

fNIRS in Rural Gambia: Studies of Cognitive Function from Birth to 24 Months of Age

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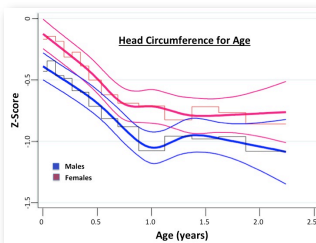
Aims

- To establish functional near infrared spectroscopy (fNIRS) as a low cost, non invasive brain imaging tool for assessing neurocognitive function in infants from birth in resource poor settings.
- To provide early biomarkers of cognitive development to inform and evaluate nutritional intervention strategies.
- To supplement current assessment methods with a direct measure of cognitive functioning, unbiased to cultural background.

Study Protocol

A total of 99 infants were studied between birth and 24 months of age. Infants wore an fNIRS source detector array over the right hemisphere. Newborn infants were presented with social and non-social auditory stimuli whilst sleeping. All other age groups were presented with social and non social visual stimuli in addition to the auditory stimuli. Additionally, infants 6 months and older underwent behavioural assessment using the Mullen Scales of Early Learning (MSEL). An assessment of the implementation of MSEL was performed to control for cultural bias.

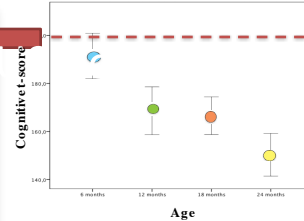
Rationale



Faltering head growth is apparent by 12 months of age in rural Gambian infants. Associated neurocognitive ramifications are poorly understood.



Standardised assessment measures are designed and normed on Western population, and are biased as such.



Anthropometric measurements are commonly used to track physical development; indices from which indicators of nutritional status can be derived.

Results

* When the same aged UK infants were studied, similar patterns of selective cortical activation were seen

Experimental Setup



0-2 months



4-8 months*



12-16 months



18-24 months



VISUAL

social vs. non-social



INFANTS WERE SLEEPING

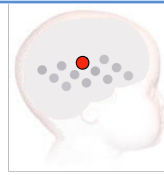


AUDITORY

social vs. non-social

cough
cry
throat-clear
laugh

rattle
shake
running water



Brain regions showing significant cortical activation:

● NON-SOCIAL > SILENCE

● SOCIAL and NON-SOCIAL > SILENCE

● SOCIAL > NON-SOCIAL

Conclusions

- fNIRS can be used to measure neurocognitive function in infants from birth to 24 months of age in a resource poor setting.
- Cross-sectional and longitudinal studies revealed distinct regions of the posterior superior temporal and inferior frontal cortex activated by either visual or auditory social stimuli.
- fNIRS may be used to elucidate typical and atypical brain development from birth and hence investigate the effects of nutritional insults and interventions in global health studies.

More Information

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Lloyd-Fox, S., Papademetriou, M., Darboe, M. K., Everdell, N. L., Prentice, A. M., Moore, S. E., & Elwell, C. E. (2014). Functional near infrared spectroscopy (fNIRS) to assess cognitive function in infants in rural Africa. *Nature Scientific Reports* 4:4740. DOI: 10.1038/srep04740

