Prenatal protein intake: Protects birth weight and length of gestation in African American women with psychiatric disorders

- Louise H. Flick, RN, DrPH[1]
- Cynthia Cook, RN, PhD[2]
- Millie Mattfeldt-Beman, PhD[3]
- Kristen Pierce [3]
- Sharon Homan, PhD[3]
- Claudia Campbell, PhD[4]

Maryellen McSweeney, PhD[3]
Nujjaree Chaimongkol, RN,PhD[5]
Mary Beth Gallagher, PhD[3]
Lisa Parnell, MSW[6]
Leigh Tenkku, PhD[3]

[1]Southern Illinois University-Edwardsville
[2]Indianapolis Veterans Administration
[3]Saint Louis University, [4]Tulane University
[5]Burapha University, Thailand, [6]St. Lukes Hospital, St. Louis, MO

Supported by NIMH, SLU2000 & the Beaumont Fund

Background

- Psychiatric symptoms and disorders
  - Birth complications & poor birth outcomes (Mancuso et al., 2004; Jablensky et al., 2005)
  - Specific disorders associated with specific neuroendocrine 'footprints' (Heim et al., 1997; Mancuso et al., 2004)
  - Disorder associated with more life stressors

Background

- Neuroendocrine stress hormones in pregnancy
  - Restricted fetal growth (Teixeira, 1999; Wadhwa, 2000)
  - Shorter gestation
  - Early elevation of cortisol, trigger preterm birth
  - Compromised maternal immune system (Wadhwa, 2001)
  - Only 10% cross the placenta
- Findings are somewhat inconsistent

Know from animal studies

- Placental enzyme blocks maternal stress hormones (only 10-20% gets across)
- Rat studies:
  - % protein for a normal (non-pregnant) diet
  - Placental enzyme not produced
  - Effect of maternal stress hormones increased 8-10 fold

(Couzin, 2002 Science)

Research Question:

Does protein intake < pregnancy RDA increase the effect of psychiatric disorder on birth outcomes?

Hypothesis: Protein intake <85% of the pregnancy RDA modifies the effect of psychiatric disorder on birth outcomes

(a significant interaction effect)

Design/Sampling

- DESIGN: Population based prospective cohort
- SAMPLING
  - poverty program nutrition sites (WIC)
  - urban center & rural region of Missouri
  - 13 or older, African-American/Caucasian, English speaking
  - Stratified by residence (urban/rural)
  - Representative by race in 6 counties sampled
  - 744 pregnant women
    - 500 with singleton live births
    - complete birth certificate and nutrition data

Birth Data

- Missouri Certificates of Live Birth
- Matched by Missouri Department of Health and Senior Services

Assessment of Psychiatric Disorder

- Diagnostic Interview Schedule-IV
  - Lay administered, structured interview
  - Based on DSM-IV criteria
  - Made 22 current diagnoses

Diagnoses

- Major depression
- Panic disorder
- Schizophrenia
- Schizoaffective disorder
- Bipolar I & II
- Dysthymia
- PTSD
- Obsessive compulsive Disorder
- Alcohol abuse/dependence
- ADHD
- Drug abuse/dependence
- Tobacco dependence
- Conduct disorder
- Oppositional disorder
- Antisocial personality
- Anorexia/bulimia
- Generalized anxiety disorder
- Phobias (specific, social & agoraphobia)

Exposure Variables

- Any psychiatric disorder:

  At least one disorder in the past 12 months

- Number of lifetime symptoms (proxy for chronicity and severity)
  - >75th percentile (37 symptoms)

Exposure Variables

- % Recommended Daily Allowance (RDA) of protein consumed
  - WIC entry
  - Harvard Food Frequency Questionnaire (HFFQ)
  - Deleted cases with extreme values of total calorie intake (Wei, Gardner, Field, et al., 1999; Suiter, Gardner & Willett, 1989)
    - <500 calories
    - >4500 calories

Outcome Variables

- Birth weight in grams
- Gestational age
  - Determined via LMP by interview during pregnancy and birth date from BC
  - Data cleaned using tables from Alexander, Himes, Kaufman, et al., 1996

