Neural development of spatial cognition: an fMRI study on the effects of current and past nutritional status

Published: 22-05-2018
Last updated: 12-04-2024

To assess whether nutritional status can affect the outcome of spatial cognition training in the brain.

Ethical review	Approved WMO
Status	Recruiting
Health condition type	Other condition
Study type	Observational non invasive

Summary

ID

NL-OMON44559

Source
ToetsingOnline

Brief title
Nutrition & Spatial cognition

Condition

- Other condition

Synonym
not applicable

Health condition

gezonde proefpersonen, eventueel met overgewicht

Research involving
Human

Sponsors and support

Primary sponsor: Radboud Universiteit Nijmegen
Source(s) of monetary or material Support: Europees Fonds voor Regionale Ontwikkeling (EFRO),Mead Johnson Nutrition

Intervention

Keyword: fMRI, Neural development, Nutrition, Spatial cognition

Outcome measures

Primary outcome

Differences in brain activation patterns (fMRI) pre- and post-training are the main outcome measures for this study. These will be related to nutritional status, as measured by a composite score of the Dutch healthy diet index (i.e. a food frequency questionnaire assessing adherence to the Dutch healthy diet guidelines) and visceral adipose tissue quantified by abdominal MRI.

Secondary outcome

In secondary analyses, we want to see how inflammatory markers, DNA methylation (LY86 gene) (both measured from saliva) and gut microbiome diversity (measured from stool) relate to the neurocognitive development of spatial cognition, as potential mediators of the primary effects.
We will also decompose the composite score based on the FFQ and visceral adipose tissue to explore whether sub-components are driving the effects.
As motivation for food reward and executive functioning have been clearly related to obesity in previous studies with children, we will include behavioural measures of these as a positive control (using the Progressive Ratio task and Flanker task respectively).

Study description

Background summary

Childhood obesity is one of the most serious public health challenges of the 21st century. Obesity is highly associated with dietary quality, and poor dietary quality is associated with cognitive decline. Recent evidence suggests that inflammation of visceral adipose tissue and subsequent neuroinflammation may underlie this association. In adults, poor dietary quality has been linked to reduced performance in a spatial cognition task. One brain structure particularly prone to neuroinflammation is the hippocampus, which is also the core brain hub for spatial cognition. Indeed, a recent rodent study demonstrated high fat diet-induced detriments in spatial cognition, mediated by enhanced inflammation of the hippocampus. Importantly, these findings were particularly strong in juvenile rats, i.e. during development, rather than in adult rats. Here, we propose to examine the relation of nutritional status to the neural development of spatial cognition in primary school children. We adopt a spatial cognition paradigm that allows investigating training-induced neural plasticity changes. Training effects will be compared between groups with a low versus high nutritional status, measured by dietary assessment and visceral adipose tissue.

Study objective

To assess whether nutritional status can affect the outcome of spatial cognition training in the brain.

Study design

The proposed study uses a 5-day spatial cognition training to assess the relationship between nutritional status and the neural development of spatial cognition. The assessments are observational.

Study burden and risks

The children are not exposed to any risks when participating in this study. Participants will come to the Donders Institute three times: (1) for the intake session (90-120 minutes, including 20 minutes anatomical MRI scans), (2) for the pre-training fMRI session (60 minutes in total, of which 30 minutes in the MRI scanner) and after five days (3) for the post-training fMRI session (60 minutes in total, of which 30 minutes in the MRI scanner). In between the pre- and the post-scan session, subjects will perform the spatial cognition training from a computer at home, for 30 minutes a day, 5 days in a row. Saliva samples for inflammatory markers will be collected twice, a saliva sample for epigenetics and a stool sample for gut microbiome markers will be collected

once.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Children (2-11 years)

Inclusion criteria

Age: 8-10
Healthy
fMRI compatible
Proficient use of Dutch in both child and parent

Exclusion criteria

- Deafness, blindness, or sensori-motor handicaps

- Neuropsychiatric disorders
- Diabetes
- Chronic inflammatory diseases
- Daily use of ibuprofen, aspirin or glucocorticoids
- Any recent tooth extraction one month prior to the experiment
- History of oral candidiasis
- Acute illness with fever, vomiting, or diarrhea within 5 days of the study
- Recent use of antibiotics (within 3 months prior to the experiment);Exclusion criteria for MRI:
- Non-removable metal in the upper body
- Active implant, pacemaker, neurostimulator, insulin pump and/or auditory prosthetic
- Epilepsy
- Claustrophobia
- Brain surgery in the anamnesis

Study design

Design

Study type: Observational non invasive

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Recruiting
Start date (anticipated):	12-12-2018
Enrollment:	52
Type:	Actual

Ethics review

Approved WMO

Date:	22-05-2018
Application type:	First submission
Review commission:	CMO regio Arnhem-Nijmegen (Nijmegen)

Approved WMO

Date:	24-09-2018
Application type:	Amendment
Review commission:	CMO regio Arnhem-Nijmegen (Nijmegen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL64464.091.17