

## Prenatal Nutrition

### Healthy Mother, Healthy Baby

Pregnancy places increased nutritional needs on the body of the expectant mother. These increased nutritional needs fall into two basic categories: macro-nutrition and micro-nutrition. The pregnant mother's diet has a direct impact on the growth and development of the evolving fetus. There is a need to increase macronutrient intake to support fetal development as well as the changes in the mother's body in preparation for child birth and subsequent lactation. Macronutrients include protein, fats, and carbohydrates. During the prenatal period, the fetus has an enormous task in evolving from a single-celled, fertilized egg into a newborn infant. To accomplish this, the fetus must be supplied with all the necessary nutrients in proper quantities at the exact time needed.

In 2002, the Institute of Medicine developed new guidelines for total energy intake (calories) during the course of pregnancy. The revised Dietary Reference Intake (DRI) for energy consumption during pregnancy state:

1. No additional calories for the first trimester
2. An additional 340 kilocalories/day for the second trimester
3. An additional 452 kilocalories/day for the third trimester

(Panel on Macronutrients, Institute of Medicine, 2002)

Additional studies have been done regarding energy intake during pregnancy resulting in recommendations concerning the DRI for energy intake during pregnancy. A study by Butte et al (*AJCN* 2004, 79(6), 1078-1087) states that additional energy requirements vary not only by trimester but should also be adjusted based on the mother's body mass index (BMI) prior to conception. Underweight women, normal weight women, and overweight women would have differing DRI for energy intake. The Institute of Medicine has also developed a table for what is considered to be acceptable weight gain during pregnancy. See Table below:

| Weight Category                 | Total Weight Gain (lbs) |
|---------------------------------|-------------------------|
| Underweight BMI under 18.5      | 28-40 lbs               |
| Normal Weight BMI 18.5-24.9     | 25-35 lbs               |
| Overweight BMI 25-29.9          | 15-25 lbs               |
| Obese BMI greater or equal 30.0 | 11-20 lbs               |

Although nutrition is important for everyone, it is very important for the expecting mother to take in adequate protein. Healthy fetal development requires adequate **protein** because protein provides the basic building blocks needed

for formation of muscle, enzymes, antibodies, and collagen. **Collagen** is needed for the development of skin, bones, blood vessels, ligaments, and other important tissues. During pregnancy, the mother must consume enough protein not only for the growing fetus but also for her own needs to grow in size to carry the baby. The DRI for protein intake during pregnancy has been set by the Institute of Medicine in 2002 at 1.1 g/kg/day (*The DRI for non-pregnant women was set at 0.8 g/kg/day*). Other nutrients that are of high importance to support pregnancy include **lipids, essential fatty acids, choline, iron, fiber, carbohydrate, vitamin A, vitamin D, calcium, B-vitamins, magnesium, zinc, and iodine.**

Of the B-vitamins, **folic acid** and **vitamin B-12** are of a bit more critical concern, due to their special roles in fetal development and potential for deficiency in the mother. The B-vitamins are primarily needed as cofactors in energy metabolism. **Lipids** are essential to the formation of cell membranes and hormones, and are required for proper eye and brain development. **Essential fatty acids**, such as the omega-6 and omega-3 are needed for brain and eye formation. They are precursors to the hormone-like substances called prostaglandins, which play important roles in regulating the immune system, and in

particular to the inflammatory response to injury and infection. **Choline** is needed, amongst other things, to make the neurotransmitter acetylcholine. Choline's roles will be discussed in more detail later in this newsletter. **Iron**, a component of hemoglobin, is involved in many other important physiological roles and will also be discussed in more detail. **Fiber**, though not involved in the development of the fetus, is important to the comfort of the mother during pregnancy by helping fight against constipation - a common occurrence in pregnancy. **Carbohydrates** are needed as a source of glucose, a source of energy for the growing fetus and mother. **Vitamin A** is involved in fetal growth, vision, protein synthesis, and cell differentiation. **Vitamin D** is needed for building and maintaining strong bones and teeth. **Calcium** is of course needed for proper bone formation, as well as protecting the mother from too much bone loss during pregnancy.

