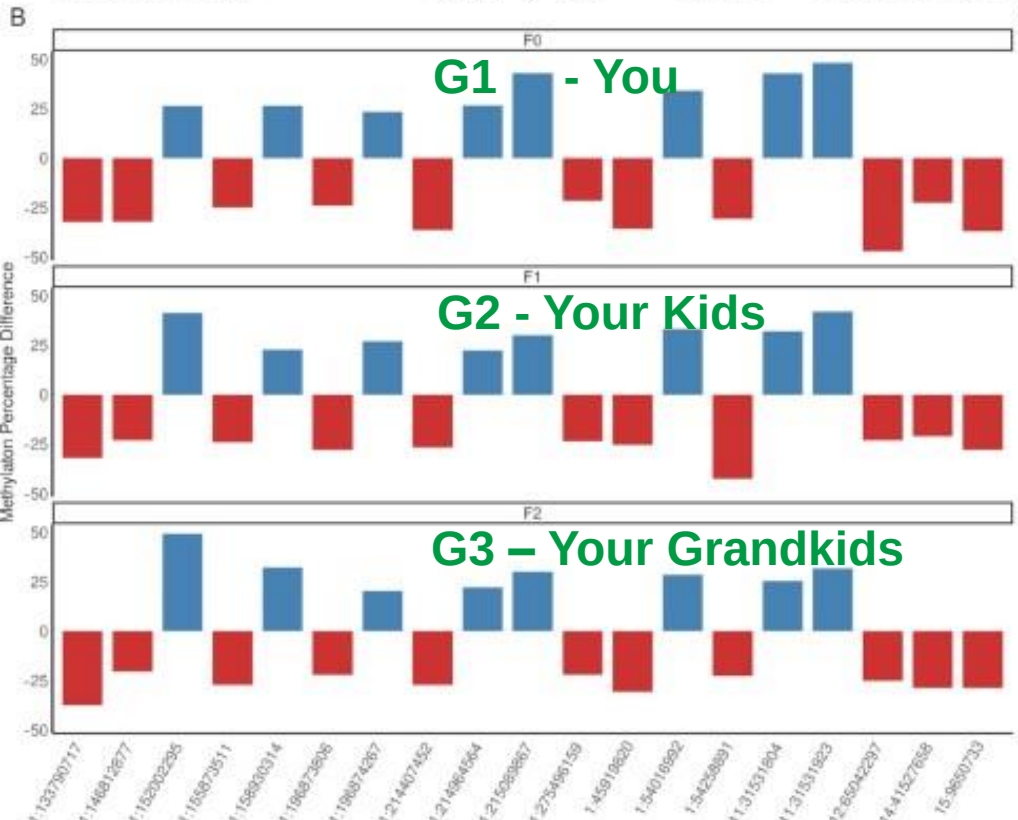
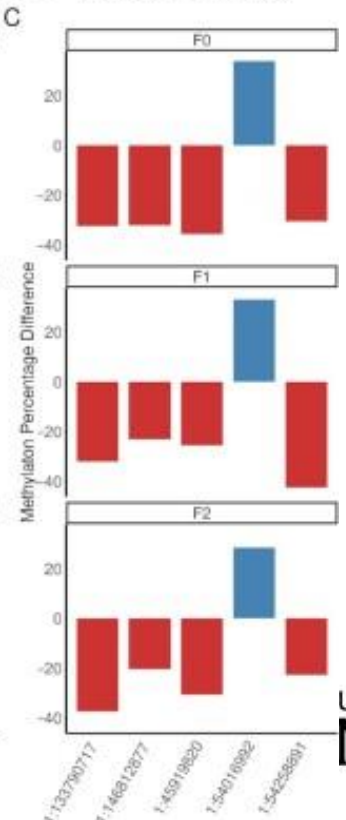
Food, Epigenetics, & Depression



Borçoi, A. R., Mendes, S. O., Moreno, I. A. A., Gasparini dos Santos, J., Freitas, F. V., Pinheiro, J. A., Oliveira, M. M. de, Barbosa, W. M., Arpini, J. K., Archanjo, A. B., Hollais, A. W., Couto, C. V. M. da S., David, C. V. C., Risse Quaioto, B., Sorroche, B. P., Louro, I. D., Arantes, L. M. R. B., & Silva, A. M. Á. da. (2021). Food and nutritional insecurity is associated with depressive symptoms mediated by NR3C1 gene promoter 1F methylation. *Stress*, 24(6), 814–821. https://doi.org/10.1080/10253890.2021.1923692







