

Supplementary Materials

1. Eligibility criteria

Inclusion criteria

- Participants are aged 18–49 years, inclusive ¹
- Participants self-report that they are in good health
- Willing to maintain habitual diet, physical activity pattern, and body weight throughout the trial
- Willing to abstain from consumption of caffeine within 12 h of testing
- Willing to abstain from alcohol consumption and avoid vigorous physical activity for 24 h prior to all test visits
- Willing to refrain from ‘over the counter’ medications (e.g. pain medication) and stimulant medication for 12 h, seasonal allergy/hayfever nasal antihistamine medications for 24 hours and oral antihistamines for 48 h prior to all test visits
- Understanding the study procedures and willing to provide informed consent to participate in the study and authorization to release relevant protected health information to the study Investigator.

¹ Age range was based on research demonstrating natural decline in some cognitive performance measures is more likely to occur at 50+ years in the general population

Exclusion criteria

Participants complying with at least one of the following criteria were not eligible:

- Failure to meet any one of the inclusion criteria
- Current use of prescription medication, except for contraceptives
- Report hypersensitivity to caffeine
- Major trauma or major surgical event within 6 months of screening
- Extreme dietary habits, as judged by the Investigator (high fat, very high protein diets, intermittent fasting, etc.)
- Exposure to coffeeberry within 30 d prior to screening
- History of cancer in the prior two years, except for non-melanoma skin cancer
- Have a visual impairment that cannot be corrected with glasses or contact lenses
- Food allergies/intolerances/sensitivities to any ingredients in the study products (including coffee or related foods/beverages/products)
- Self-report excessive leisure time physical activity (>7 strenuous bouts per week)
- Have a current or chronic gastrointestinal, sleep, or psychiatric disorders
- Work night shifts or follow a variable work pattern that results in irregular sleep pattern
- Are pregnant, trying to get pregnant or lactating
- Smoke tobacco, vape nicotine or use nicotine replacement products
- Use illegal/recreational drugs
- Unable to demonstrate adequate minimal performance on lab, computer-based cognitive tasks (See Appendix V for minimum performance scores)
- Have participated in another clinical trial within past 30 days and/or participation in another PepsiCo trial in the past 6 months
- Have high blood pressure (systolic over 139 mm Hg or diastolic over 89 mm Hg)
- Have a Body Mass Index (BMI) outside of the range 18.5–35 kg/m²

- Have learning and/or behavioural disorders such as dyslexia or ADHD
- Excessive caffeine intake (>500 mg per day)
- Have taken dietary supplements e.g. Vitamins, omega 3 fish oils etc. in the last 4 weeks (Note: participation is possible following a 4 week supplement washout prior to participating and for the duration of the study on the proviso that the supplements they are taking are out of choice and not medically prescribed or advised)
- Have any health condition that would prevent fulfilment of the study requirements (this includes non-diagnosed conditions for which no medication may be taken)
- Has been diagnosed with/ undergoing treatment for alcohol or drug abuse in the last 12 months
- Have been diagnosed with/ undergoing treatment for a psychiatric disorder in the last 12 months
- Suffers from frequent migraines that require medication (more than or equal to 1 per month)
- Any known active infections
- Does not have a bank account (required for payment)

2. Participant characteristics at enrolment

Table S1. Participant characteristics at enrolment for continuous variables. N = 72.

Measure	Mean	SD
Age (years)	28.85	8.45
Education (years)	17.47	2.81
Normal hours sleep per night	7.64	0.68
Fruit & veg consumption (portions/day)	3.39	1.72
Caffeine consumption (mg/day)	114.21	104.81
Systolic BP (mm/Hg)	119.03	11.678
Diastolic BP (mm/Hg)	77.58	7.34
Heart Rate (beats per minute)	75.14	13.45
BMI (kg/m ²)	24.873	3.52

Table S2. Participant characteristics at enrolment for categorical variables. N = 72.

Measure	Count	%
Male/female	26/46	36/64
Race:		
White	50	69.4
Black	3	15.3
Asian	11	11.1
Other	8	4.2
Wear glasses (yes/no)	31/41	43/57
Handedness (left/right)	7/65	10/90
Dietary habits:		
Omnivore	62	86

Vegetarian	8	11
Pescatarian	2	3
Highest level of education:		
Entry Level (Entry Level Certificates)	0	0
Level 1 (NVQ level 1, GCSE D-G, BTEC Intro)	0	0
Level 2 (NVQ level 2, GCSE A*-C, Young Apprenticeships, BTEC ½)	4	5.6
Level 3 (NVQ level 3, AS & A-levels, BTEC 3)	19	26.4
Level 5 (NVQ level 5, HND, HNC, Dip HE/FE, Found. Deg, BTEC 5)	4	5.6
Level 6 (Bachelors Degree, GradDip, Grad Cert., BTEC 6)	29	40.3
Level 7 (Masters, PGDip, PG Cert, BTEC 7)	14	19.4
Level 8 (Doctorates, BTEC 8)	2	2.8

3. Computerised cognitive tasks

Cognitive Demand Battery (CDB)

The objective of this battery is to assess the impact of treatment on speed/accuracy and mental fatigue during continuous performance of cognitively demanding tasks.

Participants complete the 10-min battery of tasks four times in immediate succession (i.e., for a continuous period of 40 min).

