Nutrition and Mental Performance

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www.nutrition-neuroscience.com

Focus on ‘safe’ treatments: essential nutrients, phytochemicals, functional foods and dietary components thought to improve mood and/or cognition

**ESSENTIAL NUTRIENTS**
- Oxygen
- Glucose
- Water
- Polyunsaturated fatty acids
- Vitamins
- Minerals

**PLANT SECONDARY METABOLITES**
- Ginkgo biloba
- Panax ginseng
- Ginkgo-ginseng combination
- Melissa officinalis
- Salvia officinalis
- Salvia lavandulaefolia
  - Valerian
- Guarana
- Ginkgo-phosphatidylserine
- Cocoa polyphenols
  - Reeveratrol
  - EGCG
  - Caffeine
  - Theanine

Publications can be found at: www.nutrition-neuroscience.org
Vitamins and Minerals

- Intrinsic to every aspect of brain function
- Epidemiological evidence suggestive
- Survey and analyte data suggest deficiencies
- Intervention trial evidence scant

Vitamin B6 - 10% of males and 11% of females

% iron saturation indicating anaemia - 7% males, 16% females

Vitamin C - 5% males, 3% females

Folate - 4% males, 5% females

Vitamin B2 (riboflavin) – 66% of sample

25% males
16% females

13% males
11% females

Effects of high-dose B vitamin complex with vitamin C and minerals on subjective mood and performance in healthy males

David O. Kennedy · Rachel Verney · Anthony Watson · Fiona Doell · Emma Jones · Merin Maguire · Crystal F. Ruskell
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Multivitamins and Mental performance

**Design:** Randomised, placebo-controlled, double-blind study assessing 33 days administration with multivitamins/minerals.

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Amount</th>
<th>Minerals</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Vitamin B₁</td>
<td>15 mg</td>
<td>Calcium</td>
<td>100 mg</td>
</tr>
<tr>
<td>Vitamin B₂</td>
<td>15 mg</td>
<td>Magnesium</td>
<td>100 mg</td>
</tr>
<tr>
<td>Vitamin B₆</td>
<td>10 mg</td>
<td>Zinc</td>
<td>10 mg</td>
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<tr>
<td>Vitamin B₁₂</td>
<td>10 mcg</td>
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<td></td>
</tr>
<tr>
<td>Vitamin C</td>
<td>500 mg</td>
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</tr>
<tr>
<td>Biotin</td>
<td>150 mcg</td>
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</tr>
<tr>
<td>Folic Acid</td>
<td>400 mcg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicotinamide</td>
<td>50 mg</td>
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<tr>
<td>Pantothenic acid</td>
<td>23 mg</td>
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</table>

**Outcomes:** subjective feelings of stress (Perceived Stress Scale), general health (GHQ), mood (POMS) and mental performance (CDB, Stroop, Executive tasks).

**Participants:** 210 healthy male participants (30 – 55 years) in full time work.
Serial subtractions

A random number between 800 – 1000 is generated by the computer as a starting number.

Subtract 3 or 7 from that starting number. The response shows as asterisks in the box.

Enter key

Hold this new number in memory

RVIP

Numbers appear in the middle of the screen at a rate of 100 per minute.

Task is to press the space bar whenever you see three consecutive odd or even digits.
Results

**GHQ-12**

![GHQ-12](image1)

**Perceived Stress Scale**

![Perceived Stress Scale](image2)

**POMS Vigour**

![POMS Vigour](image3)

**POMS Total Score**

![POMS Total Score](image4)

**Serial 3s correct**

![Serial 3s correct](image5)

**Serial 7s correct**

![Serial 7s correct](image6)

**Mental Tiredness**

![Mental Tiredness](image7)

**Mental Fatigue**

![Mental Fatigue](image8)

Mobile Phone Study: Kennedy et al (2011) Human Psychopharmacology
Omega-3 Fatty acids

**Kennedy et al (2008)** No cognitive effects of 8 weeks administration in children

**Jackson et al (2011)** No cognitive effects of 12 weeks administration of high DHA or high EPA fish oil in healthy adults

**Jackson et al (2012)** assessed the effects of 12 weeks administration of two doses (1 g, 2 g) of DHA rich fish oil on the cerebral blood flow response to neural activation in 65 healthy adults.

