



CHOLINE IN FOODS, FUNCTIONAL FOODS, AND DIETARY SUPPLEMENTS

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Disclosures

- Employment
 - George Mason University
 - Dr. Taylor Wallace – Food & Nutrition Blog
 - National Osteoporosis Foundation
 - National Bone Health Alliance
- Travel supported by Balchem Inc.



Today's Overview

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- Dietary Reference Intakes

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- Choline Intakes in the U.S.

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- Choline in Foods and Supplements

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- Concluding Thoughts and Future Directions

Choline

- Humans can synthesize in small amounts by converting phosphatidylethanolamine to **phosphatidylcholine**.
- Lecithin extracts used in food processing have been estimated to increase choline intake by about **1.5 mg/kg** body weight in adults.

Anal Chem. 2002;74(18):4734-4740.

Choline. Dietary Reference Intakes. National Academy Press; 1998:390-422.

Dietary Reference Intakes

- Reference values that are quantitative estimates of nutrient intakes to be used for planning and assessing diets for healthy people. They include both recommended intakes and upper limits as reference values.
- DRI values:
 - Estimated Average Requirement (EAR)
 - Recommended Dietary Allowance (RDA)
 - Adequate Intake (AI)
 - Tolerable Upper Intake Level (UL)

Why DRI's Are Important

DRIs PROMOTE HEALTH THROUGH:

Nutrition monitoring



Dietary guidelines



Assistance programs



Health professionals



Nutrition research



Food policies



Military



Nutrition labeling



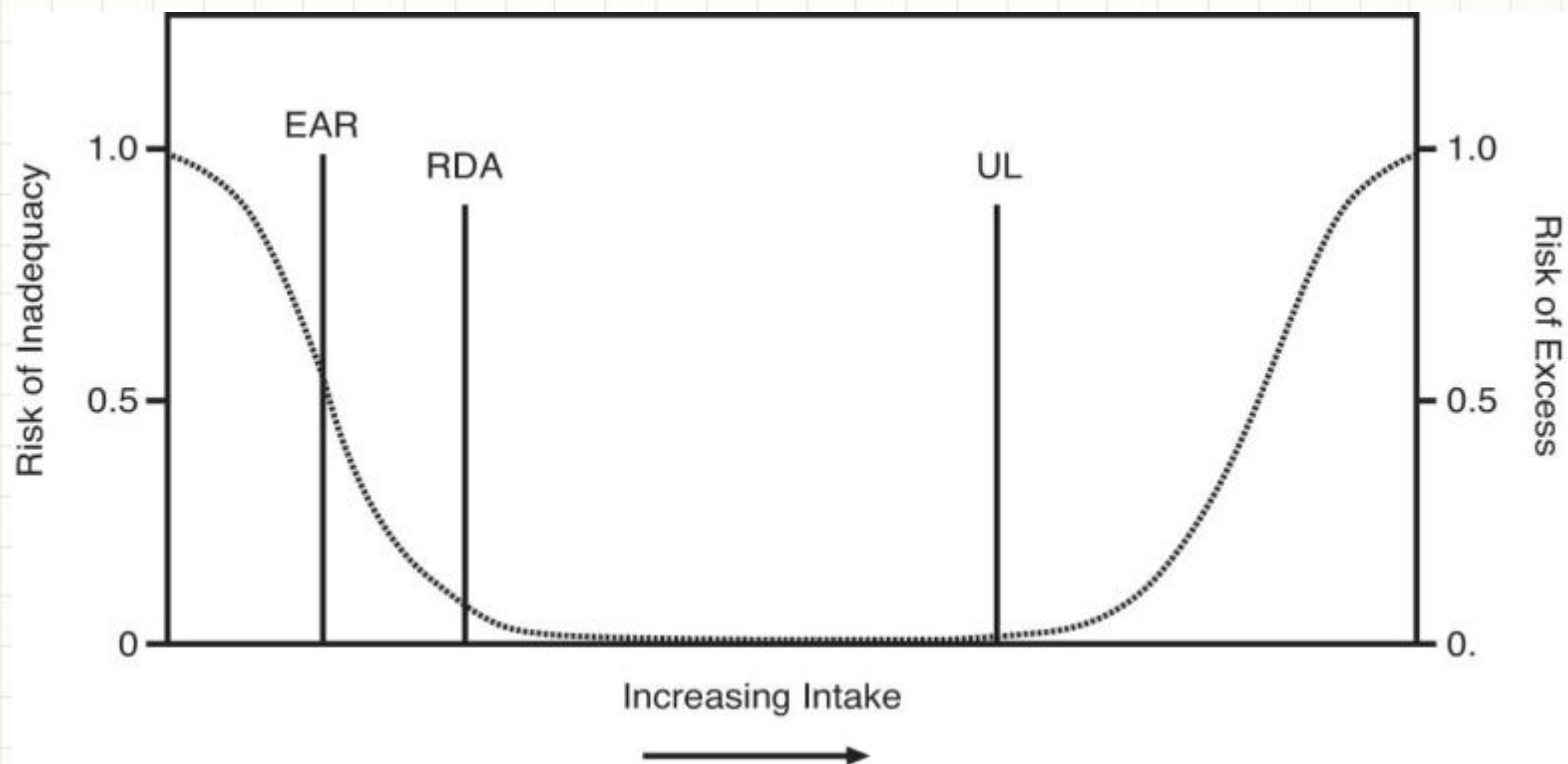
Food and supplement industries



Global nutrient standards



Dietary Reference Intakes