Application of this battery has been shown to reliably increase self-ratings of 'mental fatigue' and to be sensitive to a number of herbal and natural interventions [1–5]. Particularly relevant here, the battery has been shown to be sensitive to performance enhancement by single doses of cocoa-flavanols (520 mg/920 mg) [6] and caffeinated products [1,2].

The 10-min battery comprises:

Serial 3s subtraction task (2 min): Computerised versions of the serial subtraction tasks will be implemented using tests of 2-min duration. Participants are required to count backwards in threes from a given number as quickly and as accurately as possible using the number keys to enter each response. A random starting number between 800 and 999 is presented on the computer screen, which is cleared by the entry of the first response. The task is scored for number of correct responses and number of errors. In the case of incorrect responses subsequent responses are scored as positive if they were scored as correct in relation to the new number.

Serial 7s subtraction task (2 min): This is identical to the serial threes task with the exception that it involves the serial subtraction of sevens.

Rapid Visual Information Processing task (RVIP – 5 mins): The participant is required to monitor a continuous series of digits for targets of three consecutive odd or three consecutive even digits. The digits are presented at the rate of 100 per minute and the participant responds to the detection of a target string by pressing the response button as quickly as possible. The task is

continuous and lasts for 5 minutes, with 8 correct target strings being presented in each minute. The task is scored for percentage of target strings correctly detected, average reaction time for correct detections, and number of false alarms.

'Mental fatigue' visual analogue scale; Participants rate their current subjective 'mental fatigue' state by making a mark on a line with the end points labelled "not at all" (left hand end) and "extremely" (right hand end). Scores are calculated as percentage along the line from left to right.

'Alertness' visual analogue scale; Participants rate their current subjective 'alertness' state by making a mark on a line with the end points labelled "not at all" (left hand end) and "extremely" (right hand end). Scores are calculated as percentage along the line from left to right

'Motivation' visual analogue scale; Participants rate their current subjective level of 'motivation' by making a mark on a line with the end points labelled "no motivation at all" (left hand end) and "strongest degree of motivation imaginable" (right hand end). Scores are calculated as percentage along the line from left to right

Episodic memory

Word Presentation: A unique set of fifteen words will be presented. Words will be selected at random from a large bank of words (MRC Psycholinguistic Database) matched for word length, frequency, familiarity and concreteness. Stimulus duration will be one second, as will be the inter-stimulus duration.

Picture presentation: Fifteen colour photographic images of objects will be presented sequentially on screen for the participant to remember at the rate of 1 every 1 s, with a stimulus duration of three seconds.

Delayed Word Recall: Participants write down as many of the 15 words that they were presented during the stimulus presentation period. This task is scored for accuracy only.

Delayed Word Recognition: A series of words are displayed on the screen, one at a time. The number of pictures, the rate at which they are displayed and the interstimulus interval can be modified. All target words shown during Word Presentation plus an equal number of decoys will be displayed on the screen one at a time. For each stimulus participants select 'Yes' or 'No' to indicate if they have seen the word before or not. The task outcomes include accuracy and reaction time.

Delayed Picture Recognition: A series of pictures are displayed on the screen, one at a time. The number of pictures, the rate at which they are displayed and the interstimulus interval can be modified. All target pictures shown during Picture Presentation plus an equal number of decoys will be displayed on the screen one at a time. For each stimulus participants select 'Yes' or 'No' to indicate if they have seen the picture before or not. The task outcomes include accuracy and reaction time.

4. Response to caffeine (positive control)

Table S3. Estimated means \pm standard error of the mean (SEM) derived from linear mixed models of change from baseline data for outcome measures where the Type III tests of fixed effects showed a significant treatment effect. *p* Values are derived from pairwise comparisons between caffeine and the three other investigational beverages using Sidak adjustment for multiple comparisons.

		Mean	SEM	p
VAS - Mental Fatigue	Caff	-3.51	1.57	
	Pla	2.84	1.58	<0.001
	300 mg CB	4.11	1.58	<0.001
	100 mg CB	6.97	1.58	<0.001
VAS - Alertness	Caff	6.47	1.67	
	Pla	-3.78	1.68	<0.001
	300 mg CB	-1.80	1.68	<0.001
	100 mg CB	-2.95	1.68	<0.001
VAS - Motivation	Caff	3.74	1.61	
	Pla	-4.56	1.62	<0.001
	300 mg CB	-5.63	1.62	<0.001
	100 mg CB	-2.95	1.62	<0.001
EFS - Physical Energy	Caff	4.62	1.90	
	Pla	-1.05	1.91	0.033
	300 mg CB	1.65	1.91	0.726
	100 mg CB	-3.73	1.92	0.002
EFS - Physical Fatigue	Caff	-4.44	1.84	
	Pla	0.52	1.85	0.123
	300 mg CB	1.58	1.85	0.089
	100 mg CB	3.16	1.87	0.018
EFS - Physical Vigour	Caff	5.23	1.65	
	Pla	0.03	1.66	0.019
	300 mg CB	-0.87	1.66	0.008
	100 mg CB	-2.99	1.67	<0.001
EFS - Physical Exhaustion	Caff	-4.62	1.90	
	Pla	0.33	1.91	0.124
	300 mg CB	0.70	1.91	0.140
	100 mg CB	3.74	1.92	0.003
EFS - Physical Pep	Caff	5.86	1.82	
	Pla	-1.64	1.83	<0.001
	300 mg CB	-1.09	1.83	0.006
	100 mg CB	-3.07	1.84	<0.001
EFS - Physical Worn Out	Caff	-4.67	1.77	
	Pla	0.06	1.78	0.114
	300 mg CB	2.43	1.78	0.012

