

## Editorial

Over the last several decades, evidence indicates that many strategies to prevent the two leading causes of infant mortality in the developed world - birth defects and prematurity/low birthweight - have their greatest influence when commenced before a pregnancy is conceived. The traditional prenatal care pathway to preventing poor pregnancy outcomes is often inadequate because it starts too late. A good example is that adequate folate levels at the time of organogenesis (days 17-56 after conception) is associated with a 50%-70% reduction in neural tube defects. By waiting to start vitamins with folic acid at the first prenatal visit it will be too late to prevent most neural tube defects.

Unfortunately, as illustrated by the articles featured in this issue, most women, even those hoping to become pregnant, are not adopting proven protective behaviors before conception. Many explanations exist: health promoting messages are not reaching women; they are being framed in a way that lacks personal relevance; they are not reiterated regularly; they involve personal or financial costs that are judged negatively; or they lack credibility. The bottom line is that impacting health choice, such as eating more green leafy vegetables, taking a multivitamin with folic acid daily or achieving a healthy BMI, is far more complex than we know how to address. Until translational research receives the funding and respect it deserves, we will continue to have a disconnect between the science we know and its ability to shape the futures of today's women and tomorrow's children.

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# Pregnancy intention and Health Behaviors

## The Central Pennsylvania Women's Health Study Cohort

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Health behaviors before pregnancy impact pregnancy outcomes. Research is limited on whether women adopt healthier behaviors when they intend to become pregnant. In a cross-sectional study, Green-Raleigh et al.<sup>1</sup> showed that women planning pregnancy within the next year reported healthier behaviors including smoking and vitamin supplementation compared with women not planning pregnancy.

The aim of this study<sup>2</sup> was to use longitudinal data to determine whether pregnancy intention affects health behaviors that could impact pregnancy outcomes.

### The Central Pennsylvania Women's Health Study

The Central Pennsylvania Women's Health Study (CePAWHS) included a population-based longitudinal cohort of women aged 18-45 residing in Central Pennsylvania interviewed at baseline and 2-years later<sup>3</sup>. The analytic sample presented here included 847 women who were not pregnant at baseline and had not had a hysterectomy or tubal sterilization.

The outcome variables were measures of health behaviors over a two-year period: nutrition (Fruit and Vegetable (F&V) consumption), folic acid supplementation, physical activity, binge drinking, smoking and vaginal douching. For each health behavior, we assessed whether women engaged in positive longitudinal behavior, defined as sustained healthy levels of the behavior or improved health behavior between baseline and follow-up. The main independent variable was pregnancy intention at baseline, which was defined as considering pregnancy within the next year, at some other time in the future, or not at all.

Analyses were adjusted for pregnancy-related variables (previous pregnancy, perceived severity of preterm birth or low birthweight, incident pregnancy during the two-year study), health status variables (overall self-rated health status, stress, depressive symptoms, obesity), accessibility to the health care system and sociodemographic variables (age, race/ethnicity, education, marital status, poverty status).

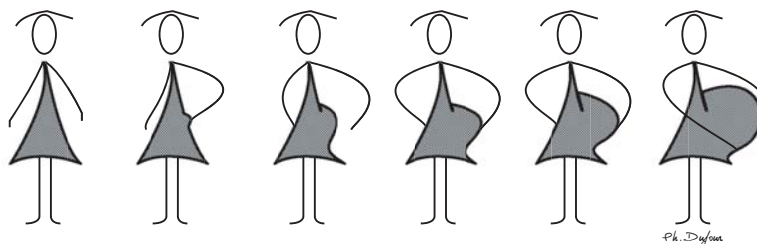
### Pregnancy intention did not change health behaviors

At baseline, 9% of women were considering pregnancy in the next year, 37% some other time in the future and 53% not at all. In unadjusted analysis, women considering pregnancy within the next year were more likely to report positive longitudinal folic acid supplementation only.

In adjusted analyses, women considering pregnancy in the next year were no more likely to be engaging in positive longitudinal health behaviors than other women. However, becoming pregnant during the two-year follow-up period increased the odds of folic acid supplementation and avoiding binge drinking.

### The need to for improved health promotion

In this population, intention for pregnancy was not associated with maintaining or improving healthy behaviors. These findings confirm the need for improved preconception health promotion. The importance of health behaviors including F&V consumption, physical activity, and avoiding alcohol and tobacco needs to be emphasized by health care providers and policy makers.