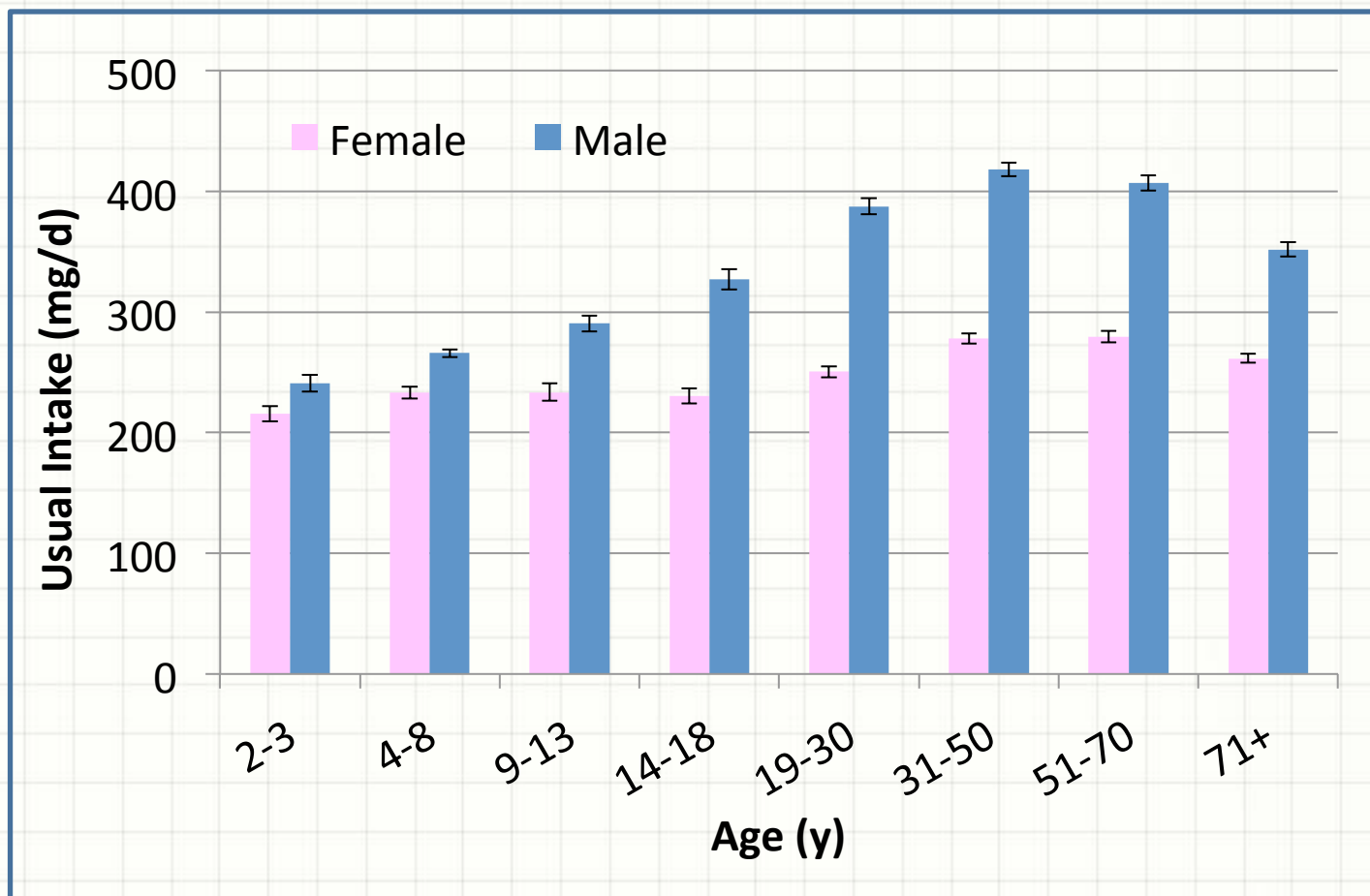


DRIs for Choline

Life-Stage Group	AI (mg/D)	UL (mg/d)
Infant		
0-6 mo.	125	Not established
7-12 mo.	150	Not established
Children		
1-3 y.	200	1,000
4-8 y.	250	1,000
9-12 y.	375	2,000
Males		
14-18 y.	550	3,000
≥ 19 y.	550	3,500
Females		
14-18 y.	400	3,000
≥ 19 y.	425	3,500

