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Investigating the effects of acute tryptophan loading on attention and impulsivity in adults with and without Attention Deficit Hyperactivity Disorder (ADHD)

Submission date
27/04/2023

Recruitment status
No longer recruiting

Registration date
03/05/2023

Overall study status
Completed

Last Edited
12/12/2023

Condition category
Mental and Behavioural Disorders

[_] Prospectively registered
[X] Protocol
[_] Statistical analysis plan
[X] Results
[X] Individual participant data

Plain English summary of protocol

Background and study aims
ADHD is a condition where people have trouble paying attention, are impulsive, and hyperactive. It's not just a childhood thing - some adults have it too. The most common treatment is medicine that helps with the chemicals in the brain that affect attention, but this medicine can have bad side effects. Some research suggests that other chemicals in the brain, like serotonin, might be involved in ADHD too. Serotonin can be affected by what we eat, especially by a chemical called tryptophan. There haven't been many studies on using tryptophan to treat ADHD in adults, and the ones that have been done haven't looked at the main ADHD symptoms. This study wants to see if increasing tryptophan levels can help with attention and impulsivity in both healthy people and those with ADHD. They will compare how people do on cognitive tasks after taking tryptophan supplements to how they do after taking a control supplement with a normal amount of tryptophan.

Who can participate?
Adults aged 18-35 years with:
1. No current or previous diagnosis of ADHD
2. A current diagnosis of ADHD but not currently receiving any drug treatment for the condition (and have not done so for 3 months)
3. A current diagnosis of ADHD and currently receiving and adhering to medication treatment for the condition with at least 70% adherence

What does the study involve?
Participants will first complete a brief online screening survey (<10 minutes) to assess eligibility to participate. Eligible participants will be asked to provide a UK post address for a protein powder to be sent and will be invited to an online test session. Testing will be in two phases – before and after consuming the protein shake – with the same computerised tests completed in both phases and aim to measure attention and impulsivity. Brief descriptions of the tests are given below:

1. Test of attention – participants will be asked to press a letter on a keyboard to respond to a target stimulus whilst inhibiting responses to non-target stimulus. This will provide a measure of attention and motor impulsivity
2. Tests of impulsivity – two specific tests will be used to measure impulsivity. In the first test participants will be asked to make choices, using keyboard presses, between hypothetical rewards now or at a point in the future for several different delays e.g. 1 week, 2 weeks, 1 month, 3 months, 6 months and 1 year. In the second test, participants will be shown four decks of cards (labelled A, B, C, and D) and asked to choose 100 times from the decks with two decks giving greater gains and losses. These tests measure cognitive and temporal impulsivity

What are the possible benefits and risks of participating?
The data collected will provide valuable information about the effectiveness of tryptophan in treating ADHD and therefore has the potential to be beneficial to patients with the condition in the future. There are no direct benefits to participants for participating in this study, although those who attend and complete testing will receive an Amazon voucher as a 'thank you'. The researchers don't anticipate any specific risks in taking part in the study because we will only enroll participants who can safely consume the protein shake (e.g. do not have allergies to any of the ingredients). We will be asking about symptoms of ADHD and use of medication, where appropriate. These questions are asked during the screening survey and it is clear this information is required in the information sheet so it is hoped that participants choosing to participate in the study will be comfortable sharing this information. If they do not, they can withdraw at any point.

Where is the study run from?
The researchers conducting this study are based at King's College London (UK) but the study is an online study so testing can be done from anywhere and uses MS Teams.

When is the study starting and how long is it expected to run for?
May 2020 to September 2023

Who is funding the study?
Investigator initiated and funded

Who is the main contact?
Dr Eleanor Dommett, eleanor.dommett@kcl.ac.uk

Contact information

Type(s)
Principal investigator

Contact name
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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
Nil known

Study information

Scientific Title
Investigating the effects of tryptophan modulation on attention and impulsivity in adults with and without Attention Deficit Hyperactivity Disorder: A double blind randomised controlled trial

Acronym
TrypCoreADHD

Study objectives
1. Participants with ADHD will perform significantly worse on tasks measuring attention and impulsivity in comparison to those without ADHD prior to any tryptophan modulation.
2. There will be a dose-dependent effect of tryptophan modulation on attention and impulsivity that will differ between those with ADHD and those without.

