Response to Invited Commentary

Van Ewijk et al. Respond to “Ramadan Prenatal Fasting and Adult Health Outcomes”

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Initially submitted January 28, 2013; accepted for publication February 1, 2013.

We thank Drs. Susser and Ananth for their insightful commentary (1) on our study (2), which highlights the importance of the novel line of research into the associations of prenatal exposure to Ramadan with offspring health.

Susser and Ananth argue that our findings are relevant only for the Muslim population and cannot be extrapolated to other situations of nutritional restrictions. We agree that there are many aspects of Ramadan that might cause the associations, including interference with nocturnal sleep, dehydration, stress, and glucose fluctuations.

Nevertheless, we cannot rule out that some processes occurring during Ramadan are similar to those occurring during other situations in which food intake is (temporarily) reduced. Evidence of accelerated starvation has been reported among women who fast during Ramadan (3, 4). Our findings of lower body mass indices among people who had been exposed to Ramadan prenatally are similar to findings of studies investigating associations of prenatal famine exposure in other developing countries (5). Moreover, results from 2 Ramadan studies published in (health) economics journals resemble results from the Dutch Famine Birth Cohort Study. Van Ewijk (6) found higher pulse pressures and more anemia and symptoms of coronary heart problems and type 2 diabetes among Muslims who were exposed prenatally to Ramadan (7, 8); Almond and Mazumder (9) reported more mental and other disabilities in this group (10). Future research will need to determine which aspects of Ramadan lead to these associations.

Susser and Ananth argue that our results might be biased if fasting probabilities differ between thin and overweight women because thinner women tend to have smaller babies. However, our intention-to-treat approach rules out this type of bias because we rely only on dates of birth for our Ramadan exposure classification. That is, provided thinner women do not systematically conceive on dates that lead to overlap of pregnancy with Ramadan, this type of bias cannot occur. Indeed, it has been shown by using data from the same wave of the Indonesian Family Life Survey that was used in our study that neither mothers’ body mass indices nor other potentially confounding parental characteristics differ between exposed and unexposed Muslim children. Moreover, when children born to the same mother were compared, associations between prenatal Ramadan exposure and health remained unchanged (6).

Yet, it seems too early to formulate public health implications. The aforementioned papers are only a start (2, 6, 9). We are currently working on studies that aim to shed light on how prenatal exposure to Ramadan affects health. We asked pregnant Muslims during Ramadan whether they were fasting, and we are currently following them and their offspring to investigate potential effects of exposure to Ramadan on the course of pregnancy and offspring’s health. We are also using birth registry data to study the associations of prenatal exposure to Ramadan with birth outcomes. Furthermore, we recently found preliminary evidence suggesting that prenatal exposure to Ramadan affects glucose metabolism in young children (T.R., unpublished data, 2013). By using school registry data, we have also found that prenatal exposure to Ramadan is associated with decreased cognitive performance in children (11).

Susser and Ananth note important directions for future research. Research on biological mechanisms, including placental function, is scarce (12). To investigate long-term health effects, prospective cohort studies in which the timing of Ramadan can be used as an instrumental variable for actual exposure indeed seem to be the optimal direction for ensuring unbiased results. However, follow-up times are long before the associations with clinical outcomes can be examined. Future research that uses intention-to-treat designs, actual fasting behavior combined with instrumental variables, or other designs such as those used by Langley et al. (13) is certainly needed.
There is a growing body of evidence suggesting that variations in maternal lifestyle during pregnancy affect offspring health. Our findings support the notion that prenatal exposure to Ramadan may have consequences for later health as well. The worldwide Muslim population is large enough to warrant more studies investigating these effects.

ACKNOWLEDGMENTS

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Conflict of interest: none declared.

REFERENCES