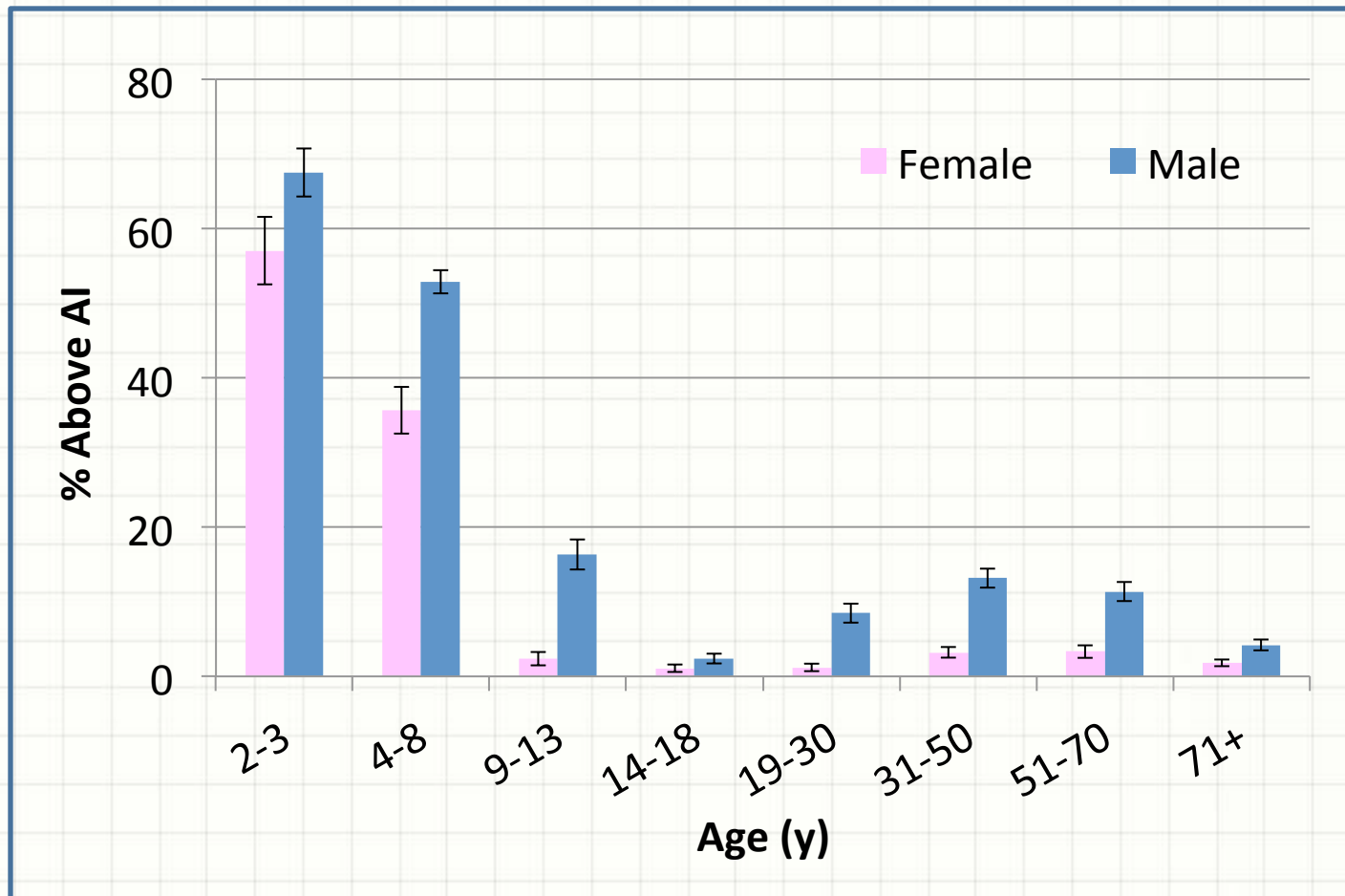
Choline. Dietary Reference Intakes. National Academy Press; 1998:390-422.

Choline Intakes (2009-12)



Wallace TC, Fulgoni VL III. J Am Coll Nutr. 2015 (accepted).

Choline Intakes (2009-12)



