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Meeting Nutritional Needs of Pregnancy Through Whole Foods

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Abstract

In order to maintain her health, a pregnant woman requires higher amounts of nutrients than a non-pregnant woman. Prenatal multivitamins are commonly suggested as a source for these essential nutrients. Synthetic multivitamins provide a pregnant woman with the reassurance that she is consuming the daily recommended amount of nutrients that will keep her and her developing baby healthy. Not commonly known is the unsettling fact that prenatal multivitamins can be potentially damaging to a mother and her developing baby. Contributors to this potential harm are the unlisted ingredients within these synthetic multi-vitamins and the risk of the actual amount of vitamins present being higher or lower than the labeled amount. Because of this inconsistency, a pregnant woman risks consuming unknowingly more or less than her daily recommended amount of nutrients. If maternal nutrient intake falls below or exceeds optimum levels, fetal growth and development and or the mother's health can be compromised, sometimes severely. The uncertainty of the contents and effects of prenatal multivitamins and the importance of maternal nutrient intake reinforces the significance of a healthy well-balanced diet. Essential nutrients are most easily absorbed from whole foods, rather than from synthetic multivitamins. In addition to better absorption fractions of many nutrients, whole foods offer a reliable source of nutrients at amounts and types consistent with the need for these nutrients. Therefore, in order for a pregnant woman to be confident she is consuming her daily recommended amount of nutrients responsible for keeping her and her developing baby healthy, she should consume a balanced diet of whole foods, largely from plant sources. In order for a pregnant woman to feel confident in the food choices she is making to ensure her and her developing baby's health, she needs dietary information in an easy and accessible form.

1. Background

A study conducted by Consumer Lab, a company that independently evaluates hundreds of health and nutrition products, found that out of 38 multivitamins tested, almost half contained more or less of the amount of nutrients labeled. One children's vitamin tested in this study contained 216% of its labeled amount of vitamin A, which an excess of can be potentially harmful. Four other multivitamins tested lacked their labeled amount of folic acid and vitamin A by 15% to 46%.[1] A similar study performed by the Chemistry of Food class at the University of North Carolina Asheville tested the amount of calcium and iron in two popular brands of prenatal supplements. The results showed consistently lower than the labeled amounts in a recommended serving. Of the 300 mg of labeled calcium in One-A-Day Prenatal Multivitamins, only 271 mg were actually found. A similar trend was found in the labeled amount of iron as well, with 28 mg labeled, but only 17 mg measured. Because all supplements, including prenatal vitamins, are only very loosely overseen by the Federal Food and Drug Administration, these false claims are possible and common. The questionable amount of vitamins and minerals in these supplements cause prenatal vitamins to be an unreliable source for the necessary and essential nutrients a pregnant woman and her developing baby need.

Misleading labels are not the only factor in prenatal vitamins that place the health of a pregnant woman and her developing baby in jeopardy. Research has shown that suspect ingredients found in prenatal vitamins such as croscarmellose sodium, polyvinyl alcohol, titanium dioxide, talc and FD&C Red #40 Lake could also have detrimental health effects. For example, polyvinyl alcohol makes up the coating on the outside of the multivitamin and could have toxic effects like carcinogenicity, and effects on behavior and metabolism. FD&C #40 Lake, which is made from petroleum, is associated with some increased hyperactivity and ADHD behaviors in children.[2] A study conducted by the Department of Maternal and Child Health at the University of Alabama found that since prenatal care became popular in the U.S, infant mortality rates have decreased and low birth-weight and preterm births have increased.[3] An exact explanation of the increase in low birth-weight and preterm births has not yet been found, but certain chemicals present in prenatal vitamins, like the ones previously mentioned, have been discovered to have carcinogenic effects, as well as effects on metabolism, behavior, and birth weight.[2]