	100 mg CB	3.62	1.79	0.003
EFS - Mental Energy	Caff	7.77	2.02	
	Pla	-1.96	2.03	<0.001
	300 mg CB	-0.74	2.03	0.002
	100 mg CB	-0.90	2.04	0.002
EFS - Mental Fatigue	Caff	-8.43	2.00	
	Pla	0.75	2.01	<0.001
	300 mg CB	0.67	2.01	0.001
	100 mg CB	2.56	2.03	<0.001
EFS - Mental Vigour	Caff	6.21	1.80	
	Pla	-0.33	1.80	0.002
	300 mg CB	-0.85	1.81	0.005
	100 mg CB	-1.60	1.82	0.002
EFS - Mental Exhaustion	Caff	-6.58	2.05	
	Pla	2.09	2.06	<0.001
	300 mg CB	0.60	2.06	0.020
	100 mg CB	0.65	2.07	0.024
EFS - Mental Pep	Caff	7.47	1.81	
	Pla	-0.29	1.82	<0.001
	300 mg CB	-0.80	1.82	0.001
	100 mg CB	-2.10	1.83	<0.001
EFS - Mental Worn Out	Caff	-7.35	2.00	
	Pla	0.46	2.01	0.002
	300 mg CB	2.59	2.01	<0.001
	100 mg CB	1.26	2.02	0.004
Bond Lader - Alert	Caff	8.96	1.92	
	Pla	-0.15	1.92	<0.001
	300 mg CB	1.27	1.93	0.001
	100 mg CB	0.08	1.93	<0.001
Bond Lader - Content	Caff	4.24	1.17	
	Pla	0.53	1.18	0.011
	300 mg CB	-0.64	1.18	0.002
	100 mg CB	0.99	1.19	0.109
Serial 3 subtractions Total (number)	Caff	4.35	0.43	
	Pla	2.26	0.43	<0.001
	300 mg CB	1.46	0.43	<0.001
	100 mg CB	1.87	0.43	<0.001
Serial 3 subtractions Accuracy (%)	Caff	0.67	0.34	
	Pla	0.15	0.34	0.859
	300 mg CB	-0.39	0.34	0.149
	100 mg CB	-0.61	0.34	0.044
	Caff	3.61	0.29	

Serial 7 subtractions Total (number)	Pla	2.60	0.29	0.013
	300 mg CB	2.12	0.29	<0.001
	100 mg CB	1.77	0.29	<0.001
Serial 7 subtractions Accuracy (%)	Caff	1.54	0.56	
	Pla	1.30	0.56	1.000
	300 mg CB	-0.24	0.57	0.093
	100 mg CB	0.03	0.57	0.221
RVIP Accuracy (%)	Caff	3.85	0.79	
	Pla	-2.28	0.79	<0.001
	300 mg CB	-2.85	0.79	<0.001
	100 mg CB	-4.38	0.79	<0.001
RVIP RT (ms)	Caff	-8.63	2.11	
	Pla	-6.25	2.11	0.923
	300 mg CB	-0.15	2.13	0.006
	100 mg CB	0.85	2.12	0.001
RVIP False alarms (number)	Caff	-0.23	0.13	
	Pla	0.03	0.13	0.457
	300 mg CB	0.28	0.14	0.009
	100 mg CB	0.45	0.14	<0.001

Caff, 75 mg caffeine; Pla, placebo; CB coffeeberry; VAS, visual analogue scale; EFS, Energy and Fatigue Scales; RT, reaction time; ms, milliseconds; RVIP, rapid visual information processing

Table S4. Performance on the cognitive demand battery task outcomes. The Baseline data are raw means (plus SEM) collected prior to dosing. Data presented from the 60 and 120 minute post dose (p.d.) assessments are estimated means (plus SEM) of change from baseline values derived from the linear mixed model analysis, with the final two columns showing test statistics (F) and associated probabilities (p) for each of the fixed effects included in the model.