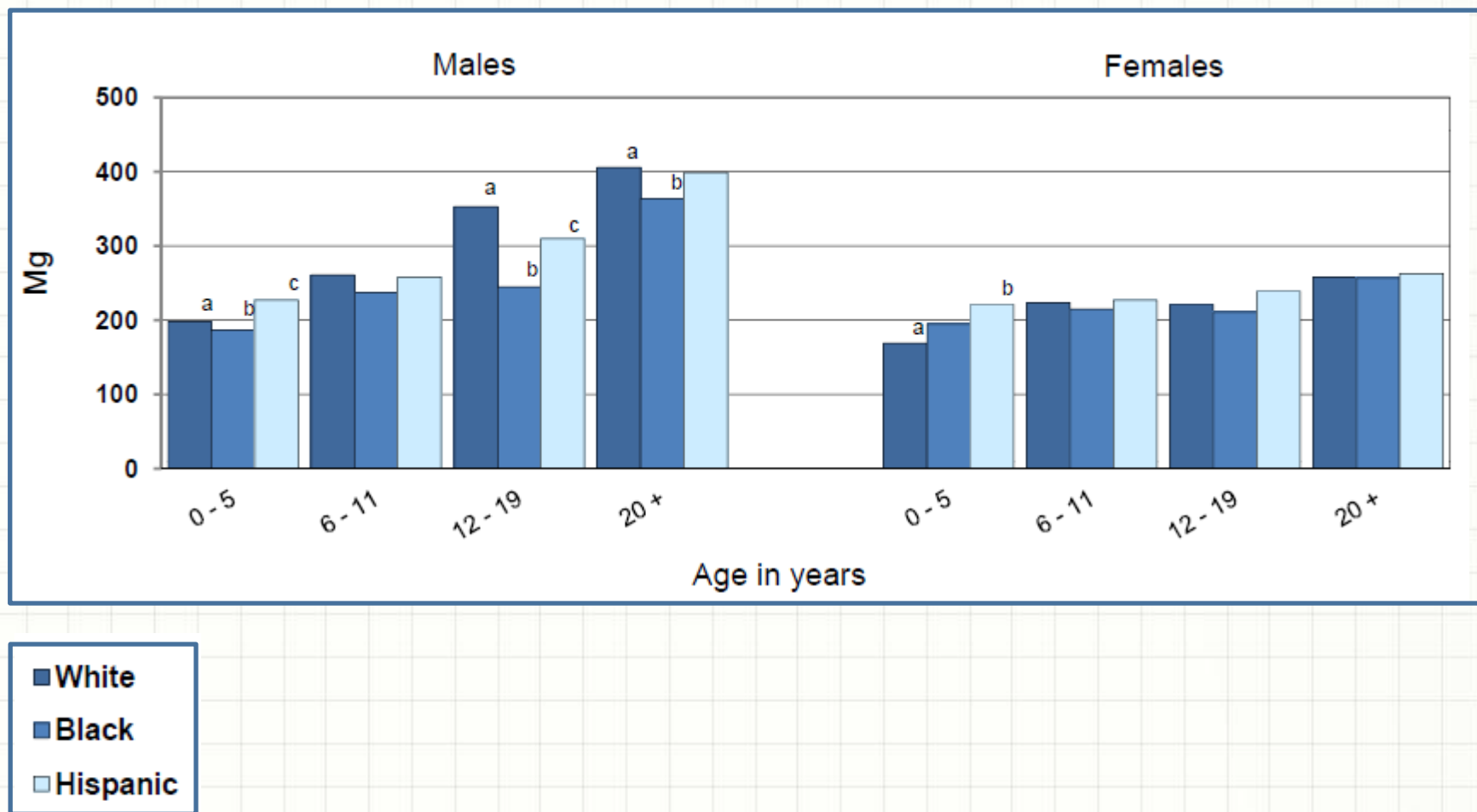
Wallace TC, Fulgoni VL III. J Am Coll Nutr. 2015 (accepted).

Choline Intakes (2009-12)

- No instance of exceeding the UL among any life stage group.



Choline Intakes (2007-08)



