PRAMSGRAM
OKLAHOMA PREGNANCY RISK ASSESSMENT MONITORING SYSTEM · VOL 8 NO 3

Folic Acid Knowledge and Multivitamin Use Among Oklahoma Women

Introduction

Birth defects are the leading cause of infant mortality in the United States. In 1994, one of every five infant deaths was caused by a birth defect.[1] Unfortunately, two-thirds of birth defects are of unknown causes. Research has discovered that folic acid, a B vitamin, can help prevent neural tube defects (NTDs), serious birth defects of the brain and spine.[2] An estimated 50 to 75 percent of NTDs can be prevented if women consume enough folic acid. This exciting finding can assist in the reduction of infant morbidity and mortality.

Three days after a woman has missed her menstrual period the neural tube (the part that becomes the baby's brain and spinal cord) has already begun to form. Ten days later, about the time she confirms the pregnancy with a pregnancy test, the neural tube is completely formed. If the neural tube fails to develop normally, very serious defects can occur. The infant may be born with anencephaly (no brain) and die soon after birth. Or, the infant may be born with spina bifida (an opening in the spine). Most children with spina bifida can have problems such as paralysis of the legs, lack of bowel and bladder control and hydrocephalus (water on the brain). Learning disabilities are also associated with spina bifida.

The US Public Health Service issued a recommendation for all women of child bearing age (teens to 50s) who are physically capable of becoming pregnant to consume 400 micrograms (0.4 milligrams) of folic acid every day to prevent NTDs.[2] Consuming folic acid every day throughout childbearing years is critical, because half of all pregnancies in Oklahoma are unplanned. As discussed previously, waiting to take folic acid until after a positive pregnancy test is too late — the neural tube is already formed. Whether or not women are using a method of birth control, they need to be consuming enough folic acid every day, even though they may not be planning a pregnancy.

It is difficult to obtain enough folate (the natural form of folic acid found in food) from food sources alone for the following reasons: few foods are high in folate, only about half the folate occurring naturally in foods is absorbed by the body, and food processing and cooking destroys 50 to 90 percent of folate in foods.[3] The Oklahoma State Department of Health recommends women of childbearing age obtain their folic acid from three sources each day: a multivitamin that contains 400 micrograms (0.4 milligrams) of folic acid, foods high in folate, and foods fortified with folic acid. This recommendation assures women get adequate amounts of folic acid each day.

Additional studies have identified other potential benefits of folic acid including reducing a number of other serious birth defects, such as cleft lip, limb reduction defects, and heart defects.[4,5] Tamura et al.

In Oklahoma

- Knowledge of the importance of folic acid in reducing certain birth defects increased from 66% in 1996 to 74% in 1997.
- Multivitamin use one month prior to pregnancy increased by only 2% from 1996 to 1997.
- Only 28% of new mothers were taking multivitamins daily one month prior to pregnancy.
- Of mothers taking folic acid prior to pregnancy, 64.5% intended the pregnancy and 35.5% did not intend to be pregnant at that time.
- Mothers with 13 or more years of education were 2.8 times as likely to take multivitamins daily one month prior to pregnancy if their pregnancy was intended rather than unintended.
- 40% of mothers 30 or older were taking multivitamins one month prior to pregnancy, but these mothers delivered only 23% of live births.
- Only 27% of mothers age 20-29 were taking multivitamins one month prior to pregnancy and these mothers delivered 60% of live births.

found, among pregnant women with higher serum folate concentrations, that fetal growth retardation and maternal infection were less prevalent, and birth weight and Apgar scores of newborns were higher.[6] Folic acid has also been shown to reduce levels of homocystine in the blood. Homocystine is associated with the risk of heart disease and strokes in adults.[7]

Background

The Oklahoma Birth Defects Registry (OBDR) is a public health surveillance program that identifies birth defects among children born in Oklahoma. According to OBDR, NTDs affect a significant portion of babies born in Oklahoma. The three-year rate for NTDs in Oklahoma (1994–96) is 8.7 per 10,000 live births. The 1995-97 rate is 7.2 per 10,000 live births. Three or four infants are born every month in Oklahoma with an NTD. While the rate of NTDs appears to be declining, it is well above the Healthy People 2000 Goal of 3.0 per 10,000 live births.