Near Infrared Spectroscopy

![Near Infrared Spectroscopy Image]

**Oxygenated Haemoglobin**

**Cerebral Blood Flow**

![Graph showing Oxygenated Haemoglobin and Cerebral Blood Flow]
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Monoterpenoid extract of sage (Salvia lavandulaefolia) with cholinesterase inhibiting properties improves cognitive performance and mood in healthy adults

Improved Secondary memory
Improved Mood

A.
B.
C.

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>RETENTION TIME (MIN)</th>
<th>PERCENTAGE COMPOSITION</th>
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<td>a-Pinene</td>
<td>9:56.04</td>
<td>5.6</td>
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<tr>
<td>Camphene</td>
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<td>Sabinene</td>
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<td>b-Pinene</td>
<td>11:00.31</td>
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<td>b-Mycene</td>
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<td>p-Cymene</td>
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<td>Limonene</td>
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<td>a-Terpineol</td>
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**Methodology**

- **Design**
  - 36 healthy young participants
  - Randomised, placebo controlled, double-blind, balanced crossover
- **Two matched treatments**
  - placebo; 50 µl *S. lavandulaefolia* essential oil

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**Testing days: assessment**

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<th>Minutes</th>
<th>3s, 7s, RVIP, vas</th>
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<td>90</td>
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**Cognitive assessment**

- Bond-Lader Mood Scales
- Shopping lists presentation
- Picture presentation
- Name-to-face presentation
- Immediate word recall
- Immediate name-to-face recall
- Telephone numbers task
- Simple reaction time
- Choice reaction time
- Bond-Lader Mood Scales
- State-Trait Anxiety Inventory
- Delayed name-to-face recall
- Delayed word recall
- Delayed word recognition
- Delayed picture recognition

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Cognitive assessment

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- Simple Reaction Time
  - Salvia
  - Placebo

- Delayed Word Recall
  - Salvia
  - Placebo

- Word Recognition

- Picture Recognition

- Change from baseline
  - 1 hour post-dose
  - 4 hour post-dose
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**Alert**

Interaction (assessment X treatment): F(1, 35)=2.21, P=0.003

Combined mm

Salvia

Placebo

1 hour post-dose 4 hours post-dose

**Mood**

Salvia

Placebo

1 hour post-dose 4 hours post-dose

**Mental Fatigue**

Serial 3s

Total number of subtractions

1 hour post-dose 4 hour post-dose

repetitions
Effects of resveratrol on cerebral blood flow variables and cognitive performance in humans: a double-blind, placebo-controlled, crossover investigation¹⁻³

David O Kennedy, Emma L Wrightman, Jonathon L Reay, Georg Leitz, Edward J Okello, Anthea Wilde, and Crystal F Haskell

- Resveratrol – phytoalexin polyphenol
- Attributed with a plethora of health benefits in humans (but low bioavailability in mammals)
- Increases peripheral and cerebral blood flow in rodents
- Anti-oxidant and promoter of Nitric Oxide synthesis
- Nitric Oxide is a key modulator of neurovascular coupling between neural activity and blood flow
- N = 22, balanced cross-over.

![Cerebral Blood Flow Diagram]
Summary and conclusions

It is clear from our research that the populations of economically developed societies can benefit from augmented levels of the essential nutrients that they should be consuming in a normal healthy diet.

Furthermore many 'voluntarily' consumed plant derived chemicals can have specific effects on brain function in terms of modulation of physical parameters or cognitive performance.
Thanks to:

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Anthea Milne

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