Vegetarian Status

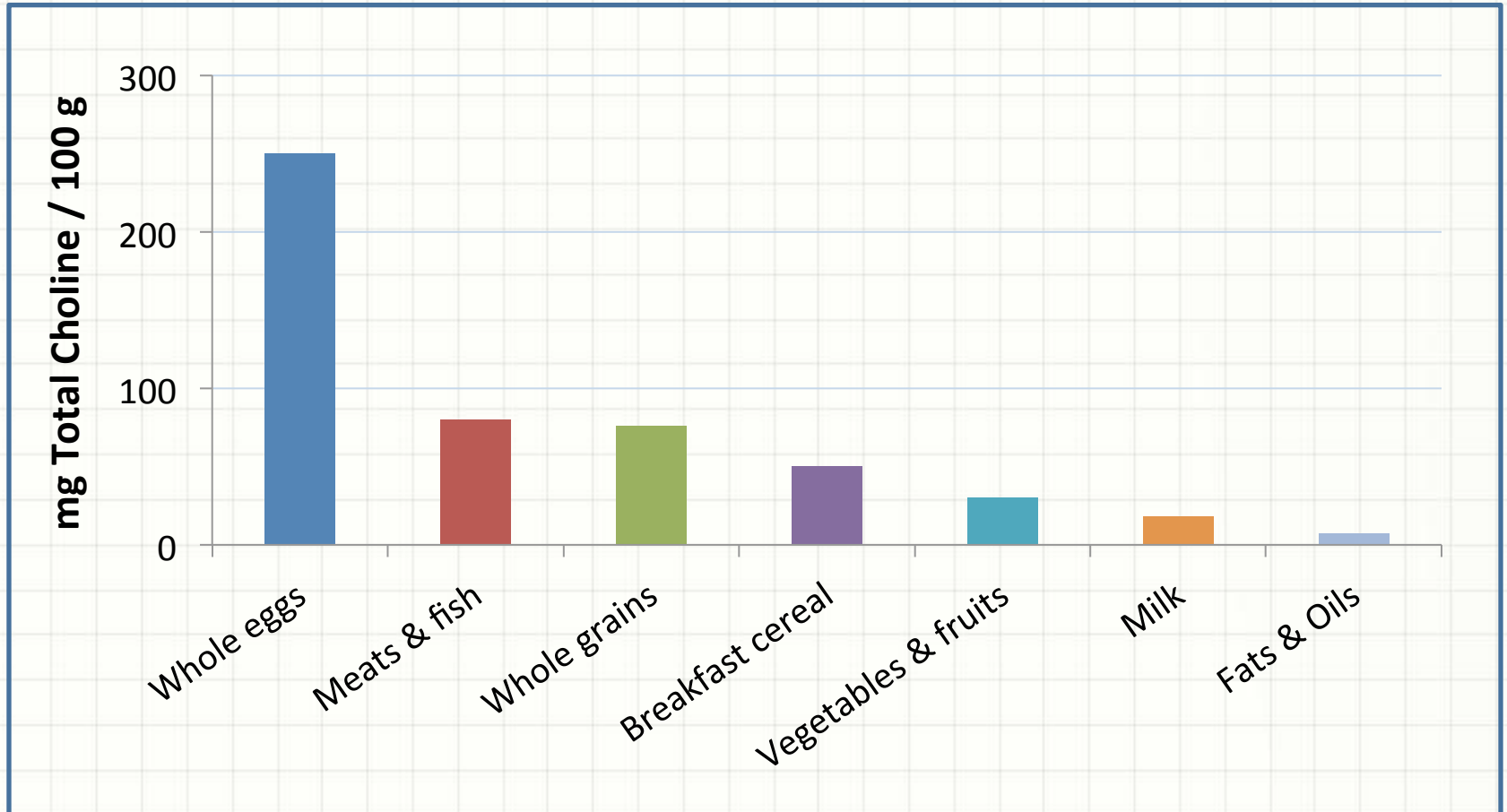
NHANES 2007-2010	Total Choline (\pm SD)
All	327.6 \pm 2.2 ^a
Non-Vegetarian	336.6 \pm 3.2 ^b
Vegetarian	191.9 \pm 7.3 ^c

* Data on food only among individuals \geq 19 y.



Unpublished data.

