

Knowledge and Usage Patterns of Folic Acid amongst Physician Assistant Students at the University of Texas Medical Branch at Galveston.

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Citation

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Abstract

Physician Assistant (PA) students are educated that 400 micrograms (μg) of daily folic acid (FA) is a vital component of prenatal care to reduce fetal development abnormalities. Studies have shown that higher education level is correlative with the use of daily FA in women of reproductive age. The objective of this study was to assess PA students' knowledge of the physiologic implications of FA supplementation, the recommended dosage and intake regimen, and how having this knowledge impacted their behavior. A knowledge-based questionnaire was given to 59 first year female PA students and 39 third year female PA students at the University of Texas Medical Branch at Galveston (UTMB). Overall FA use amongst female UTMB PA students is 66.3%. Furthermore, 40% of the third year students consumed 400 μg of FA daily as opposed to 7.8% of the first year students. One-hundred percent of the third year students knew that FA deficiency caused NTDs, and 86.4% of the first year students recognized this causation. There was poor compliance for following the United States Preventative Services Task Force (USPSTF) recommended FA regimen amongst students in the UTMB PA program. The results in our study were comparable to the previous publications, finding that the majority of women in both our study and the general population acknowledged the importance of FA supplementation.

BACKGROUND AND SIGNIFICANCE

Folate, Vitamin B₉, is a naturally occurring water-soluble vitamin. Foods containing folate include leafy green vegetables, oranges, legumes, and liver (Brown et al., 1997). Due to the poor bioavailability and limited food sources of folate, a synthetic form was developed: FA (Winkels, Brouwer, Siebelink, Katan, & Verhoef, 2007). The U.S. Public Health Service issued a recommendation in 1992 stating "all women of reproductive age in the U.S., capable of becoming pregnant, should consume 400 μg of FA daily to reduce the risk of having a pregnancy affected by [neural tube defect] NTD" (Prue, Flores, Panissidi, & Lira, 2008). The Food and Drug Administration (FDA) utilized this recommendation in 1998, and mandated that all enriched grains be fortified with FA (CDC, 2007). In 2005 the Dietary Guidelines for Americans (DGA) made an effort to inform the general population about these new recommendations, and advocated women consume 400 μg of FA daily in multivitamin or supplement form in addition to the FA provided by enriched foods (Cena et al., 2008). In May

2009, the USPSTF recommended "all women planning or capable of pregnancy take a daily supplement containing 400 μg – 800 μg of FA" (U.S. Preventative Services Task Force, 2009). The importance of FA is annually recognized by the Department of Health and Human Services, the Centers for Disease Control, and the National Birth Defects Prevention Network during January's National Birth Defects Prevention Month (Center for Disease Control and Prevention, 2007). Lifetime healthcare costs for children suffering from spina bifida can exceed two million dollars per child for medical and surgical care of the individual (Spina Bifida Association, 2009). It is important for women of reproductive age to be proactive regarding their health and the health of a potential fetus.

Despite the profound FA fortification programs enforced by the FDA in the early 1990s, approximately 4,000 cases of NTDs are reported annually in the U.S. (Pawlak et al., 2008). NTDs are caused by failure of the neural tube to close during embryogenesis. During pregnancy neural tube closure begins on day 18 and concludes on day 26 of embryonic

development (Lamers, Prinz-Langenohl, Brämshwieg, & Pietrzik, 2006). The three most common NTDs are: spina bifida, anencephaly, and encephalocele. Studies show that if a pregnant woman consumes 400 µg of FA daily periconception, the incidence of spina bifida and anencephaly are decreased 40-80 percent (Grosse & Collins, 2007). In addition to NTD prevention, FA supplementation also reduces cleft palate deformities and genitourinary abnormalities (Berry et al., 1999). Almost 50 percent of pregnancies are unplanned and NTDs develop by the fifth week of pregnancy. Thus, it is paramount that FA be supplemented daily by all women of reproductive age (Grosse, Waitzman, Romano, & Mulinare, 2005). The most important periods of supplementation include antenatal, intranatal, and internatal. Antenatal, or preconception, includes the entire time frame of reproductive age, but at least one month before conception (Wehby & Murray, 2008). Internatal care is defined as the care between pregnancies (Lu et al., 2006). Due to the high rate of unplanned pregnancies, FA consumption during the antenatal period is essential.

