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Original article

Alcohol consumption among first-time mothers and the risk of preterm birth: a cohort study

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ABSTRACT

Purpose: Our aim was to explore the association between alcohol consumption, before and during pregnancy, and the risk of preterm birth among 46,252 primiparous mothers.
Methods: We obtained information on alcohol consumption from questionnaire responses at pregnancy week 15 from the prospective, observational Norwegian Mother and Child Cohort Study. Data on preterm birth, categorized as delivery before gestation week 37, were retrieved from the Medical Birth Registry of Norway.
Results: Among the participants, 91% consumed alcohol before pregnancy and fewer than 20% reported consuming alcohol during pregnancy. The adjusted odds ratio (aOR) for preterm birth associated with prepregnancy alcohol consumption was 0.81 (95% confidence interval [CI], 0.70–0.95). We did not find a risk reduction for overall drinking during pregnancy, aOR = 1.03 (95% CI, 0.90–1.19). However, dose-response analyses showed tendencies toward adverse effects when drinking 1–3 times per month during the first 15 weeks of pregnancy, aOR = 1.51 (95% CI, 1.14–2.00).
Conclusions: We did not find any effects of alcohol consumption during pregnancy, whereas pre-pregnancy drinking was associated with reduced risk of preterm birth. Residual confounding may have influenced the risk estimates, especially before pregnancy, as nondrinkers have lower socioeconomic status and well-being than drinkers.

Introduction

Most public health and medical authorities advise total abstinence of alcohol both during pregnancy and when contemplating pregnancy [1,2]. This advice is an invocation of the precautionary principle since existing evidence is inconclusive as to whether there is a threshold dose below which alcohol intake is safe. Overall, there are few studies that indicate adverse effects of low levels of alcohol intake [3,4], whereas there is broad consensus in the literature that abusive and heavy drinking has a teratogenic effect on the fetus, such as the risk of fetal alcohol syndrome, growth restriction, birth defects, and neurodevelopmental problems [5–7].

A concern has been that alcohol intake may increase the risk of preterm birth. Preterm birth is among the leading causes of child mortality, to which 35% of neonatal deaths on a global basis are estimated to be attributable [8,9]. In 2013, about 5.8% of all births in Norway were preterm, as defined by the World Health Organization as delivery before 37 weeks (259 days) of gestation. This rate is similar to the rest of Europe and other developed countries, where 5%–9% of all births were preterm [10,11]. From the 1990s, the chances of survival have increased because of better medical intensive care with advances such as antenatal corticosteroids, assisted ventilation, and administration of surfactant to prevent lungs from collapsing [12]. Almost in parallel with these improvements, preterm birth rates appear to increase [13]. Overall, from 1990 to 2010, there has been a 19.4% increase in the preterm birth rate in high-income countries (from 7.2% to 8.6%). The United States has a particularly high rate (12%) [8]. Better knowledge of causes and mechanisms is needed to prevent preterm birth.

Several studies on the subject of alcohol and preterm birth exist, but the findings are inconsistent. Apparently, some studies suggest that the relation between alcohol and preterm birth is J-shaped or U-shaped. A study using a Danish pregnancy cohort suggested that an intake of more than seven drinks of alcohol per week increased the risk of preterm birth [14]. Another study showed that the risk

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increased when more than 10 drinks were consumed per week [15]. However, both studies reported that lower levels of consumption might provide a small advantage as the risk of preterm birth was significantly decreased compared to nondrinkers (relative risks of 0.7–0.9) with an intake of alcohol below four drinks per week. Decreased risk at low to moderate alcohol intake was also found in a cross-sectional study by Wright et al. (1998) [16], who reported a relative risk of 0.4 (95% confidence interval [CI], 0.2–0.7) for preterm birth associated with alcohol intake in the third trimester. Looking only at induced preterm birth, Meis et al. (1997) [17] found that alcohol intake reported in gestational week 24 was associated with reduced risk (relative risk 0.34, 95% CI, 0.15–0.76). A very recent prospective cohort study by Lundsberg et al. (2015) [18] support these earlier findings, reporting reduced risk of preterm birth with low to moderate alcohol intake both during early and late pregnancy (relative risk of 0.79 and 0.60).

Other studies suggest that daily drinking has an adverse effect on preterm delivery. Jaddoe et al. (2007) [19] found that an average consumption of one drink per day either during early or late pregnancy had a relative risk of 2.5 (95% CI, 0.9–6.8) for preterm birth. Another prospective study showed a dose-response risk for low and moderate intake ($\leq$0.10 oz or $>$0.10–0.25 oz of absolute alcohol per day) during late pregnancy and risk of preterm birth (relative risks of 2.88 and 2.96) [20]. Both studies indicate that daily alcohol intake has a risk-increasing effect and that greater the exposure the greater the risk, but no studies have found adverse effects of occasional drinking. A recent systematic review and meta-analysis by Patra et al. (2011) [4] sum up the aforementioned findings: only heavy consumption, 1.5 drinks per day and more, increased the risk of preterm birth, whereas lower levels were associated with reduced risk or no risk.

