

# Are nutritional variables associated with cognition in stimulant dependence?





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### Introduction

Treatment of drug addiction is still a challenge. Although medications are available which are effective for dependent users of alcohol, nicotine and opiates, none have proven effective for users of stimulants like cocaine and amphetamine<sup>1</sup>.

# Methods

Fifty-eight stimulant dependent volunteers, all except one of whom were dependent on cocaine, and 63 healthy volunteers were recruited. All participants completed neurocognitive tests from the widely-used and validated Cambridge Neuropsychological Testing Battery (CANTAB; www.camcog.com), as shown in Figure 2.

#### Table 1, Sample Characteristics

Demographics	Healthy Volunteers	Stimulant Dependent Volunteers	F or X <sup>2</sup>	Р	
Ν	63	58			
Age (years)	35.49 (±9.65)	35.75 (±7.90)	0.03	0.869	
Gender (male:female)	50:13	55 : 3	5.02	0.025	
Years of education (years)	13.56 (±2.80)	11.28 (±1.91)	26.94	< 0.001	
Verbal intelligence (NART; score)	115.00 (±7.00)	107.56 (±9.70)	22.29	< 0.001	
Dysphoric mood (BDI-II; score)	2.56 (±3.36)	17.53 (±11.92)	91.43	<0.001	
<b>Smoking status</b> (non- smoker, previous smoker, smoker)	25:31:7	3 : 2 : 53	77.96	<0.001	
Body mass index (BMI; score)	25.56 (±3.83)	24.23 (±3.50)	3.89	0.051	
<b>Scorings</b> . BDI-II (0-13: minimal, 14- 18.5-25: ideal, 25-30: overweight, 30	19: mild, 20-28: mode and above: obese).	erate, 29-63: severe), BMI (	0-18.5: ur	nderweigh	

Cognitive deficits arsing from, or exacerbated by, chronic drug use seem to moderate treatment outcomes because skills such as attention and memory are required in order to learn and implement strategies taught during treatment sessions<sup>2</sup>. As a result, some researchers have suggested that tackling cognitive deficits pharmacologically with cognitive enhancing drugs may improve treatment prognosis<sup>3</sup>.

Food has also been suggested as cognitively enhancing<sup>4</sup>. For example, high fat diets have been linked to decreased attention<sup>5</sup>, while vitamin and fish oil supplements may improve domains of cognition which typically decline with age<sup>6</sup>. Nutritional supplements are often given to alcohol dependent individuals to alleviate cognitive symptoms<sup>7</sup>.

However, the subject of nutrition in drug dependent individuals is not well studied. Available research suggests that diets are poor: high in fats, sugars, and carbohydrates, and low in vitamins, protein and fruit<sup>8,9</sup>. We aimed to investigate whether differences in diet shown by stimulant dependent individuals might be related to their cognitive deficits. If so, dietary intervention might enhance treatment success.

#### Hypothesis

We hypothesised that the dietary intake of stimulant dependent and healthy volunteers would differ, as has been reported in the literature. Due to the reported link between nutrients and cognitive functions, we further hypothesised that such dietary differences would be related to stimulant dependent and healthy volunteers' differential cognitive functioning.

Participants also completed the EPIC-Norfolk Food Frequency Questionnaire (FFQ) which is a validated measure within Europe for the assessment of usual dietary intake in the past year<sup>10,11</sup> (Figure 1).

FFQ and cognitive data were analysed for differences between groups with Multivariate Analysis of Covariance (MANCOVA) with gender, smoking status, alcohol and calorie intake as covariates in the analysis of FFQ, and verbal intelligence, dysphoric mood, smoking status, alcohol and calorie intake as covariates in the analysis of cognitive data. We corrected for multiple comparisons using the Bonferroni correction.