			Baseline			60 min p.d.			120 min p.d.			Fp		
			N	Mean	SEM	N	Mean	SEM	N	Mean	SEM			
Serial 3 subtractions Total (number)	Rep 1	Caff	70	40.97	1.69	70	3.61	0.86	70	4.83	0.86	Treatment	15.73	<.001
		Pla	69	41.52	1.67		2.45	0.86		1.83	0.86	Treat*Assess	0.28	0.839
		300 mg CB	69	42.74	1.81		0.58	0.87		1.75	0.86	Treat*Rep	0.45	0.909
		100 mg CB	68	42.49	1.81		1.70	0.86		2.31	0.86	Treat*Assess* Rep	0.74	0.713
	Rep 2	Caff	70	42.01	1.78	5.14	0.86	4.90	0.86					
		Pla	69	41.90	1.91	1.52	0.87	3.34	0.87					
		300 mg CB	69	44.04	1.94	0.73	0.87	2.02	0.86					
		100 mg CB	68	42.72	1.71	1.51	0.86	2.86	0.86					
	Rep 3	Caff	70	42.67	1.77	3.66	0.86	3.49	0.86					
		Pla	68	42.28	1.84	2.07	0.87	0.99	0.87					
		300 mg CB	69	43.32	1.88	1.57	0.88	1.46	0.87					
		100 mg CB	68	42.43	1.69	0.80	0.86	2.31	0.86					
	Rep 4	Caff	70	41.40	1.75	4.73	0.86	4.41	0.86					
		Pla	68	40.40	1.82	2.74	0.87	3.16	0.87					
		300 mg CB	68	42.53	1.98	1.68	0.88	1.92	0.87					
		100 mg CB	68	42.62	1.65	1.98	0.86	1.48	0.86					
Serial 3 subtractions Accuracy (%)	Rep 1	Caff	70	94.74	0.70	70	0.72	0.88	70	0.10	0.88	Treatment	2.89	0.035
		Pla	69	95.72	0.55		-1.47	0.89		-0.26	0.89	Treat*Assess	0.91	0.436
		300 mg CB	69	96.12	0.64		-1.24	0.89		-1.36	0.89	Treat*Rep	1.43	0.170
		100 mg CB	68	95.46	0.74		0.32	0.89		0.40	0.89	Treat*Assess* Rep	0.39	0.967
	Rep 2	Caff	70	95.79	0.59	0.40	0.88	0.12	0.88					
		Pla	69	94.78	0.73	-0.70	0.89	0.65	0.89					
		300 mg CB	69	94.96	0.68	-1.29	0.89	0.49	0.89					
		100 mg CB	68	95.13	0.75	-1.03	0.89	0.37	0.89					
	Rep 3	Caff	70	95.13	0.83	0.74	0.88	0.01	0.88					
		Pla	68	94.05	1.11	0.11	0.89	1.18	0.89					
		300 mg CB	69	95.22	0.77	-0.60	0.90	-0.72	0.89					
		100 mg CB	68	95.09	0.75	-1.97	0.89	-1.24	0.89					
	Rep 4	Caff	70	93.66	0.92	1.39	0.88	1.87	0.88					
		Pla	68	93.45	1.05	0.57	0.89	1.16	0.89					
		300 mg CB	68	92.45	1.22	-0.28	0.90	1.86	0.89					
		100 mg CB	68	95.13	0.84	-1.58	0.89	-0.16	0.89					
Serial 7 subtractions Total (number)	Rep 1	Caff	70	24.79	1.33	70	2.65	0.62	70	4.87	0.61	Treatment	11.40	<.001
		Pla	69	24.91	1.39		2.46	0.62		3.77	0.62	Treat*Assess	0.70	0.551
		300 mg CB	69	26.39	1.45		2.60	0.62		2.92	0.62	Treat*Rep	2.33	0.013
		100 mg CB	68	25.07	1.23		1.55	0.62		2.68	0.62	Treat*Assess* Rep	0.54	0.891
	Rep 2	Caff	70	25.31	1.30	2.94	0.61	4.77	0.61					

		Pla	69	26.29	1.23		2.01	0.62		1.89	0.62			
		300 mg CB	69	27.03	1.49		1.35	0.63		2.09	0.62			
		100 mg CB	68	26.19	1.23		1.52	0.62		1.76	0.62			
	Rep 3	Caff	70	26.40	1.31		2.31	0.61		3.76	0.61			
		Pla	69	25.13	1.23		3.01	0.62		3.76	0.62			
		300 mg CB	69	26.84	1.56		1.93	0.62		3.02	0.62			
		100 mg CB	68	26.54	1.23		1.02	0.62		1.26	0.62			
	Rep 4	Caff	70	26.10	1.34		3.56	0.61		4.03	0.61			
		Pla	68	26.69	1.37		1.52	0.62		2.36	0.62			
		300 mg CB	69	27.54	1.55		0.68	0.62		2.39	0.62			
		100 mg CB	68	26.25	1.27		1.68	0.62		2.72	0.62			
Serial 7 subtractions Accuracy (%)	Rep 1	Caff	70	90.24	1.50	70	1.43	1.39	70	1.91	1.39	Treatment	2.91	0.034
		Pla	69	89.24	1.46		1.36	1.39		3.33	1.41	Treat*Assess	0.10	0.962
		300 mg CB	69	92.02	1.55		0.92	1.41		-1.08	1.39	Treat*Rep	1.23	0.272
		100 mg CB	68	91.42	1.17		0.37	1.41		-1.08	1.41	Treat*Assess* Rep	0.73	0.726
	Rep 2	Caff	70	90.90	1.32		0.84	1.39		-0.29	1.39			
		Pla	69	89.00	1.71		1.21	1.39		0.93	1.39			
		300 mg CB	69	92.35	1.21		-1.68	1.42		-2.04	1.40			
		100 mg CB	68	90.42	1.31		-0.04	1.41		0.09	1.41			
	Rep 3	Caff	70	90.05	1.33		0.42	1.39		2.07	1.39			
		Pla	69	88.53	1.39		1.78	1.39		2.66	1.39			
		300 mg CB	69	88.99	1.50		-0.12	1.41		1.36	1.39			
		100 mg CB	68	89.89	1.40		-1.02	1.41		0.39	1.42			
	Rep 4	Caff	70	87.84	1.62		2.38	1.39		3.51	1.39			
		Pla	68	90.53	1.29		-0.82	1.41		-0.08	1.40			
		300 mg CB	69	89.80	1.58		-1.88	1.41		2.62	1.39			
		100 mg CB	68	88.98	1.81		0.39	1.41		1.10	1.41			
RVIP Accuracy (%)	Rep 1	Caff	69	53.55	2.64	70	5.28	1.52	70	1.29	1.52	Treatment	38.26	<.001
		Pla	69	57.25	2.66		0.90	1.52		-6.45	1.52	Treat*Assess	1.95	0.120
		300 mg CB	68	53.71	2.59		0.99	1.54		-6.10	1.53	Treat*Rep	0.47	0.895
		100 mg CB	67	55.52	2.80		-1.90	1.53		-6.56	1.54	Treat*Assess* Rep	0.60	0.845
	Rep 2	Caff	69	51.67	2.67		5.24	1.52		1.26	1.52			
		Pla	69	53.51	2.84		1.05	1.52		-5.78	1.53			
		300 mg CB	68	50.96	2.76		0.05	1.54		-5.00	1.53			
		100 mg CB	67	53.84	2.81		-3.14	1.53		-5.41	1.54			
	Rep 3	Caff	69	49.38	2.68		5.53	1.52		2.05	1.52			
		Pla	69	51.41	2.77		0.83	1.52		-5.36	1.55			
		300 mg CB	68	50.77	2.80		-2.29	1.54		-5.66	1.53			
		100 mg CB	67	51.38	2.79		-2.95	1.53		-5.16	1.53			
	Rep 4	Caff	68	47.35	2.59		6.51	1.53		3.62	1.53			
		Pla	69	49.49	2.80		0.11	1.52		-3.58	1.54			
		300 mg CB	68	47.87	2.82		-1.39	1.54		-3.41	1.54			
		100 mg CB	67	49.66	2.81		-4.97	1.53		-4.94	1.53			
RVIP RT (ms)	Rep 1	Caff	69	515.06	5.60	70	-2.36	4.87	70	-3.91	4.87	Treatment	6.54	<.001
		Pla	69	512.86	6.13		-0.16	4.87		0.81	4.87	Treat*Assess	0.10	0.962

