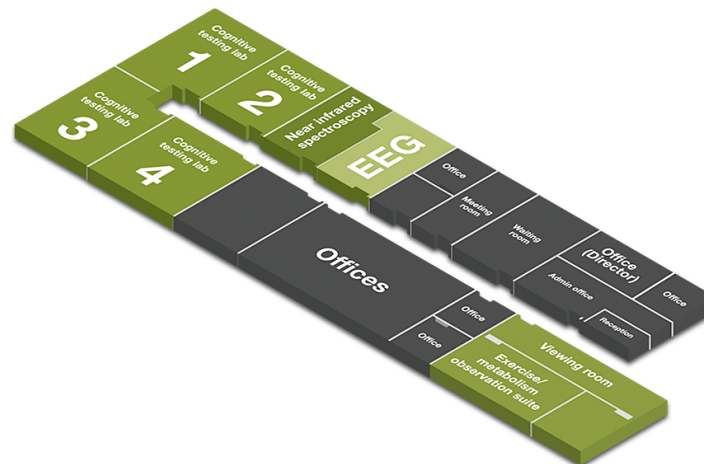


Essential Nutrients, Phytochemicals and Human Brain Function

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www.nutrition-neuroscience.com



Our Research

- 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

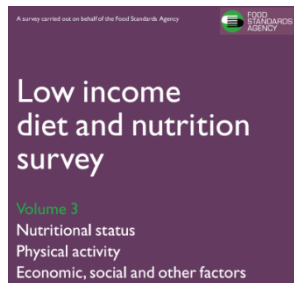
PLANT SECONDARY METABOLITES

- Ginkgo biloba
- Panax ginseng
- Ginkgo-ginseng combination
 - Melissa officinalis
 - Salvia officinalis
- Salvia lavandulaefolia
 - Valerian
 - Guarana
- Ginkgo-phosphatidylserine
 - Cocoa polyphenols
 - Resveratrol
 - 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
- **Vitamin C - 5% males 3% females**
- **Folate - 4% males, 5% females**
- Vitamin B 2 (riboflavin) – 66% of sample

**25% males
16% females**

**13% males
11% females**

Psychopharmacology
DOI 10.1007/s00213-010-1870-3

ORIGINAL INVESTIGATION

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

David O. Kennedy · Rachel Veasey · Anthony Watson ·
Fiona Dodd · Emma Jones · Silvia Maggini ·
Crystal F. Haskell

Multivitamins and Mental performance

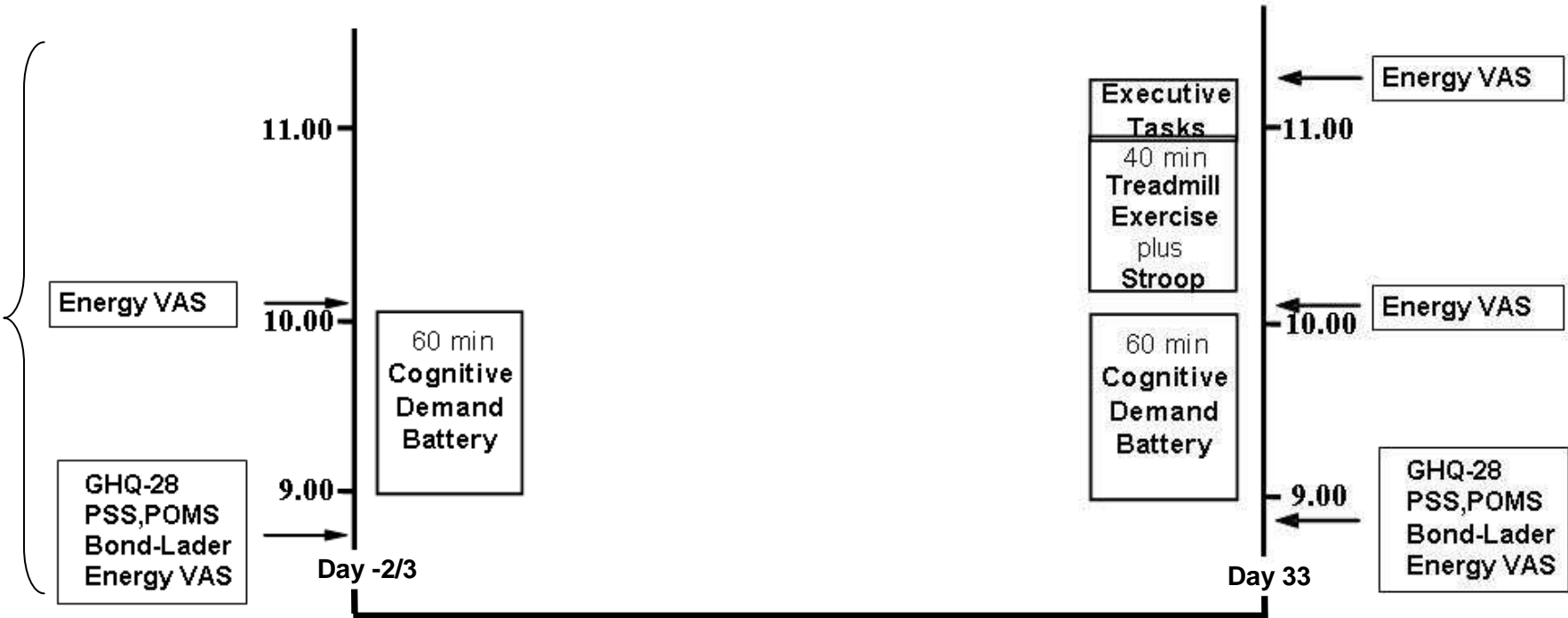
Design: Randomised, placebo-controlled, double-blind study assessing 33 days administration with multi-vitamins/minerals.

Vitamins:	Amount	Minerals:	Amount
Vitamin B ₁	15 mg	Calcium	100 mg
Vitamin B ₂	15 mg	Magnesium	100 mg
Vitamin B ₆	10 mg	Zinc	10 mg
Vitamin B ₁₂	10 mcg		
Vitamin C	500 mg		
Biotin	150 mcg		
Folic Acid	400 mcg		
Nicotinamide	50 mg		
Pantothenic acid	23 mg		

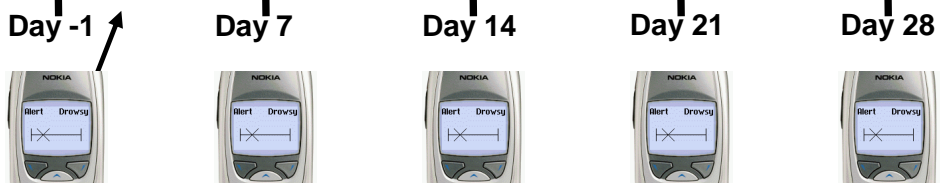
Outcomes: subjective feelings of stress (Perceived Stress Scale), general health (GHQ), mood (POMS) and mental performance (CDB, Stroop, Executive tasks) .

