Neuro-cognitive effects of tyrosine supplementation in healthy older adults: A fNIRS-EEG study

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We aim to assess the effects of tyrosine supplementation on prefrontal brain activation, as measured by a combination of fNIRS and EEG, during response inhibition and working-memory performance in older adults. We will also assess whether...

Ethical review	Positive opinion
Status	Recruitment stopped
Health condition type	-
Study type	Interventional

Summary

ID

NL-OMON29556

Source
NTR

Brief title
INTENSE

Health condition

Aging, working memory, EEG, cerebral blood flow

Sponsors and support

Primary sponsor: Wageningen University, Division of Human Nutrition
Source(s) of monetary or material Support: EFRO (Europees Fonds voor Regionale Ontwikkeling), Provincie Gelderland

Intervention

Outcome measures

Primary outcome

Changes in functional prefrontal activation as determined by oxygenated hemoglobin changes (ìmol/L) induced by tyrosine supplementation, measured during response inhibition performance

Secondary outcome

- Changes in functional prefrontal activation as determined by oxygenated hemoglobin changes (ìmol/L) induced by tyrosine supplementation, measured during working memory performance.
- Changes in functional prefrontal activation as determined by deoxygenated hemoglobin changes (ìmol/L) induced by tyrosine supplementation, measured during response inhibition performance and working memory performance.
- Changes in brain activity as determined by EEG frequency bands, induced by tyrosine supplementation, measured during response inhibition performance.

Study description

Background summary

Objective: Dopamine neurons in the prefrontal cortex, a brain region involved in response inhibition and working memory, are highly tyrosine-dependent. The amino acid tyrosine is a precursor of dopamine and has been shown to reduce cognitive impairments in young adults during environmental stress such as cold induction, acoustic noise or a demanding task. Both prefrontal dopamine availability and prefrontal brain activity decline in the aging brain and therefore elderly might also benefit from tyrosine supplementation to improve cognitive functioning. Study design: We aim to assess the effects of tyrosine supplementation on prefrontal brain activation, as measured by a combination of fNIRS and EEG, during response inhibition and working-memory performance in older adults. We will also assess whether neuropsychological functioning – as measured by paper and pencil tests – will improve due to tyrosine supplementation. Study population: 32 healthy older adults in the age range 60 to 75 will be tested twice using fNIRS-EEG. Intervention: Subjects will receive 150 mg/kg body weight L-tyrosine powder or 50 mg/kg body weight of dextrin-maltose with 100 mg/kg cornstarch (placebo condition) in a randomized order. Both interventions will be dissolved in 200 grams of flavoured light yoghurt on different test days. Main study parameters/endpoints: Changes in functional prefrontal activation as determined by oxygenated and deoxygenated hemoglobin changes (µmol/L) and by EEG frequency bands, induced by tyrosine supplementation, measured during response inhibition and working memory performance. Other study parameters are changes in performance on the neuropsychological test battery and changes in behavioural performance on the response inhibition and working memory tasks, induced by tyrosine supplementation.

Study objective

We aim to assess the effects of tyrosine supplementation on prefrontal brain activation, as measured by a combination of fNIRS and EEG, during response inhibition and working-memory performance in older adults. We will also assess whether neuropsychological functioning – as measured by paper and pencil tests – will improve due to tyrosine supplementation.

Study design

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Intervention

- A single dose of 150 mg/kg body weight of L-tyrosine powder
- A placebo, consisting of ~50 mg/kg body weight of dextrin-maltose and ~100 mg/kg body weight of cornstarch Both mixed with banana-flavoured yoghurt in a ratio of 1:20

Contacts

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Eligibility criteria

Inclusion criteria

- Aged 60-75 years
- Right-handed
- Dutch speaking
- Normal or corrected to normal vision
- Willing to comply with study procedures

Exclusion criteria

- Mini-Mental State Examination (MMSE) score of <24 (Folstein et al. 1975)
- Estimated IQ of <85 (based on Nederlandse Leestest voor Volwassenen (NLV) -score) (Schmand et al. 1991)
- Hospital Anxiety and Depression Scale score of >11 (Bjelland et al. 2002)
- Current or past psychiatric disorder, such as psychosis or major depression
- Current or past neurological disorder, such as severe cerebral vascular disease (e.g. cortical stroke, subarachnoid hemorrhage), Parkinson's disease, epilepsy, traumatic brain injury, central nervous system infection, brain tumor, and alcoholic encephalopathy. N.B. Transient Ischaemic Attack, lacunar infarction and white matter lesions are no exclusion criteria.
- Current severe systemic disease such as coronary artery disease, myocardial infarction < 6 months, heart failure (unstable), chronic obstructive pulmonary disease (unstable)
- Current endocrine or metabolic disorders such as hepatic or renal problems
- First degree family history of schizophrenia, bipolar disorder or major depressive disorder
- Thyroid problems, such as hyperthyroidism, subclinical hyperthyroidism (TSH <0.4 mU/L), hypothyroidism, thyroid cancer.
- Using medication that can interfere with tyrosine's action: monoamine oxidase inhibitors and other antidepressants, sympathomimetic amines, and opioids
- Following a low-protein diet as prescribed by a dietician or physician
- Use of tyrosine supplements within one month prior to visit
- Being allergic or having a dislike to the product carrier (banana-flavored yoghurt)
- Blood pressure <90/60 mmHg or >160/90 mmHg (use of antihypertensives are allowed)
- General medical conditions, such as repetitive strain injury (RSI), colorblindness or sensori-motor handicaps, which may confound the results of the study, as judged by the investigator
- Alcohol consumption of more than 14 (women) or 21 (men) units per week
- Habitual smoking, defined as more than a pack of cigarettes per week
- Current participation in another study, or a specific cognitive training study within the past six months, or a study using the same cognitive paradigm as the current study

Study design

Design

Study type:	Interventional
Intervention model:	Crossover
Allocation:	Randomized controlled trial
Masking:	Double blinded (masking used)
Control:	Placebo

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	01-05-2015
Enrollment:	32
Type:	Actual

IPD sharing statement

Plan to share IPD: No

Ethics review

Positive opinion

Date:	28-04-2015
Application type:	First submission

Study registrations

Followed up by the following (possibly more current) registration

ID: 41819
Bron: ToetsingOnline
Titel:

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

No registrations found.

In other registers

Register	ID
NTR-new	NL5075
NTR-old	NTR5206
CCMO	NL52264.091.15
OMON	NL-OMON41819

Study results