RVIP False alarms (number)	Rep 2	300 mg CB	68	508.70	5.39		4.84	4.94		2.17	4.91	Treat*Rep	1.23	0.273
		100 mg CB	67	510.54	6.88		-1.22	4.91		1.11	4.94	Treat*Assess* Rep	0.29	0.991
		Caff	69	527.47	6.21		-7.24	4.87		-6.65	4.87			
		Pla	69	523.58	6.18		-7.15	4.87		-2.72	4.91			
	Rep 3	300 mg CB	68	521.23	6.25		-4.16	4.94		-4.64	4.91			
		100 mg CB	67	521.71	6.55		-3.27	4.91		-0.28	4.94			
		Caff	69	531.86	6.53		-6.84	4.87		-13.93	4.87			
		Pla	69	531.65	6.50		-8.65	4.87		-13.19	4.98			
	Rep 4	300 mg CB	68	522.89	6.31		3.11	4.94		-3.42	4.91			
		100 mg CB	67	520.56	5.64		6.86	4.91		4.03	4.91			
		Caff	68	535.84	6.22		-13.48	4.91		-14.66	4.91			
		Pla	69	532.16	6.28		-6.77	4.87		-12.21	4.94			
		300 mg CB	68	523.36	6.91		1.19	4.94		-0.27	4.94			
		100 mg CB	67	524.05	5.95		1.75	4.91		-2.15	4.91			
Mental Fatigue	Rep 1	Caff	69	2.54	0.33	70	-0.37	0.30	70	-0.19	0.30	Treatment	6.88	<.001
		Pla	69	2.67	0.34		-0.07	0.30		-0.30	0.30	Treat*Assess	0.04	0.988
		300 mg CB	68	2.37	0.40		-0.27	0.30		0.27	0.30	Treat*Rep	0.95	0.479
		100 mg CB	67	2.61	0.38		-0.12	0.30		-0.02	0.30	Treat*Assess* Rep	0.51	0.911
	Rep 2	Caff	69	2.58	0.43		-0.53	0.30		-0.50	0.30			
		Pla	69	2.68	0.40		0.28	0.30		0.06	0.30			
		300 mg CB	68	2.12	0.35		0.58	0.30		0.37	0.30			
		100 mg CB	67	2.19	0.30		0.49	0.30		0.55	0.30			
	Rep 3	Caff	69	2.22	0.28		-0.06	0.30		0.21	0.30			
		Pla	69	2.65	0.42		0.01	0.30		0.30	0.31			
		300 mg CB	68	2.19	0.35		0.69	0.30		0.47	0.30			
		100 mg CB	67	2.21	0.34		0.71	0.30		0.78	0.30			
	Rep 4	Caff	68	2.65	0.39		-0.06	0.30		-0.33	0.30			
		Pla	69	2.77	0.37		-0.18	0.30		0.18	0.30			
		300 mg CB	68	2.63	0.56		-0.14	0.30		0.27	0.30			
		100 mg CB	67	2.45	0.29		0.46	0.30		0.75	0.30			
Mental Fatigue	Rep 1	Caff	72	38.24	2.20	72	-2.14	2.47	72	7.51	2.47	Treatment	15.43	<.001
		Pla	71	42.23	2.01		-0.78	2.49		8.80	2.49	Treat*Assess	0.74	0.527
		300 mg CB	71	38.56	2.09		5.89	2.50		10.26	2.49	Treat*Rep	1.92	0.045
		100 mg CB	70	37.97	2.00		7.67	2.49		11.92	2.49	Treat*Assess* Rep	1.42	0.148
	Rep 2	Caff	72	48.26	2.32		-7.17	2.47		-3.01	2.47			
		Pla	71	46.49	2.19		1.19	2.49		9.25	2.49			
		300 mg CB	71	46.01	2.19		3.30	2.50		8.18	2.49			
		100 mg CB	70	43.94	2.15		6.87	2.49		11.52	2.49			
	Rep 3	Caff	72	52.43	2.38		-7.01	2.47		-2.15	2.47			
		Pla	71	51.01	2.14		0.66	2.49		7.01	2.49			
		300 mg CB	71	51.41	2.31		2.25	2.50		5.70	2.49			
		100 mg CB	70	48.93	2.29		6.22	2.49		6.63	2.49			
	Rep 4	Caff	72	54.97	2.33		-8.53	2.47		-5.58	2.47			
		Pla	71	55.66	2.04		-7.05	2.49		3.68	2.49			

