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Life-course approaches to investigate adverse effects of caffeine

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Caffeine is found in commonly consumed food and beverage items including coffee, tea, soda, energy drinks, and chocolate (1). Coffee, the most frequent caffeine source for adults in North America, is associated with overall longevity and protective effects on cardiovascular disease, type 2 diabetes, Parkinson's disease, and several types of cancers (2–5). Coffee was previously listed as a possible carcinogen by the WHO, but was removed from the list in 2016 (6). The effect of coffee consumption continues to be highly debated possibly because of the complexity and pathophysiologic differences in various diseases and types of cancers. Coffee itself is complex, containing an array of healthful components such as riboflavin, magnesium, and polyphenols, but also potentially harmful components such as acrylamide and caffeine. In addition to the food sources and disease outcomes, the specific life-stages of consumers may influence the adverse effects of caffeine (7).

For pregnant women, moderate caffeine intake to <300 mg/d (or 200 mg/d depending on the source) has been recommended, based on some data linking high intake to miscarriage and low birthweight (8, 9). [An 8 oz cup of brewed coffee contains close to 100 mg of caffeine (10); a large (20 oz) commercial coffee can have as much as 475 mg (11).] However, the safe amount of caffeine intake during pregnancy continues to be questioned, and the longer-term impact on exposed offspring has not been given much attention. In this issue of the Journal, Chen et al. (12) shed light into this knowledge gap through the use of data from a prospective cohort study from Ireland which included >500 mother-child dyads. The authors conclude that maternal antenatal, but not paternal or grandparental, caffeine intake, is associated with higher offspring childhood obesity risk (12). This study of maternal pregnancy caffeine intake on the long-term health outcome of children collected dietary information from not only the pregnant mothers, but also from fathers and grandparents, further clarifying the potential influence of in utero compared with shared environment. Maternal caffeine intake >200 mg/d was associated with a higher BMI *Z* score in offspring at the ages of both 5 and 9 y. Further, maternal caffeine intake was associated with childhood overweight/obesity and central obesity (waist circumference >90th percentile), whereas paternal intake was not associated.

Although the present report adds to emerging evidence on the potential impact of pregnancy diet on long-term offspring health, it has several limitations in providing concrete answers about possible adverse effects of pregnancy caffeine intake. First, the specific timing of pregnancy diet is not clearly captured. Some women reported first-trimester intake, while others reported intake in part of the second trimester in addition to the first. This raises several concerns related to both random and systematic errors. Since women may change their caffeine intake in early pregnancy, women who reported intake later in pregnancy may have reported less frequent caffeine intake compared with those who reported intake earlier in pregnancy, although the true intake for both may be similar. Therefore, the important public health question of whether changing maternal caffeine intake during the first trimester reduces the long-term risk for offspring obesity remains unanswered. Further, not taking maternal postpartum caffeine intake into consideration questions the critical timing of maternal diet influence on child development since women can pass caffeine through breastfeeding. Second, substitutional analysis by other beverage choices was not performed to assess the effect of drinking noncaffeinated beverages instead of caffeinated ones on offspring health. Such information may help knowledge translation in developing optimal public health recommendations for healthy pregnancy. Third, the interpretation and generalizability of the current study are limited by the modest sample size and the homogeneous study population setting. The current study was conducted in 2 hospitals located in the Republic of Ireland recruiting Irish mothers. Although the Food Safety Authority of Ireland recommendation for caffeine intake during pregnancy of <200 mg/d is similar to some countries, other countries have higher recommended limits of 300 mg/d (7). Since the upper category limit in the current analysis was ≥200 mg/d, this cannot answer the critical question about the direction of contribution of the intake between 200 and 300 mg/d. In addition, the food and beverage sources of caffeine differ in different regions (1). Since different food and beverage items contain varying nutrient and bioactive components, the overall contributing effect of caffeine from the specific food or beverage source may change based on its interaction with other components. Therefore, caffeine intake needs further investigations in various cultural and population settings to be relevant in the specific regions.

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In summary, the report by Chen et al. (12) contributes to the field highlighting the usefulness of the lifecourse approaches to understand the longer-term dietary impact on human health. One of the conclusions is that a maternal caffeine intake of <200 mg/d cutoff appears to be safe for childhood obesity outcomes. On the other hand, the observed positive association between higher (>200 mg/d) maternal caffeine intake and childhood obesity suggests potential for influence of other untested dietary components on offspring health. This report also raises additional questions of relevance for future maternal caffeine intake research to capture specific life-stage timing of dietary exposures, to consider alternate food and beverage choices by implementing substitutional analysis, and to conduct studies in larger sample sizes and various populations. In addition, pregnancy dietary recommendations in general need to consider longer-term outcome measures for women and child health such as obesity and chronic diseases beyond acute pregnancy outcomes.

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