The lack of agreement between labeled amounts and actual amounts of nutrients in these prenatal supplements is likely to result in the consumer under or over consuming certain vitamins. The risk of consuming too much or too little of a particular vitamin can be detrimental to the mother's health as well as that of her developing baby's. Because fetal growth and development relies highly on maternal nutrient intake, over or under-consuming nutrients could result in lifelong defects in organ and tissue structure and function. If there is a deficit in the nutrients being supplied to the developing baby, the limited nutrients will serve the mother's nutrient needs first before the fetus is able to absorb the nutrients it needs. Therefore, a poor nutritional status effects the developing baby more than the mother.[4] A common consequence of an inadequate nutritional status for a pregnant woman is a baby with a low birth weight. For example, during pregnancy, a woman's blood volume increases by fifty percent, therefore it is necessary for her body to make a surplus of red blood cells. If her body does not absorb enough iron, she risks premature delivery and a baby with a low birth weight.[5] Over-consuming the recommended amount of a particular vitamin can also have negative effects on the mother and developing baby. For example, an excessive intake of vitamin A could result in malformations of the embryo or fetus.[4] Because of the unpredictable amount of vitamins present in prenatal multivitamins, the repercussions of a deficient nutritional status for a pregnant woman and her developing baby are possible.

While prenatal multi-vitamin and mineral supplements are almost always prescribed to pregnant women, studies have shown that vitamins are most easily absorbed in their original whole plant food state, rather than a synthetic and concentrated form. Research conducted by Dr. Barnard illustrated that synthetic supplements are generally absorbed less effectively than the nutrients found in whole foods. Worse yet they have been separated from other nutrients and beneficial plant substances found in whole foods. Their conclusion states, "Supplements do not provide as many essential nutrients as are present in calcium-rich foods. Therefore, it is important to eat a variety of nutrient-rich whole foods rather than supplements to meet nutrition needs."[6] Consequently, in order to avoid the uncertainty of synthetic vitamins and absorb the recommended essential prenatal nutrients; a pregnant woman would need to eat a balanced, diverse and healthy diet.

This project addresses the development and marketing of a diet that would meet the nutritional needs of a pregnant woman and her developing baby without the use of prenatal multivitamins. The goal was to develop and test-market an accessible, healthy, and reliable option for meeting nutrient needs during pregnancy with whole foods. In order to achieve this goal and answer this hypothesis, preliminary research was conducted to gain an in depth understanding of the nutritional needs of pregnant women--especially nutrients that are needed in high amounts. Next, the author identified whole locally grown and sold foods in Western North Carolina that contained these critical nutrients. Data was then gathered through interviews and focus groups from women who were or had been pregnant within the last year. These interviews identified barriers to the use of tailgate markets and other local food sources, eating habits during pregnancy, and the willingness to consume all essential nutrients from whole foods. The dissemination of the research findings is through a web site, Baby Belly Basket, (http://babybellybasket.wix.com/asheville) designed by the author to market local whole foods for meeting nutrient needs during pregnancy.

2. **Methods**

A literature review was conducted to choose key nutrients for pregnancy. Local food purveyors websites (www.asapconnections.org) were consulted to determine whole foods locally available. Informal interviews were conducted with pregnant women to better understand their attitudes and beliefs about prenatal nutrition and their willingness to consider whole food sources of nutrients rather than supplemental ones.

3. Results

3.1 key nutrients for pregnancy

Each vitamin and mineral is essential to achieving optimum health for a pregnant woman and her developing baby. During pregnancy, a woman requires certain vitamins and minerals in higher amounts than the recommended amounts for a non-pregnant woman. This research focuses on nutrients that are recommended in significantly higher amounts compared to those that ranged closer to the non-pregnant recommended daily amount, and those for which the effects of over- or under-consumption could be detrimental to maternal health and fetal development. The nutrients highlighted are folate, calcium, iron, zinc, magnesium, protein, vitamin A, and vitamin B12.

Folate: Due to extensive organ and tissue growth that occurs during pregnancy, folate requirements increase considerably. Folate is involved in the synthesis of DNA, gene expression, and gene regulation. These processes can be impaired if there is a deficit of folate in a pregnant woman's diet, resulting in possible neural tube defects. Neural tube defects are malformations in the spine and brain. To prevent these malformations from occurring, it is recommended that women who are pregnant intake 600 mcg of folate per day. While there are severe consequences of under-consuming the recommended amount of folate, there is no upper limit intake of folate.[4]

Calcium: Fetal skeleton development occurs rapidly, particularly in the mother's third trimester, which enforces the significance of an adequate intake of calcium.[7] If a woman does not consume a sufficient amount of calcium during pregnancy she runs the risk of significant bone density loss, putting her at risk for osteoporosis later in life. In addition to maternal bone density loss, a deficit in calcium intake could also result in a disruption of the development of the fetal skeleton. Over-consuming calcium during pregnancy also poses a threat to maternal health and fetal development. A drastic increase in calcium intake could hinder the mother's ability to absorb other minerals such as iron, magnesium, and zinc, which are also imperative to the mother and fetus's health.[8] The recommended daily amount of calcium for pregnant women is 1000 mg.