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

Laboratory Study



Mobile Phone Study



brain, performance and nutrition research centre
 food and diet neuroscience at **northumbria university**

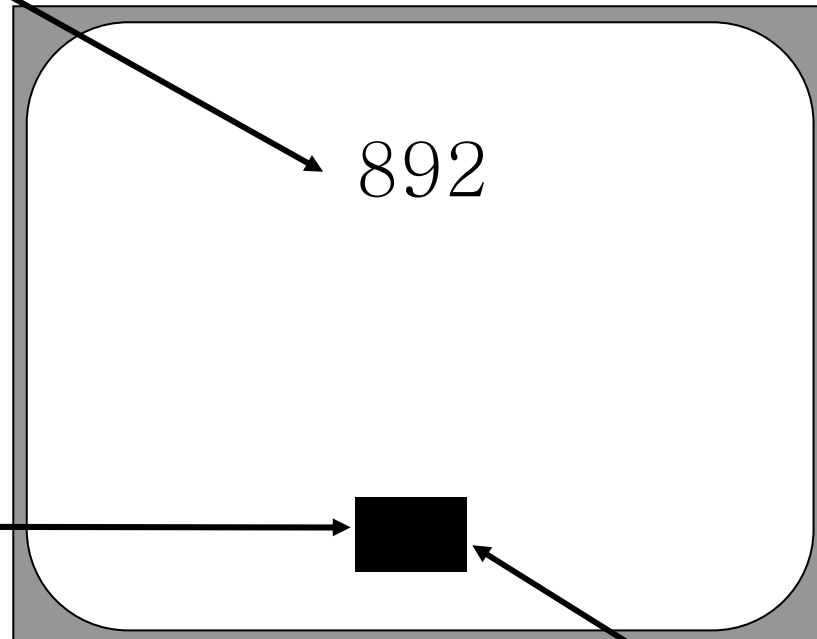
Treatment Commences Day 1

Mobile Phone Battery before and after a days work



Serial subtractions

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



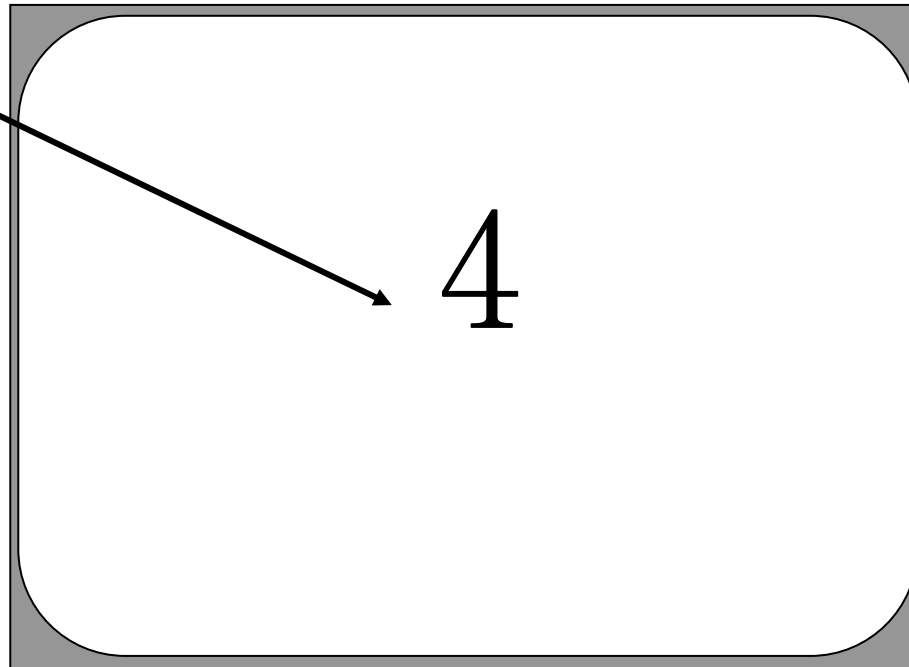
Subtract 3 or 7 from that starting number. The response shows as asterisks in the box

Enter key

Hold this new number in memory

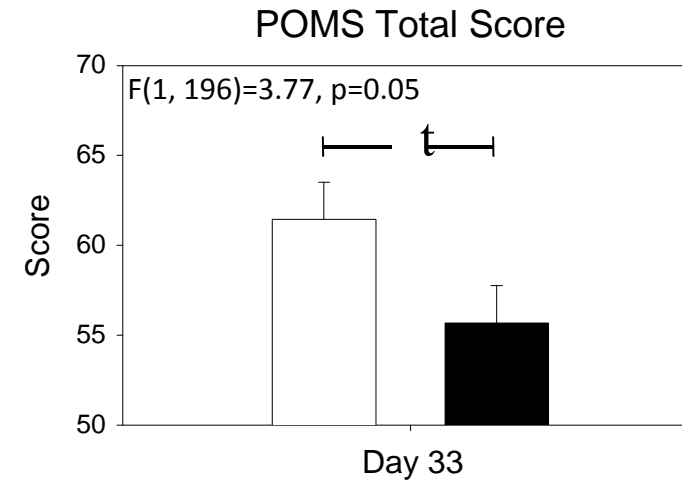
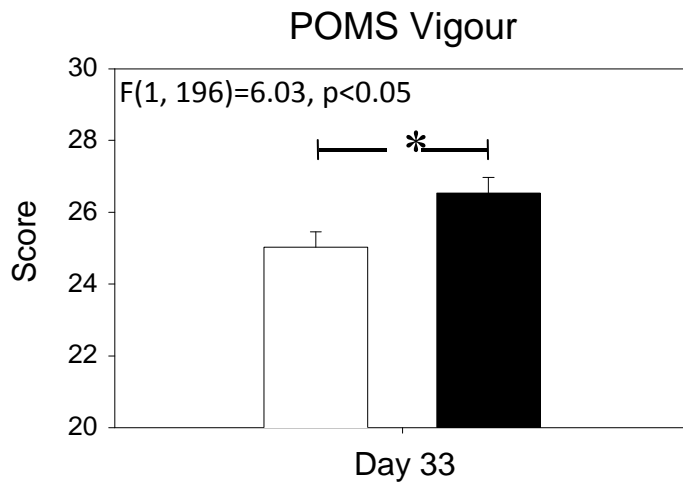
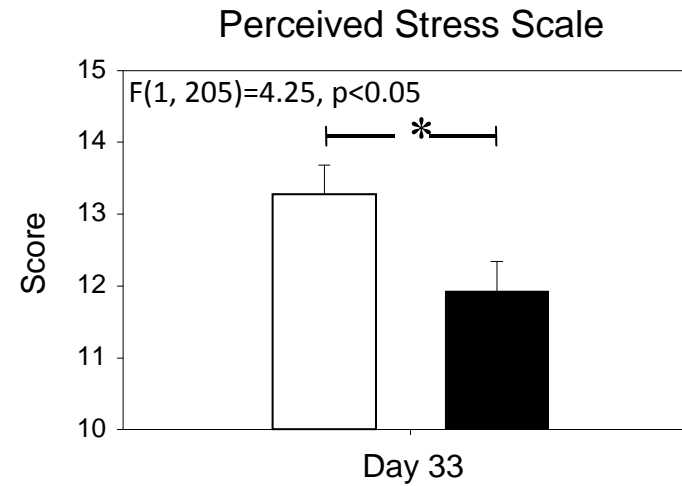
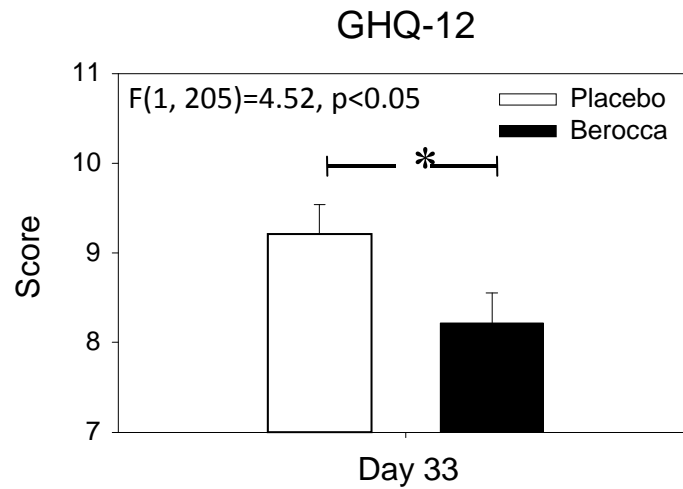
RVIP

