Marie Caudill

Web Bio

Information

Biography

Biographical Statement

Dr. Marie Caudill received her PhD degree in Nutritional Sciences from the University of Florida in 1997. Shortly thereafter she became an Assistant Professor in the Department of Human Nutrition and Food Science at Cal Poly Pomona University in Southern California where she served for 10 years. Dr. Caudill joined the Division of Nutritional Sciences at Cornell University in August 2007 as an associate professor of Human and Molecular Nutrition and was promoted to full professor in May 2012.

Dr. Caudill is internationally recognized for her work on folate and choline, and the intake levels of these nutrients required to promote human health. She has published about 100 papers, reviews, or chapters in this area, and is frequently an invited speaker on topics related to methyl nutrients, one-carbon metabolism and nutritional genomics.

Dr. Caudill teaches the popular upper level Nutrition and Disease course (NS 4410) which focuses on disease pathology and its intersection with nutrition.

Teaching

Teaching and Advising Statement

A top priority for me in my teaching and advising is to convey respect for the students and a sense that I care about their learning.

Professional

Current Professional Activities

Invited Scientific Seminars and Presentations

CME-accredited initiative, “Choline: An Essential Nutrient for Improving Prenatal Development, Pregnancy Outcomes and Ongoing Health. Annenbery Center for Health Sciences at Eisenhower, Faculty Speaker. Towson, Maryland. March 12, 2014.

Research

Current Research Activities

A primary goal of the Caudill laboratory is to generate data that will inform the development of nutrient intake recommendations that promote mother and child nutrition, health and well-being. A systems biology approach which includes targeted and non-targeted assessments of genomic, epigenetic, biochemical and physiologic endpoints is employed. Our most recent work focused on the effects of pregnancy, and maternal choline supplementation during the last third of pregnancy, on biochemical and genomic readouts in maternal circulation, placental tissue and cord blood. Key findings of this work are outlined below:

Pregnancy substantially increases the demand for choline

Human pregnancy depleted several choline-derived methyl donors (Yan et al. 2012, *AJCN*) and increased the use of choline for phosphatidylcholine biosynthesis and methyl donation (Yan et al. 2013, *AJCN*). Choline intakes approximately twice current recommendations only partially restored pregnancy-induced disturbances in choline metabolism to the nonpregnant state (Yan et al. 2013, *AJCN*). Overall, these data indicate that pregnant women require choline intakes exceeding current recommendations.

Maternal choline supplementation may ease baby's response to stress

A higher maternal choline intake (930 vs 480 mg choline/d) during the last third of pregnancy lowered baby's circulating cortisol by altering the methylation state, and expression patterns, of genes that regulate cortisol production in the placenta (Jiang et al. 2012, *FASEB J*). A lower response to stress among the "choline" babies would be expected to reduce their lifetime risk of stress related diseases such as type 2 diabetes and hypertension.

Maternal choline supplementation may improve placental function

A higher maternal choline intake (930 vs 480 mg choline/d) during the last third of pregnancy improved placental function by decreasing the expression of sFLT1, an anti-angiogenic factor and marker of preeclampsia risk (Jiang et al. 2013, *FASEB J*). In addition, data from a human trophoblast cell line showed that choline insufficiency decreases angiogenesis and increases inflammation, apoptosis, and oxidative stress (Jiang et al. 2014 *JCP*); results which are consistent with the importance of adequate choline for placental function. Thus, supplementing the maternal diet with extra choline during pregnancy may reduce the risk of placental dysfunction and improve the angiogenic (and inflammatory) balance in preeclampsia and intrauterine growth restriction (IUGR).