Sample for Analyses

- 501 with birth and nutrition data
- 425 after excluding extreme values of total calorie intake
  - 238 African American
  - 187 White

Frequencies for African Americans (n=301)

Variable		
Exposures	# (%)	
Any Psych Disorder	75 (24.9)	
Hi Psych Sx[1]	59 (19.6)	
Low Protein[2]	76 (25.2)	
Covariates		
First birth	116 (38.5)	
Age <19	85 (28.2)	
Extreme poverty[3]	177 (58.8)	
BMI Underweight Normal weight Overwt/obese	 38 (12.6) 111 (36.9) 153 (50.5)	
Outcomes	Mean SD	Range
Birth weight	3026.24 589.85	320-4876
Gestational age	38.26 3.04	24-44 weeks

[1]Hi Psych Symptoms ≥ median of 37, [2]Low protein ≤ 85% of the pregnancy RDA, [3]Extreme poverty ≤ median for entire sample of $8,224 for a family of four.

Data analyses

- Multiple linear regression
- Adjusting for:
  - Parity (first birth)
  - Age of mother (<19 years of age)
  - Prepregnancy BMI (IOM categories)
    - Underweight (BMI<19.8)
    - Normal weight (BMI 19.8 to 26)
    - Overweight/obese (BMI > 26)
  - Extreme poverty
    - Ext. poverty < sample median of $8,224 yr for 4

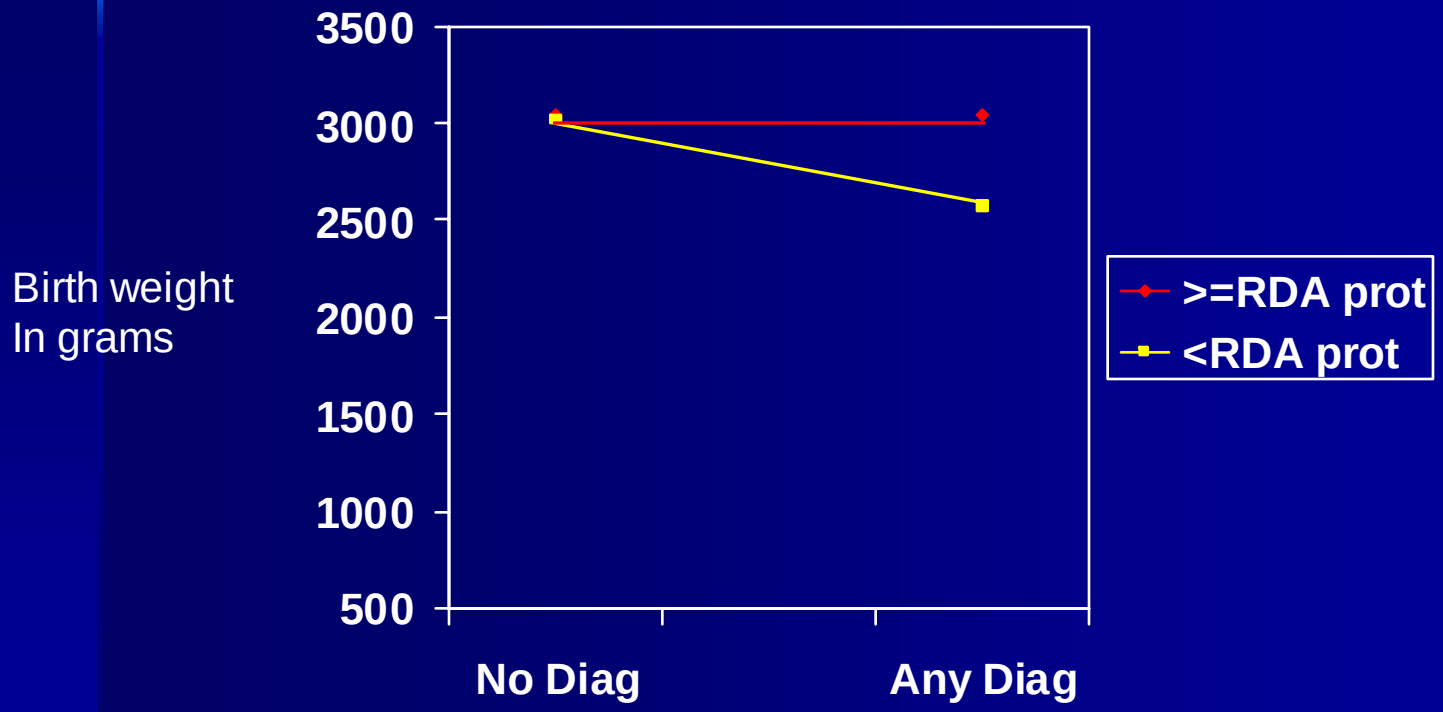
Effect of prenatal psychiatric disorder on birth weight in the presence protein consumption <85% pregnancy RDA. (n=238)