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

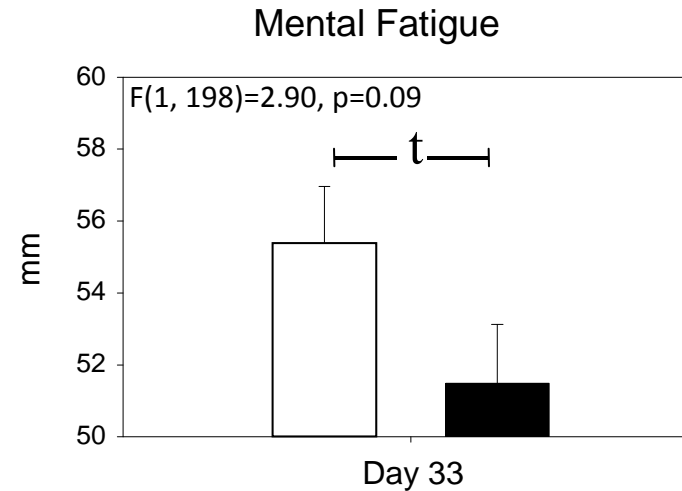
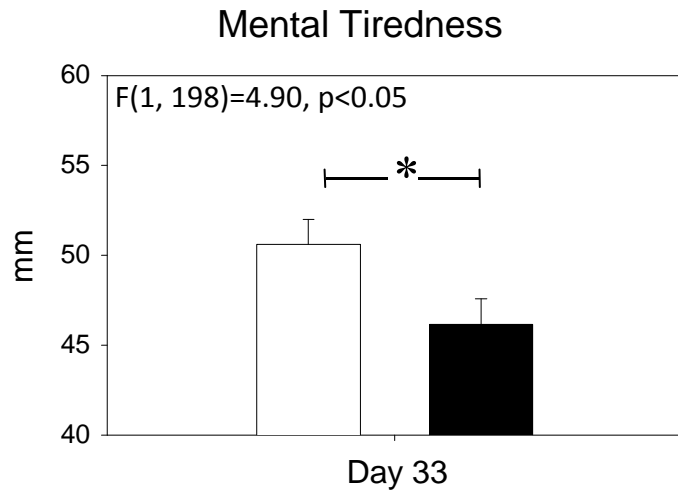
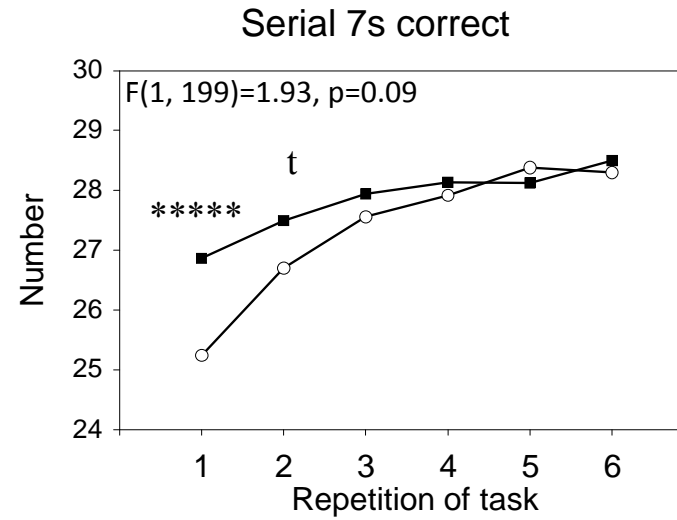
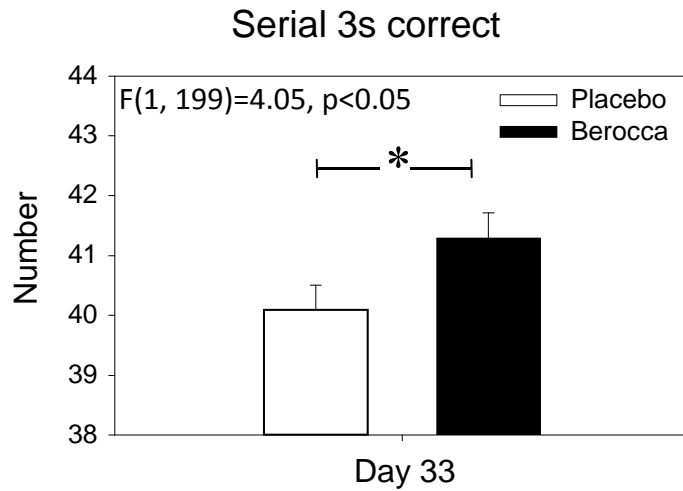


Task is to press
the space bar
whenever you
see three
consecutive odd
or even digits

Results



POMS Total Score



Mobile Phone Study: Kennedy et al (2011) Human Psychopharmacology
Healthy adult females: Haskell et al (2010) Human Psychopharmacology
Children: Haskell et al (2008) British Journal of Nutrition