These inconsistent findings of risk at relatively high consumption levels and no risk and/or reduced risk at moderate and low levels may be due to the heterogeneity across studies, large divergence in defining and measuring alcohol consumption, and that some findings are not adjusted for important lifestyle and related socioeconomic factors [4,19–21]. Another source of confounding could be undetected differences in health-related behavior due to previous reproductive experience [21] or due to the presence of publication bias [3].

Most pregnant women in Norway either abstain from alcohol or drink occasionally. The proportion of women who are occasional drinkers may be relatively large, a recent study in Norway indicates that one in 10 women maintain light alcohol consumption during pregnancy [22]. A more solid scientific basis for advice to these women is needed and should be provided by epidemiologic cohort studies rather than studies focusing only on women with high alcohol consumption [23]. Our objective is to examine critically, in a large prospective pregnancy cohort, the effect of alcohol before and during pregnancy on preterm delivery. Studies suggesting that low levels of alcohol intake have a protective effect have been the subject of controversy—is there a biological explanation for this association or is the outcome attributed to maternal lifestyle and background variables? A major problem in this area of research is confounding by background factors such as socioeconomic status and lifestyle. We had the opportunity to control for prepregnancy drinking, as well as the drinking pattern of the spouse. Together with educational level, these two variables reveal a major part of the family's lifestyle that might have confounding effects, which allows us to identify better the alcohol-specific effects on pregnancy. This present study provides dose-response information in the drinkers versus nondrinkers analyses, making it possible to explore if low amounts of alcohol relate to preterm risk. As alcohol intake was assessed in the first trimester, prospective to the birth outcome, we avoid recall bias and under-reporting among women with adverse pregnancy outcomes. By including only singletons among primiparous births, we isolated alcohol exposure from other exposures that potentially increase the risk of preterm birth, and we captured uncontrolled confounding by previous reproductive experiences or fetal complications.

Materials and methods

Study population and data collection

This study is a subproject of the Norwegian Mother and Child Cohort Study (MoBa) conducted by the Norwegian Institute of Public Health [24]. MoBa is a prospective pregnancy cohort comprising all pregnant women in Norway attending routine ultrasound examinations at gestational weeks 17–18. Recruitment started in 1999 and ended in 2008, and participants were recruited to the study through a postal invitation after they have signed up for the routine ultrasound examination in their local hospital. Of the total, 40% of the invited women consented to participate, and the cohort now includes 112,768 pregnancies [25].

Questionnaires used in MoBa can be found online at http://www.fhi.no/moba-en. The record of the pregnancy and delivery in the Medical Birth Registry of Norway (MBRN) is included in the MoBa database. The information in MBRN is based on antenatal forms and data recorded at the maternity departments at delivery and during the hospital stay [26]. The present study was based on version 7 of the quality-assured data files made available in 2013. Written informed consent was obtained from all participating women, and the study has been approved by the Regional Committee for Ethics in Medical Research and the Data Inspectorate.

Variables

We defined preterm delivery as delivery before 37 weeks (259 days) of gestation. Predictions from ultrasound measures determined the outcome variable gestational age, or if this was missing, from the date of the last menstrual period. Information on maternal age at child birth was categorized as "less than 20 years," "20–24 years," "25–29 years," "30–34 years," and "35 years or more." The variables gestational age, maternal age, and child's sex were drawn from the MBRN.

Questionnaire Q1, with assessment point at gestation week 15, asks about alcohol use during the last 3 months before pregnancy and during pregnancy. The woman was asked how often she drinks alcohol with response categories "6–7 times," "4–5 times," "2–3 times," "1 time per week," "2–3 times per month," "less than once per month," or "never." There was also a question about how many units (for instance a glass of beer or a glass of wine) the mothers usually consumed on each occasion. Table 1 gives the distribution of these variables. If the woman reported to be a nondrinker before pregnancy and did not respond to the pregnancy intake question, we assumed that she was also a nondrinker during pregnancy.

The response categories on maternal smoking were "nonsmoker," "occasional smoker," and "daily smoker." Maternal educational attainment was categorized as "less than 12 years," "12 years," "13–16 years," and "17 years or more." The smoking variable and the information on maternal education were taken from Q1 together with variables assessing prepregnancy maternal height and weight and maternal anxiety. Prepregnancy height and body weight were used to calculate body mass index (kg/m^2) which was categorized as "less than 20," "20–24," "25–29," and "30 or more." The mothers anxiety scores range from 2 to 8 and was a sum of responses "not bothered = 1," "a little bothered = 2," "quite bothered = 3," or "very bothered = 4" on two questions on whether