In addition to aiding fetal development, FA supplementation promotes maternal health during pregnancy. FA deficiency is related to numerous maternal complications including preeclampsia, intrauterine growth restrictions, placental infarction and abruption, and early pregnancy loss (Charles et al., 2005). Research shows that 400 µg of daily FA intake during pregnancy can prevent maternal premature arteriosclerosis and venous thrombosis (Charles et al., 2005). FA intake greater than 400 µg daily has been shown to reduce the risk of low birth weight; however, FA consumption even at the recommended amount has no effect on the mean birth weight (Charles et al., 2005). Recently, a study by Dr. Bukowski and his colleagues at UTMB found FA deficiency to be related to premature births (Maugh, 2009).

Although there are benefits of daily FA supplementation during pregnancy, there is a risk of fetal toxicity if one milligram (mg) or more of FA is ingested daily. Based on recommendations from their healthcare provider (HCP), many pregnant women consume FA supplements. Occasionally unbeknownst to the HCP, the patient may concurrently ingest a multi-vitamin that contains a daily allotment of FA. Moreover, approximately 250 µg of folate can be ingested daily through natural food products. Considering the multiple sources of FA, pregnant women

may potentially ingest over 1 mg of FA daily and induce fetal toxicity. Specifically, a high FA level in newborns has been shown to cause excessive pliability of bones (Michels et al., 2008). There is no evidence of maternal toxicity with excessive FA consumption since surplus amounts are excreted in the urine (Hardman, Limbird, & Gilman, 2001). Therefore, it is important that women are educated not only about the benefits of daily FA supplementation but also potential risks to the fetus.

A relevant method for transmitting information to the general population about the benefits of daily FA supplementation is through HCPs. Healthcare providers are generally aware that 400 µg of FA daily prevents NTDs, and should be used at least one month prior to pregnancy and through the first trimester (Williams et al., 2006). Studies have shown that understanding the benefits of daily FA did not necessarily lead providers to counsel their patients about daily FA use (Williams et al., 2006). However, HCPs who took multivitamins on a daily basis were more likely to recommend the same regimen to their patients than HCPs who did not take multivitamins (Williams et al., 2006). The lack of communication between HCPs and patients about preventative health issues has been attributed to time constraints and other demands in the clinical setting (Lawrence et al., 2003). HCPs who work more closely with pregnant women have higher levels of awareness and knowledge about FA supplementation; practitioners in the field of Obstetrics and Gynecology followed by Certified Nurse Midwives are more likely to address daily FA use during well woman exams (Kondo et al., 2009). Kondo et al (2009) also found that dieticians and pharmacists had a higher level of awareness and knowledge than Urologists, General Practitioners (GP), and nurses. When providers see patients post-conception, limited opportunities are available to discuss the preventative benefits of daily FA supplementation. Healthcare practitioners who provide routine care to women of reproductive age have more opportunities to discuss preventative health issues, including daily FA supplementation (Williams et al., 2006). Healthcare providers play a crucial role in counseling women of reproductive age about the advantages of daily FA supplementation.

Multiple studies have shown that a higher education level is correlated with the use of daily FA in women of reproductive age (Maugh, 2009). In the subgroup of educated women, only 30-40 percent meet the recommended

amount of daily FA intake (Maugh, 2009). A mass media campaign in the Netherlands encouraging daily FA use for fetal neural tube development led to an increase of awareness among women of both low and high socioeconomic status (indicator used was education level). Subsequently, the heightened awareness caused an increase in daily FA supplementation in the women studied. An even greater increase in daily FA supplementation was seen among the women of higher education levels (de Walle et al., 1999). In 2007, the CDC surveyed women of reproductive age to assess the likelihood of FA compliance between age groups. The study found that women between the ages of 25 and 34 were more likely to be aware of FA's effects and consume daily FA supplements than women in the 35-45 age group. However, both the 25-34 and 35-45 age groups were more likely to be aware of the proper indications of daily FA than the 18-24 age group (CDC, 2007). This study demonstrated the differences pertaining to FA awareness, knowledge, and subsequent change in behavior between age groups in the general population.

Our study focused on daily FA supplementation amongst reproductive age women of higher education levels, specifically those educated in a medical field. The participants in our study were questioned about demographic factors, social history, and educational background regarding FA supplementation. Our objective was to assess the level of understanding amongst women of reproductive age enrolled in the UTMB PA program regarding the physiologic implications of daily FA supplementation and the current recommended dosage and intake regimen. Additionally, we studied first and third year students to measure the broadest difference between levels of training concerning physiologic implications of FA supplementation.

OBJECTIVES

Assess FA education, awareness, and use amongst female UTMB PA students of reproductive age.

Assess the effect of various demographic and social factors on female UTMB PA students' proclivity for following the correct FA regimen.

Compare data obtained from first year (incoming) female UTMB PA students with the data from third year (graduating) female UTMB PA students.

Compare the scientific understanding and usage of FA amongst health profession students and the general

population.