In 1997, the Oklahoma State Department of Health, the Oklahoma Chapter of the March of Dimes Birth Defects Foundation, and the Oklahoma Pharmacists Association collaborated in a statewide Folic Acid Mother's Day Campaign. Posters and educational Mother's Day cards were sent to all pharmacies and county health departments throughout Oklahoma. Health care providers throughout Oklahoma were encouraged to educate their childbearing age patients about the importance of folic acid intake before pregnancy.

Methods

To measure knowledge of folic acid, the PRAMS survey asks women, "Have you ever heard or read that taking the vitamin folic acid can help prevent some birth defects?" To determine prevalence of multivitamin use prior to pregnancy, women are asked, "Were you taking a multivitamin daily for one month before you got pregnant?" Selected family planning questions have been evaluated to determine intention of pregnancy.

Overall prevalence and demographic characteristics associated with knowledge of folic acid and multivitamin use are examined. Frequency distributions and 95percent confidence intervals (95% CI) are presented. All differences discussed in the narrative are significant at a p=0.05 level.

Knowledge of Folic Acid

Knowledge of the importance of folic acid in preventing some birth defects was shown to increase between year 1 and year 2 of the study period. The odds of women who delivered a live birth in 1997 knowing about folic acid was 1.5 times greater than among women who delivered a live birth in 1996. Such knowledge could have been obtained at any time prior to, during, or subsequent to the pregnancy.

Multivitamin Use

Daily multivitamin use one month prior to pregnancy was examined among all women delivering a live birth. Differences according to maternal age, education, marital status, race and ethnicity were related to use of multivitamins.

As age increased, multivitamin use did as well. Compared with teenage mothers, mothers aged 20-29 were 2.1 times more likely and mothers 30 or older were 3.2 times more likely to take multivitamins. Mothers with 13 or more years of education were more likely to take multivitamins than those with 12 years of education or less. White mothers were more likely to take multivitamins than minority populations; however, when adjusted by education level, the difference was insignificant (data not shown). Married mothers were more than 1.5 times as likely to take multivitamins as unmarried mothers (Table 1). Income source was another predictor of multivitamin use prior to pregnancy. Mothers whose source of income was either a job or business were 1.5 times as likely to take multivitamins as mothers receiving public assistance (data not shown).

PRAMS is a population-based survey of Oklahoma women with a recent delivery. Analysis weights were applied to adjust for selection probability and non-response. By using weighted analysis, researchers can make strong statements about the preconception and perinatal periods for the entire population of women in Oklahoma delivering a live birth. Thus, state-specific decisions on policy and program development can be made. A stratified systematic sampling approach is used to select approximately 200 new mothers each month from the state's live birth registry. Up to three mailed questionnaires are used to solicit a response. Telephone interviews are attempted for non-respondents. Data for this report reflect live births occurring between January 1996 and December 1997. The overall response rate was 78 percent (78% in 1996 & 78% in 1997). This analysis includes information collected from 4146 mothers. The following are the sample sizes for the questions used in this analysis: Knowledge of Folic Acid 4,114; Multivitamin Use 4,117; Intention of Pregnancy 3878; Mothers age 4,135; Mother's education 3,822; Race 4,077; Marital Status at Conception 4,118; Parity 4,109; Source of Income 4,074; Source of Prenatal Care Payment 3726; all data represent state estimates.