Variable	B	Std error	B	Std error
Constant	3075.88	103.97	3040.67	104.01
First child	11.53	87.34	23.49	86.62
Mother<19yr	-172.22	95.27	-171.08	94.32
Pre-preg BMI underweight normal overwt/obese	 -176.13 Reference 124.42	 119.72 Reference 83.23	 -159.23 Reference 111.49	 118.74 Reference 82.58
Extreme poverty	25.10	76.86	26.00	76.10
Psych disorder	-134.82	88.16	2.15	104.82
Low Protein	-135.91	82.08	-440	93.86
Disorder x Lo protein	-------	-----	-440.80*	186.80

*p<.05, **p<.01, ***p<.001

Psych disorder=any of 22 current disorders, Low protein <85% of the RDA for pregnancy

Interaction between prenatal psychiatric disorder and protein consumption (<85% pregnancy RDA) for birth weight. (n=238)



Adjusting for parity, age of mother, prepreg BMI & extreme poverty

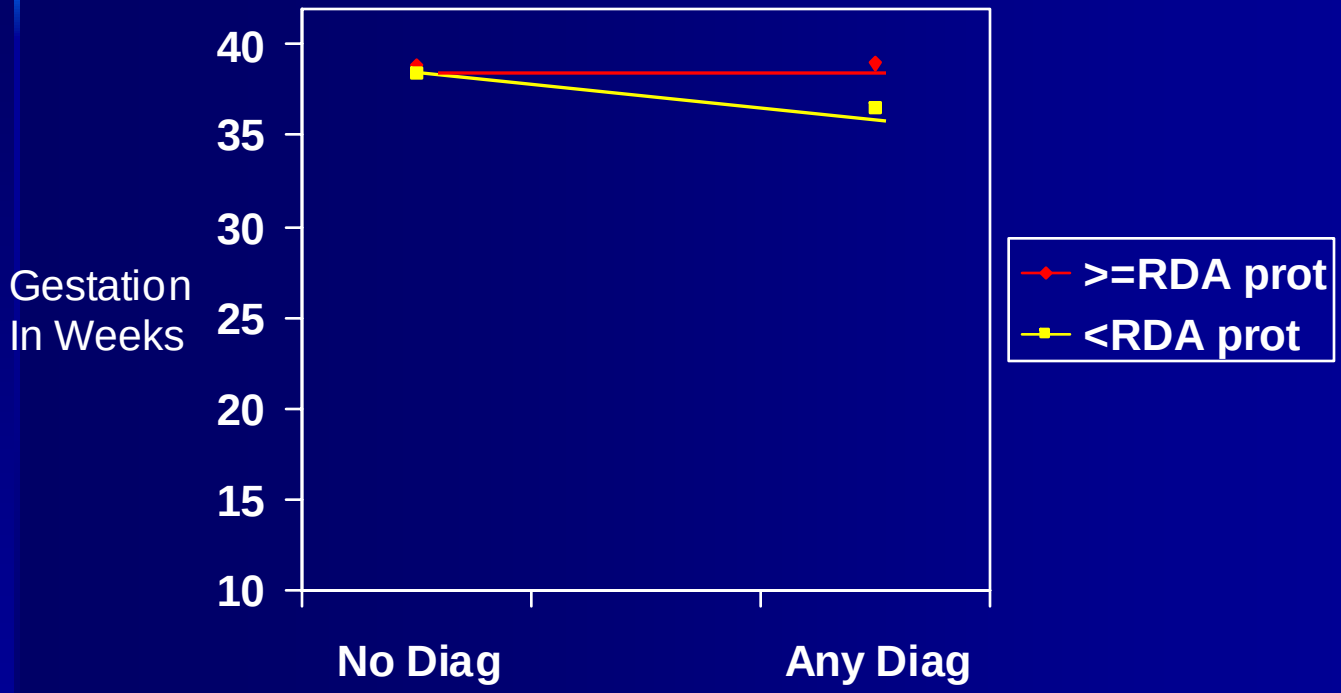
Effect of prenatal psychiatric disorder on gestational age at birth (wks) in the presence protein consumption <85% pregnancy RDA. (n=238)