Determine the most effective method for educating all women of reproductive age about daily FA supplementation.

HYPOTHESES

There is poor compliance for following the USPSTF-recommended FA regimen amongst female reproductive age students in the UTMB PA program.

Female reproductive age PA students at UTMB are educated about the benefits of daily FA in the prevention of NTDs.

EXPERIMENTAL DESIGN AND METHODS

SUBJECTS

Ninety-eight female students voluntarily completed the questionnaire while enrolled in the UTMB PA program. Fifty-nine of the participants were enrolled in the first year (incoming) PA class, and the remaining 39 were enrolled in the third year (graduating) PA class. Participants were females of reproductive age, between 18-45 years of age.

INSTRUMENTATION

Participants completed a 30 question, three-page questionnaire. The survey included factors pertaining to demographics, personal history of FA supplementation, social history concerning marital and parity status, relevant medical history, general education, education regarding FA, and patient education.

PROCEDURE

Participants were approached in a classroom setting. An oral presentation was given to introduce the study, explain the questionnaire and confirm the participants' informed consent. The participant retained the first page of the questionnaire. This initial page explained the procedure for completing the Institutional Review Board (IRB) approved questionnaire, contained additional information about informed consent, and listed contact information for the researchers conducting the study. If at any time the participant needed assistance, the proctor provided aid with reading or comprehending the question. There were no questions posed by the participants which went beyond the scope of the proctor's understanding.

POSSIBLE LIMITATIONS

False reporting is a significant limitation in self-report studies, specifically the Hawthorne effect. These volunteers understood they were being studied, and might have

modified their answers in an effort to appear more desirable as subjects. Additionally, the topic of daily FA supplementation is sensitive because of the ramifications on fetal health. People may have diverted from their first instinct when completing the questionnaire if they felt their answer may be perceived as harmful to a fetus. The only populations studied were the first year and third year reproductive age females enrolled in the UTMB PA program. Moreover, we encountered an unequal distribution of participants between the two populations.

ANALYTIC PROCEDURES AND EVALUATION OF DATA

The data was analyzed using the SPSS Statistics 17.0 computer software. The descriptive statistic appropriate for our study was Frequency Analysis. We used Frequency Analysis to determine the statistical differences in personal history of FA supplementation, social history concerning marital and parity status, and education regarding FA between the first and third year PA classes. Crosstabulations were performed for the following measures: demographic factors and FA consumption, social factors and FA consumption. We further evaluated FA education and awareness in female UTMB PA students, FA consumption in female UTMB PA students, and the best method to educate women about FA supplementation.

RESULTS

Prior to the survey 14.3% of female UTMB PA students received FA education from their HCP, the media 23.5%, schooling 85.7%, acquaintances 26.5%, and literature 11.2%. Out of the female PA students educated at UTMB, 90.8% recognized that FA deficiency caused NTDs and 34.7% recognized FA deficiency caused Small for Gestational Age (SGA) infants. Students' understanding of the beneficial preventions of FA on maternal health during pregnancy included: placental abruption or infarction 31.6%, early occurrence of venous thrombosis 9.2%, preeclampsia 36.7%, and early occurrence of arteriosclerosis 7.1%. Students recognized the following foods contained FA: enriched grains 62.2% and orange juice 30.6%. Students believed beans 18.4%, greens 79.6%, and fruit 13.3% contain FA, when in reality they contain folate.

Figure 1

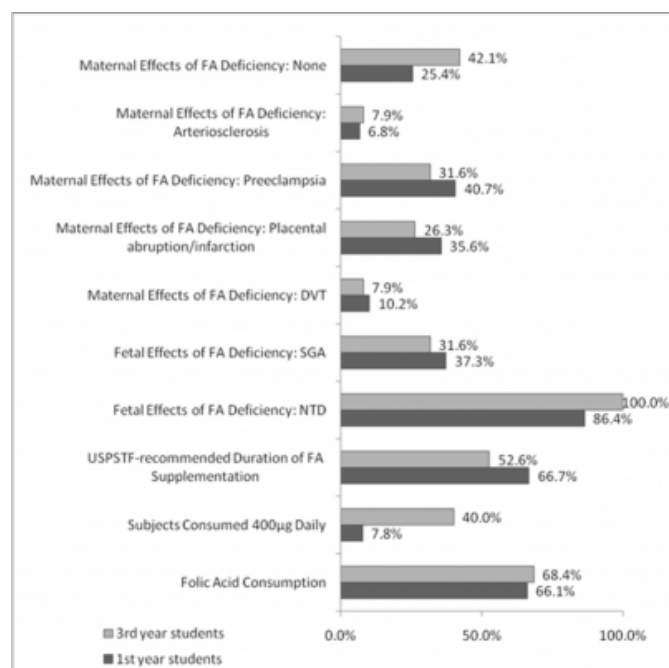
Demographics and Folic Acid Consumption by Female UTMB PA Students

