Maternal Nutrition, SES, and Infant Neurocognitive Development: The Role of Inflammation

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Background and Aims:

The first 1000 days of life are critical for neurodevelopment. Low socioeconomic status (SES) groups are particularly susceptible to environmental adversity during this window, with consequential lifelong impacts on neurocognitive development[1]. Increasingly, chronic inflammation is cited as a potential mediator of this relationship, with maternal nutrition representing a likely underestimated and key route through which this inflammation might manifest and influence infant outcomes[2,3].

The aims of this project are three-fold:

1) To validate the use of the Dietary Inflammatory Index (DII) in reproductive aged women.

2) To examine whether early infant habituation and novelty detection (HaND) responses can be detected at one-month.

3) To understand whether maternal dietary inflammation impacts early HaND responses, and whether this mediates the relationship between socioeconomic status and infant neurocognitive outcomes.
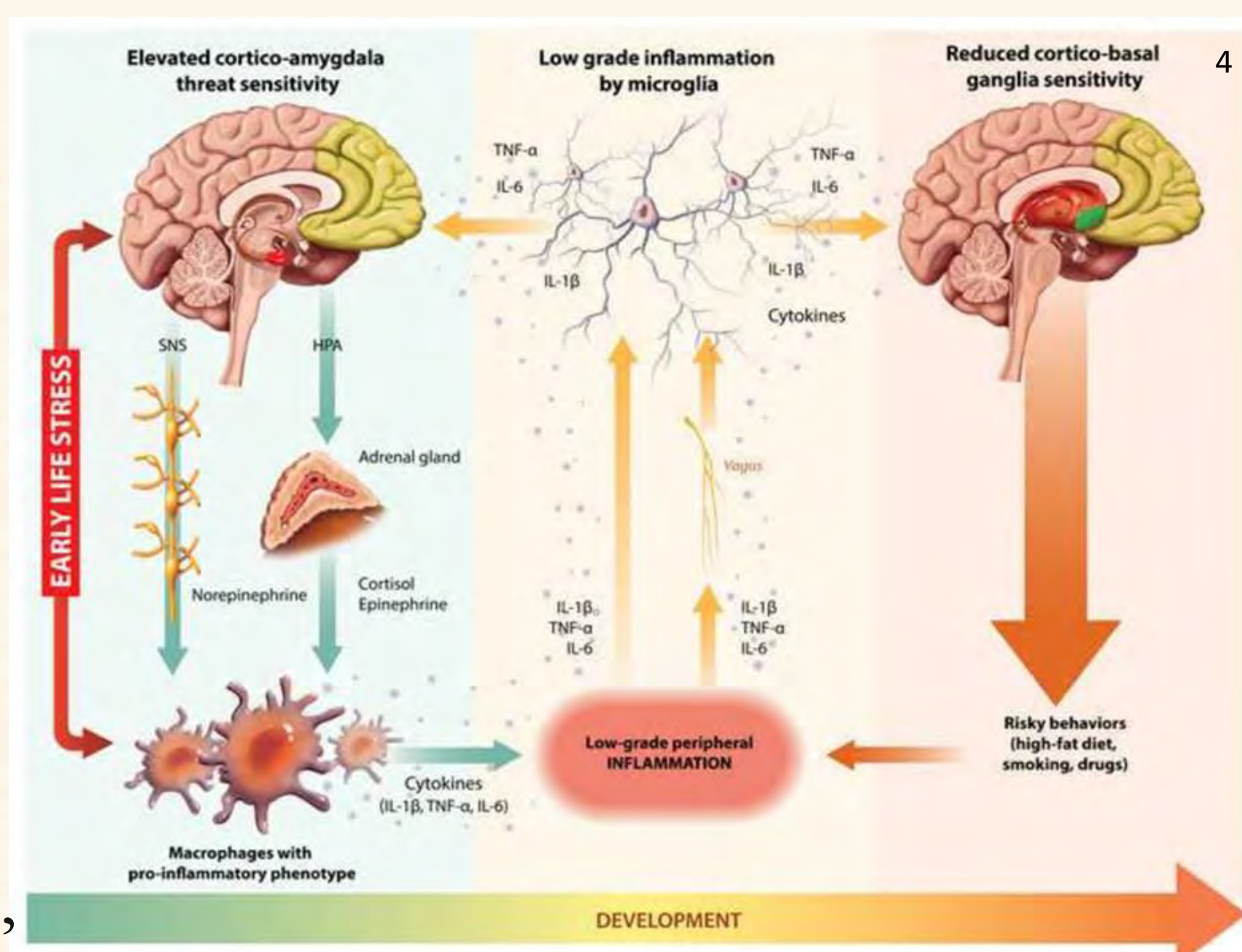

Figure 1. Schematic diagram relating early adversity, inflammation and neurodevelopment[4].