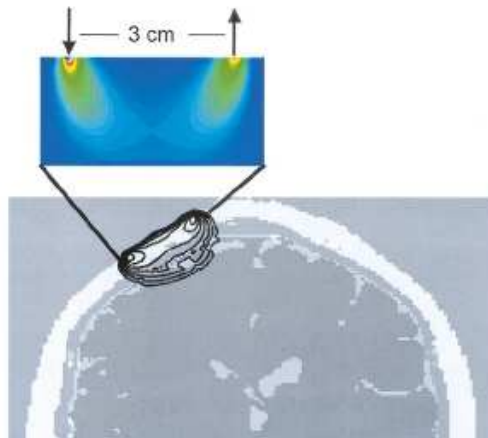
Omega-3 Fatty acids

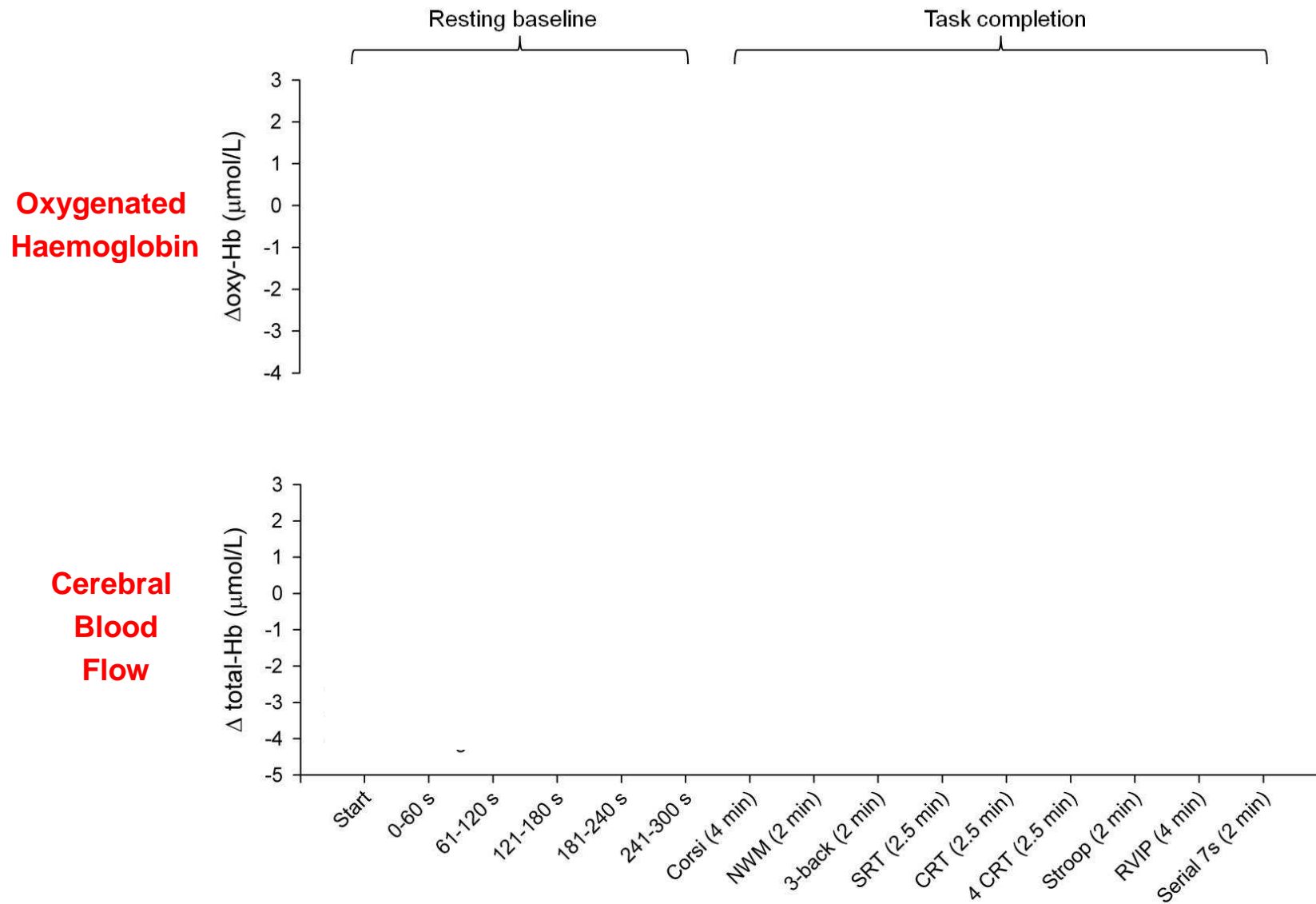
Kennedy et al (2008) No cognitive effects of 8 weeks administration in children

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





Original Paper

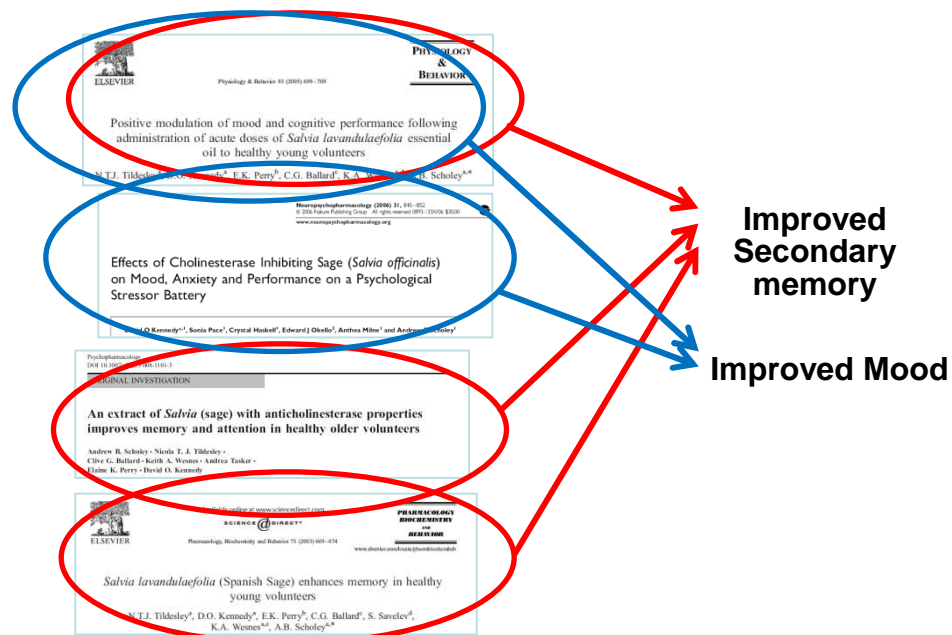
Monoterpenoid extract of sage (*Salvia lavandulaefolia*) with cholinesterase inhibiting properties improves cognitive performance and mood in healthy adults

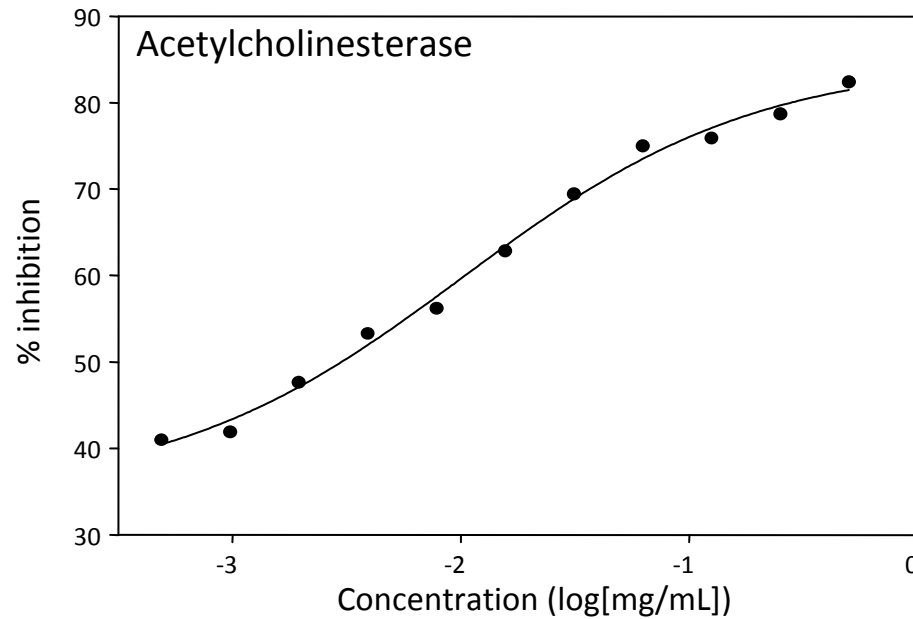
David O Kennedy¹, Fiona L Dodd¹, Bernadette C Robertson¹, Edward J Okello², Jonathon L Reay¹, Andrew B Scholey³ and Crystal F Haskell¹

Psychopharm

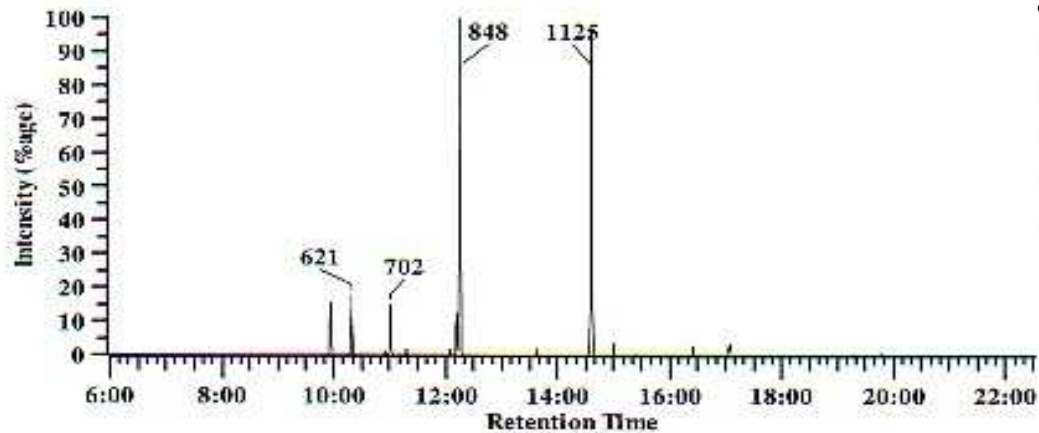
Journal of Psychopharmacology
0(0) 1-13
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DOI: 10.1177/0269881110385594
jop.sagepub.com

