Abstract citation ID: ckad160.266

Temperature around conception and metabolic health in adulthood: Evidence from the UK Biobank

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Background:
Mice studies and correlational evidence among humans suggest that paternal cold exposure around conception is associated with improved metabolic outcomes among the offspring, which is caused by an increase in their amount of active brown fat. Especially the 2 weeks prior to conception are relevant as epigenetic programming during spermatogenesis takes place. Causal evidence on humans is thus far lacking. We overcome this challenge by exploiting quasi-random temperature variation around conception and studying metabolic health in a large sample.

Methods:
We combine daily temperature data with individual-level data from UK Biobank (N = 430,000, birth years 1934 - 1971) and link quasi-random temperature variations around conception to later-life metabolic health outcomes. We do not use actual temperatures, since conceiving during cold months or living in cold areas may be associated with socioeconomic and other characteristics that may affect offspring later-life metabolic health. Instead, we utilize deviations from the temperature that is to be expected for a certain place at a certain time point in a natural experiment framework. Date of conception is estimated from date of birth and our main exposure is temperature variation in the 2 weeks before conception. Since pregnancy length varies, temperatures during several time windows around conception are considered.

Results:
Individuals who were conceived when it was one degree Celsius colder than usually have a lower BMI (-0.018; 95% CI -0.033, -0.003), waist circumference (-0.038; 95% CI -0.071, -0.004), as well as lower levels of triglycerides (-0.004; 95% CI -0.007, -0.001) and cholesterol (-0.013; 95% CI -0.017, -0.010).

Conclusions:
Comparatively subtle environmental shocks such as temperature variations around conception are causally associated with long-term metabolic health. This study points to the importance of future research on similar potential health externalities of rising global temperatures.

Key messages:
- Colder temperatures around conception lead to improved metabolic health outcomes in adulthood, including lower BMI, waist circumference, and levels of triglycerides and cholesterol.
- Subtle environmental factors during the periconceptional period can have long-term health impacts, highlighting the need for further research on potential health externalities of climate change.