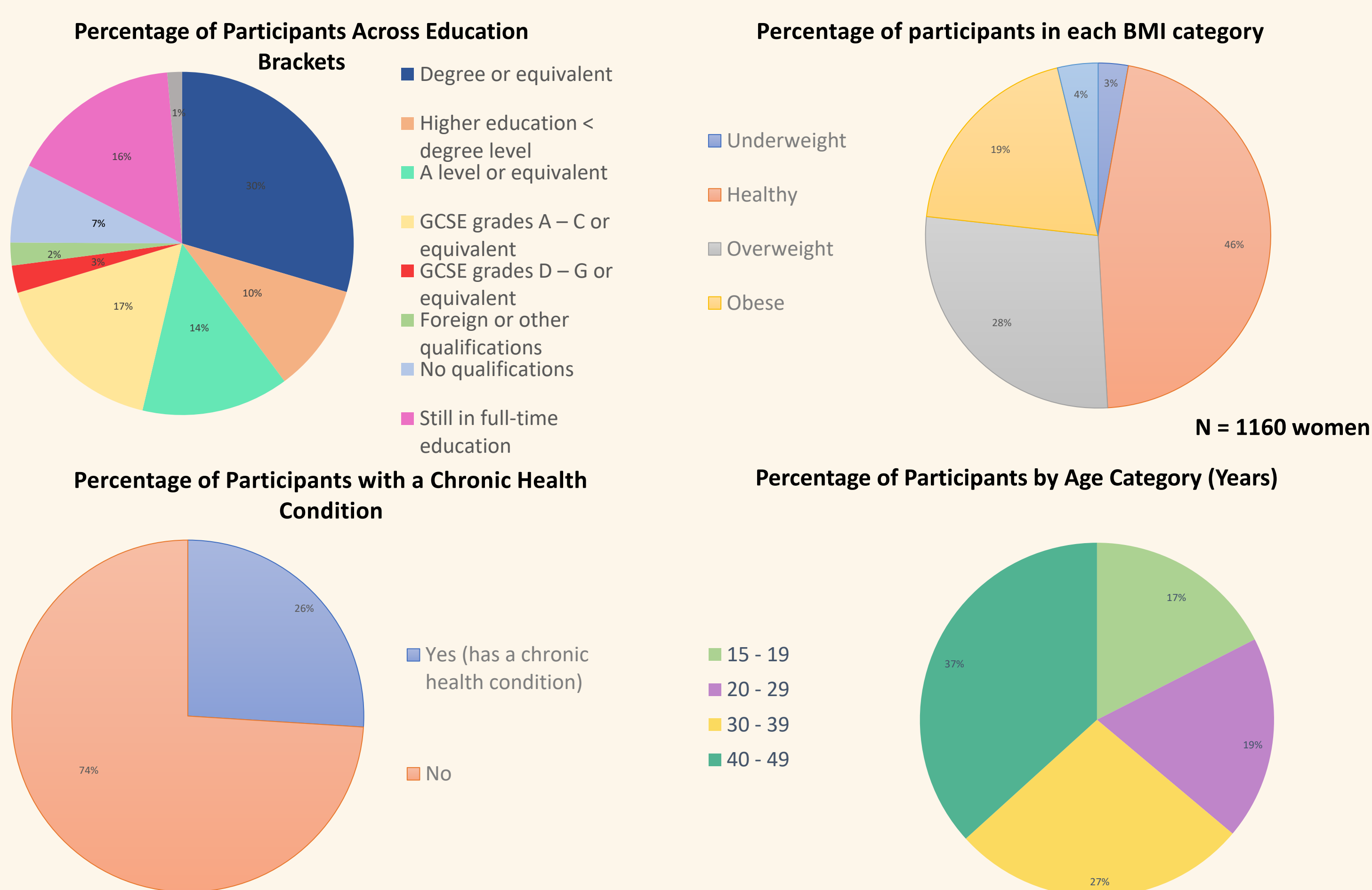## Results from National Survey (Step 1):

Figure 3. Proportion of national survey participants across education, BMI, Chronic Health, and Age brackets.

Predictor	Beta Coefficient	T-value	Significance	95% Confidence Interval
DII	1.08	4.335	P<0.001	1.001 - 1.160
BMI	1.05	13.875	P<0.001	1.000 - 1.097
Chronic Health	1.21	3.695	P<0.001	1.074 - 1.336

Table 1. Results from multiple linear regression with CRP. R^2 indicated 17.4% of the variance in CRP was explained by the model. Cohen's $f^2 = 0.21$ (medium effect size).

Predictor	Outcome	T-value	Significance
Education	DII	-7.464	P<0.001
BMI	CRP	-3.953	P<0.001

Table 2. A subgroup of participants in the highest and lowest brackets of education were also examined using Welch two-sample t-tests.

Materials & Methods:

Step 1: National Diet and Nutrition Survey (NDNS)

National Cohort:
- Dietary patterns scored with Dietary Inflammatory Index[5] (**DII**) for 1160 women aged 16-49 years
- DII regressed with C-reactive Protein (CRP)

Step 2: BRain Imaging for Global HealTh (BRIGHT)

Cambridge (Pilot) Cohort 1:
- Infant 1-month HaND responses to be examined using:
  - Neonatal Behavioural Assessment Scale (**NBAS**)
  - Near-infrared spectroscopy (**NIRS**) (right).