Table 1 Mothers Taking Multivitamins Daily One Month Prior to Pregnancy

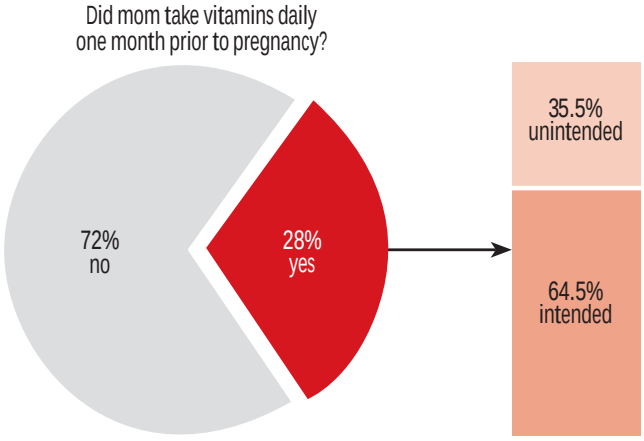
			Intended		Unintended	
Characteristics	All	95% CI	Preg	95% CI	Preg	95% CI
Age						
≤17	9.6	(3.7,15.6)	7.0	(-3.4,17.3)	10.6	(3.3,18.0)
18-19	15.3	(8.9,21.8)	8.5	(0.0,17.0)	17.2	(8.6,25.8)
20-29	27.1	(24.1 ,30.1)	33.5	(29.2,37.8)	19.4	(15.3,23.5)
30+	40.1	(35.1,45.2)	46.0	(39.6,52.5)	30.6	(22.2,39.1)
Race						
White	30.4	(27.6,33.1)	38.5	(34.5,42.4)	20.4	(16.6,24.2)
Black	19.5	(12.5,26.4)	18.9	(6.3,31.4)	17.0	(8.8,25.1)
Native Amer.	22.3	(15.2,29.4)	28.3	(16.1,40.4)	19.7	(10.3,29.1)
Hispanic	20.8	(12.9,28.7)	20.2	(10.3,30.1)	22.0	(8.0,36.0)
Education						
≤12 yrs	21.5	(18.6,24.4)	21.0	(16.7,25.4)	20.6	(16.6,24.6)
13+	37.1	(33.2,41.0)	48.8	(43.7,53.8)	17.3	(12.3,22.3)
Marital Status						
Married	33.5	(30.5,36.5)	39.3	(35.4,43.2)	23.4	(18.6,28.2)
Unmarried	19.4	(15.9,22.9)	20.9	(14.3,27.5)	17.2	(13.0,21.3)
Parity						
1st Birth	26.1	(22.5,29.6)	35.9	(30.6,41.2)	15.3	(10.9,19.6)
Prev. Births	28.3	(25.1,31.4)	34.5	(30.0,39.1)	22.0	(17.8,26.3)

CI= Confidence Interval

Intention of Pregnancy and Multivitamin Use

Mothers with intended pregnancies were more likely to take multivitamins prior to pregnancy compared to those whose pregnancies were unintended (Figure 1). Intended pregnancies overall showed a significant relationship to daily multivitamin use prior to pregnancy. However, the difference was more pronounced among selected demographic groups. Mothers 20 or older were over 1.5 times as likely to use multivitamins if their pregnancy was intended rather than unintended.

Figure 1 Multivitamin Use and Intention of Pregnancy

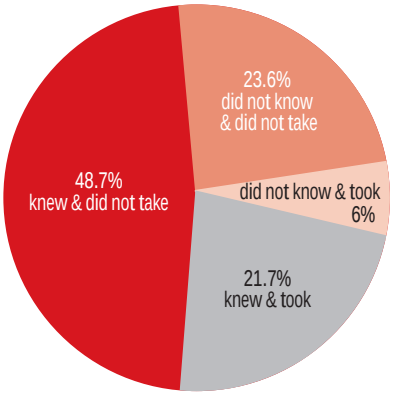


White mothers were almost twice as likely to use multivitamins if their pregnancy was intended rather than unintended. Mothers with 13 or more years of education were 2.8 times as likely to take multivitamins if their pregnancy was intended rather than unintended. Married mothers were 1.6 times as likely to take multivitamins if their pregnancy was intended rather than unintended (Table 1). Mothers receiving income from a job were twice as likely to take multivitamins if their pregnancy was intended rather than unintended (data not shown).

Folic Acid Knowledge and Multivitamin Use

Among mothers responding to both questions about knowledge of folic acid and vitamin use: 21.7 percent knew about folic acid and were taking a multivitamin daily one month prior to pregnancy, 48.7 percent knew and were not taking vitamins, 6 percent did not know and were taking vitamins and 23.6 percent did not know about folic acid and were not taking multivitamins daily one month prior to pregnancy (Figure 2) .