Maternal choline supplementation may enhance docosahexaenoic acid (DHA) availability (an omega 3 fatty acid) to the developing embryo and fetus

We showed that a higher choline intake (930 vs 480 mg choline/d) among nonpregnant women of reproductive age increased circulating concentrations of DHA-phosphatidylcholine (West et al. 2013, *AJCN*). As DHA-phosphatidylcholine is synthesized via the phosphatidylethanolamine *N*-methyltransferase (PEMT)

pathway, our findings suggest that extra choline enhances PEMT activity and therefore the availability of DHA-phosphatidylcholine to extrahepatic tissue. Among third trimester pregnant women, extra choline did not increase circulating DHA-phosphatidylcholine, but it did increase the use of choline derived methyl groups for PEMT-mediated phosphatidylcholine synthesis (which is elevated during the second half of pregnancy and a main consumer of methyl groups). Moreover, PEMT derived phosphatidylcholine was selectively transferred from the maternal to the fetal compartment suggesting a unique requirement of PEMT-phosphatidylcholine by the developing fetus (Yan et al. 2013, *AJCN*). In sum, these data suggest that supplementing the maternal diet with extra choline during pregnancy improves DHA availability to the developing fetus in the early stages of pregnancy (i.e., as observed in women of reproductive age) and supports the methyl group needs of an elevated PEMT pathway in the later stages.

Maternal choline supplementation during rodent pregnancy produces lifelong alterations in choline metabolism of trisomic (Down syndrome) offspring

In a mouse model of Down Syndrome, supplementing the maternal diet with extra choline during pregnancy increased hepatic PEMT activity in the adult offspring and yielded higher brain levels of PEMT-phosphatidylcholine (i.e., a molecule enriched with DHA) (Yan et al. 2014. *FASEB J*). The lasting increases in phosphatidylcholine-DHA delivery to brain as a result of maternal choline supplementation may be one of the mechanisms through which maternal choline supplementation improves cognitive functioning in normal and trisomic offspring of choline supplemented mothers.

We also performed accompanying studies using samples derived from our feeding study to explore the effect of reproductive state on folate, biotin, vitamin B12 and Vitamin D metabolism and status. Key findings of this work are as follows:

Pregnant and lactating women require more biotin than currently recommended:

Biotin status response to a known biotin intake of 57 mcg/d was assessed among pregnant, lactating and control women. Pregnant women excreted 69% more (vs. control; $P < 0.001$) 3-hydroxyisovaleric acid (3-HIA), a metabolite that accumulates during the catabolism of leucine when the activity of biotin-dependent methylcrotonyl–coenzyme A carboxylase is impaired. In addition, lactating women excreted 76% more (vs. control; $P = 0.001$) of the biotin catabolite bisnorbiotin, indicating that lactation accelerates biotin turnover and loss. In sum, pregnancy and lactation increase the dietary requirement for biotin. Because the study provided a biotin intake >60% higher than recommended, dietary intakes exceeding current recommendations are needed to the meet metabolic demands for biotin in these reproductive states. Perry et al. 2014. *J Nutr.*

A commonly consumed folate intake level yields supranutritional folate status among women differing in reproductive status

Folate status response to a known folate intake (750 mcg/d from a prenatal supplement plus 400 mcg/d dietary folate) was assessed among pregnant, lactating women, and control women. Study-end serum total folate concentrations

averaged 30 ng/mL (sufficiency is >6 ng/mL) and did not differ by reproductive group (P = 0.9). Study-end urinary folate excretion represented 9–43% of total folate intake and ranged from 100 to 500 mcg/d. Breast-milk folate species were responsive to maternal folate intake, and FA made up 40% of breast-milk total folate at study end. These findings warrant revisiting prenatal supplement FA formulation in populations exposed to FA-fortification programs. West et al. 2013, *AJCN.*

Vitamin B12 metabolism is altered during pregnancy and lactation in a manner consistent with enhanced B12 supply to the child (Sajin Bae, Submitted)