		300 mg CB	71	55.42	2.40		-6.77	2.50		4.05	2.49			
		100 mg CB	70	52.64	2.38		-2.56	2.49		7.49	2.49			
Alertness	Rep 1	Caff	72	52.43	2.00	72	5.15	2.49	72	-1.88	2.49	Treatment	21.73	<.001
		Pla	71	52.82	2.01		-0.06	2.50		-9.11	2.50	Treat*Assess	2.14	0.094
		300 mg CB	71	53.30	2.00		-1.50	2.51		-8.68	2.50	Treat*Rep	1.62	0.105
		100 mg CB	70	50.51	2.41		-0.17	2.50		-5.35	2.50	Treat*Assess* Rep	0.53	0.899
	Rep 2	Caff	72	45.46	2.06		8.78	2.49		2.56	2.49			
		Pla	71	48.86	2.19		-1.53	2.50		-8.89	2.50			
		300 mg CB	71	47.93	2.08		-1.08	2.52		-4.93	2.50			
		100 mg CB	70	47.24	2.37		-3.66	2.50		-5.13	2.50			
	Rep 3	Caff	72	39.92	2.11		13.51	2.49		5.88	2.49			
		Pla	71	43.52	2.20		-0.13	2.50		-7.57	2.50			
		300 mg CB	71	42.72	2.31		-0.92	2.52		-1.79	2.50			
		100 mg CB	70	43.71	2.45		-3.54	2.50		-2.74	2.50			
	Rep 4	Caff	72	38.85	2.08		11.07	2.49		6.69	2.49			
		Pla	71	39.83	1.98		1.22	2.50		-4.16	2.50			
		300 mg CB	71	37.94	2.26		2.43	2.51		2.04	2.50			
		100 mg CB	70	40.77	2.44		-0.88	2.50		-2.14	2.50			
Motivation	Rep 1	Caff	72	53.00	1.90	72	2.43	2.19	72	-4.18	2.19	Treatment	21.46	<.001
		Pla	71	54.10	2.07		-2.00	2.20		-9.23	2.20	Treat*Assess	0.32	0.808
		300 mg CB	71	56.41	1.74		-3.60	2.21		-12.90	2.20	Treat*Rep	1.74	0.076
		100 mg CB	70	52.26	2.26		-3.17	2.20		-8.10	2.20	Treat*Assess* Rep	0.91	0.531
	Rep 2	Caff	72	47.10	2.15		6.18	2.19		0.39	2.19			
		Pla	71	49.72	2.20		-3.13	2.20		-8.79	2.20			
		300 mg CB	71	52.42	1.98		-5.77	2.21		-11.85	2.20			
		100 mg CB	70	47.47	2.22		-1.31	2.20		-6.75	2.20			
	Rep 3	Caff	72	43.26	2.26		7.74	2.19		2.51	2.19			
		Pla	71	47.13	2.01		-2.18	2.20		-8.66	2.20			
		300 mg CB	71	46.41	2.23		-3.20	2.21		-6.65	2.20			
		100 mg CB	70	43.03	2.30		-1.69	2.20		-1.79	2.20			
	Rep 4	Caff	72	39.43	2.22		10.08	2.19		4.75	2.19			
		Pla	71	40.59	2.07		0.77	2.20		-3.28	2.20			
		300 mg CB	71	41.21	2.18		1.31	2.21		-2.41	2.20			
		100 mg CB	70	40.33	2.38		2.38	2.20		-3.14	2.20			

Caff, 75 mg caffeine; Pla, placebo; CB coffeeberry; VAS, visual analogue scale; EFS, Energy and Fatigue Scales; RT, reaction time; ms, milliseconds; RVIP, rapid visual information processing; Treat, treatment; Assess, assessment; Rep, repetition

Table S5. Scores for the Energy and Fatigue and Bond-Lader mood scales. The Baseline data are raw means (plus SEM) collected prior to dosing. Data presented from the 60 and 120 minute post dose (p.d.) assessments are estimated means (plus SEM) of change from baseline values derived from the linear mixed model analysis, with the final two columns showing test statistics (F) and associated probabilities (p) for each of the fixed effects included in the model.