Iron: During pregnancy a woman's blood volume increases by 50%, making it vital that she consume enough iron. Iron is used by the body to make hemoglobin, which distributes oxygen from the lungs to all of the cells in the body. This supply of oxygen and nutrients is imperative for various physiological changes occurring during pregnancy. These changes include an increase in maternal blood volume, development of the baby's own blood supply, growth of the placenta and uterus, and the preparation for blood loss at the time of delivery. In addition to these physiological changes, an adequate amount of iron is important to prevent anemia during pregnancy. Iron-deficiency anemia is the most common problem seen in pregnancy and has been associated with low birth weight, pre-term birth, and infection.[9]

Zinc: Zinc is necessary for a number of bodily activities, some of those activities are critical during pregnancy such as embryo and fetal development as well as infant growth. A study conducted to assess the effects of particular nutrients during pregnancy was conducted among 1,300 pregnant women. One group of women was given a prenatal vitamin that included zinc, while a second group was given the same prenatal vitamin, excluding zinc. The women who took the prenatal vitamin with zinc had larger than average growth measures compared to the women whose prenatal vitamins did not include zinc. The results of this study support the fact that a deficiency in zinc could inhibit growth in young children.[10] Pregnant woman are recommended to consume 11 mg of zinc in order for her and her developing baby achieve an optimum level of health.

Magnesium: While magnesium is not commonly thought of as essential to a healthy diet, it is particularly important during pregnancy. During pregnancy magnesium is increasingly lost through the mother's urine because of hormonal changes. Therefore it is essential for an expectant mother to consume additional magnesium. Magnesium is necessary for the growth and normal functioning of the mother's uterus, the development of the

baby's bones and organs, and is important for the body's entire muscle system. In order to support this growth and development a pregnant woman is recommended to consume 350 mg of magnesium daily.[11]

Protein: Protein is also needed in higher amounts during pregnancy. It has been estimated that approximately 2 pounds of protein are accumulated during pregnancy. Protein is responsible for the synthesis of new maternal and fetal tissues that are vital for a healthy pregnancy. To adequately support the growth of these tissues it is recommended that 71 gm are consumed daily during pregnancy.[4]

Vitamin A: Unlike most vitamins, an excess of vitamin A is of more concern than a deficiency. In underdeveloped countries a deficiency in vitamin A is a common problem that can result in malformations of fetal lungs, the urinary tract, and heart, but this is less of a concern for developed nations. In the United States the widespread availability of vitamin A poses a larger problem with over-consumption of vitamin A. Vitamin A comes in two main forms, pre-formed vitamin A found in animal products and some supplements and as beta-carotene (a precursor to vitamin A that can be turned into vitamin A in the body) in fruits and vegetables and some supplements. It is only the pre-formed Vitamin A that is toxic at higher levels. Vitamin A is not only found in food and multivitamins, but also in medications such as Accutane and Retin-A for acne and wrinkle treatment. An excess amount of vitamin A in a pregnant woman's diet increases the risk of fetal abnormalities. Due to this risk of over-consumption, pregnant women are recommended to take no more than 5000 IU of vitamin A daily.[4]

Vitamin B12: During pregnancy the daily recommended amount of vitamin B12 is not as elevated as other vitamins, but it is just as important to a healthy pregnancy. If a woman is following a vegetarian diet during pregnancy it can be difficult for her to find vitamin B12 from whole foods. Vitamin B12 is produced from bacteria that lives in animals' gastrointestinal tract, therefore it cannot be found in plant based foods. Because of this, a pregnant woman following a vegetarian or vegan diet would need to take a vitamin B12 supplement while also adding enriched cereal and fortified soy milk to her diet.[12] A deficiency in vitamin B12 may not be seen until after pregnancy, and can result in neurological impairments and growth failure. To prevent this and sustain a healthy intake of vitamin B12, pregnant women are recommended to consume 2.6 mcg of vitamin B12.

3.2 local food sources of key nutrients

Table 1 displays local food available in the Western North Carolina region that are the most abundant sources of the essential nutrients previously highlighted.