Inadequate **magnesium** intake has been demonstrated to be a common finding in American women. This poor intake of magnesium has been associated with an increased risk of miscarriage, fetal growth retardation, maternal hospitalizations, and preterm delivery (*Durlach, J, J Am Coll Nutr. 2004 Dec;23(6):694S-700S.*). Magnesium has an influence on so many systems that to cover all of the problems associated with inadequate magnesium intake during pregnancy could take a complete issue of this newsletter. Other problems from lack of magnesium include leg cramps, gestational diabetes, and more. The RDA for magnesium during pregnancy is at least 25% higher than the regular RDA. **Zinc** plays a role in the development of the immune system,

and the RDA for zinc is increase from 8 mg to 11 mg/day for pregnant women. Iodine deficiency during pregnancy is the leading cause of mental retardation. The RDA for pregnant women is 220 mcg/day. **Iodine** deficiency puts the baby at greater risk of mental retardation, as well as growth impairment, hearing, and speech problems.

## Choline and Iron

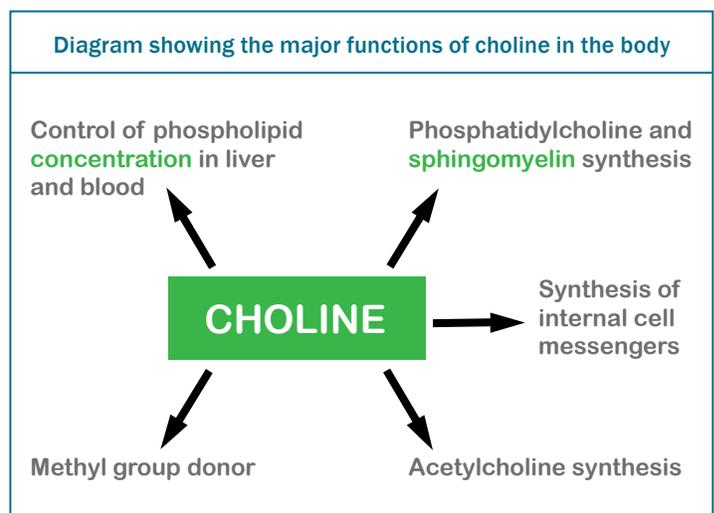
The importance of choline and iron during pregnancy is the main thrust of this edition of the Research Notes. Both of these nutrients play extremely critical roles for fetal development.

## Choline

Methyl donors, like choline, can affect brain development through its involvement in the methylation process. Methyl donors are in the pathway that produces s-adenosylmethionine. Choline's involvement in the production of s-adenosylmethionine is of critical importance to fetal development. Why? Because s-adenosylmethionine (SAME) is a compound found in almost every tissue and fluid in the body. It plays roles in the developing immune system, maintains cell membranes, and helps produce and breakdown brain chemicals (serotonin, melatonin, and dopamine). Choline is a component of phospholipids and is needed for synthesis of lecithin, a structural component of cell membranes, and is an essential component of the human brain and nervous

system. During fetal development, **choline supports the structure and function of the brain and spinal cord**. Choline is needed for the formation of the neural transmitter acetylcholine, required for nervous transmission. The rate of synthesis and release of acetylcholine varies with the availability of free choline. Choline has been seen to improve cognition through better DHA uptake. Animal studies have shown that choline increases the formation of neurons of the hippocampus, thus improving memory.

Proper intake of choline by the mother during pregnancy leads to less neural tube defect, as well as less pre-eclampsia. The DRI for choline during pregnancy has been raised to 450 mg/day, and 550 mg/day during lactation. It has been seen that 92% of pregnant women do not get the required amounts of choline. Evidence exists that the DRI for choline is probably not high enough. In fact, it has been observed that choline intake in the United States has been declining in the past few decades due to reduced consumption of eggs (egg yolks are a high source of choline) and dairy products. The diagram below depicts the many roles of choline



Given the importance of choline in prenatals, it makes sense to use the finest source of choline, VitaCholine®.