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 15/05/2020, King's College London PNM Research Ethics Subcommittee (5.9 Waterloo Bridge Wing, Waterloo Road, London, SE1 9NH, United Kingdom; +44 (0)207 8484020; rec@kcl.ac.uk), ref: 19/20-17983

Study design
Interventional double blind randomized controlled trial

Primary study design
Interventional

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Attention Deficit Hyperactivity Disorder (ADHD)

Interventions
Participants will first complete a brief online screening survey (<10 minutes). This information is used to assess eligibility and allocate participants to specific groups (e.g. those with and without ADHD). The survey assesses:
- Information relating to food intolerance and diet
- Demographic information e.g., age and gender
- Clinical information including use of medication, ADHD symptoms

Finally, participants will be asked to provide an email address so that they can be contacted by the research team to confirm eligibility and book in a test session where appropriate. A protein powder sachet will be sent to the participants at a UK address in advance of this session.

Test sessions take place online via MS Teams. On arrival in the online space, participants will be directed to make up their protein shake from the posted powder and then refrigerate this. They will be asked to complete three computerised tests via their browser. They will be asked to have their camera on and screen share throughout.
Brief descriptions of the tests are given below:
1. Test of variables of attention (TOVA) task – participants will be asked to press a letter on a keyboard to respond to a target stimulus whilst inhibiting responses to non-target stimulus. This will provide a measure of attention and motor impulsivity.
2. Delayed Discounting Task (DDT) - participants will be asked to make choices, using keyboard presses, between hypothetical rewards now or at a point in the future for several different delays e.g. 1 week, 2 weeks, 1 month, 3 months, 6 months and 1 year. This provides a measure of temporal impulsivity.
3. Iowa Gambling Task - participants will be shown 4 decks of cards (labelled A, B, C, and D) and asked to choose 100 times from the decks with two decks giving greater gains and losses. This provides a measures of cognitive impulsivity.

After completion of these tasks participants will have around 10 mins to consume the protein shake before taking a 1 hour break and then returning to the online call. On return the tasks will be repeated. The protein shake will either contain a balanced amino acid profile, a low loading of tryptophan or a high loading of tryptophan. The participants and researcher running the session will not be aware of which type of protein shake is being consumed to avoid any bias. We are using stratified randomisation (stratified by gender and medication use) with a random number generator to allocate to intervention condition.

Intervention Type
Supplement

Primary outcome(s)
Measured pre and post intervention (baseline and ~1 hour):
1. Attention measured using the computerised Test of Variable of Attention (TOVA) task (omission errors, response sensitivity, reaction time).
2. Motor impulsivity measured using the computerised Test of Variable of Attention (TOVA) task (commission errors).
3. Temporal impulsivity measured using the computerised Delay Discounting Task (indifference points, discounting function, area under the curve).
4. Cognitive impulsivity measured using the computerised Iowa Gambling Task (proportion of risky decisions, net score).

Key secondary outcome(s))
There are no secondary outcome measures

Completion date
30/09/2023

Eligibility

Key inclusion criteria
All participants:
1. Adults aged 18-35 years

Healthy control participants (HC):
2. No diagnosis of ADHD and score on the Adult ADHD Self-Report Scale below the threshold indicative of ADHD.

ADHD
3. Existing current diagnosis of ADHD and score on the Adult ADHD Self-Report Scale above the threshold indicative of ADHD.
4. Either not receiving ADHD medication and have not received any for a period of at least 3 months or receiving medication for ADHD (psychostimulant or non-stimulant) and adhering to this with a rate of at least 70%.

Participant type(s)
Mixed

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Upper age limit
35 years

Sex
All

Total final enrolment
144

Key exclusion criteria
1. Gluten or lactose intolerance, as participants will be asked to ingest a whey protein drink
2. Current or past diagnosis of nutritional, psychiatric (excluding ADHD) or neurological illnesses
3. Being pregnant/breastfeeding
4. Being a smoker (including e-cigarettes)
5. Currently taking medication known to affect the serotonergic system such as antidepressants

6. Learning disabilities
7. Following a restrictive diet (e.g. keto), as this might interfere with the experiment

Date of first enrolment
01/07/2020

Date of final enrolment
01/08/2023

Locations

Countries of recruitment
United Kingdom

England

Study participating centre
King's College London
Guy's Campus
London
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SE1 1UL

Sponsor information

Organisation
King's College London

ROR
https://ror.org/0220mzb33

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study are/will be available upon request from the principal investigator (Dr Eleanor Dommett, eleanor.dommett@kcl.ac.uk).

IPD sharing plan summary

Stored in publicly available repository, Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		30/11/2023	05/12/2023	Yes	No
Dataset		14/10/2023	12/12/2023	No	No
Participant information sheet	version 3	07/10/2021	03/05/2023	No	Yes
Protocol file			17/08/2023	No	No