Table 1.Western North Carolina whole food sources of key pregnancy nutrients

Folate	Calcium	Iron	Zinc	Magnesium	Protein	Vitamin A	Vitamin-B12
Spinach, boiled,1/2 cup: 131 mcg	Collard Greens, boiled, 1 cup: 148 mg	Spinach, boiled, 1/2 cup: 3.21 mg	Collard Greens, boiled, 1 cup: 1.22 mg	Spinach, boiled, 1/2 cup: 79 mg	Potato, baked, 1 potato with skin: 4.7 g	Sweet potato, baked with skin, 1 potato: 2488 RE	Beef Flank, 3.5 ounces: 3.36 mcg
Asparagus, boiled, 1/2 cup: 88 mcg	Spinach, boiled, 1/2 cup: 122 mg	Potato, baked, 1 potato with skin: 2.75 mg	Leeks, raw, 1/4 cup: 1.2 mg	Potato, baked, 1 potato with skin: 55 mg	Peas, boiled, 1/2 cup: 4.3g	Spinach, boiled, 1/2 cup: 737 RE	Salmon, smoked, 3 ounces: 2.77 mcg
Turnip Greens, boiled, 1/2 cup: 85 mcg	Turnip Greens, boiled, 1/2 cup: 99 mg	Peas, boiled, 1/2 cup: 1.24 mg	Peas, raw, 1/2 cup: 0.97 mg	Broccoli, boiled, 1/2 cup: 47 mg	Spinach, boiled, 1/2 cup: 2.7g	Kale: 481 RE	Egg, boiled, 1 large: 0.66 mcg
Broccoli, boiled, 1/2 cup: 54 mcg	Broccoli, boiled 1/2 cup: 89 mg	Broccoli, boiled, 1/2 cup: 0.89 mg	Spinach, boiled, 1/2 cup: 0.69 mg	Beets, boiled, 1/2 cup: 31 mg	Sweet Corn, boiled, 1/2 cup: 2.7g	Collard Greens, boiled, 1 cup: 422 RE	Whole Wheat Bread, 1 slice: 1.1 mcg

Folate	Calcium	Iron	Zinc	Magnesium	Protein	Vitamin A	Vitamin-B12
Peas, raw or boiled, 1/2 cup: 51 mcg	Bok Choy, boiled, 1/2 cup: 79 mg	Bok Choy, boiled, 1/2 cup: 0.88 mg	Potato, baked, 1 potato with skin: 0.65 mg	Sweet Corn, boiled, 1/2 cup: 26 mg	Asparagus, boiled, 1/2 cup: 2.3 g	Turnip Greens, boiled, 1/2 cup: 396 RE	Tempeh, 1/2 cup: 0.7 mcg

3.3 beliefs and practices of local pregnant women

In order to be confident that the information relayed through Baby Belly Basket is pertinent to its target audience, 5 interviews were conducted with women who were pregnant. The interview questions addressed the women's interest in purchasing local food to meet their nutritional needs, their dietary and supplement use experiences during pregnancy, barriers they have experienced to the use of tailgate markets, and their preferred way of receiving information about a whole foods diet for prenatal nutrition. All five women were taking prenatal multi-vitamins during pregnancy, but agreed that it would be possible to get all of the nutrients they needed from whole foods. Four of the five women experienced nausea when they began taking the vitamins which was relieved by taking them at night time before bed.

When asked what information would make them feel confident that they were meeting their nutrient needs through whole foods, each woman agreed that a detailed dietary plan outlined for them from a reliable source would be helpful. Despite this optimistic response to the idea of whole foods meeting nutritional needs, two women also said that prenatal multi-vitamins provide them with security. Their responses were, “prenatal vitamins ease my mind” and “prenatal vitamins serve a good purpose for the everyday eater.” Each of the five women said that their doctor never provided nutritional information. Three of the women sought nutritional information from books and internet sources. The women’s responses to the question of whether they pay attention to where their food comes from were congruent with suggestions made in Baby Belly Basket, those suggestions being to focus on whole, local, organic food. Two out of the five women focus on purchasing organic foods while the other three women base their food purchases on what is local. Three of the women already shop at local tailgate markets for their produce, while one woman has her own garden in which she grows food and the fifth woman feels that the tailgate market produce is too expensive for her budget. The last question asked the women how they would like to access the information from my research. Four out of the five women stated that the information should either come from or be recommended by a reliable source. Because this research has been conducted by an undergraduate Health and Wellness Promotion Major, myself, and the research and content on Baby Belly Basket has been reviewed by a PhD nutritionist, Amy Lanou, Baby Belly Basket meets this requirement of a reliable source. Each woman agreed that an internet source would be most accessible.