SAGE



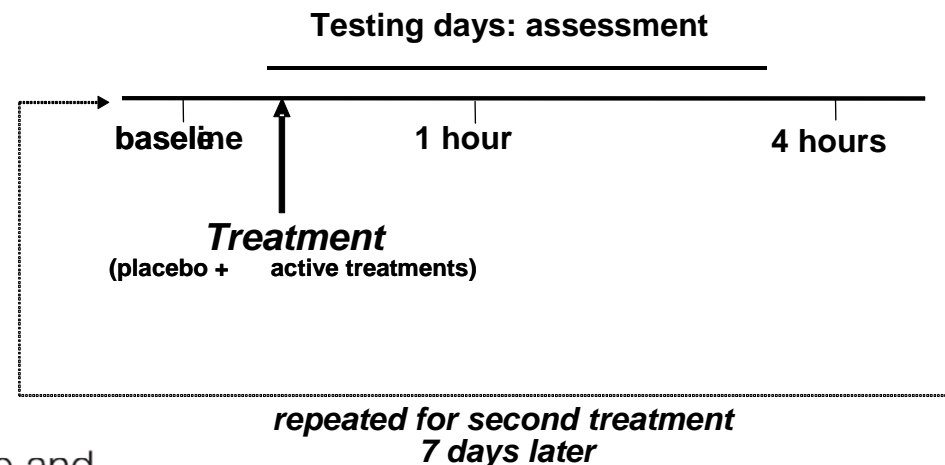


COMPOUND	RETENTION TIME (MIN)	PERCENTAGE COMPOSITION
a-Pinene	9:56.04	5.6
Camphene	10:18.99	5.7
Sabinene	10:55.21	0.3
b-Pinene	11:00.31	5.1
b-Myrcene	11:17.65	0.6
p-Cymene	12:05.09	0.5
Limonene	12:11.21	4.2
1,8-Cineole	12:14.78	36.4
Linalool	13:37.41	0.4
Camphor	14:36.07	37.0
endo-Borneol	15:00.04	1.2
a-Terpineol	15:24.52	Tr
Linalyl acetate	16:25.22	0.7
Bornyl acetate	17:02.97	0.7
Unidentified	17:04.50	1.2
Unidentified	19:16.10	0.1
Unidentified	19:46.19	0.1