Variable	B	Std error	B	Std error
Constant	39.06	.52	38.91	.52
First child	-1.53**	.44	-1.48**	.44
Mother<19yr	-.93	.48	-.93	.48
Pre-preg BMI underweight normal overwt/obese	-1.06 Reference 1.09*	.60 Reference .42	-.98 Reference 1.03*	.60 Reference .42
< Median income	.38	.39	.38	.38
Psych disorder	-.53	.44	.07	.53
Low Protein	-.98*	.41	-.50	.47
Disorder x Lo protein	-------	-----	-1.92*	.94

*p<.05, **p<.01, ***p<.001

Psych disorder=any of 22 current disorders, Low protein <85% of the RDA for pregnancy

Interaction between prenatal psychiatric disorder and protein consumption <85% pregnancy RDA for gestational age at birth (n=238).



Note: Adjusting for parity, mother's age, prepregnancy BMI and extreme poverty.

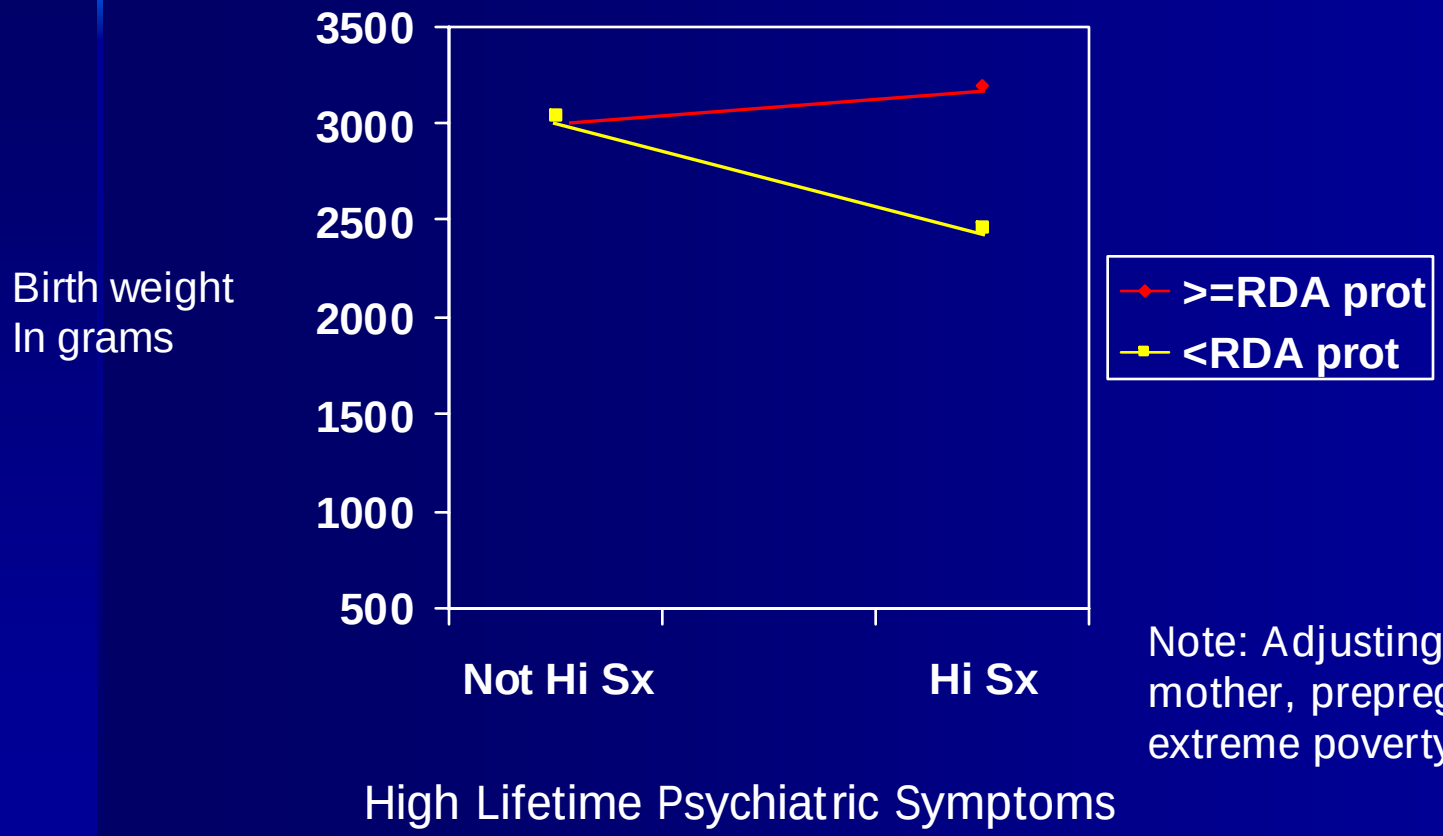
Effect of high lifetime psychiatric symptoms on birth weight in the presence protein consumption <85% pregnancy RDA (n=238).