3.4 dissemination of information

The findings of this research are dissemination in a website titled, Baby Belly Basket, (http://babybellybasket.wix.com/asheville). The name was chosen because of its playful, welcoming and non-intimidating connotation. While the research is quite serious, the project title and online presentation have been crafted so as to make the information approachable and the experience of browsing the site enjoyable in hopes of maintaining the lighthearted appeal of visiting a local tailgate market. The language chosen to relay the content addresses the reader personally as if the author were actually talking to them. This provides an intimate aspect to the website, making the content more approachable.

The website content is separated into seven sections: the home page, a description of my research, local tailgate markets, essential nutrients, local foods that are in season, recipes, and a contact form. The home page includes a slide show of recent happenings in the area that concern food or pregnancy and is updated on a regular basis. This element provides the website with a personal detail, much like a personal blog would. The section devoted to describing why the research was conducted is titled, The Story. The Story provides background on who I am, why I am interested in pregnancy and nutrition, and why I conducted this research. By relaying my own personal information the readers will be able to trust and know where the content is coming from. The page titled, Local Markets, lists tailgate and farmers markets in the surrounding area. The months in which each particular market is in

operation is provided, as well as its location. There is also a map for each market so that the market can be easily located.

The essential nutrients highlighted are located under the tab titled, Nutrients. Once a particular nutrient is selected the viewer is taken to a page that describes the benefits of the nutrient for the mother and baby as well as the consequences of over or under consuming the nutrient. Beneath this description is a list of 6 local foods that are most abundant in the featured nutrient. The fifth page entitled, The Goods, allows the viewer to learn about which local foods are in season during each month of the year. Under each local food item for a particular month is a list of the abundance of the highlighted essential nutrients within that food. This allows the viewer to know how much of the essential nutrients are in the food she is consuming. The recipes page incorporates the 6 local foods previously discussed into healthy recipes that the viewer can make and trust that she is getting the nutrients that she needs. This section serves as a way to help the viewer understand that absorbing the essential nutrients that her and her developing baby need through whole local foods is possible. The last section of the website is a contact form that the viewer can fill out and will be sent to my email for me to answer any questions or comments.

Figure 1. Home page of Baby Belly Basket

Figure 2. Vitamin A nutrient page of Baby Belly Basket

4. Discussion

For a pregnant women to achieve optimum health for herself and her baby, her body requires a higher amount of nutrients than a non-pregnant women. While prenatal multivitamins are the suggested source for these nutrients, they could also cause the over- or under-consumption of certain vitamins. This is possible due to the actual amount of nutrients within these multivitamins being inconsistent with the labeled amount, as well as additional ingredients that could be harmful to the body if ingested. Nutrients are more easily absorbed when in a whole foods form rather than in a synthetic multivitamin. Also the amount of nutrients in whole foods is more reliable compared to nutrients found in synthetic multivitamins. Data collected from interviews with pregnant women supports the idea that a diet of whole foods could be a possible method to meeting nutrient needs during pregnancy, and needs to be relayed in a detailed nutritional plan. Because prenatal multivitamins provide a sense of security for some pregnant women, it could be beneficial for pregnant women to include a supplement of a particular nutrient that is needed in high amounts during pregnancy, such as a folate supplement, in their diet of whole foods. Data from the interviews supports the dissemination of this research through a web venue, such as a website, as a successful way to access this information. In order for the website to be creditable and reliable it must be supported by a reliable source. Baby Belly Basket is supported by Dr. Amy Lanou and by the National Research Initiative of the National Institute of Food and Agriculture, USDA, Grant. In conclusion, Baby Belly Basket is a reliable source for pregnant women to learn about a whole foods diet that can meet nutritional needs during pregnancy.

The next steps in my research will be to test market Baby Belly Basket among a focus group that will include up the seven currently pregnant or recently pregnant women. The feedback these women will provide will help determine what is most helpful about Baby Belly Basket and what is lacking. The results of this focus group will provide the information needed to mold Baby Belly Basket into an accessible venue that effectively supplies the information necessary to consume a whole foods diet that will meet the nutritional needs of a pregnant woman and her developing baby.

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