Total Choline from Select Foods



USDA Database for Choline Content of Common Foods

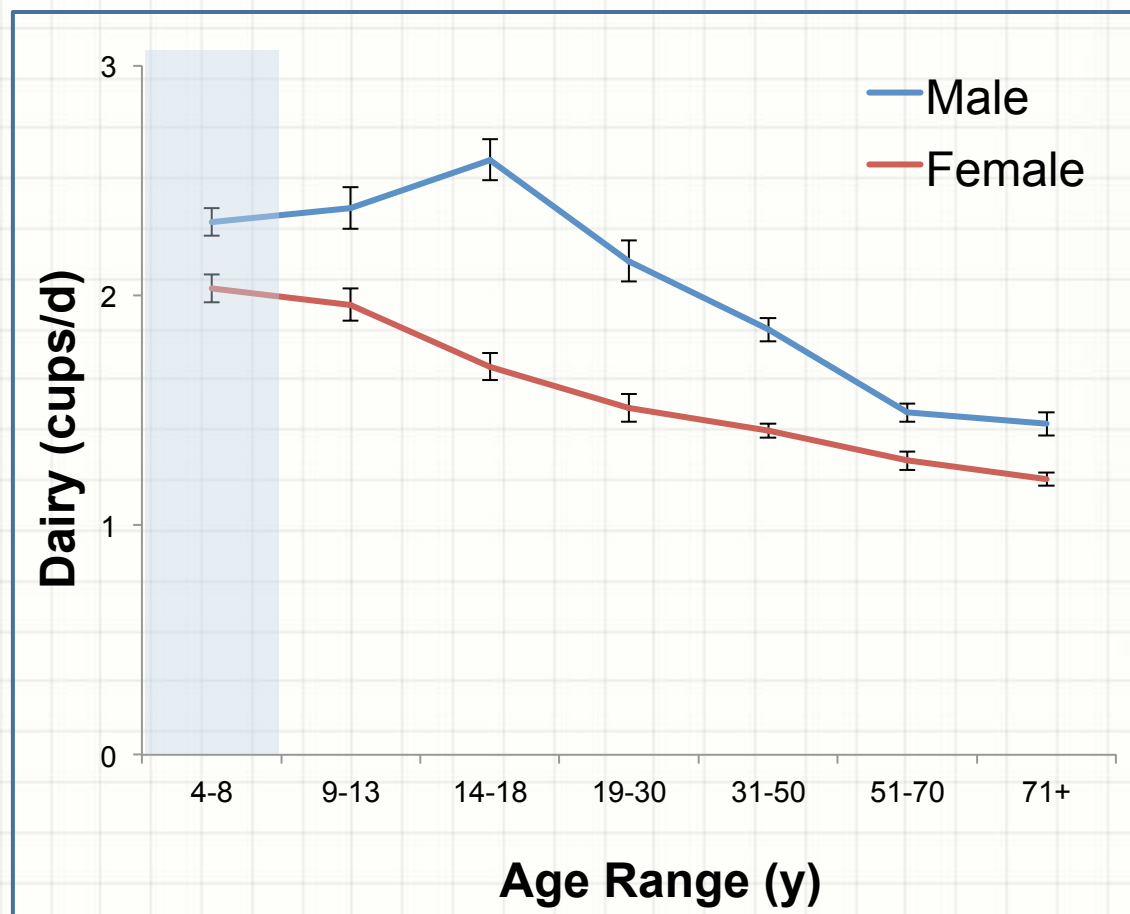
Contribution of Food Categories

Food Category	Contribution to Choline Intake
Meat, Poultry and Fish	24%
Grain-based Mixed Dishes	13%
Dairy	13%
Eggs and Egg Dishes	12%
Bread and Grain Products	9%
Vegetables	7%
Beverages	7%
Meat, Poultry and Fish Based Mixed Dishes	6%

