Impact of heat stress on pregnant subsistence farmers in West Africa

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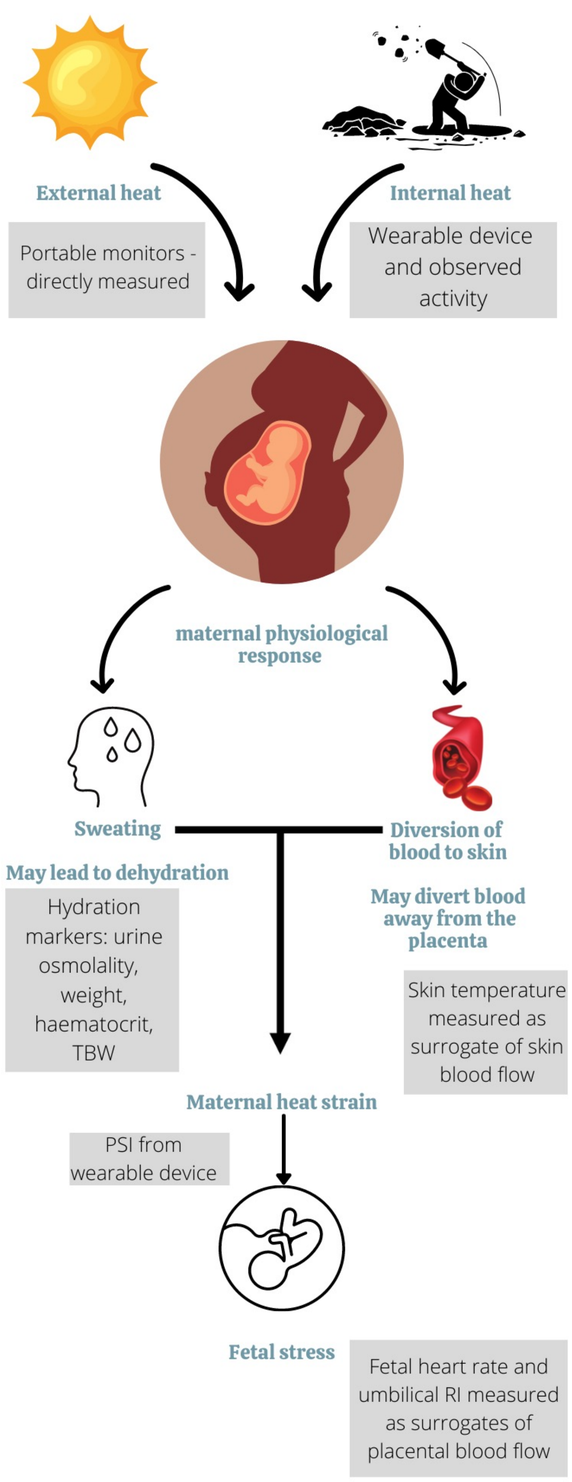
Introduction

Anthropogenic climate change has led to increasingly extreme temperatures worldwide. Sub-Saharan Africa (SSA), including West Africa, is considered especially vulnerable to the impacts of climate extremes. In SSA women make up 50% of agricultural workforce and often work throughout pregnancy, while maternal exposure to high temperatures increases the risk of adverse birth outcomes. Understanding the physiological mechanisms responsible is central to designing targeted interventions to reduce the risks of heat exposure.

Method

This observational cohort study utilised the high heat stress in West Africa to gain understanding of the physiological impact of heat on maternal and fetal physiology. Pregnant subsistence farmers who performed manual tasks throughout pregnancy were observed during field visits where environmental measurements, maternal physiology (e.g. heat strain) and fetal stress (fetal heart rate > 160 or < 115, or increase in umbilical artery resistance index) were measured.



TBW = total body water
PSI = physiological strain index
RI = resistance index of umbilical artery

Schematic representation of physiological response to thermal factors and measurements taken at each field visit to quantify these factors in grey

Results

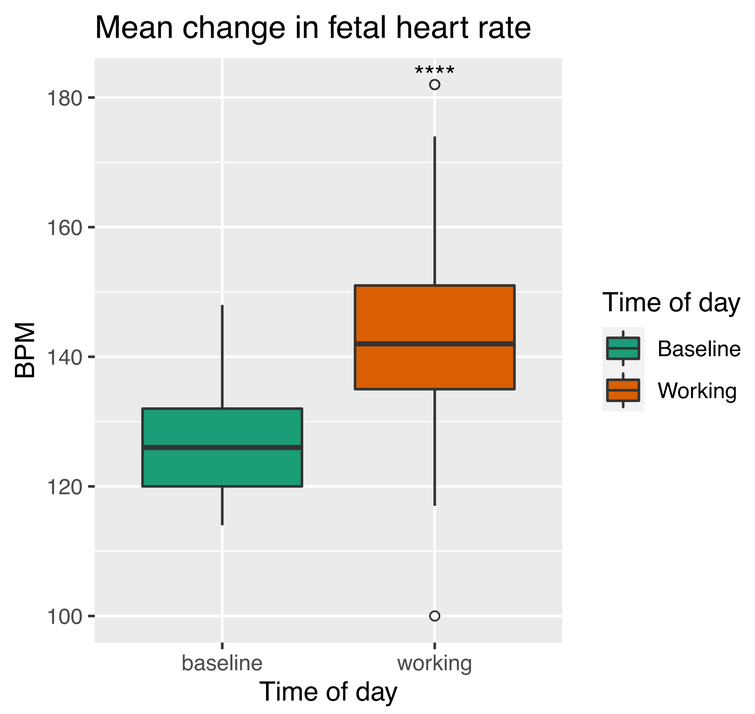
A total of 92 participants were included (122 field visits). Extreme heat stress was observed in 31% of field visits. Maternal temperature, heat strain and fetal heart rate were all significantly increased from baseline to working. Fetal stress occurred in 41/122 (33%) field visits. Multilevel modelling revealed that fetal stress was significantly associated with both Universal Thermal Climate Index (OR 1·17, CI 1·05;1·29, p=0.01) and gestational age (OR 1·12, CI 1·02;1·22, p=0.02).

Multilevel model of fetal stress

	Odds Ratio	95% CI	P-value
Intercept	0.00	0.00;0.28	
UTCI	1.17	1.05;1.29	0.01
PSI	1.20	0.99;1.46	0.06
Gestational age	1.12	1.02;1.22	0.02
Osmolality	1.00	1.00;1.00	0.61
Haematocrit	0.97	0.87;1.07	0.49
TBW	0.93	0.83;1.05	0.27

UTCI = universal thermal climate index; PSI = physiological strain index; TBW = total body water

Decreasing maternal exposure to heat stress in later pregnancy may reduce fetal stress, a potential pathophysiological mechanism leading to adverse birth outcomes.
However, there remain large evidence gaps in relation to the pathophysiology of heat in pregnancy, identification of those at risk and development of suitable and effective interventions to reduce adverse birth outcomes. Further work exploring changes in placental blood flow and the association with pregnancy outcomes is urgently needed, in a variety of settings and populations. In addition, co-development and trials of interventions in pregnant subsistence farmers in SSA would be a welcome and exciting area to explore.



Mean change in fetal heart rate from cool baseline to heat exposed work environment

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