Vitamin B12 status response was investigated among pregnant, lactating, and control women consuming equivalent B12 intakes of ~8.6g/d [mixed diet (~6g/d) plus prenatal multivitamin supplement (2.6g/d)]. Consumption of this intake level increased serum holotranscobalamin (holoTC; bioactive form of B12) among all reproductive groups ($P<0.009$). At study-end, pregnant (vs. control) women had a higher holoTC:B12 ratio ($P=0.04$), indicating that more of the total vitamin B12 existed in the bioactive form among pregnant women. In addition, lactating women had higher serum B12 than control (+26%;$P=0.04$) and pregnant (+60%;$P<0.001$) women. These data indicate that pregnancy and lactation alter vitamin B12 biomarkers in a manner consistent with enhanced B12 supply to the child. The study B12 dose, which is ~3 times higher than current dietary recommendations, yielded normal but not elevated levels of B12 indicating that women in these reproductive states may benefit from vitamin B12 intakes exceeding current recommendations.

Vitamin D intakes below RDA levels yield adequate vitamin D status among pregnant and lactating women (Hey Jun Park, PhD Candidate; In Prep)

Vitamin D status response was investigated among pregnant, lactating, and control women consuming equivalent Vitamin D intakes of 430 IU [mixed diet (230 IU) plus prenatal multivitamin supplement (200 IU)]. At study-end, pregnant women showed approximately 30% higher concentrations of serum 25(OH)D (89 nmol/L) than control women (69 nmol/L) ($P < 0.01$; LMM). Serum 25(OH)D concentrations in lactating women (75 nmol/L) did not differ from pregnant and control women ($P > 0.15$; LMM). All reproductive groups achieved mean serum levels (from LMM) above the EAR and RDA target values of 40 nmol/L and 50 nmol/L, respectively. In addition, all participants except for two (1 pregnant, 1 control) had serum 25(OH)D exceeding 40 nmol/L (unadjusted). These data collectively indicate that the vitamin D RDA of 600IU is adequate for women of childbearing age regardless of reproductive status.

In sum, these data show that upward adjustments to the dietary intake recommendations for pregnant women are needed for choline, biotin and vitamin B-12, but not for vitamin D. In addition, reductions in the folic acid content of prenatal vitamins (i.e., those providing ≥600 mcg/d) should be considered in populations exposed to fortified foods.

Ongoing Projects (with graduate students working on the projects in parenthesis and underlined)

Molecular mechanisms by which maternal choline supplementation improves placental function (Cecilia Kwan and Julia King; in collaboration with the

laboratories of Dr. Mark Roberson, Cornell University and Dr. Patsy Brannon, Cornell University)

Impact of Diet and Gut Microbiota on Trimethylamine-N-Oxide Production and Fate in Humans (Clara Cho, Postdoctoral Associate; in collaboration with Dr. Ruth Ley, Cornell University)

Influence of common genetic variants on choline dynamics in women of reproductive age (Ariel Ganz)

Influence of a methyl-nutrient enriched diet on brain choline metabolites in a mouse model of autism (Siraphat Taesuwan; in collaboration with Hava Golan, Ben-Gurion University of the Negev Beer-Sheva 84105, Israel)

The effect of choline on breastmilk nucleotide content and parameters of genomic integrity (Sajin Bae, in collaboration with Patrick Stover, Cornell University)

The role of the placenta in vitamin D nutriture during pregnancy (HeyJun Park, in collaboration with Patsy Brannon, Cornell University)

Extension

Current Extension Activities

Education

Education

BA, 1990, Physical Education (Summa Cum Laude), College of Education, University of North Florida, Jacksonville, FL.

BS, 1992, Health Science (Summa Cum Laude), College of Health, University of North Florida, Jacksonville, FL

MS, 1993, Health Science, College of Health, University of North Florida, Jacksonville, FL

PhD, 1997, Nutritional Sciences, Food Science and Human Nutrition, College of Agriculture, University of Florida, Gainesville, FL (Lynn Bailey, Thesis Advisor)

Courses

Courses Taught

NS 4410 - Nutrition and Disease (4 credit units)
This course combines the principles of nutrition, biochemistry, physiology,

genetics, pharmacology, and pathology to understand disease risk, prevention, progression and management. The course is organized in a lecture format with opportunities for the class to engage in the discussion of original research articles on topics of high current interest in the area of nutrition and health.