Step 3: Perinatal Imaging in Partnership with Families (PIPKIN)

Cambridge (Established) Cohort 2:
- Analyses to be run on full PIPKIN cohort.
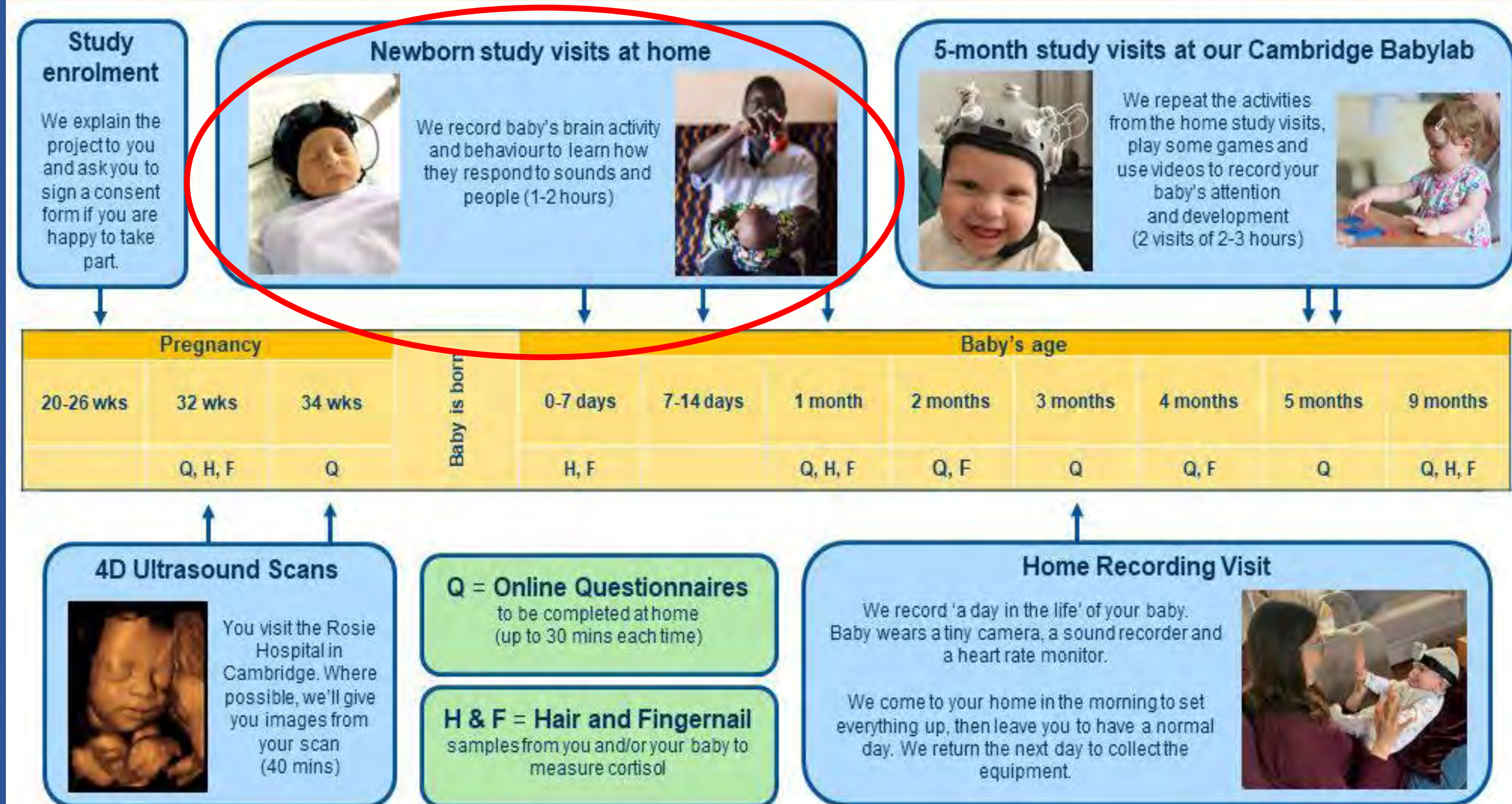- SES and longitudinal DII scores to be added into the model.

Figure 2. Visual representation of the PIPKIN project study visits. Top left scan the SQ code for more information on PIPKIN.

Conclusions:

- Pro-inflammatory diets may represent a route through which inflammation manifests at a biological level in reproductive-aged women.

- A higher instance of dietary-based and physiological inflammation in the lowest, compared with highest, educated groups may indicate discrepancies in such indices between different socioeconomic groups.

- This could point towards a role of inflammation, routed through maternal diet, in the association between infants of lower SES groups and poorer cognitive outcomes.

References:
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5. Shivappa, N., Steck, S. E., Hurley, T. G., Hussey, J. R., & Hébert, J. R. (2014). Designing and developing a literature-derived, population-based dietary inflammatory index. *Public Health Nutrition*, *17*(8), 1689–1696. https://doi.org/10.1017/S1368980013002115