## Iron

The trace mineral iron is one of the most critical nutritional needs during pregnancy, for both the fetus and the expectant mother. Iron is transported from the mother to the fetus via the placenta. At birth, a healthy infant's system contains about 270 mg of iron. However, the total iron needed during pregnancy is much higher. According to L. Gambling, et al (*AJCN published ahead of print, May 4, 2011*) the net requirement for iron in pregnancy is about 600 mg. During the first trimester of pregnancy, there is only a minor increase in iron need, which can be met by the cessation of menses. However, as the mother's blood volume expands and the fetus grows, the need for iron increases substantially. Due to the importance of iron for both the mother and the fetus, iron insufficiency during pregnancy can have catastrophic results. Iron is a cofactor for the enzymes involved in oxidation-reduction reactions that occur in all cells during metabolism, and in this way is vital to fetal growth and development. Of course, iron, as a component of hemoglobin allows the red blood cells to distribute oxygen throughout the fetal body. Fetal oxygen is transferred from the mother to the fetus via the placenta.

Iron is needed for the normal neurodevelopment of the fetus and early childhood mental development. Iron deficiency is the most common nutrient deficiency in the world, affecting 2 billion people and as much as 30-50% of pregnant women. Given these numbers, it is startling to think about the potential

impact that a single nutrient may have on world-wide intelligence (*M.K.Georgieff, Bio Soc Tran.2008:36(6)1267-71*). Fetal and early postnatal life is a period of rapid brain growth and development. Iron is a necessary nutrient for rapidly proliferating and differentiating tissue. So, the rapidly growing fetal brain exhibits a high need for iron. Iron is important to the development of the hippocampus of the brain, which plays roles in memory (particularly long term memory), spatial navigation, and emotions. Studies have shown that inadequate iron during the prenatal period can have negative life-long neurologic effects that can never be reversed. The importance of iron for the developing fetal brain is why there is such emphasis on adequate iron intake by the World Health Organization (WHO), as well as the Institute of Medicine. The DRI for iron during pregnancy has been raised to 27 mg/day.

Given the importance of iron in prenatal nutrition, it would be a good idea to formulate a prenatal supplement with a superior form of iron, like Ferrochel® (ferrous bisglycinate) from Albion Minerals. Below is an abstract of an article concerning a clinical study that gives evidence to the value of Ferrochel® as part of prenatal nutrition.

Milman, N, et al, *J. Perinat.Med.* 2013: DOI 10.1515

Ferrous bisglycinate 25 mg iron is as effective as ferrous sulfate 50 mg iron in the prophylaxis of iron deficiency and anemia during pregnancy in a randomized trial

**Objective:** to compare the effects of oral ferrous bisglycinate 25 mg iron/day vs. ferrous sulfate 50 mg iron/day in the

prevention of iron deficiency (ID) and iron deficiency anemia (IDA) in pregnant women. Design: Randomized, double-blind, intention to treat study. Setting: Antenatal case clinic. Sample: 80 healthy ethnic Danish pregnant women.

**Key Finding:** In the prevention of iron deficiency and iron deficiency anemia in pregnant women, low dose ferrous bisglycinate 25 mg iron/day appears to be as effective as ferrous sulfate 50 mg iron/day, most likely due to the higher bioavailability of the bisglycinate iron. In addition, the frequency gastrointestinal complaints was significantly lower in the bisglycinate group than in the sulfate group. In addition, newborns weight was modestly higher in the bisglycinate group (about 6% higher on average).

## Concluding Remarks

Prenatal nutrition is key to the development of healthy newborns. There are a number of nutrients that are important in the development of the fetus. The importance and the roles for choline and iron in prenatal nutrition have been reviewed. They are two of the most important nutrients in the development of the fetus, and the bringing about of a healthy newborn. The best sources for choline and iron are:

VitaCholine® from Balchem for the best in Choline

Ferrochel® (ferrous bisglycinate chelate) from Albion

The best prenatal supplements would contain in a daily dose\*:

- 450 mg of choline from VitaCholine®
- 27 mg of iron from Ferrochel®

\* Based on the current nutrient RDA/AI for pregnancy from all dietary sources; not intended as medical advice, always consult with your doctor.

## ALBION<sup>®</sup> RESEARCH NOTES

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