Websites

Related Websites

http://www.cornell.edu/video/?videoID=940&startSecs=0&endSecs=96

Administration

Publications

Selected Publications

Peer Reviewed Original Research Publications (last five years)

1. Kathirvel E, Morgan K, Caudill MA, Nandgiri G, Sandoval BC, Bottiglieri T, French SW, Morgan TR. Betaine improves nonalcoholic fatty liver and associated hepatic insulin resistance: a potential mechanism for hepatoprotection by betaine. Am J Physiol. 2010;299:G1068-77.
2. Chan J, Deng L, Pickell L, Wu Q, Yan J, Caudill MA, Rozen R. Low dietary choline and low dietary riboflavin during pregnancy influence reproductive outcomes and heart development in mice. Am J Clin Nutr. 2010;91:1035–43.
3. Shin W, Yan J, Abratte CF, Vermeylen F, and Caudill MA. Choline intake exceeding current dietary recommendations preserves markers of cellular methylation in a genetic sub-group of folate-compromised men. J Nutr. 2010;140:975-980.
4. Christensen KE, Wu Q, Wang X, Deng L, Caudill MA, Rozen R. Steatosis in mice is associated with gender, folate intake and expression of genes of one-carbon metabolism. J Nutr. 2010;140: 1736-1741
5. Yan J, Wang W, Gregory JF III, Malysheva OV, Brenna JT, Stabler SP, Allen RH, Caudill MA. MTHFR C677T genotype influences the isotopic enrichment of one carbon metabolites in folate compromised men consuming d9-choline. Am J Clin Nutr. 2011;93:348-55.
6. Li J, Li XM, Caudill MA, Malysheva O, Gorce-Bardag F, Oliva J, French BA, Gorce E, Morgan K, Kathirvel E, Morgan T, French SW. Betaine feeding prevents the blood alcohol cycle in rats fed alcohol continuously for 1 month using the rat intragastric tube feeding model. Exp Mol Pathol. 2011;91:540-47.
7. Chew TW, Jiang X, Yan J, Wang W, Lusa AL, Carrier BJ, West AA, Malysheva OV, Brenna JT, Gregory JF III, Caudill MA. Folate intake, Mthfr genotype and sex modulate choline metabolism in mice. J Nutr. 2011;141:1475–1481.
8. Yan J, Winter LB, Whitmore BB, Vermeylen F, Caudill MA. Plasma choline