Genetic changes related to dietary intake are passed down to at least the second generation (i.e., grandchildren)

Braz, C. U., Taylor, T., Namous, H., Townsend, J., Crenshaw, T., & Khatib, H. (2022). Paternal diet induces transgenerational epigenetic inheritance of DNA methylation signatures and phenotypes in sheep model. *PNAS nexus*, *1*(2), pgac040

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Nutritional Epigenetics

What you eat could alter your unborn children and grandchildren's genes and health outcomes

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The relatively new discipline of epigenetics explores how diet and nutrition can affect not only our own health but that of future generations. Drazen Zigic/iStock via Getty Images Plus

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Within the last century, researchers' understanding of genetics has undergone a profound transformation.

Genes, regions of DNA that are largely responsible for our physical characteristics

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Addressing Food Security

- Screen and assess all patients for food insecurity

Assessing Food Security

- Six-item Short Form Food Security Survey Module (usda.gov)
  - https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/measurement/

1. Food that (I/we) bought just didn't last, and we didn't have money to get more in the last 12 months.
2. (I/we) couldn't afford to eat balanced meals in the last 12 months.
3. In the last 12 months, since last (current month) did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?
4. How often did this happen?
5. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?
6. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?

Scoring:

Raw score: 0-1
High or marginal food security

Raw score: 2-4
Low food security

Raw score: 5-6
Very low food security

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Addressing Food Security

- Screen and assess all patients for food insecurity
- Determine if eligible for WIC or SNAP benefits
- Expand Meals-On-Wheels program for those in perinatal period
- Create health system food banks that provide opportunity for food at medical appointments
- Produce food at health system facilities
  - There are psychological benefits to gardening, as well
- Partner with non-profits and charitable organizations

Food Agency

- **Food agency** is the ability to produce **healthy meals**
  - Nutrition knowledge – needed to make healthy food choices
    - Improved by nutrition classes or lessons
  - Cooking ability and knowledge – needed to prepare food
    - Affected by physical health
    - Improved by cooking classes or lessons
  - Equipment – needed to prepare food
  - Food Security – access to and ability to afford healthy food

Trubek, A. B., Carabello, M., Morgan, C., & Lahne, J. (2017). Empowered to cook: The crucial role of 'food agency' in making meals. *Appetite*, *116*, 297–305. https://doi.org/10.1016/j.appet.2017.05.017

Nutrition Education

Variables	Control group(n = 54)	Intervention group(n = 53)	p value[1]
	Mean ± SD	Mean ± SD	
Blood Hb level gm/dl			
Baseline	10.18±0.62	9.99±0.87	0.209
End line	10.35±0.64	10.55±0.79	0.144
Change	0.16±0.82	0.56±0.40	0.002*

[1] Independent sample t-test

*statistically significant is at $p<0.05$

https://doi.org/10.1371/journal.pone.0213982.t002

- Nutrition education is effective and can be combined with cooking lessons

- Get folks to come in for the cooking lesson and free food, and get them to stay for the nutrition education

Sunuwar, D. R., Sangroula, R. K., Shakya, N. S., Yadav, R., Chaudhary, N. K., & Pradhan, P. M. S. (2019). Effect of nutrition education on hemoglobin level in pregnant women: A quasi-experimental study. *PLoS ONE*, *14*(3). https://doi.org/10.1371/journal.pone.0213982