FOODS AND AMOUNTS	AVERAGE USE LAST YEAR										Less than once a w	eek	Never
SWEETS AND SNACKS	Never or	1-3	Once	2-4	5-6	Once	2-3	4-5	6+				
(medium serving)	less than	per	a	per	per	a	per	per	per	). 1	How often did you eat fried food away from home?		1.6 times a wook
weet biscuits, chocolate, eq. digestive (one)	Unce/monut	monu	WCCK	WCCK	WEEK	uay	uay	uay	uay		Daily 1-5 times a w	eek V	4-0 unles a week
Sweet biscuits, plain, eq. Nice, ginger (one)				1	~				-		Less than once a w	eek	Never
cakes eq. fruit, sponge, home baked		-	1	~						10. 1	What did you do with the visible fat on your meat?		
cakes eq. fruit, sponge, ready made	1		V						-		Ate most of the fat	At	e as little as possible
Buns, pastries eg, scones, flapiacks, home baked	1				-						Ate some of the fat		Did not eat meat
uns, pastries eg, croissants, doughnuts, ready made	v				1						How often did you eat grilled or roast meat?		O 1 times a w
ruit pies, tarts, crumbles, home baked		1	-		•						How often did you eat grined of roast meat:		
ruit pies, tarts, crumbles, ready made		1								10 1	How well cooked did you usually have grilled or roa	est meat?	
ponge puddings, home baked	1	~						1		2. 1	Well done /dark brown	or mouri	Lightly cooked/rare
ponge puddings, ready made	v	1									Medium		Did not eat meat
lilk puddings, eg, rice, custard, trifle	./	V	-										Dia not cur mout
e cream, choc ices	v		1							3 1	How often did you add salt to food while cooking?		
nocolates, single or squares			v	1							Always		Rarely
hocolate snack bars eg. Mars. Crunchie				v	1						Usually		Never
veets, toffees, mints		1			•						Sometimes		
ugar added to tea, coffee, cereal (teaspoon)		v							1				
isps or other packet snacks, eq. Wotsits							./		v	14. 1	How often did you add salt to any food at the table'	?	
eanuts or other nuts			1				V				Always		Rarely
OUPS, SAUCES, AND SPREADS			v						-		Usually		Never
egetable soups (bowl)	./										Sometimes		
eat soups (bowl)	1									15. 1	Did you regularly use a salt substitute (eg LoSalt)?		Yes No
auces, eg. white sauce, cheese sauce, avy (tablespoon)		1									If yes, which brand?		
omato ketchup (tablespoon)				1						16. I	During the course of last year, on average, how ma	any times a wee	k did you eat the follo
ckles, chutney (tablespoon)	/			~						1	foods?		
armite. Bovril (teaspoon)	V	1								1	Food type	Times/week	Portion size
m. marmalade, honey (teaspoon)		~	1							1	Vegetables (not including potatoes)	02	medium serving
anut butter (teaspoon)			1								Salads	01	medium serving
	Maura	10	~		5.0	0					Fruit and fruit products (not including fruit juice)	01	medium serving or 1
	less than	1-3 per	a	2-4 per	5-6 per	Once	2-3 per	4-5 per	6+ per	1	Fish and fish products	00	medium serving
	once/month	month	week	week	week	day	day	day	day	-	Meat, meat products and meat dishes (including bacon, ham and chicken)	10	medium serving

#### Results

Demographic data are shown in Table 1. There were significant differences in gender, verbal intelligence, years of education, and smoking status between drug users and controls, but not in body mass index (a measure of weight relative to height) or age. These differences were statistically controlled for in the subsequent analyses.

#### Group differences in dietary food intake

Stimulant dependent participants had a higher calorie diet and drank more alcohol than healthy volunteers. Holding these differences constant, there were eight foods which stimulant dependent participants ate in greater quantities, and two which they ate lesser of (see Table 2). Drug users also performed more poorly than healthy volunteers in each of the cognitive tasks (see Figure 3).

Relationship between food intake and cognition In healthy volunteers, fibre (r = .43, p<.01), fructose (r = .28, p<.05), glucose (r = .27, p<.05), vitamin B6 (r = .34, p<.001) and fruit (r = .40, p<.01) were positively correlated with **processing speed** in the test of sustained attention. However, there were no correlations between food and cognitive functions in drug users.



**Figure 1**. Food Frequency Questionnaire (www.srl.cam.ac.uk/epic/nutmethod)

#### Figure 2



Nutrients	Healthy Volunteers	Stimulant-Dependent Volunteers	F	Р	
Fibre (g)	17.79 (±14.18)	18.08 (±13.79)	13.10	<0.001	
Glucose (g)	24.23 (±18.98)	27.03 (±24.57)	17.42	<0.001	
Vitamin B6 (mg)	2.52 (±1.30)	2.66 (±1.40)	19.03	<0.001	
Fat (g)	75.74 (±28.23)	143.57 (±100.93)	24.10	<0.001	
Monounsaturated Fatty Acids (g)	27.55 (±10.88)	54.11 (±40.57)	18.52	<0.001	
Saturated Fatty Acids (g)	28.13 (±10.49)	55.31 (±37.69)	23.56	<0.001	
Fruit (g)	287.24 (±448.10)	193.03 (±348.64)	13.16	<0.001	
Fructose (g)	26.47 (±20.49)	26.20 (±24.89)	17.95	<0.001	



**Note**. Comparisons between groups were controlled for differences between groups in gender composition, smoking status, alconol (g), and energy (calorie) intake.

# Conclusions

Stimulant dependent volunteers were more cognitively impaired than healthy volunteers in tests of spatial working memory, visual memory and new learning, and attention, as has been shown in previous research<sup>12</sup>. Diets between groups differed in terms of energy intake, alcohol content, and types of foods consumed. However, while there was a correlation, albeit weak, between dietary variables and cognition in healthy volunteers, such a relationship was not present in the drug using individuals. This suggests that the cognitive deficits of the stimulant-dependent volunteers may be too severe to be amenable to dietary interventions, and that the subject of cognitive enhancement via nutrition for treatment-seeking drug users requires further consideration and investigation. As improving unhealthy diets could also be beneficial to general health, nutritional intervention might also bring positive outcomes in this sense.

# References

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