metabolites associate with metabolic stress among young overweight men in a genotype-specific manner. Nutrition and Diabetes (2012) 2, e49; doi:10.1038/nutd.2012.23
9. Jiang X, Bar HY, Yan J, West AA, Perry CA, Malysheva OV, Devapatla S, Pressman E, Vermeylen F, Wells MT, Caudill MA. Human pregnancy induces transcriptional activation of the peripheral innate immune system and increases oxidative DNA damage. PLoS One. 2012;7(11):e46736.
10. West AA, Jian J, Perry CA, Jiang X, Malysheva OV, Caudill MA. Folate status response to a controlled folate intake among nonpregnant, pregnant, and lactating women. Am J Clin Nutr 2012;96:789–800. PMID:22932279
11. Jiang X, Yan J, West AA, Perry CA, Malysheva OV, Devapatla S, Pressman E, Vermeylen F, Caudill MA. Maternal choline intake alters the epigenetic state of fetal cortisol regulating genes in humans. FASEB J. 2012;26(8):3563-74. PMID:22549509
12. Jadavji NM, Deng L, Leclerc D, Malysheva O, Bedell BJ, Caudill MA, Rozen R. Severe methylenetetrahydrofolate reductase deficiency in mice results in behavioral anomalies with morphological and biochemical changes in hippocampus. Mol Genet Metab. 2012;106(2):149-59. PMID:22521626
13. Yan J, Jiang X, West AA, Perry CA, Malysheva OV, Devapatla S, Pressman E, Vermeylen F, Stabler SP, Allen RH, Caudill MA. Maternal choline intake modulates maternal and fetal biomarkers of choline metabolism in humans. Am J Clin Nutr. 2012;95:1060–71.
14. Beaudin AE, Abarinov EV, Malysheva OV, Perry CA, Caudill MA, Stover PJ. Dietary folate but not choline modifies neural tube defect risk in Shmt1 knock-out mice. Am J Clin Nutr. 2012;95:109–14. PMCID: PMC3238454
15. Yan J, Jiang X, West AA, Perry CA, Malysheva OV, Brenna JT, Stabler SP, Allen RH, Gregory JF III, Caudill MA. Pregnancy alters choline dynamics: results of a randomized trial employing stable isotope methodology in pregnant and nonpregnant women. Am J Clin Nutr. 2013;98:1–9. PMID: 24132975
16. K.E. Christensen, L. Deng, K.Y. Leung, E. Arning, T. Bottiglieri, O.V. Malysheva, M.A. Caudill, N.I. Krupenko, N.D. Greene, L. Jerome-Majewska, R.E. MacKenzie, R. Rozen. A novel mouse model for genetic variation in 10-formyltetrahydrofolate synthetase exhibits disturbed purine synthesis with impacts on pregnancy and embryonic development. Human Molecular Genetics. 2013;22:3705-19.
17. Ash JA, Jiang X, Malysheva OV, Fiorenza CG, Bisogni AJ, Levitsky DA, Strawderman MS, Caudill MA, Stover PJ, Strupp BJ. Dietary and genetic manipulations of folate metabolism differentially affect prefrontal cortical functions in mice. Neurotoxicology and Teratology. 2013;38:79-91.
18. West AA, Yan J, Perry CA, Jiang X, Malysheva OV, Innis SE, Caudill MA. Choline intake influences phosphatidylcholine docosahexaenoic acid enrichment in nonpregnant women but not third-trimester pregnant women. Am J Clin Nutr. 2013; 97(4):718-27. PMID:23446897
19. Jiang X, Bar HY, Yan J, Jones S, Brannon PM, West AA, Perry CA, Malysheva OV, Pressman E, Devapatla S, Vermeylen F, Wells MT, Caudill MA. A higher maternal choline intake decreases the anti-angiogenic factor fms-like tyrosine kinase-1 (sFLT1) in both the placenta and maternal circulation. FASEB J. 2013; 27:1245-53. PMID:23195033
20. Toriola AT, Cheng T-YD, Neuhouser ML, Wener MH, Zheng Y, Brown E, Miller JW, Song X, Beresford SAA, Gunter MJ, Caudill MA, Ulrich CM. Biomarkers of inflammation are associated with colorectal cancer risk in women but are not suitable as early detection markers. International Journal of Cancer.

