Maternal Fish Consumption, Mercury Levels, and Risk of Preterm Delivery

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Background: Pregnant women receive mixed messages about fish consumption in pregnancy because unsaturated fatty acids and protein in fish are thought to be beneficial, but contaminants such as methylmercury may pose a hazard.

Methods: In the Pregnancy Outcomes and Community Health (POUCH) study, women were enrolled in the 15th to 27th week of pregnancy from 52 prenatal clinics in five Michigan communities. At enrollment, information was gathered on amount and category of fish consumed during the current pregnancy, and a hair sample was obtained. A segment of hair closest to the scalp, approximating exposure during pregnancy, was assessed for total mercury levels (70–90% methylmercury) in 1,024 POUCH cohort women.

Results: Mercury levels ranged from 0.01 to 2.50 μg/g (mean = 0.29 μg/g; median = 0.23 μg/g). Total fish consumption and consumption of canned fish, bought fish, and sport-caught fish were positively associated with mercury levels in hair. The greatest fish source for mercury exposure appeared to be canned fish. Compared with women delivering at term, women who delivered before 35 weeks' gestation were more likely to have hair mercury levels at or above the 90th percentile (≥ 0.55 μg/g), even after adjusting for maternal characteristics and fish consumption (adjusted odds ratio = 3.0; 95% confidence interval, 1.3–6.7).

Conclusion: This is the first large, community-based study to examine risk of very preterm birth in relation to mercury levels among women with low to moderate exposure. Additional studies are needed to see whether these findings will be replicated in other settings.

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High levels of maternal fish consumption during pregnancy have been associated with longer gestation (Borod et al. 1999; Olsen and Secher 1990, 2002; Olsen et al. 1989, 1991, 1992, 2000; Reddy et al. 1994), increased birth weight (Borod et al. 1999; Grandjean et al. 2001; Olsen and Secher 1990, 2002; Olsen et al. 1992, 1993; Reddy et al. 1994), reduced risk of intrauterine growth retardation (IUGR) (Olsen and Secher 2002; Olsen et al. 2000), and lower prevalence of pregnancy-induced hypertension (Olsen and Secher 1990). These reported beneficial effects from fish consumption have been attributed to large amounts of omega-3 fatty acids in fish. But fish and seafood, especially species high in the food chain, are also potential sources of exposure to pollutants such as methylmercury that may adversely affect pregnancy outcomes. Thus, advising pregnant women on fish consumption requires consideration of potential risks as well as benefits (Cohen et al. 2005).

Methylmercury bioaccumulates in predatory fish (Gilbert and Grant-Webster 1995); when these fish are eaten, approximately 95% of the methylmercury is absorbed via the gastrointestinal tract (Aberg et al. 1969; Miettinen et al. 1971). There is concern that levels of methylmercury that are not toxic to adults may pose a hazard to the developing fetus. Total mercury in hair, which is approximately 70–90% methylmercury (Berglund et al. 2005; Chen et al. 2002), has been evaluated in relation to newborn neurologic abnormalities, primarily in studies of heavily exposed populations (Murata et al. 2004; Myers et al. 2003). However, a recent study of mother–infant dyads in a population with relatively lower levels of mercury exposure reported a small negative effect of increasing *in utero* mercury exposure on a visual recognition memory test at 6 months of age (Oken et al. 2005).

Studies on birth weight and total mercury levels, measured in maternal hair or cord blood, have produced mixed results, with some reporting an inverse relationship (Foldspang and Hansen 1990; Sikorski et al. 1986) and others showing no association (Grandjean et al. 2001; Lucas et al. 2004). In addition, one study of maternal occupational exposure to metallic mercury found no effect on birth weight (Fu 1993). Lower birth weights can result from poorer fetal growth and/or delivery at an earlier gestational age. Of the four studies that have examined levels of mercury in relation to gestational age at birth, three measured total mercury in cord blood (Foldspang and Hansen 1990; Grandjean et al. 2001; Lucas et al. 2004), and one focused on women exposed to metallic mercury through work (Fu 1993); all reported no association. Because preterm delivery rates are on the rise in the United States (Goldenberg et al. 1998), and there is some evidence that fish oils may help reduce the risk of preterm delivery (Oakeshott et al. 2002; Olsen and Secher 2002; Olsen et al. 2000), it is particularly important to examine risks associated with pollutants in fish.

Overall, there is limited information from U.S. populations regarding maternal mercury levels and fish consumption and their effects on pregnancy outcome such as preterm delivery. In the Pregnancy Outcomes and Community Health (POUCH) Study (Holzman et al. 2001), a prospective study of biologic and psychosocial factors related to preterm delivery (PTD), the authors had an opportunity to examine maternal mercury levels in hair at mid-pregnancy in > 1,000 women recruited from five communities in Michigan, a state that borders four of the five Great Lakes. Fish consumption and corresponding mercury exposure were evaluated in relation to the risk of PTD.

Materials and Methods:

Population. The POUCH Study recruited women from 52 participating prenatal clinics located in five Michigan communities, each of which include urban, suburban, and rural areas (Holzman et al. 2001) (Figure 1). Women were enrolled in the 15th to 27th week of pregnancy, with approximately 70% before the 24th week. Eligibility criteria included screening for maternal serum alpha-fetoprotein (MSAFP) levels between 15 and 22 weeks of pregnancy, > 14 years of age, competency in English, singleton pregnancy with no known congenital or chromosomal anomalies at the time of recruitment, and no prepregnancy diabetes mellitus. A total of 1,226 women were enrolled in the POUCH cohort during the first part of the study

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