A BRIEF ORIGINAL CONTRIBUTION

Effect of Caffeine Intake During Pregnancy on Birth Weight

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The aim of this study was to examine the effect of caffeine consumption during pregnancy on birth weight and its possible interaction with smoking. The sample included 1,011 women who were interviewed during their first 3 days after delivery in one of the hospitals of Belgrade, Yugoslavia. A significant reduction in birth weight was found to be associated with an average caffeine intake of ≥71 mg per day, after adjustment for gestational age, infant sex, parity, and maternal height and weight, but only in infants born to nonsmoking mothers. Am J Epidemiol 1997;145:335-8.

birth weight; caffeine; pregnancy; smoking

During the 1970s, caffeine was suspected of reducing birth weight (1). Caffeine metabolism in pregnant women is three times slower than that in nonpregnant women (2). Caffeine crosses the placenta to accumulate in the fetus (3). Kirkinen et al. (4) found that the intervillous blood flow in the placenta was decreased by 25 percent after ingestion of 200 mg of caffeine.

Some animal studies have shown an association of caffeine with birth defects, fetal resorption, and lower fetal weight (5). However, results of epidemiologic studies of caffeine intake during pregnancy have not been consistent. The aim of the present study was to examine the effect of caffeine consumption during pregnancy on birth weight and its possible interaction with smoking.

MATERIALS AND METHODS

The study was conducted in one of the hospitals of Belgrade, Yugoslavia, and comprised women who gave birth to a live born singleton between June 1992 and March 1993. Of 1,268 women, 1,032 (81 percent) were interviewed by one person during the mothers’ first 3 days after delivery. The mothers were asked to estimate the amount of coffee (per day), tea (per week), and cola drink (per month) they drank during pregnancy. A standard serving was considered to be 80 ml for a cup of coffee (special small cup for Turkish coffee), 180 ml for a cup of tea, and 200 ml for a glass of cola. Daily caffeine intake was calculated on the basis of 70 mg per serving of coffee, 61 mg per serving of tea, and 26 mg per serving of cola drinks (6). Data were also collected on potential confounders, including age, education, marital status, obstetric history, height, weight before pregnancy, weight gain during pregnancy, history of diseases before and during pregnancy, smoking, alcohol consumption, housekeeping and occupational activities, and data related to delivery.

From the infants’ medical histories, the following data were collected: sex, birth weight, presence of congenital malformation, and gestational age at delivery. Gestational age was based on the date of the last menstrual period and clinical ultrasound assessment. Infants with malformation (n = 21) were excluded, and the final study group comprised 1,011 subjects.

Data on caffeine and alcohol consumption and smoking were available for the first, second, and third trimesters of pregnancy. The results presented here are limited to consumption during the third trimester.

The crude relation of caffeine consumption to the outcome was examined first. Adjustment was made for the potential confounders by the use of multiple regression analysis. Variables associated with both the birth weight and caffeine intake or smoking (i.e., maternal height, weight, and parity) were considered to be potential confounders. Infant sex and gestational age were also included as possible confounders due to their strong link with birth weight. Alcohol consumption, which according to data in the literature is related...
to a significant reduction in birth weight, was not considered as a confounding factor in our study since only a very small proportion of women (1.1 percent) reported drinking six or more drinks per week, and the mean alcohol consumption for all participants in the study who were drinkers was 1.5 drinks per week. Alcohol consumption was not related to birth weight, caffeine consumption, or smoking. The interaction between smoking and caffeine intake was analyzed by comparing the association between caffeine intake and outcome in smokers and nonsmokers.