Methodology

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



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

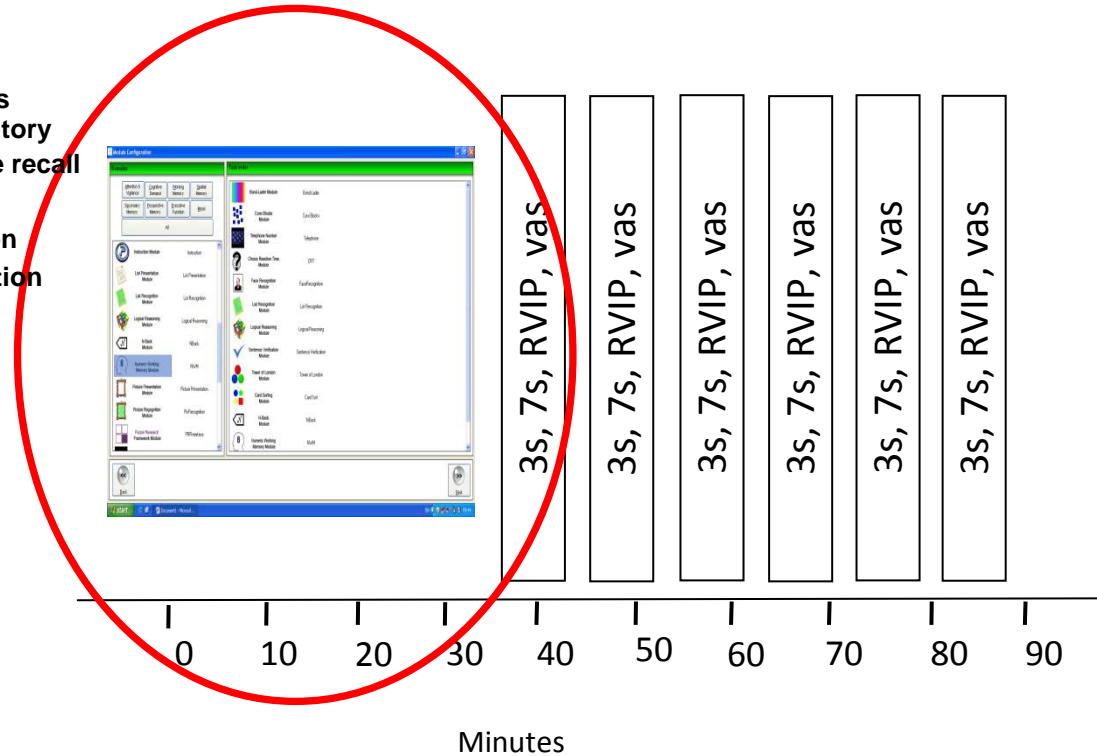
Delayed name -to -face recall

Delayed word recall

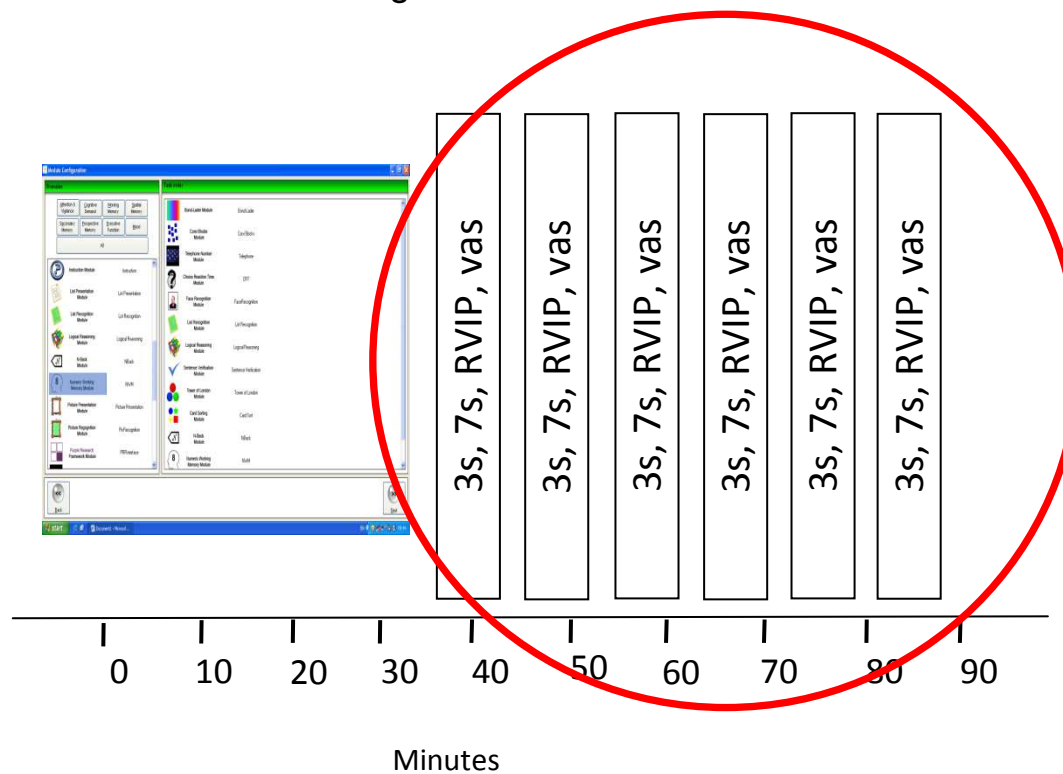
Delayed word recognition

Delayed picture recognition

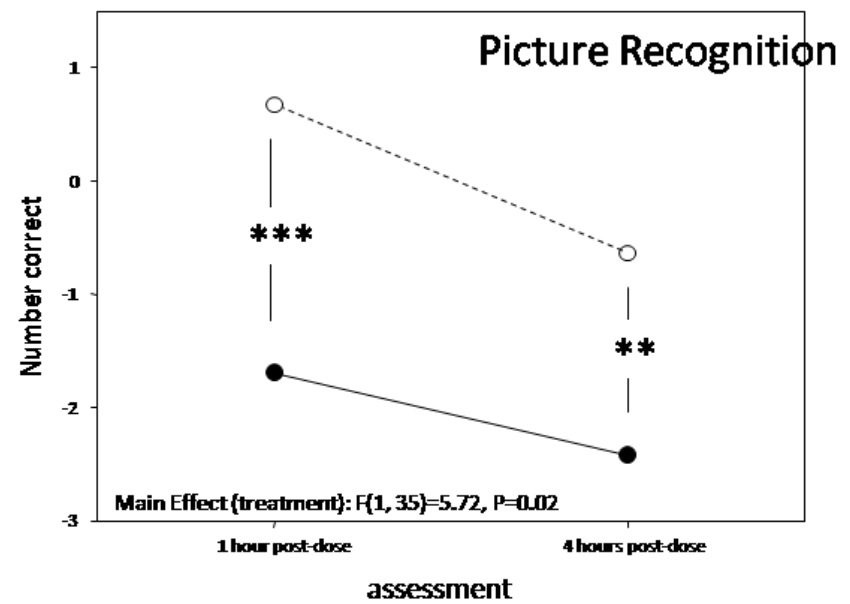
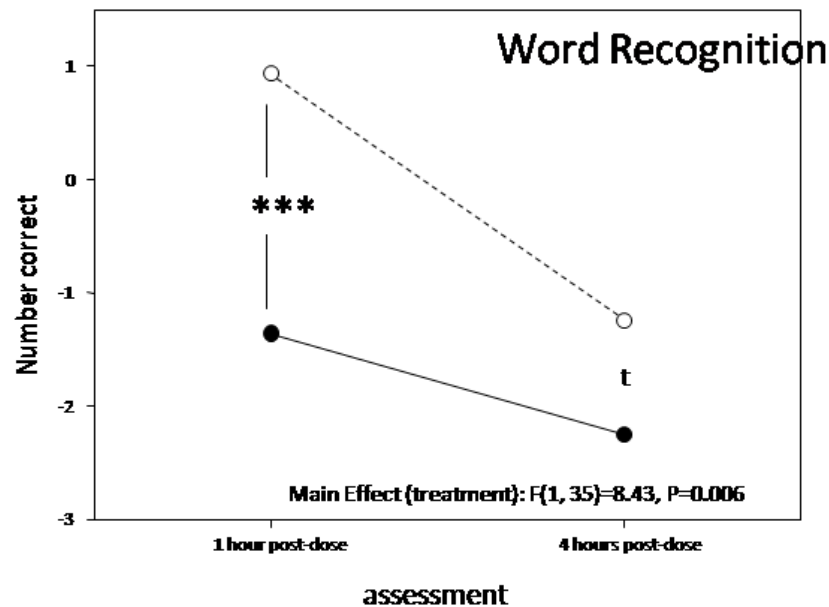
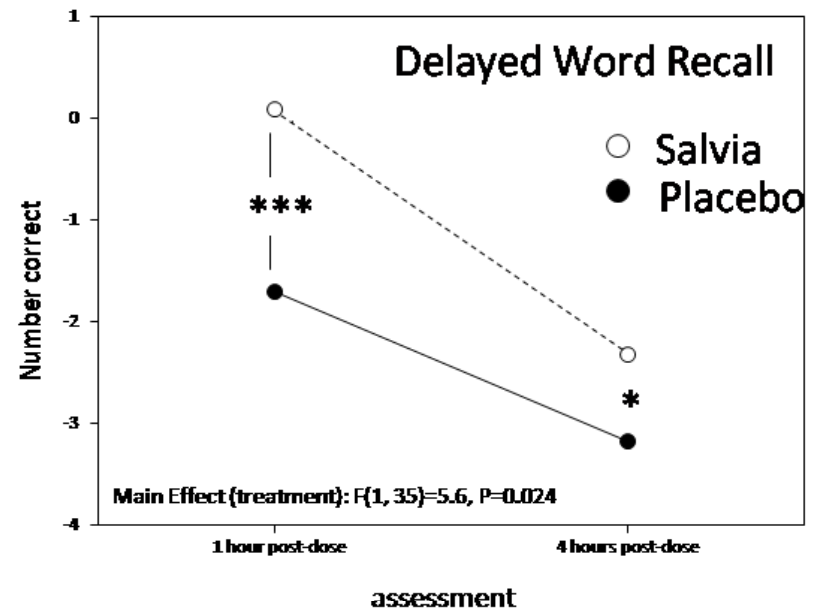
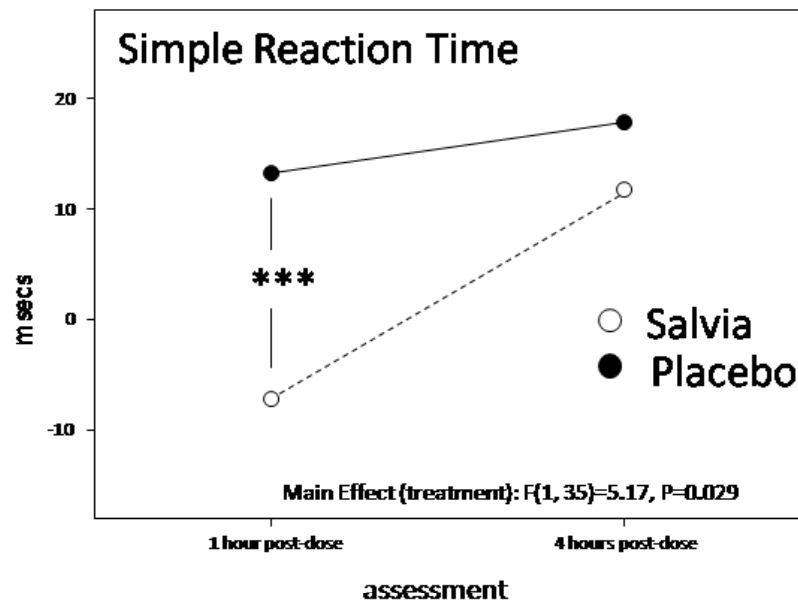
Cognitive assessment