2013;132:2648-58.
21. Field MS, Shields KS, Abarinov EV, Malysheva OV, Allen RH, Stabler SP, Ash JA, Strupp BJ, Stover PJ, Caudill MA. Mthfd1 deficiency in mice perturbs folate and choline dependent one-carbon metabolism as well as transsulfuration. J. Nutr. 2013;143:41-5.
22. Mikael LG, Pancer J, Jiang X, Wu Q, Caudill MA, Rozen R. Low dietary folate and methylenetetrahydrofolate reductase deficiency may lead to pregnancy complications through modulation of ApoA1 and IFN-gamma in spleen and placenta. Molecular Nutrition & Food Research. 2013;57:661-70.
23. Bae S, Ulrich CM, Bailey LB, Malysheva O, Brown EC, Neuhouser ML, Cheng TY, Miller JW, Zheng Y, Xiao L, Hou L, Song X, Buck K, Beresford SA, Caudill MA. Impact of folic acid fortification on global DNA methylation and one-carbon biomarkers in the Women's Health Initiative Observational Study cohort. Epigenetics. 2014;9:396-403.
24. Bae S, Ulrich CM, Neuhouser ML, Malysheva O, Bailey LB, Xiao L, Brown EC, Zheng Y, Cheng T-Y D, Miller JW, Lane DS, Beresford SAA, Caudill MA. Plasma choline metabolites and colorectal cancer risk in the Women's Health Initiative Observational Study. Cancer Res. 2014;74:7442–52.
25. Perry CA, West AA, Gayle A, Smith L, Yan J, Jiang X, Malysheva O, Caudill MA. Pregnancy and Lactation Alter Biomarkers of Biotin Metabolism in Women Consuming a Controlled Diet. J Nutr. 2014;144: 1–8.
26. Jadavji NM, Bahous RH, Deng L, Malysheva O, Maison MG, Bedell BJ, Caudill MA, Rozen R. Mouse model for deficiency of methionine synthase reductase exhibits short-term memory impairment and disturbances in brain choline metabolism. Biochem J. 2014;461:205-12.
27. Yan J, Ginsberg SD, Powers B, Alldred MJ, Saltzman A, Strupp BJ, Caudill MA. Maternal choline supplementation programs greater activity of the phosphatidylethanolamine N-methyltransferase (PEMT) pathway in adult Ts65Dn trisomic mice. FASEB J. 2014;28: 4312–4323.
28. West AA, Shih Y, Wang W, Oda K, Jaceldo-Siegl K, Sabate J, Haddad E. Rajaram S, Caudill MA, Burns-Whitmore, B. Egg n-3 fatty acid composition modulates biomarkers of choline metabolism in free-living lacto-ovo vegetarian women of reproductive age. J Acad Nutr Diet. 2014;114:1594-1600.
29. Jiang X, Jones S, Andrew BY, Ganti A, Malysheva OV, Giallourou N, Brannon PM, Roberson MS, Caudill MA. Choline inadequacy impairs trophoblast function and vascularization in cultured human placental trophoblasts. J Cell Physiol. 2014;229:1016-27.
30. Christensen KE, Mikael LG, Leung K-Y, Levesque N, Deng L, Wu Q, Malysheva OV, Best A, Caudill MA, Greene NDE, and Rozen R. High folic acid consumption leads to pseudo-MTHFR deficiency, altered lipid metabolism and liver injury in mice.
31. Am J Clin Nutr. 2015; doi: 10.3945/ajcn.114.086603. Davenport C, Yan J, Taesuwan S, Shields K, West AA, Jiang X, Perry CA, Malysheva OV, Stabler SP, Allen RH, Caudill MA. Choline intakes exceeding recommendations during lactation improve breastmilk choline content by increasing PEMT pathway metabolites. Submitted
32. Andrew BY, Jiang X, Ganti A, Jones S, Roberson MS, Francoise V, Caudill MA, Brannon PM. Hypoxia modulates the effect of choline on the angiogenic profile in cultured human trophoblasts. Submitted.
33. Lynn B. Bailey, Patrick Stover, Helene McNulty, Michael Fenech, Jesse Gregory, James Mills, Christine M. Pfeiffer, Zia Fazili, Mindy Zhang, Per Magne

Ueland, Anne Molloy, Marie A. Caudill, Barry Shane, RJ Berry, Regan Bailey, Ramkripa Raghavan, Daniel Raiten. Biomarkers of Nutrition for Development (BOND) - Folate Review. Submitted

34. Bae S, West AA, Yan J, Jiang X, Perry CA, Malysheva O, Stabler SP, Robert H. Allen RH, Caudill MA. Pregnancy and lactation alter vitamin B12 status biomarkers in women with controlled nutrient intakes. Submitted