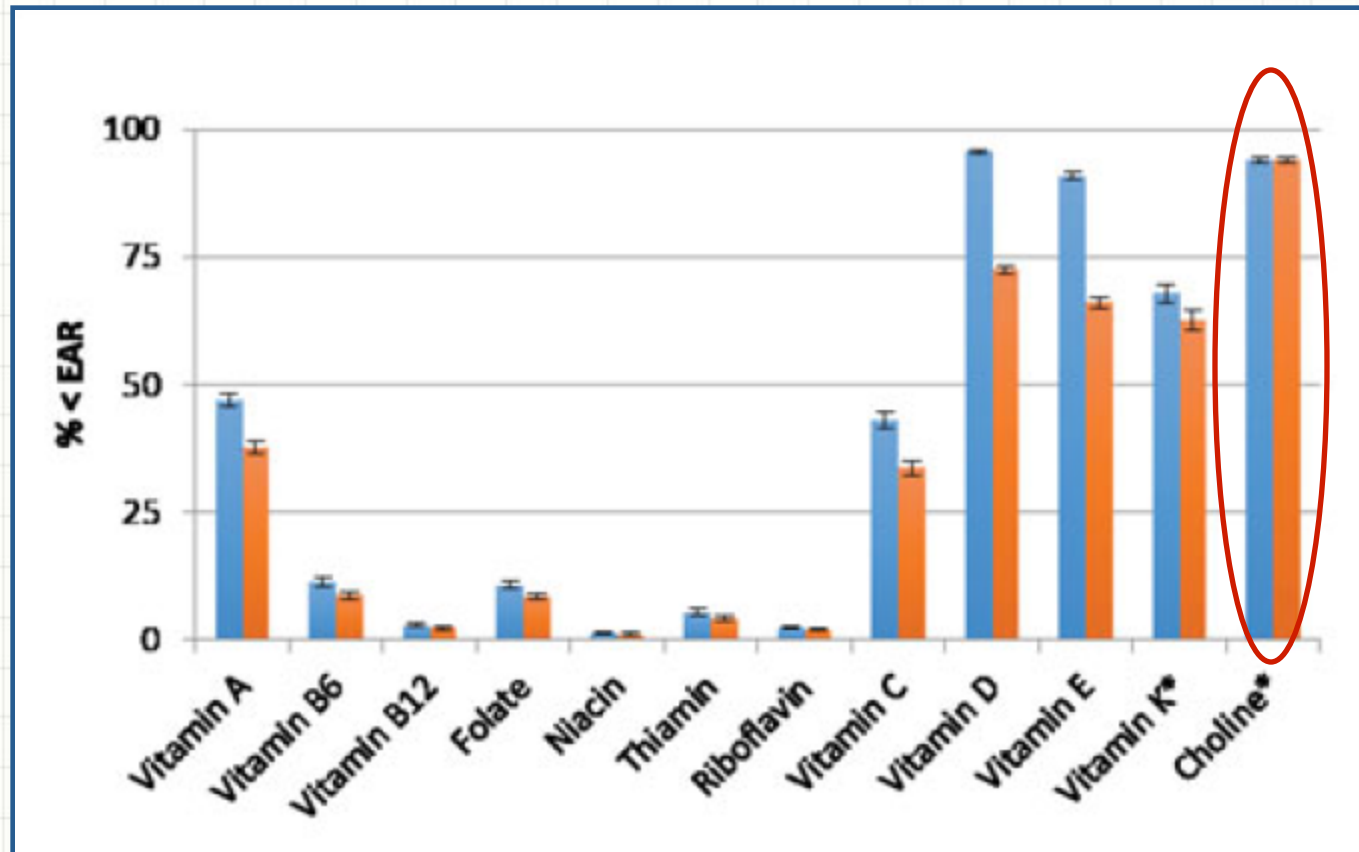
2015 DGAC – Choline

- *“The nutrients for which adequacy goals are not met in almost all patterns are potassium, vitamin D, vitamin E, and **choline**.”*
- *“If no dairy is consumed, modeling analysis shows that levels of calcium, magnesium, iron, vitamin A, and riboflavin, drop below 100% of goals, and intake levels of potassium, vitamin D, and **choline** also drop substantially.”*

Dairy Intake in the U.S.



Multivitamin-mineral Supplements



Concluding Thoughts

- Dietary intakes of choline are not above the AI for the majority of Americans.
 - Current food modeling does not offer many solutions.
- Choline has a documented high degree of safety at levels under the UL.
- Supplementation and fortification seem to be warranted.

Future Endeavors

- Continue NHANES cross-sectional work with a focus on health outcomes (CVD, dementia, etc).
- RCT of choline supplementation on markers of CVD in healthy individuals and those with metabolic syndrome.
- Cohort study of choline intake and development of dementia.





THANK YOU!

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FOOD & NUTRITION BLOG