Figure 2 Multivitamin Use* and Knowledge of Folic Acid**



* Vitamin use daily one month prior to conception
**Knowledge could have been obtained up to 15 months after conception

Data Limitations

One limitation in comparing knowledge of folic acid and vitamin intake is the discrepancy between the questions concerning knowledge and vitamin use. Since the mother could have learned of folic acid up to 15 months after conception, it is important not to assume that use or non-use of multivitamins during the month prior to conception was necessarily related to knowledge of folic acid. Other limitations include the self reported nature of the data and recall bias. Participants may over or under report either knowledge or use.

Summary and Conclusions

The importance of folic acid in preventing birth defects became a major public health educational effort in 1997 with Oklahoma's Folic Acid Mother's Day Campaign. From 1996 to 1997, there was an increase in knowledge of folic acid to prevent birth defects of 7.8 percent. However, the daily use of multivitamins one month before pregnancy increased by only 2 percent from 1996 to 1997 (from 26.8% to 28.7%). This is comparable to the results of a national survey that found 30 percent of non-pregnant women took multivitamins daily in 1997.[8] Clearly, information is reaching childbearing age women regarding folic acid but few women are making a conscious choice to increase their intake of folic acid before pregnancy.

There is disparity in use of multivitamins between intended and unintended pregnancy among all demographic variables. With half of all Oklahoma pregnancies being unintended, assuring women obtain adequate levels of folic acid even when they are not planning to become pregnant should be a primary focus of NTD prevention activities. At approximately 4 cents per day, multivitamins are inexpensive considering the financial and emotional cost to Oklahoma families impacted by neural tube defects.

Recommendations

Great strides have been made in educating childbearing age women in Oklahoma concerning the importance of folic acid to prevent birth defects. The challenge now is to assure knowledge translates into behavioral change, and women take multivitamins prior to pregnancy.

- Create an Oklahoma Coalition on Folic Acid to coordinate NTD prevention activities statewide and at the community level.
- Provide educational opportunities for health care professionals concerning folic acid and NTD prevention.
- Incorporate NTD prevention into medical school and other allied health curriculum (prevention of both first occurrence and recurrence of NTDs).
- Assure all health care providers make the standard recommendation that childbearing age women obtain their folic acid from all three sources each day: a multivitamin that contains 400 micrograms (0.4 milligrams) of folic acid, foods high in folate, and foods fortified with folic acid.
- Increase folic acid knowledge of the public to reduce NTDs through educational materials and multimedia.
- Utilize materials developed by the National Council on Folic Acid, the Centers for Disease Control and Prevention and the March of Dimes, especially those targeting women not planning pregnancy.
- Develop a system to distribute multivitamins to all childbearing age women throughout the state of Oklahoma.
- Continue to support and utilize public health surveillance programs such as the Oklahoma Birth Defects Registry, PRAMS, and Behavioral Risk Factor Surveillance System to monitor incidence, occurrence, and effectiveness of NTD prevention efforts.

References

1. Petrini, J, et al. An Overview of Infant Mortality and Birth Defects in the United States. *Teratology,* 1997, 56 (1/2): 8-9
2. Recommendations for the Use of Folic Acid to Reduce the Number of Cases of Spina Bifida and Other Neural Tube Defects. *Morbidity and Mortality Weekly Report.* September 11, 1992/Vol 41/No RR-14
3. *Perspective in Nutrition.* Times Mirror/Mosby College Publishing,1990. P349-354.
4. Shaw, G.M., et al. Risks of orofacial clefts in children born to women using multivitamins containing folic acid periconceptionally. *Lancet* 1995; 346: 393-396.
5. Shaw, G.M., et al. Maternal periconceptional use of multivitamins and reduced risk for conotruncal heart and limb reduction defects among offspring. *American Journal of Medical Genetics,* 1995, 59(4): 536-545.
6. Tamura, T, et al. Serum concentrations of zinc, folate, vitamins A and E, and proteins and their relationships to pregnancy outcome. *Acta Obstetricia et Gynecolagica Scandinavica,* 1997, Supplement 165: 76: 63-70.
7. Selhub, J. et al. Association between plasma homocysteine concentrations and extracranial carotid-artery stenosis. *The New England Journal of Medicine,* 1995, 332(5): 286-291.
8. *Preparing for Pregnancy II,* March of Dimes Birth Defects Foundation, June 1997.