35. Carly E. Visentin, Shannon Masih, Lesley Plumptre, Olga Malysheva, Daiva E. Nielsen, Kyoung-Jin Sohn, Anna Ly, Andrea Lausman, Howard Berger, Ruth Croxford, Ahmed El-Sohemy, Marie Caudill, Deborah L. O'Connor, Young-In Kim. Concentrations of choline and its metabolites in plasma of Canadian pregnant women and their newborn infants. Submitted

36. D Cheng, K Makar, M Neuhouser, J Miller, X Song, E Brown, SA Beresford, Y Zheng, L Poole, R Galbraith, D Duggan, N Habermann, LB Bailey, D Maneva; MA Caudill, A Toriola, R Green, C Abbenhardt, C Ulrich. Folate-mediated one-carbon metabolism genes and interactions with nutritional factors on colorectal cancer risk: Women's Health Initiative Observational Study. Submitted

37. Shannon E Washburn, Marie A Caudill, Amanda J MacFarlane, Brian Harnett, Luke MacMillan, Theerawat Pongnopparat, Margaret E. Brosnan and John T Brosnan. A key role for formate in fetal and neonatal development in sheep. Submitted

Chapters and Reviews (last five years)

1. West AA, Caudill MA. Genetic Variation: Impact on folate (and choline) bioefficacy. Int J Vitam Nutr Res. 2010;80 (4 – 5), 319 – 329

2. Zeisel SH, Caudill MA. Choline. Adv Nutr. 2010;1:46–48, doi:10.3945/an.110.1010

3. Caudill MA. Pre- and Postnatal Health: Evidence of Increased Choline Needs. J Am Diet Assc. 2010;110:1198-1206.

4. Caudill MA. Folate bioavailability: Implications for establishing dietary recommendations and optimizing status. Am J Clin Nutr. 2010;91(suppl):1455S-60S.

5. Caudill MA, daCosta K-A, Zeisel SH, Betsy Hornick "Choline Call to Action: Elevating Awareness and Intake of an Essential Nutrient for Public Health" Nutrition Today. 2011;46:235-241.

6. Caudill MA, Gregory JF III, Miller J, Shane B. Folate, choline, vitamin B-12 and vitamin B-6. In: Stipanuk MH and Caudill MA (eds). Biochemical, Physiological and Molecular Aspects of Human Nutrition. 3rd edition. St Louis, MO: Elsevier Saunders; 2012.

7. Bailey LB, Caudill MA. Folate. In: Present Knowledge in Nutrition. 10th edition. ILSI Press, Washington, DC. 2012

8. Perry CA, Caudill MA. Biotin: Critical for fetal growth and development yet often overlooked. NutritionToday. 47(2):79-85, March/April 2012.

9. Jiang X, Yan J, Caudill MA. Choline. In: Zemplini J, Stover PJ, Gregory JF III, Suttie K. Handbook of Vitamins. 5th edition. Taylor and Francis.

10. Bailey LB, da Silva V, West AA, Caudill MA. Folate. In: Zemplini J, Stover PJ, Gregory JF III, Suttie K (eds) Handbook of Vitamins. 5th edition. Taylor and Francis.

11. Davenport C, Caudill MA. Choline in human milk. In: Zibadi S, Watson RR, Preedy VR (eds) Handbook of Dietary and Nutritional Aspects of Human Breast Milk. Wageningen Academic Publishers. 2013; pp 335-351.

12. West AA, Caudill MA. Applied choline-omics: Lessons from human metabolic studies for the integration of genomics research into nutrition practice. J Acad Nutr Diet. 2014 Aug;114(8):1242-50.
13. Jiang X, West AA, Caudill MA. Maternal choline supplementation: A nutritional approach for improving offspring health? Trends in Endocrinology and Metabolism. 2014;25(5):263-73
14. S Kwan, J King, MA Caudill. Choline and Placental Trophoblast Development. In: Human Placental Trophoblast: Impact of Maternal Nutrition. Editors: Asim K. Duttaroy and Sanjay Basak; CRC press, Taylor & Francis group, USA. 2015 (Submitted)