Variable	B	Std error	B	Std error
Constant	3078.96	95.61	3032.98	103.86
First child	-1.07	79.06	-10.12	85.24
Mother<19yr	-190.13*	85.88	-196.01*	93.01
Pre-preg BMI underweight normal overwt/obese	-180.58 Reference 112.66	107.21 Reference 75.15	-156.22 Reference 124.74	117.54 Reference 81.28
< Median income	22.17	70.97	29.59	75.35
Hi life symptoms	-73.67	60.27	152.91	116.48
Low protein	-137.89	82.39	-9.80	88.53
Hi sx x Low protein	-------	-----	-722.39***	208.33

*p<.05, **p<.01, ***p<.001

High lifetime symptoms ≥37 symptoms, Low protein <85% of the RDA for pregnancy

Interaction between high lifetime psychiatric symptoms and protein consumption <85% pregnancy RDA for birth weight. (n=238)



Note: Adjusting for parity, age of mother, prepreg BMI & extreme poverty

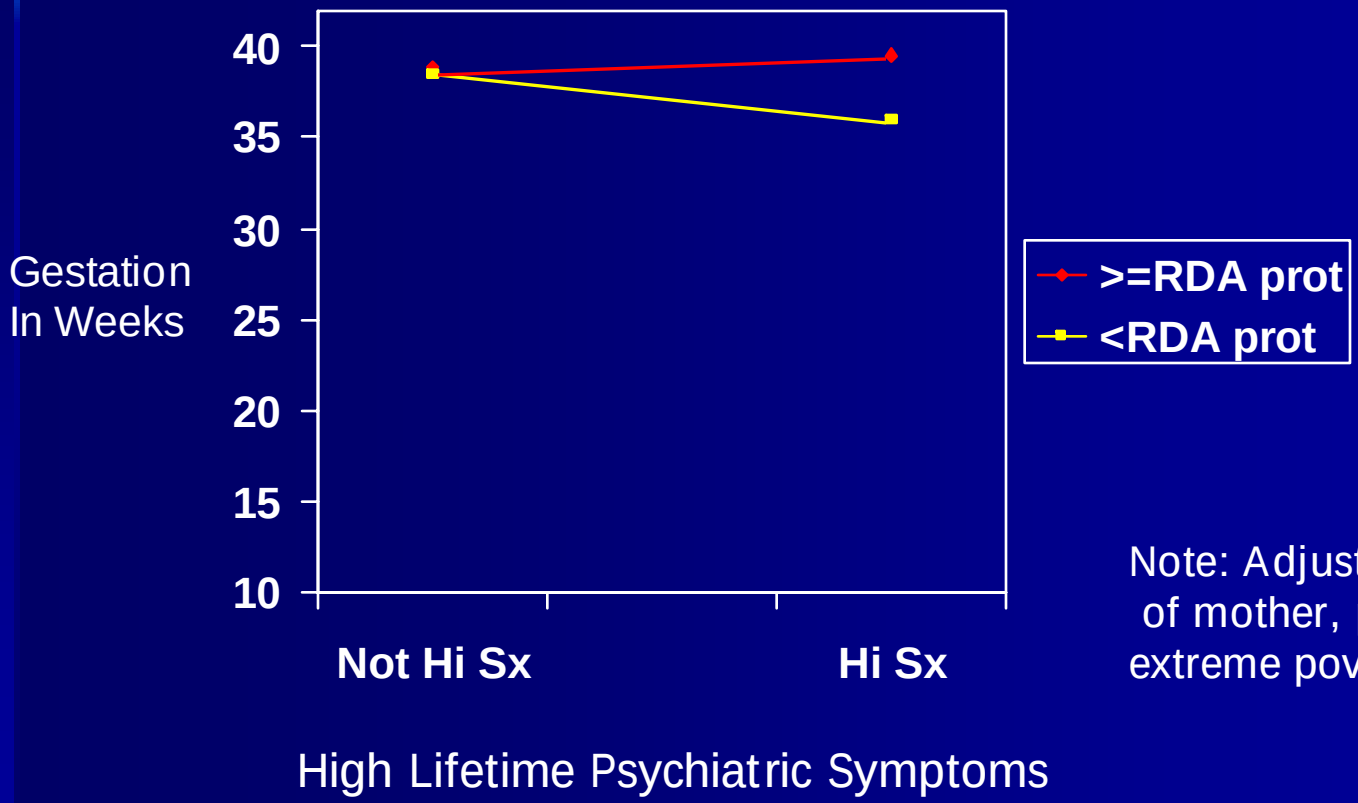
Effect of high lifetime psychiatric symptoms on gestational age (wks) in the presence protein consumption <85% pregnancy RDA. (n=238)

Variable	B	Std error	B	Std error
Constant	39.08	.53	38.88	.53
First child	-1.58***	.44	-1.62***	.43
Mother<19yr	-1.01*	.48	-1.03*	.47
Pre-preg BMI underweight normal overwt/obese	-1.07 Reference 1.04*	.60 Reference .42	-.97 Reference 1.09*	.60 Reference .41
< Median income	.36	.39	.40	.38
High life symptoms	-.34	.50	.64	.59
Low Protein	-.99*	.41	-.43	.45
Hi sx x Lo protein	-------	-----	-3.12**	1.05

*p<.05, **p<.01, ***p<.001

High lifetime symptoms ≥37 symptoms, Low protein <85% of the RDA for pregnancy

Interaction between high lifetime psychiatric symptoms and protein consumption <85% pregnancy RDA for gestational age at birth (n=238).



Note: Adjusting for parity, age of mother, prepreg BMI & extreme poverty

Summary

- Prenatal psychiatric disorder and low protein (<85% RDA)
  - Babies 466 grams lighter
  - Born 2.4 weeks earlier
- High lifetime Symptoms (chronicity & severity) & low protein
  - Babies 732 grams lighter
  - Born 3.6 weeks earlier

Conclusions

- Mechanism for effect of psychiatric disorder not clear
- Apparent strong interaction effect with protein consumption, but only among African Americans
- Protein as %RDA, not other measures of protein intake
- May explain inconsistent results in other studies of effects of stress on birth outcomes