The PRAMS team acknowledges contribution to authorship by Kay Pearson, MS, RD, LD, Juliann Montgomery, MPH; Wanda Thomas; Janis Campbell, PhD; and Michele Cote, MPH. The PRAMS team expresses appreciation to the Centers for Disease Control and Prevention (CDC) for review and comment.

PRAMS Program
Maternal & Child Health Service
Oklahoma State Department of Health
1000 NE 10th St. · Oklahoma City, OK
73117-1299 · (405) 271-6761
http://www.health.state.ok.us

Funding for the PRAMS Program is provided in part by the Centers for Disease Control and Prevention, Atlanta, GA (Grant No. U50/CCU613668), and Maternal and Child Health Bureau, Department of Health and Human Services.

The PRAMS GRAM is issued by the Oklahoma State Department of Health, as authorized by J.R. Nida, M.D., Commissioner of Health. 8,000 copies were printed by Oklahoma University Printing Services in June 1999 at a cost of $1,875. Copies have been deposited with the Publications Clearinghouse of the Oklahoma Department of Libraries.

Design: Shauna Schroder Faltyn, Office of Communications, OSDH

Facts About Neural Tube Defects

What is a neural tube defect?

The neural tube forms the baby's brain and spinal cord. The neural tube is completely formed at 26 to 28 days after conception. This is about the time most women find out they are pregnant. If the neural tube does not develop normally, the two most common defects that occur are Anencephaly and Spina Bifida.

Anencephaly

The infant may be born with anencephaly (no brain). It is caused by partial or complete absence of the baby's skull. The baby's brain is damaged without this protection and does not develop as it should. These babies die soon after birth.

Spina bifida

The infant may be born with spina bifida (an opening in the spine). A lump is present on the back that contains part of the spinal cord. The lump may be very small or as large as a grapefruit. Sometimes the defect does not have a skin covering. Spinal fluid may leak from the surface. Infection is always a danger until surgery and healing take place.

Both genetics (inherited) and the environment could cause neural tube defects. However, not enough is known to pinpoint one specific cause.

What health problems do children with spina bifida have growing up?

Babies born with spina bifida may need many surgeries throughout their life. The opening in the spine must be closed to prevent nerve damage and infection. Many children with spina bifida have hydrocephalus (water on the brain). They must have a shunt put in to reduce pressure on the brain. A shunt is a long tube that drains extra fluid from the brain to the heart or stomach area. Many children have paralysis of the legs. They may have a mild form of spina bifida and need splints on their legs and feet, and/or canes to help them walk. However, they may be completely paralyzed and need a wheelchair. Many children with spina bifida have problems controlling their bowel and bladder. This is a difficult issue for children with spina bifida, and one that causes concern and embarrassment. Children can be taught self catheterization and bowel management to prevent urinary tract infection and avoid accidents.

What can you do to prevent a neural tube defect in your baby?

The Centers for Disease Control and Prevention (CDC) want to prevent 50 percent to 75 percent of all neural tube defects. There is an easy way to do this. Childbearing age women (teens through 50s) should take a multivitamin with 400 micrograms (0.4 milligrams) of folic acid before they become pregnant. If women wait until they find out they are pregnant to start taking a multivitamin, it is too late. The brain and spinal cord are already formed.

Half of all pregnancies in Oklahoma are not planned. All women throughout their childbearing years should make it a part of their daily routine to take a multivitamin containing 400 micrograms (0.4 milligrams) of folic acid. They also need to eat foods high in folate. The amount of folic acid absorbed from foods is not enough to prevent birth defects. That is why women should do all three: take a multivitamin with folic acid, eat foods high in folate, and eat foods fortified with folic acid. A list of foods high in folate is on the back of this brochure.

What should women do who have already had an NTD affected pregnancy?