		Baseline			60 min p.d.			120 min p.d.						
		N	Mea n	SEM	N	Mean	SEM	N	Mea n	SE M			F	p
Physical Energy	Caff	72	47.92	2.03	72	5.64	2.22	72	3.60	2.22	Treatment	5.96	<.001	
	Pla	71	46.18	1.93		2.12	2.23		-4.21	2.23	Treat*Assess	0.85	0.467	
	300 mg CB	71	46.21	2.26		2.23	2.23		1.08	2.23				
	100 mg CB	70	47.66	2.05		-2.25	2.24		-5.21	2.24				
Physical Fatigue	Caff	72	46.07	2.12	72	-7.22	2.19	72	-1.67	2.19	Treatment	3.45	0.017	
	Pla	71	46.56	1.79		-2.60	2.20		3.64	2.20	Treat*Assess	0.53	0.659	
	300 mg CB	71	45.00	2.07		0.03	2.20		3.14	2.20				
	100 mg CB	70	46.23	2.08		1.72	2.21		4.59	2.22				
Physical Vigour	Caff	72	44.21	1.81		6.85	1.96		3.61	1.96	Treatment	6.83	<.001	
	Pla	71	43.25	1.77	72	3.14	1.97	72	-3.09	1.98	Treat*Assess	1.43	0.235	
	300 mg CB	71	45.31	2.11		-0.83	1.98		-0.91	1.98				
	100 mg CB	70	45.66	2.03		-2.12	1.99		-3.85	1.99				
Physical Exhaustion	Caff	72	45.44	2.17	72	-5.74	2.28	72	-3.50	2.28	Treatment	4.33	0.005	
	Pla	71	47.94	1.94		-1.37	2.29		2.03	2.29	Treat*Assess	0.10	0.961	
	300 mg CB	71	45.41	2.25		0.00	2.29		1.39	2.29				
	100 mg CB	70	45.01	1.90		2.38	2.30		5.09	2.31				
Physical Pep	Caff	72	43.00	2.07	72	7.19	2.11	72	4.53	2.11	Treatment	7.86	<.001	
	Pla	71	42.18	1.88		0.39	2.12		-3.66	2.12	Treat*Assess	0.32	0.812	
	300 mg CB	71	42.96	2.16		-0.60	2.12		-1.58	2.12				
	100 mg CB	70	44.74	2.07		-1.88	2.13		-4.25	2.13				
Physical Worn Out	Caff	72	45.90	2.24	72	-6.46	2.10	72	-2.88	2.10	Treatment	4.85	0.003	
	Pla	71	48.45	1.97		-1.44	2.12		1.55	2.12	Treat*Assess	0.20	0.896	
	300 mg CB	71	46.41	2.09		1.82	2.12		3.04	2.12				
	100 mg CB	70	45.09	2.03		2.49	2.13		4.74	2.13				
Mental Energy	Caff	72	39.32	1.84	72	10.75	2.33	72	4.79	2.33	Treatment	8.49	<.001	
	Pla	71	38.87	1.75		1.01	2.34		-4.93	2.34	Treat*Assess	0.49	0.690	
	300 mg CB	71	38.83	2.01		1.72	2.34		-3.20	2.34				
	100 mg CB	70	38.00	2.06		0.37	2.36		-2.16	2.36				
Mental Fatigue	Caff	72	54.21	2.03	72	11.33	2.32	72	-5.53	2.32	Treatment	8.89	<.001	
	Pla	71	54.27	1.69		-3.13	2.33		4.63	2.33	Treat*Assess	0.18	0.913	
	300 mg CB	71	54.87	1.86		-2.11	2.33		3.44	2.33				
	100 mg CB	70	54.19	1.95		-0.33	2.35		5.45	2.35				
Mental Vigour	Caff	72	40.61	1.76	72	8.35	2.05	72	4.07	2.05	Treatment	6.20	<.001	
	Pla	71	39.52	1.52		2.93	2.06		-3.60	2.06	Treat*Assess	0.84	0.473	
	300 mg CB	71	39.52	1.90		0.30	2.06		-2.01	2.06				
	100 mg CB	70	40.71	1.95		-0.13	2.07		-3.08	2.08				
Mental Exhaustion	Caff	72	53.33	2.03	72	-8.81	2.35	72	-4.36	2.35	Treatment	6.16	<.001	
	Pla	71	54.76	1.88		-1.26	2.36		5.43	2.36	Treat*Assess	0.21	0.887	