RESULTS

Of the 1,011 women, 137 (13.55 percent) reported consuming no caffeine during pregnancy. The mean intake of the other 874 women was 133.44 mg (standard deviation 85.82), ranging from 0.29 to 696 mg per day. Average daily intake during the third trimester of pregnancy was calculated and classified according to empirical distribution as 0–10, 11–70, 71–140, and ≥141 mg. The main source of caffeine in this population was coffee. The average intake of caffeine was greater for smokers than for nonsmokers, with those who smoked 10 or more cigarettes per day consuming the most caffeine (table 1). Cigarette smoking and caffeine intake were significantly related. Caffeine intake was significantly, positively related to parity and occupational and housekeeping activities during pregnancy and negatively related to maternal height. Smokers were shorter and leaner, with longer duration of occupational activity during pregnancy, and frequently without any assistance in housekeeping. Birth weight was significantly, positively related to gestational age, infant male sex, maternal height and weight, weight gain in pregnancy, parity, and cerclage. Birth weight, after adjustment for gestational age, infant sex, parity, maternal height and weight, and smoking decreased as caffeine consumption increased; and there was a significant linear trend (table 2). The reduction of birth weight of 114 g was found in infants born to mothers whose daily caffeine consumption was ≥141 mg, and this difference was at the limit of significance (p = 0.06).

When the effect of smoking on birth weight was adjusted for caffeine consumption in addition to the other confounders described above, the weight reduction of 162 g was found in children born to mothers who smoked ≥10 cigarettes per day. The difference was significant in comparison with nonsmokers and light smokers (one to nine cigarettes per day).

When the relation between caffeine consumption and birth weight was analyzed in the different groups of tobacco use, the effect of caffeine intake was recognized only among nonsmokers (table 3). Among nonsmokers, women whose caffeine intake was 71–140 mg per day had infants weighting 116 g less than the infants of women whose caffeine consumption was 0–10 mg per day. For those whose caffeine intake was ≥140 mg per day, the decrease in birth weight was 153 mg. These differences, as well as linear trend, were statistically significant.

DISCUSSION

The majority of women in our study consumed caffeine during their pregnancy, but the level of caffeine intake was low (mean of 133.44 mg per day, standard deviation = 85.82) compared with some other populations (7, 8). Only caffeine intake in coffee, tea, and cola drink was taken into account. No information was collected about other sources of caffeine, such as chocolate, cocoa, or drugs; and the first two were not readily available when this study was conducted because of United Nations economic sanctions.

Variation in caffeine content, serving size, and preparation method of coffee (which was usually Turkish)
and tea could affect caffeine values and cause misclassification. Misclassification of exposure was also possible as a result of the women’s incomplete or inaccurate recall, although they were not aware of the postulated hypothesis. Nevertheless, there is no reason to doubt that any classification was random. As far as smoking is concerned, some differential misclassification is possible since it is likely that the women were aware of the harmful effects of smoking in pregnancy.

In the present investigation, a clear association between caffeine consumption and birth weight was observed after adjustment for gestational age, infant sex, parity, and maternal height and weight, but only in nonsmokers.

An overview of the literature shows that no consistent association between caffeine use and pregnancy outcome has been found (9–15). In studies in which the association was observed after controlling for smoking (9–11, 16), the decrease in birth weight was most frequently found for high levels (>300 mg per day) of caffeine consumption (9–11), although in the study of Fortier et al. (15), caffeine intake of 11–150 mg per day was a risk factor for intrauterine growth retardation. In our investigation, the effect of caffeine on fetal growth was already present at relatively small daily intakes of 71–140 mg. In most of these studies (9–11) including ours, a dose-response trend has been observed.

Contrary to some other investigations (9, 13, 16) that have suggested that caffeine might affect birth weight but only of infants born to smokers, in our study caffeine effect was found only in nonsmokers. Findings similar to our results are suggested by Larroque et al. (8). We believe that caffeine and smoking affect intrauterine growth in a similar way but that the effect of smoking is more powerful so that in women who smoke, caffeine intake does not produce any noticeable effect. However, the possibility that the results were affected by misclassification on smoking or by some confounding factors that were not taken into account cannot be ruled out.

Although the results about the effect of caffeine consumption on fetal growth are not fully consistent, it seems justified to recommend to pregnant women that they reduce their caffeine intake during pregnancy.
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REFERENCES