Demographic	Number of Subjects	FA Consumption	400 µg Daily Intake (Total Population)
<25 years of age	50	68.0%	6.5%
25-34 years of age	41	61.0%	35.1%
>34 years of age	7	85.7%	50.0%
Total	98		
American Indian & Alaskan Native	1	100.0%	0.0%
Asian	12	50.0%	25.0%
Black or African American	4	25.0%	0.0%
Native Hawaiian or Other Pacific Islander	1	100.0%	0.0%
White, Non-Hispanic	59	71.2%	18.9%
Hispanic, Non-White	20	65.0%	25.0%
Total	98		

Overall FA use amongst female UTMB PA students is 66.3%. Students reported consuming FA through the following sources: vitamins 46.9%, FA supplements 2.0%, and food 60.2%. The comparison between demographics and FA consumption by female UTMB PA students is outlined in Table 1. Students greater than 34 years of age reported the highest percentage of FA consumption and were most compliant with the USPSTF-recommended daily intake. The FA consumption amongst single subjects was 67.7%, engaged subjects 68.8%, and married subjects 66.7%. The participants were polled regarding their current FA consumption and potential pregnancy plans: of those who reported no future pregnancy plans 77.8% were consuming FA, pregnancy within 12 months 100%, pregnancy 2-3 years in the future 72.7%, and pregnancy 3-5 years in the future 61.8%. The students less than 25 years of age reported 100% nulliparity, 25-34 years of age 4.8% parity, greater than 34 years of age 66.7% parity. All subjects with a history of pregnancy consumed the USPSTF-recommended dosage of FA through the first five weeks of gestation, and no infants were born with NTDs.

Figure 2

. Comparison of consumption, knowledge, and supplementation between first and third year female UTMB PA students.



According to Figure 1, FA consumption between first and third year students was within two percentage points; however, 40% of the third year students consumed the recommended 400 µg of FA daily as opposed to 7.8% first year students. Of the first year students, 66.7% knew the USPSTF-recommended duration of FA supplementation compared to 52.6% of the third year students. One-hundred percent of the third year students knew that FA deficiency caused NTDs, and 86.4% first year students recognized this causation. The correlation between SGA and FA deficiency was reported as 37.3% by the first year students and 31.6% by the third year students. The beneficial preventions of FA on maternal health as reported by first and third year students, respectively, were: DVT 10.2%, 7.9%; placental abruption or infarction 35.6%, 26.3%; preeclampsia 40.7%, 31.6%; arteriosclerosis 6.8%, 7.9%; no benefits 25.4%, 42.1%.

Students reported the following as the best method for FA information transmission: 54% preferred education by a HCP, 38.6% felt television and other media outlets would be most beneficial, 1.8% believed magazine advertisements were most informative, and 5.3% preferred to receive information from pamphlets in HCP offices. Of the students educated by a HCP, 5.1% were educated by the practitioner performing their well-woman exam (WWE) and 7.1% were

educated by their GP.

DISCUSSION

Based on previously reported data, we expected HCPs to be the most common source of FA education. Lantz et al (2010) reported family physicians were responsible for advising sixty-four percent of subjects with varying levels of education about FA supplementation (Lantz, Edmundson, Kisely, & MacLellan, 2010). The second most common source of information was family and friends (Lantz et al., 2010). Contrary to published literature, only fourteen percent of our subjects reported receiving information about FA supplementation from their HCP. Our results demonstrated that schooling received prior to the survey was the most significant method of instruction. We attribute the divergence of our results to healthcare professional students having a stronger nutritional background than women in the general population.

Although ninety percent of female UTMB PA students recognize that NTDs are associated with FA deficiency, a considerable number lack specific knowledge regarding the physiologic implications of FA deficiency. This limited understanding is not restricted to PA students but has been documented in pharmacy programs as well. In 2002, Lynch performed a single site survey which found that 94 percent of student pharmacists knew FA was essential in preventing NTDs. Only half of the student pharmacists distinguished the recommended dosage of FA, and 58-65 percent of students could identify the sources of FA (Lynch, 2002).