### REFERENCES

1. Green-Raleigh K et al. (2003) Pregnancy planning status and health behaviors among nonpregnant women in a California managed health care organization. *Perspectives on Sexual and Reproductive Health*, 37,179-183.
2. Chuang CH et al. [2009] Pregnancy intention and health behaviors: results from the Central Pennsylvania Women's Health Study Cohort. *Matern Child Health J* [Epub ahead of print].
3. Weisman CS et al. (2006) Preconceptional health: Risks of adverse pregnancy outcomes by reproductive life stage in the Central Pennsylvania Women's Health Study (CePAWHS). *Womens Health Issues*, 16, 216-224.

# Vegetable and fruit consumption and reduced risk of preeclampsia

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## Background

Preeclampsia is a major cause of maternal and fetal morbidity and mortality, but the origin is unknown. Several dietary substances have been hypothesized to influence the risk of preeclampsia. The present study aimed to investigate the relationship between dietary patterns and the risk of developing preeclampsia in a large population of women who have never given birth.

## Dietary patterns among pregnant women

The study was conducted in pregnant women in the Norwegian Mother and Child Cohort Study (MoBa). Participating women answered questionnaires at gestational weeks 15 (a general health questionnaire) and at weeks 17 to 22 (a food frequency questionnaire). The pregnancy outcomes were obtained from the Medical Birth Registry of Norway. Exploratory factor analysis was used to identify underlying patterns in the dietary data. We identified four dietary patterns. Each participant was assigned a score for each of the four patterns. The first pattern, which was denoted the “vegetable pattern”, was characterized by high consumption of both fresh and cooked vegetables, cooking oil, olive oil, fruits and berries, rice, poultry and drinking water. The second pattern, which was denoted the “processed pattern” was characterized by high consumption of processed meat products, white bread, French fries, salty snacks and sugar-sweetened drinks. The “vegetable” factor scores increased with maternal age, length of education and height. The “vegetable” factor scores decreased with BMI and were higher in non-smokers than smokers. In comparison the “processed foods” factor scores decreased with increasing age, length of education and height, and increased with BMI and smoking. The other two patterns were not associated with maternal characteristics or with preeclampsia.

## Associations between dietary patterns and preeclampsia

Among 23,423 women (who have never given birth), 1,267

(5.4%) developed preeclampsia. Women with preeclampsia had lower “vegetable” pattern scores and higher “processed food” pattern scores than those who did not develop preeclampsia ( $p < 0.001$ ). When adjusting for confounders the results showed that women with high scores on the vegetable pattern had significantly reduced risk of preeclampsia [relative risk (OR) for tertile (T) 3 versus T1: 0.72; 95% CI: 0.62, 0.85], and women with high scores on the processed food pattern had increased risk [OR for T3 versus T1: 1.21; 95% CI: 1.03, 1.42]. The effects of the patterns were also examined according to different combinations of factor scores (tertiles). The effect of having high scores on the vegetable pattern were strongest within the lowest tertile of the processed food pattern (35-40% risk reduction), while having high scores on the processed food pattern did not significantly increase the risk in any of the vegetable pattern tertiles.

## Implications

Several mechanisms for a biological effect of dietary factors on the risk of preeclampsia may exist. The risk factors for preeclampsia include obesity, dyslipidemia, insulin resistance and other risk factors for atherosclerosis. Vegetables and plant foods are rich in micronutrients such as phytochemicals, antioxidants, vitamins and minerals and dietary fibre, whereas many processed foods are made with the addition of sugar, salt and saturated fats. In non-pregnant populations, dietary patterns characterized by high consumption of Fruit and Vegetables (F&V), and low consumption of processed meats and foods rich in sugar and fats have been shown to reduce markers of the metabolic syndrome, inflammation and cardiovascular disease.

The results of our study suggest that adherence to dietary advice to consume a diet abundant in F&V may also be beneficial with regard to preeclampsia. Pregnancy is a period when most women are highly motivated for dietary advice as changes towards a healthier diet may also benefit their children. Dietary changes are low cost and low risk compared to medical interventions and even a moderate increase in the intake of vegetables and plant foods may be of public health importance.