If you have had a baby with a neural tube defect, you can reduce the risk of it occurring in future pregnancies. Take a multivitamin with 400 micrograms (0.4 milligrams) of folic acid every day and eat foods high in folate. When you are trying to become pregnant, switch to 4 milligrams of folic acid every day. This level can only be given by a physician's prescription. Do not try to get this amount by taking more

than one multivitamin. Once you become pregnant, continue taking 4 milligrams of folic acid the first three months of your pregnancy.

Can neural tube defects be diagnosed during pregnancy?

A test that will detect most babies with neural tube defects can be done at 16 weeks of pregnancy. This prenatal blood test measures the level of the chemical alpha-feta-protein (AFP) in the mother's blood. AFP is a protein made by the baby's liver. An open area in the baby's spine causes AFP to leak into the amniotic fluid (the water surrounding the baby). The level of AFP in the mother's blood increases. This test is a screening test only. Ultrasound testing and amniocentesis (taking a sample of water surrounding the baby) can detect neural tube defects during pregnancy.

Foods High in Folate

It is difficult to obtain enough folate (the natural form of folic acid found in food) just from food for the following reasons: few foods are high in folate, only about half the folate occurring naturally in foods is absorbed by the body, and food processing and cooking destroys 50 to 90 percent of folate in foods. As a result, most women only get about 200 micrograms of folic acid each day. This is half the recommended amount. As an example, one cup of orange juice provides 100 micrograms of folic acid. But with only 50 percent absorption, you would have to consume 8 cups of orange juice each day to get the recommended 400 micrograms of folic acid. The following food amounts contain 400 micrograms of folic acid: 15 spears of broccoli, 8.5 cups of peas, 11 cups of cauliflower, 16.5 cups of cantaloupe, and 17 oranges.

In January 1998, the Food and Drug Administration began requiring manufacturers to add folic acid to enriched flour, bread, rolls and buns, farina, corn grits, cornmeal, rice and noodle products. A serving of each product will provide about 10 percent of the recommended amount of folic acid, or 40 micrograms. Therefore, to obtain 400 micrograms of folic acid from bread, you would have to eat 10 slices of bread each day. Most breakfast cereals are fortified with 100 micrograms of folic acid. Four bowls of most breakfast cereals would provide 400 micrograms of folic acid. However, a few brands have added 400 micrograms of folic acid per serving (these include Total, Product 19, Multi Grain Cheerios Plus, and Smart Start).

The body more readily absorbs the synthetic form of folic acid, found in multivitamins and fortified grains. The Oklahoma State Department of Health recommends women obtain their folic acid from three sources each day: a multivitamin that contains 400 micrograms (0.4 milligrams) of folic acid, foods high in folate, and foods fortified with folic acid. This recommendation assures women get the correct amount of folic acid each day.

Foods Containing Folic Acid (in mcg) by Serving Size

Chicken Liver, cooked (3 oz)	655
Product 19 Cereal (1 c)	400
Total Cereal (3/4 c)	400
MultiGrain Cheerios Plus Cereal (1 c)	400
Smart Start Cereal (1 c)	400
Lentils, cooked (1 c)*	358
Pinto Beans, cooked (1 c)*	294
Red Kidney Beans, cooked (1 c)*	229
Lima Beans, cooked (1 c)	156
Orange Juice, frozen conc. (1 c)*	109
Spinach, raw (1c)	108
Spinach, cooked (1/2 c)	105
Asparagus, cooked (5 spears)	101
Most Breakfast Cereals (1 c)*	100
Wheat Germ, toasted (1/4 c)	100
Turnip Greens, cooked (1/2 c)	85
Chick-Peas, canned (1/2 c)	80
Romaine Lettuce, shredded (1 c)	76
Split peas, cooked (1/2 c)	64
Broccoli, cooked (1 spear)	52
Cantaloupe (1 c)	48
Peas, cooked (1/2 c)	47
Brussel Sprouts, cooked (1/2 c)	47
Orange (1 medium)	47
Beets, cooked (1/2 c)	45
Bread, enriched (1 slice)	40
Rice, noodles, macaroni, cooked (1/2 c)	40
Cauliflower, cooked (1/2 c)	37

Source: *Bowes & Church's Food values of Portions Commonly Used, and manufacturers.*

*Food items available on Wood Food Package.