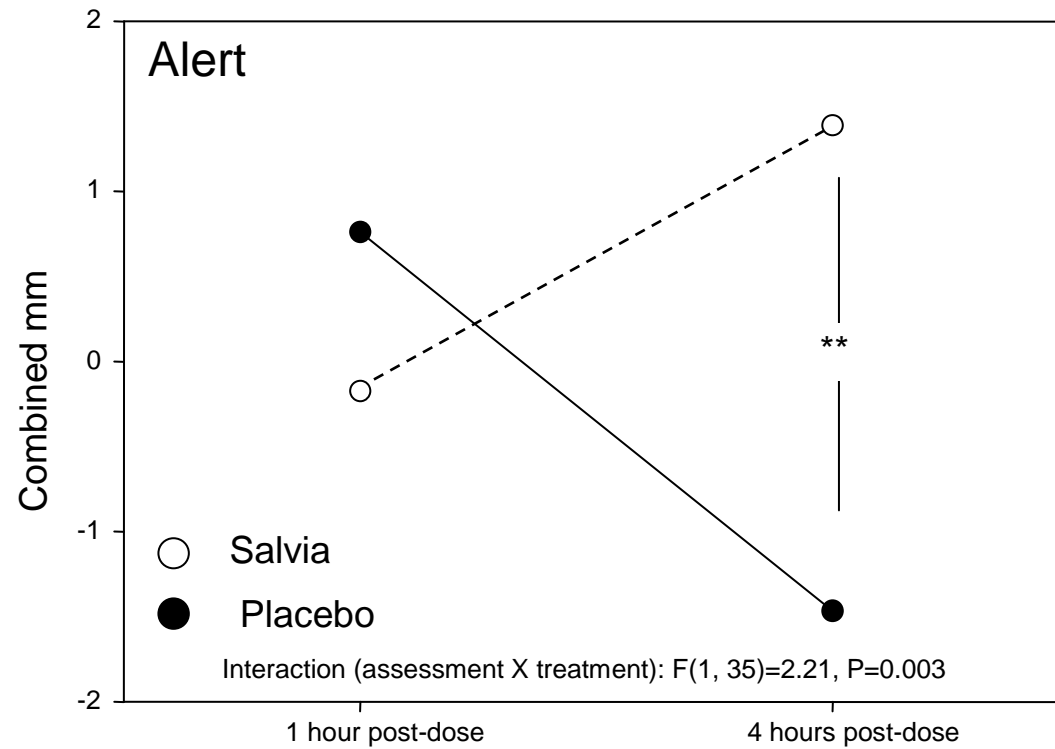
Cognitive assessment

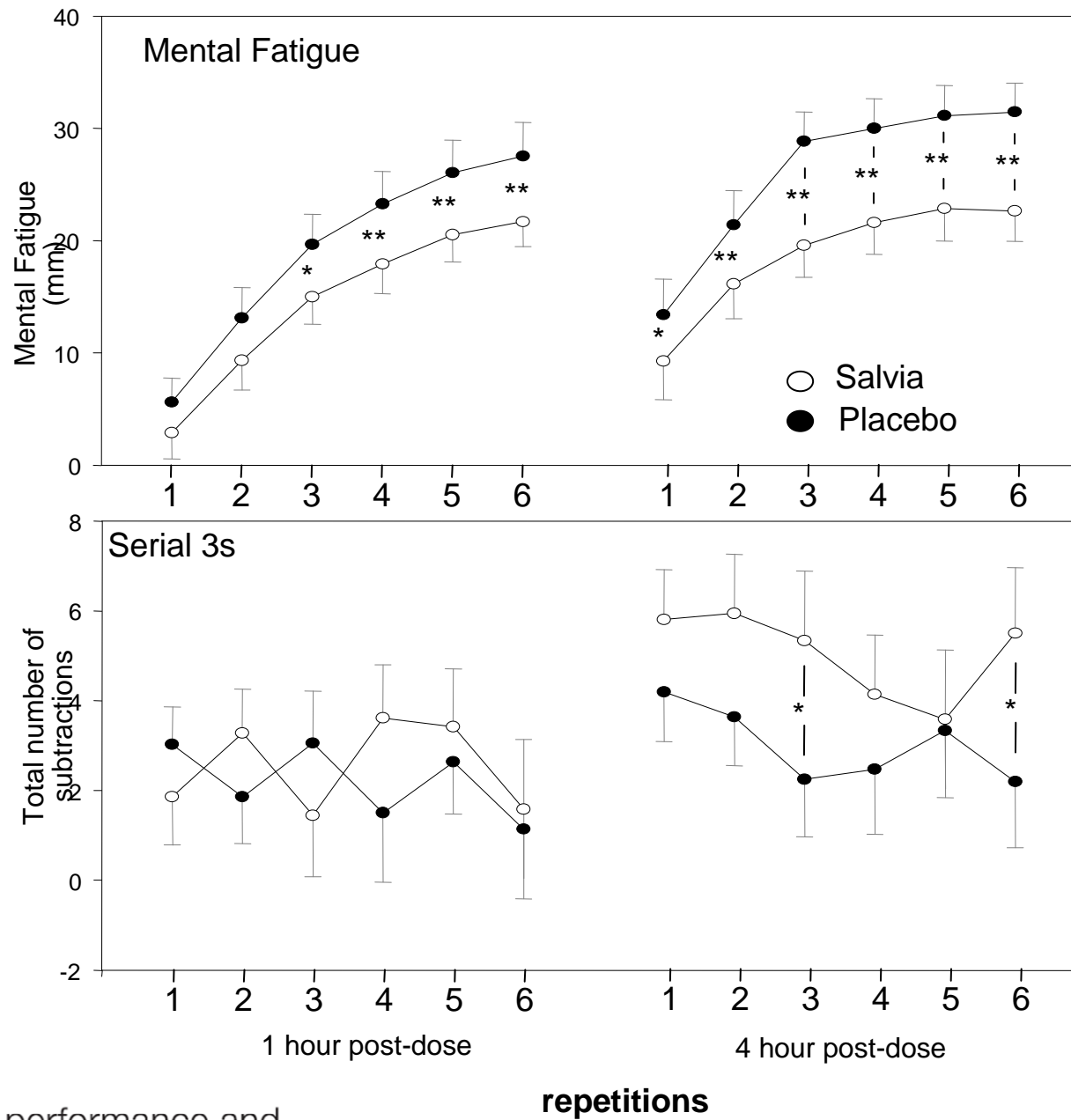


Change from baseline



MOOD





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

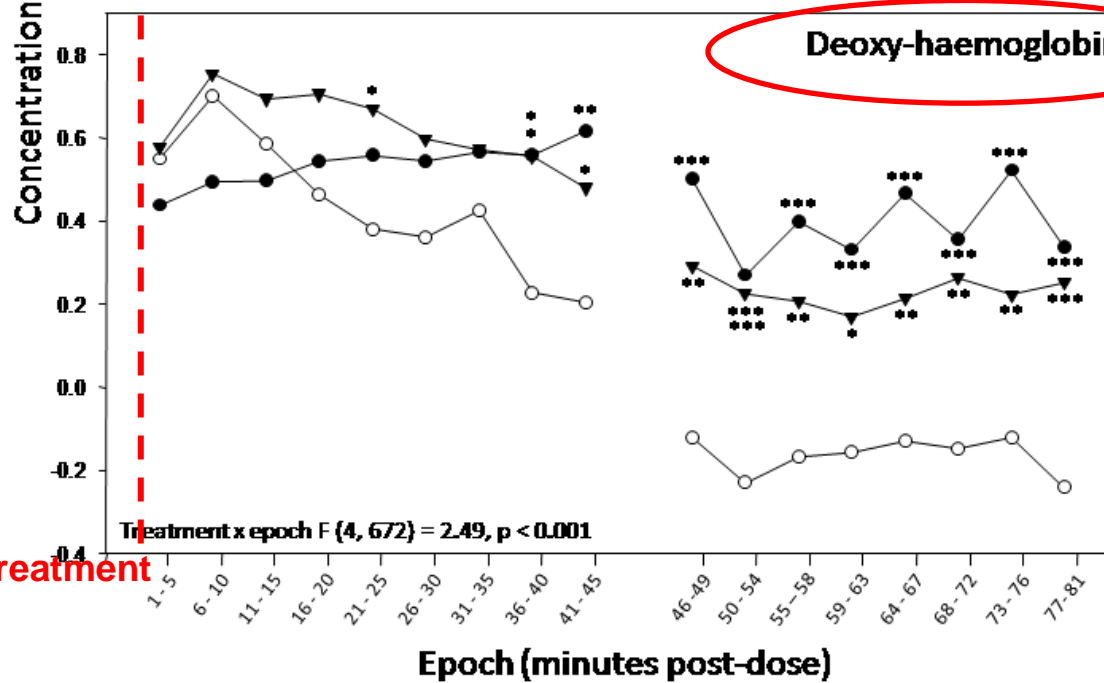
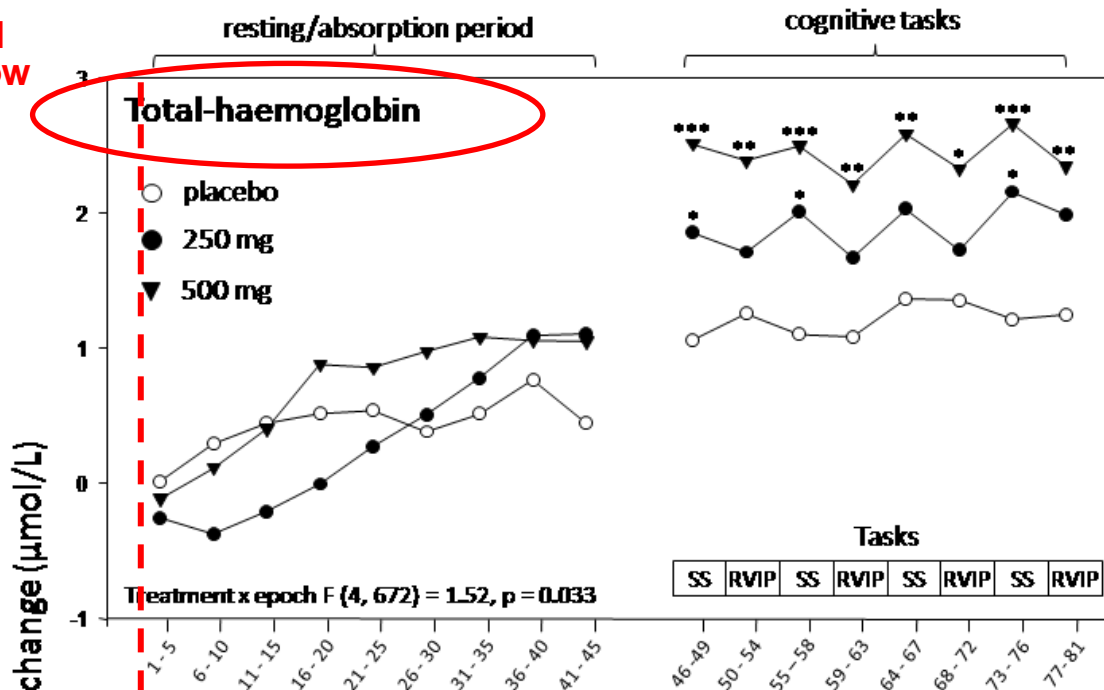
David O Kennedy, Emma L Wightman, Jonathon L Reay, Georg Lietz, Edward J Okello, Anthea Wilde, and Crystal F Haskell

Am J Clin Nutr 2010;91:1590-7.

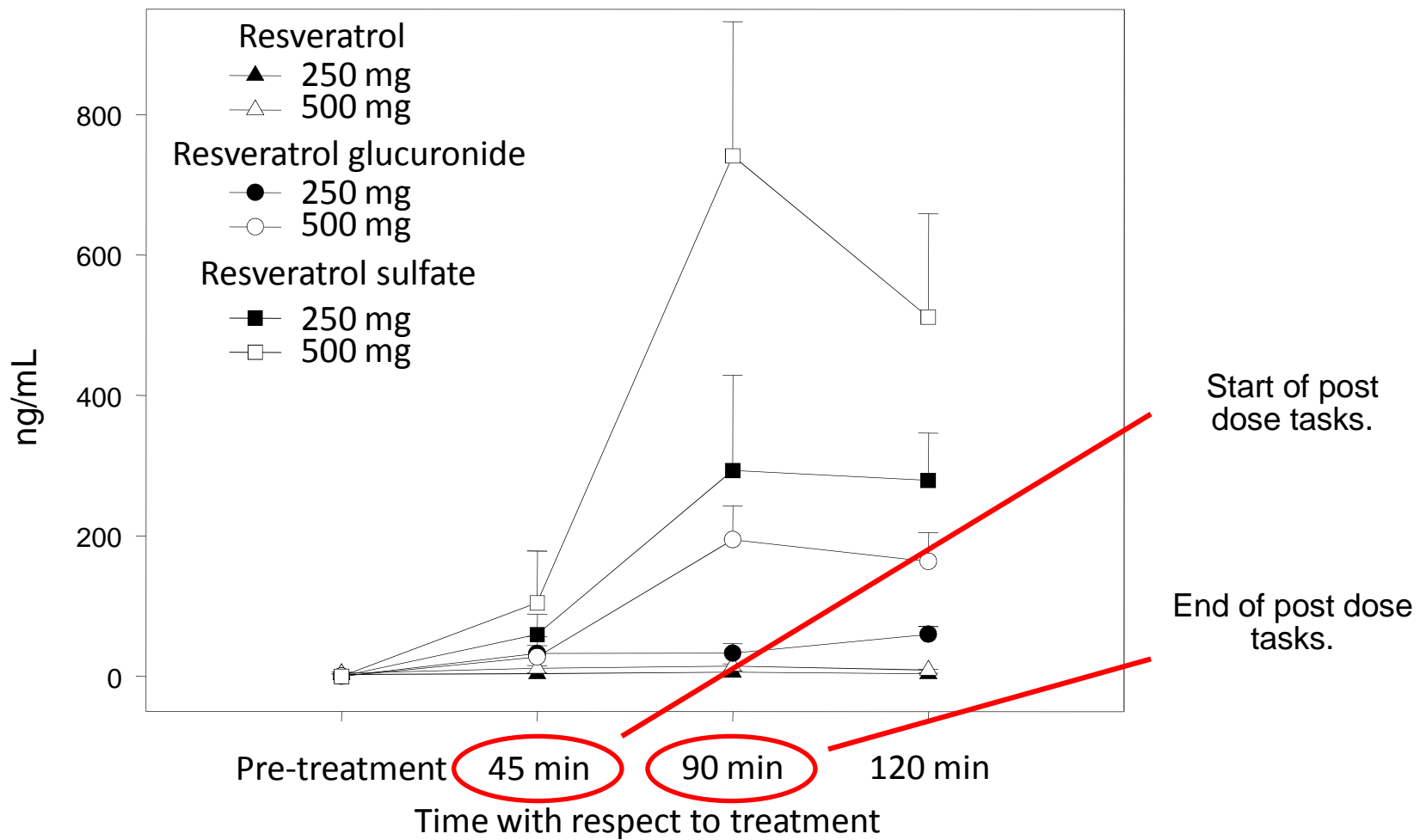
- Resveratrol – phytoalexin polyphenol
- Attributed with a plethora of health benefits in humans (but low bioavailability in mammals)
- Increases peripheral and cerebral blood flow in rodents
- Anti-oxidant and promoter of Nitric Oxide synthesis
- Nitric Oxide is a key modulator of neurovascular coupling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

- N = 22, balanced cross-over.

cerebral
blood flow



Oxygen
extraction



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.

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Anthea Milne

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