Empowerment

Reference ID/Study authors	Study design	Sample	Measure of empowerment/intervention	Measure of depressive symptoms	Major findings	Quality rating/score[a]
INTERVENTION STUDIES						
[18] Liu et al. (2010)	Quasi-experimental	70 parents of preterm newborns in Taiwan, 15 fathers, 55 mothers, *M* age = Intervention: 33.0 years, Control: 32.5 years	Parent-to-parent and parent-to-healthcare provider dialogue PP: 12 sessions over 8 months	BDI-II PP: pre- and post-intervention	Participating in dialogue w/lower post-intervention PPD symptoms, greater pre to post reduction in PPD symptoms, and greater childrearing self-efficacy	Fair (6)
[22] Pridham et al. (2005)	Randomized controlled trial	42 US mother-premature infant pairs, 28 weeks post-conception, *M* age = GP: 25.5 years, Control: 26.17 years; predominantly European American and African American	GP – program to increase feeding competencies PP: weekly, biweekly, or monthly in first year	CES-D PP: 1, 4, 8, 12 months	No difference in PD symptoms; GP w/better ability to regulate infant negative affect and feeding behaviors	Good (9)
[12] Monthshki et al. (2013)	Randomized controlled trial	230 women in Iran; 28–30 weeks' GA, *M* age = Intervention: 28.0 years, Control: 27.8 years	Multidimensional Health Locus of Control PREG: 28–30 weeks' GA PP: 4 weeks	EPDS PP: 4 weeks PP	Intervention w/increased internal health locus of control and lower PPD symptoms	Fair (7)
[23] Muzik et al. (2015)	Prospective cohort study	80 US mother-child pairs *M* age = 23.7 years; Ethn: Caucasian 48.4%, African-American 44.1%, Biracial/Hispanic 7.5%	MP – parenting and self-care skills group program for high-risk mothers and their children PP: 13-weeks/sessions	PDSS PP: pre- and post-intervention	MP w/reduction in depression, post-traumatic stress disorder, and caregiving helplessness	Good (12)
[24] Ickovics et al. (2011)	Randomized controlled trial	1047 US pregnant women, ages 14–25 (*M* = 20.4) years, 18 weeks' GA; Ethn: 80% African-American, 13% Latina, 6% White, 1% Other; Note: Sample identical to [34], in Table 3	CP, CP+ group w/additional HIV prevention information in last 3 sessions PREG and PP	CES-D PREG: 2nd and 3rd trimester PP: 6, 12 months	Initial high stress and CP+ group w/less PPD symptoms 1 year PP	Good (11)
[25] Kennedy et al. (2011)	Randomized controlled trial	322 US pregnant women in the military, 12–16 weeks' GA; *M* age = Control 25.5 years, CP: 24.0 years; Predominantly White, African American or Latina	CP PREG: 9 group sessions PP: one session	CES-D; PDSS (PP only) PREG: baseline, 32–36 weeks' GA PP: 3–4 months	No differences in PD and PPD symptoms w/CP	Good (10)
[26] Melnyk et al. (2001)	Randomized controlled trial	42 US mothers of premature infants, *M* age = COPE 26.6 years, Control, 28.8 years; Predominantly White or African American	COPE PP: 2–4 days after admission, 2–4 days thereafter, 1–2 days in NICU, 1–4 days before discharge, 7 days after discharge, 3 and 6 months	POMS PP: at all phases and follow-up	COPE w/less depressive symptoms after admission and before discharge, and w/higher infant cognitive development scores; No difference in mother's overall mood state	Good (11)
[27] Melnyk et al. (2006)	Randomized controlled trial	260 US families; 258 mothers (*M* age = 27.8 years) and 154 fathers with infant born at 26–34 weeks' GA; Predominantly White or Black	COPE PP: 2–4 days after admission 2–4 days thereafter, 1–2 days in NICU, 1–4 days before discharge, 7 days thereafter	BDI-II PP: at all times except NICU	COPE w/lower post-hospital parental stress and depressive symptoms	Good (13)
[28] Melnyk et al. (2008)	Randomized controlled trial	246 US mothers of LBW preterm infants, *M* age = 27.9 years, born at 26–34 (*M* = 31.4) weeks' GA; Predominantly White or Black Note: Sample a subset of [27]	COPE PP: 2–4 days after admission, 2–4 days thereafter, 1–2 days in NICU, 1–4 days before discharge, 7 days thereafter	BDI-II PP: 2–4 days after NICU admission, 2–4 days thereafter, and 2 months post-intervention	COPE w/decreased post-hospital depression and anxiety symptoms	Good (13)
[29] Robertson et al. (2009)	Quasi-experimental	49 Hispanic women, 24–26 weeks' GA, *M* age = Control: 26.5 years, CP: 24.6 years	CP PREG: throughout pregnancy	CES-D PP: not specified	No difference in PD symptoms w/CP	Fair (5)

Garcia, E. R., & Yim, I. S. (2017). A systematic review of concepts related to women's empowerment in the perinatal period and their associations with perinatal depressive symptoms and premature birth. *BMC Pregnancy and Childbirth*, *17*. https://doi.org/10.1186/s12884-017-1495-1

Empowerment

- Interventions intended to empower women were associated with lower levels of depression and lower chances of premature birth
- Cooking and nutrition classes offered for perinatal women should ideally also focus on empowering these women

Garcia, E. R., & Yim, I. S. (2017). A systematic review of concepts related to women's empowerment in the perinatal period and their associations with perinatal depressive symptoms and premature birth. *BMC Pregnancy and Childbirth*, *17*. https://doi.org/10.1186/s12884-017-1495-1

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