## REFERENCE

Brantsæter AL, Haugen M, Samuelson SO, Torjusen H, Trogstad L, Alexander J, Magnus P, Meltzer HM. A dietary pattern characterized by high intake of vegetables, fruits, and vegetable oils is associated with reduced risk of preeclampsia in nulliparous pregnant Norwegian women. *J Nutr.* 2009 Jun;139:1162-8.

# The Maternal Mediterranean Diet during Pregnancy and Risk of Spina Bifida in the Offspring

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## Environment and Reproductive Health

The maternal placenta was long believed to protect the developing embryo from environmental hazards. However, it has become evident that viruses, drugs, alcohol use, tobacco smoke, and nutritional imbalance can reach the embryo and foetus and are related to suboptimal pregnancy outcome and health later in life<sup>1</sup>. The role of nutrition is particularly important because this exposure is modifiable and has a large public health potential<sup>2</sup>.

## The Maternal Diet and Risk of Spina Bifida Offspring

In the past, many epidemiological studies have focused upon single nutrients, such as the B-vitamin folic acid with regard to risk of neural tube defects and other malformations<sup>3</sup>. Lately, dietary pattern analysis has emerged as a new method of assessing overall behaviour in food consumption<sup>4</sup>. We were interested whether the periconceptional maternal diet is also associated with the risk of spina bifida in the offspring<sup>5</sup>. In a case-control trial study in the Netherlands, dietary patterns in 50 mothers of children with spina bifida and 81 control mothers were analyzed (1999-2001). Maternal food intakes were obtained by food frequency questionnaires at the standardised study moment of 14 months after the birth of the index child. Principal component factor analysis and reduced rank regression were used to identify the most prevalent patterns in food consumption in this study population<sup>4, 6</sup>. Dietary patterns were validated with the maternal biomarkers folate, vitamin B12 and homocysteine of the homocysteine pathway.

## The Mediterranean Diet

The Mediterranean dietary pattern was most prevalent among study participants and was characterised by high intakes of fruit, vegetables, vegetable oil, fish, legumes and cereals, moderate

alcohol intake, and low intakes of potatoes and sweets. These healthy foods and drinks have traditionally been consumed by people living in countries near the Mediterranean Sea<sup>7</sup>. In our study we observed that the Mediterranean dietary pattern was associated with higher folate and vitamin B12 and lower homocysteine concentrations. The intake of alcohol consisted mainly of wine and was restricted to 1-2 glasses per week on average. An important finding was that we also found that the risk to give birth to a child with spina bifida was reduced by 70% in women with high adherence to a Mediterranean diet.

## Nutrition, Epigenetics, and Spina Bifida

The associations between the Mediterranean diet, biomarkers of the homocysteine pathway and spina bifida risk are in line with our previous data and that of others<sup>3</sup>. It is known that in Southern European countries the Mediterranean diet is more often used, compared with Northern European countries. Moreover, in this population the blood concentrations of homocysteine are also slightly lower and of folate higher. The homocysteine pathway plays an important role during periods of rapid cell division and growth, such as embryogenesis. Recent understanding from animal and epidemiological studies shows that nutritional stimuli can influence genetic expression through DNA methylation<sup>8</sup>. This mechanism requires methyl groups derived from the human diet (e.g. folate, choline, and methionine of the homocysteine pathway) to establish appropriate gene activating and silencing patterns during embryonic and fetal development<sup>9</sup>. Thus, it seems plausible that the Mediterranean diet provides a natural rich source of methyl groups and may affect underlying epigenetic mechanisms. Understanding how the Mediterranean diet modifies biological processes may raise new possibilities for primary prevention measures in (pre)pregnancy to avoid birth defects in offspring, especially spina bifida.



## REFERENCE

1. Barker DJ & Clark PM. *Rev Reprod* 1997;2:105-12.
2. Cetin I et al. *Hum Reprod Update*;16:80-95.
3. Lumley J et al. *Cochrane database of systematic reviews* 2001:CD001056.
4. Hu FB. *Curr Opin Lipidol* 2002;13:3-9.
5. Vujkovic M et al. *BJOG* 2009;116:408-15.
6. Schulze MB et al. *Br J Nutr* 2003;89:409-19.
7. Trichopoulou A et al. *BMJ* 2009;338:b2337.
8. Gluckman PD et al. *The New England journal of medicine* 2008;359:61-73.
9. Steegers-Theunissen RP et al. *PLoS one* 2009;4:e7845.