Investigating Neural Mechanisms Underlying Olfactory Fat Perception

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The primary objective of this study is to determine brain activation in response to olfactory (orthonasal) exposure to different fat levels contained in a ecologically-relevant fat source.

Ethical review	Approved WMO
Status	Pending
Health condition type	Other condition
Study type	Interventional

Summary

ID

NL-OMON49906

Source
ToetsingOnline

Brief title
MagniFatScent study

Condition

- Other condition

Synonym
odour - fat in dairy milk

Health condition

brain activation

Research involving
Human

Sponsors and support

Primary sponsor: Wageningen Universiteit
Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: dairy milk, fat perception, fMRI, olfaction

Outcome measures

Primary outcome

Changes in brain activation (BOLD signal) due to olfactory exposure to

different fat levels.

Secondary outcome

- Fat discrimination ability (assessed using the DR A-not A discrimination

testing methodology)

- Quantitative ratings for odour intensity and liking, obtained using a

continuous 100-unit visual analogue scale (VAS).

Study description

Background summary

Consumption of dietary fat is exceeding recommended daily intake requirements in many Western diets. Due to its high energy density and low effect on satiation (especially in obese individuals) it is considered a major contributing factor to energy overconsumption and consequential development of obesity and related comorbidities. To help reduce the public health burden of excessive fat consumption, the understanding of its perception is crucial.

The alluring flavour of fat arises from a synergy between gustation, somatosensation, as well as olfaction. Although the role of olfaction in the perception of dietary fat is relatively unexplored, an increasing body of evidence underscores the importance of odours in fat perception. It has been established that humans are capable of detecting and discriminating between fatty acids using solely olfactory cues. Moreover, research shows that humans are also capable of detecting minute fat content differences in actual foods. In our previous two experiments (manuscript submitted for publication; see "K3 Retrofat Study Manuscript* for the submitted manuscript), we replicated previous findings on olfactory fat perception in real foods and extended them by showing that humans are also capable of discriminating food fat content

solely based on retronasal olfaction. These findings support the notion that humans possess a functional olfaction-based system for detecting food fat content, however, the underlying mechanisms remain to be elucidated.

In contrast to oral fat perception, which has been investigated in numerous neurobiological studies, the underlying neurobiological mechanisms of olfactory fat perception remain unexplored. In fact, our literature search did not yield a single study investigating how olfactory exposure to fat sources is represented in the human brain. The research proposed in the current protocol therefore aims at filling this knowledge gap, by uncovering the neural mechanisms underlying olfactory fat perception and mapping relevant brain areas. We hypothesise that brain activation in reward-related brain areas will differ between the fat levels. Specifically, we expect that exposure to higher fat levels will result in a higher level of activation in the VS (NaC, VP), VTA, PFC (including OFC), ACC, amygdala, hippocampus, and insula.

See "1. Introduction and Rationale" of the research protocol for more information.

Study objective

The primary objective of this study is to determine brain activation in response to olfactory (orthonasal) exposure to different fat levels contained in a ecologically-relevant fat source.

Study design

The study follows a randomized, counterbalanced, within-subjects design in which brain responses to olfactory (orthonasal) exposure to three fat concentrations (low, medium, high) will be measured.

Intervention

During fMRI, odours from fat sources will be presented using an olfactometer. Ratings of odour liking, and intensity will be collected using 100-unit Visual Analogue Scales.

Study burden and risks

The study is non-therapeutic to the subjects. No immediate benefits for the subjects are expected from participation in this study, and the risk associated with participation can be considered negligible. In terms of time, the subject*s burden is as follows: 30 minutes for the screening/training session; 35 minutes for discrimination testing session; and 1 hour and 10 minutes for the fMRI task session. In total, the time burden amounts to 2 hours and 15 minutes.

Undergoing an fMRI scan involves: exposure to loud noise (addressed with ear protection) and a moderate amount of physical restraint (the head is inside an fMRI coil - this feeling is similar to wearing a motorbike helmet). During the test session, subjects will smell odours that originate from commercially available, considered safe, and commonly consumed food products. These odours will be embedded within a constant stream of odourless air (delivered via an olfactometer), heated to body temperature and humidified to 80% relative humidity.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)

Inclusion criteria

- Aged 18 - 55 at the time of inclusion
- Normal BMI (18.5 - 25 kg/m2)
- Self-reported healthy (see *F1-1 Screening Questionnaire*)

- Willing to comply to study procedures
- Willing to be informed about incidental findings of pathology and approving of reporting this to their general physician
- Being a consumer of dairy milk (at least once per week)
- Having a normally functioning sense of smell (scoring at least 12/16 on the Sniffin* Sticks test)
- Being right-handed (as brain anatomy differences exist between left- and right- handed individuals)

Exclusion criteria

- Regular smoker (smoking one or more cigarettes per day)
- Having any dairy-related allergies or intolerances (self-reported).
- Being pregnant, lactating or planning on becoming pregnant during the study period
- Having a psychiatric, neurological, or eating disorder
- Being employed by the Division of Human Nutrition and Health of Wageningen University
- Participation in another medical-scientific study

MRI-related Exlcusion Criteria:
- Claustrophobic (self-reported)
- Having a contra-indication to MRI scanning (including, but not limited to):
- Pacemakers and defibrillators
- Epilepsy or family history of epilepsy
- Intraorbital or intraocular metallic fragments
- Ferromagnetic implants
- Presence of non-removable piercings on the head

- Limited sight that is not corrected with contact lenses or cannot be corrected with our MRI safe glasses (maximum strength is +6 and -6)
- For women: lactating, being pregnant, or using an IUD as anti-conceptive (with exception of the Mirena IUD, which is MRI safe).

Study design

Design

Study type: Interventional

Masking:	Open (masking not used)
Control:	Uncontrolled

Primary purpose:	Other

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	20-10-2021
Enrollment:	25
Type:	Anticipated

Ethics review

Approved WMO

Date:	19-01-2022
Application type:	First submission
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	NL78261.091.21