	300 mg CB	71	54.96	2.03		-2.41	2.36		3.62	2.36			
	100 mg CB	70	55.33	1.99		-1.62	2.38		2.93	2.38			
Mental Pep	Caff	72	38.36	1.83	72	8.89	2.09	72	6.06	2.09	Treatment	9.02	<.001
	Pla	71	37.41	1.64		2.55	2.10		-3.12	2.11	Treat*Assess	0.35	0.789
	300 mg CB	71	38.68	1.93		0.67	2.11		-2.27	2.11			
	100 mg CB	70	38.46	1.96		-0.39	2.12		-3.81	2.12			
Mental Worn Out	Caff	72	52.74	2.22	72	-9.32	2.32	72	-5.38	2.32	Treatment	6.71	<.001
	Pla	71	54.99	1.71		-2.78	2.34		3.71	2.34	Treat*Assess	0.25	0.862
	300 mg CB	71	53.92	2.08		0.34	2.34		4.84	2.34			
	100 mg CB	70	54.03	2.08		-0.64	2.35		3.16	2.35			
Bond Lader - Alert	Caff	72	43.62	1.87	72	10.58	2.13	72	7.33	2.13	Treatment	11.4 9	<.001
	Pla	71	44.10	1.78		2.26	2.14		-2.56	2.14	Treat*Assess	0.83	0.477
	300 mg CB	71	43.44	2.05		1.70	2.14		0.83	2.14			
	100 mg CB	70	42.91	2.01		0.96	2.15		-0.80	2.15			
Bond Lader - Content	Caff	72	58.02	1.90	72	5.01	1.34	72	3.47	1.34	Treatment	4.95	0.002
	Pla	71	57.15	1.80		1.98	1.35		-0.92	1.35	Treat*Assess	1.03	0.380
	300 mg CB	71	58.53	1.87		-0.79	1.35		-0.50	1.35			
	100 mg CB	70	57.37	1.78		1.32	1.36		0.66	1.36			
Bond Lader - Calm	Caff	72	63.81	1.54	72	-4.79	1.51	72	-4.37	1.51	Treatment	2.15	0.094
	Pla	71	63.29	1.59		-1.57	1.52		-2.71	1.52	Treat*Assess	0.19	0.904
	300 mg CB	71	63.94	1.70		-2.27	1.52		-3.16	1.52			
	100 mg CB	70	64.50	1.59		-0.67	1.53		-0.92	1.53			

Caff, 75 mg caffeine; Pla, placebo; CB coffeeberry

Table S6. Scores for the episodic memory tasks, completed following the 120 minute post dose assessment. Data are estimated means (plus SEM) derived from the linear mixed model analysis, with the final two columns showing test statistics (F) and associated probabilities (p) for the effect of treatment.

		N	Mean	SEM	F	p
Word recognition Accuracy (%)	Caff	72	68.75	1.26	1.35	0.258
	Pla		69.41	1.27		
	300 mg CB		68.66	1.27		
	100 mg CB		66.69	1.27		
Word recognition RT (ms)	Caff	72	1063.36	29.97	1.67	0.174
	Pla		1017.04	30.10		
	300 mg CB		1068.40	30.10		
	100 mg CB		1036.36	30.20		
Picture recognition Accuracy (%)	Caff	72	79.91	1.65	0.08	0.970
	Pla		79.75	1.66		
	300 mg CB		80.12	1.66		
	100 mg CB		79.44	1.67		
Picture recognition RT (ms)	Caff	72	926.10	21.32	0.84	0.473
	Pla		900.22	21.42		
	300 mg CB		922.78	21.42		
	100 mg CB		907.65	21.57		
Delayed word recall Number	Caff	72	2.22	0.20	1.20	0.312
	Pla		2.56	0.20		
	300 mg CB		2.20	0.20		
	100 mg CB		2.31	0.20		

References

1. Kennedy, D.O.; Haskell, C.F.; Robertson, B.; Reay, J.; Brewster-Maund, C.; Luedemann, J.; Maggini, S.; Ruf, M.; Zangara, A.; Scholey, A.B. Improved cognitive performance and mental fatigue following a multi-vitamin and mineral supplement with added guarana (*Paullinia cupana*). *Appetite* **2008**, *50*, 506-513, doi:10.1016/j.appet.2007.10.007.
2. Kennedy, D.O.; Scholey, A.B. A glucose-caffeine 'energy drink' ameliorates subjective and performance deficits during prolonged cognitive demand. *Appetite* **2004**, *42*, 331-333, doi:10.1016/j.appet.2004.03.001.
3. Reay, J.L.; Kennedy, D.O.; Scholey, A.B. Single doses of *Panax ginseng* (G115) reduce blood glucose levels and improve cognitive performance during sustained mental activity. *J Psychopharmacol* **2005**, *19*, 357-365, doi:10.1177/0269881105053286.
4. Reay, J.L.; Kennedy, D.O.; Scholey, A.B. Effects of *Panax ginseng*, consumed with and without glucose, on blood glucose levels and cognitive performance during sustained 'mentally demanding' tasks. *J Psychopharmacol* **2006**, *20*, 771-781, doi:10.1177/0269881106061516.
5. Kennedy, D.; Okello, E.; Chazot, P.; Howes, M.-J.; Ohiomokhare, S.; Jackson, P.; Haskell-Ramsay, C.; Khan, J.; Forster, J.; Wightman, E. Volatile terpenes and brain function: Investigation of the cognitive and mood effects of *Mentha × piperita* l. essential oil with in vitro properties relevant to central nervous system function. *Nutrients* **2018**, *10*, 1029.
6. Scholey, A.B.; French, S.J.; Morris, P.J.; Kennedy, D.O.; Milne, A.L.; Haskell, C.F. Consumption of cocoa flavanols results in acute improvements in mood and cognitive performance during sustained mental effort. *J Psychopharmacol* **2010**, *24*, 1505-1514, doi:10.1177/0269881109106923.