After evaluating the students' knowledge of FA deficiency, we found the subjects were more proficient on the topic of fetal health than maternal health. Less than 37 percent of participants recognized the benefits FA supplies to maternal disease prevention. The majority of students recognized that enriched grains were a good source of FA. Conversely, students were unable to identify atypical sources of FA listed in the questionnaire. The subjects' insufficient education about FA leaves room for improvement in PA program curricula. Klein et al (2004) performed a study assessing PA students' knowledge and awareness of FA (Klein, Austrin, & Selbst, 2004). The trial began with a pretest to measure the students' baseline understanding of FA, followed by an educational course via CD-ROM. The posttest two weeks later showed a 22 percent increase in FA knowledge from the baseline (Klein et al., 2004). Lynch (2002) performed a comparable study with student pharmacists in which a three-week nutrition course addressing FA was given. This course

increased the number of students who recognized that FA prevents NTDs, the recommended daily intake, and the sources of FA (Lynch, 2002). Klein and Lynch's studies support our observation that PA students would benefit from a similarly focused presentation over FA.

While 86 percent of UTMB PA students received FA information through schooling, only two-thirds were currently consuming FA. These results were comparable to the general population polled in the Center for Disease Control and Prevention (2007) study. The Center for Disease Control and Prevention (CDCP) data showed 81 percent of reproductive age women were aware of FA, but less than half reported any supplementation (Center for Disease Control and Prevention, 2007). In our study food was reported as the most common source of FA, followed by multivitamins. Our data demonstrated a direct correlation between increased age and consumption of 400 µg of FA daily. The correlation may be attributed to a 67 percent parity rate in females over 34 years of age in this study. FA consumption amongst all subjects was within two percentage points regardless of marital status. Despite more than two-thirds of females reporting FA consumption, as many as 94 percent are not taking the USPSTF-recommended dosage. There is no correlation between pregnancy plans and FA consumption.

There was no significant deviation between the first and third year students' consumption of FA through multivitamins, supplements, and food. Further comparison demonstrated 32 percent more third year students than first year students took the USPSTF-recommended dosage of FA. This difference may be attributed to the third year students' exposure to maternal and fetal health education in clinical rotations. Similar to our findings, Lantz et al (2010) reported appropriate FA consumption was associated with a higher level of education. One-hundred percent of the third year students understood the causation between FA consumption and NTDs, as opposed to only 86 percent of first year students. However, the first year students' knowledge of all other questionnaire topics concerning FA effects on maternal and fetal health exceeded the third year students' knowledge. The first year students also were more aware of the USPSTF-recommendations for FA supplementation throughout reproductive age. Most likely, the first year class recognized possible disease processes and recommendations due to completing the questionnaire during their didactic curriculum.

Students were polled to determine the best future method of FA information transmission. Education by a HCP was preferred by the majority of subjects. Television and other media outlets were the second most popular choices. Despite these preferences, only 12 percent of students disclosed having been educated by a HCP according to our questionnaire. Conversely, Power et al (2000) published that 85 percent of surveyed American College of Obstetricians and Gynecologists (ACOG) fellows informed pregnant patients about FA supplementation (Power, Howlzman, & Schulkin, 2000). Since FA is required throughout reproductive age, ACOG's guidelines should be implemented by all HCPs for women of reproductive age.

An expected and unavoidable limitation of our study was relying on self-reported data. Modifiable limitations were encountered in our study as well. The sample size of our study was only 98 subjects with less than twenty percent representing ethnicities other than Caucasian and Hispanic, non-white. Also, the age distribution was skewed towards women less than 34 years of age. Our study is a reflection of only one PA program's instruction, and may not be indicative of other healthcare programs' curriculum. These limitations could be eradicated through a future study with larger samples sizes and incorporating multiple programs.

CONCLUSION

The goal of our study was to determine if reproductive age women, 18-45 years old, enrolled in a physician assistant program were more likely to follow the USPSTF-recommended FA regimen. There was poor compliance for following the USPSTF-recommended FA regimen amongst students in the UTMB PA program. Although the majority of students reported consuming FA, only a small subset consumed 400 µg. The results of our study were comparable to the general population, finding that the majority of women in both groups acknowledged the importance of FA supplementation. More UTMB PA students are taking FA than the general population, but the students are not consuming the correct dosage.

PA students at UTMB are educated about the benefits of daily FA in the prevention of NTDs. However, the students' understanding of the physiologic implications of FA on maternal and fetal health was inadequate. Considering the significant amount of patient education imparted by midlevel providers, patient care would be improved if PA programs incorporated focused FA education.

Our results revealed a need for additional FA education. Based on other publications and our results, the insufficient instruction about the effects of FA on maternal and fetal health is not limited to one healthcare program. Therefore, additional education regarding FA supplementation should be implemented across all healthcare programs. Previous studies have shown FA education can be successfully achieved using a succinct lecture series or electronic media.

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