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# The effect of glycaemic index of breakfast cereal on children's cognitive performance

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British Psychological Society  
Developmental Conference  
Edinburgh, September 2005

# Background

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- Rising demand on cognitive and intellectual performance



- Imbalanced diet



- The effects of *diet* on cognitive performance



- The effects of *breakfast* on children's cognitive performance

# Background

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- Iowa Breakfast Studies.  
Tuttle et al (1949; 1950; 1952; 1954)



- Indicate that the consumption of breakfast can enhance cognitive performance



- Surge of research into the effects of breakfast on cognitive performance



# Background

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- Skipping breakfast has detrimental effects (e.g. Smith et al, 1994)



- Consumption of breakfast has positive effects (e.g. Pollitt et al, 1998)



- Wesnes et al (2003)

- 9- to 16-year-olds
- Cheerios, Shreddies, glucose drink or no breakfast
- Computerised tests of attention and memory
- Prior to and at 30, 90, 150 and 210 minutes after breakfast



# Background

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- Glucose Drink & No Breakfast:

Decline in Focused Attention and  
Episodic Memory



- Cheerios & Shreddies:

Decline seen in Focused Attention and Episodic  
Memory was significantly reduced



- Breakfast in the form of cereal can have a  
positive effect on cognitive performance in  
school children



# Background

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- Breakfast compared to *no* breakfast



- *Composition* of breakfast

- The brain's main source of energy is glucose



- Increased blood glucose has positive effect on cognitive performance

(e.g. Martin & Benton, 1999; Sunram-Lea et al., 2002)



# Background

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- The body's main source of glucose is carbohydrates
- Carbohydrates exerts its effects on blood glucose in two ways



# Background



- High Glycaemic Index ( $GI > 70$ )
- Low Glycaemic Index ( $GI < 40$ )

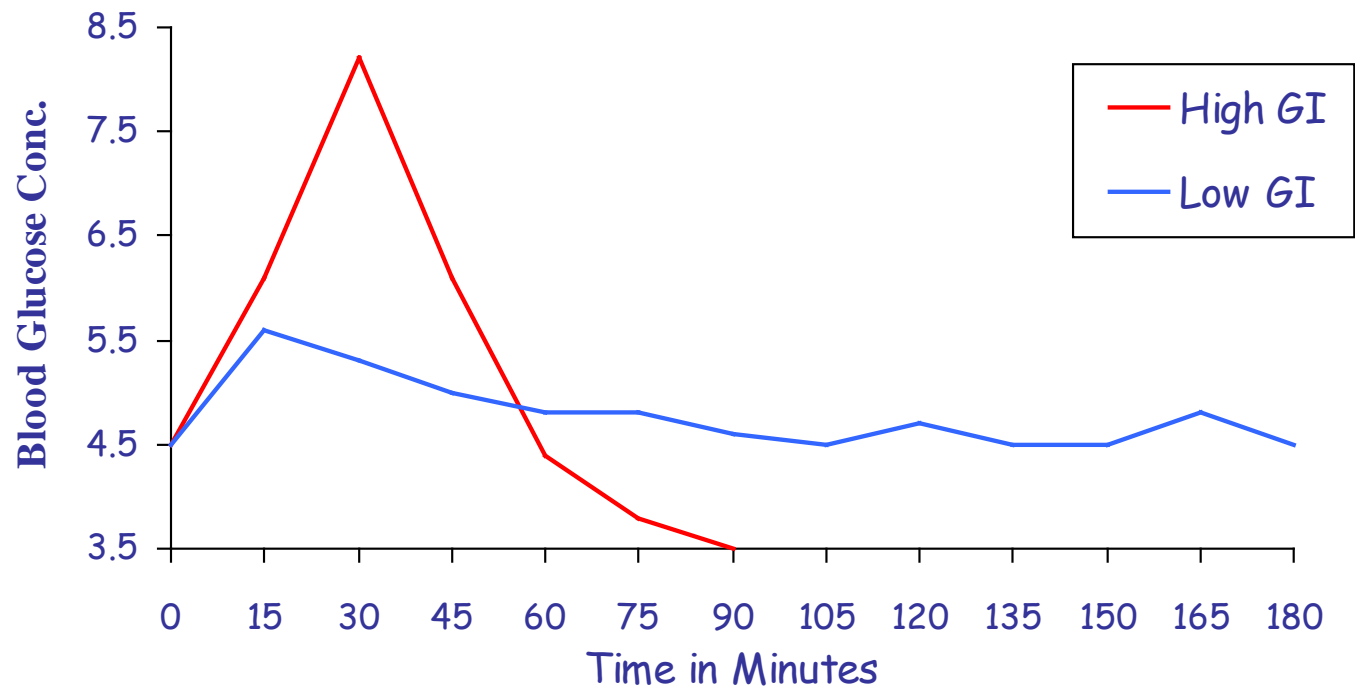


Fig. 1: Blood glucose response after intake of high and low GI carbohydrates

# Present Study

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## Aims

- a) Does the glycaemic index of breakfast have an effect on cognitive performance?



*Prediction: low rather than high GI breakfast more beneficial to performance, particularly in late morning*



- b) Are the effects found across all cognitive functions or restricted to particular processes?



# Participants

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- 6- to 11-years (N = 64)  
Mean age 9:3 (range 6:8 -11:7); 38 females, 26 males



- Three age groups:

7-year-olds (N = 18)

Mean age 7:2 (range 6:3-7:11); 10 females, 8 males



9-year-olds (N = 23)

Mean age 9:1 (range 8:2-9:11); 10 females, 13 males



11-year-olds (N = 23)

Mean age 11:0 (range 10:0-11:7); 18 females, 5 males

# Procedure

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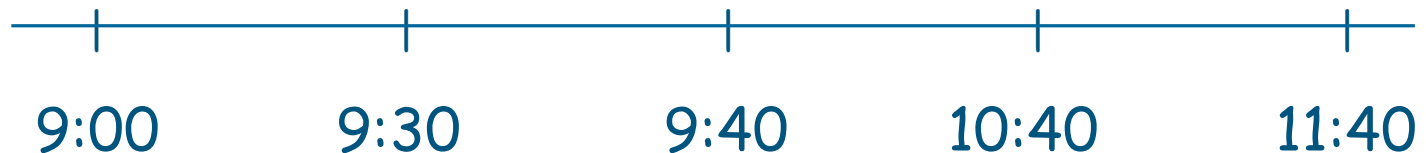
- Two consecutive days
- High GI: Coco Pops  
(35g with 125ml semi-skimmed milk)



- Low GI: All Bran  
(35g with 125ml semi-skimmed milk)



Baseline      Breakfast      Test 1      Test 2      Test 3



# Procedure



Cognitive Drug Research (CDR)  
Computerised Assessment Battery (Wesnes et al, 2003)



Word Presentation  
Immediate Word Recall  
Picture Presentation  
Simple Reaction Time  
Digit Vigilance  
Choice Reaction Time  
Spatial Working Memory  
Numeric Working Memory  
Delayed Word Recall  
Delayed Word Recognition  
Delayed Picture Recognition



Fig. 2: CDR Test Battery

# Analysis of Data

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- Focused Attention



- Sustained Attention

- Working Memory



- Episodic Memory

- Speed of Memory



# Analysis of Data

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- Change from Baseline

Test 1/2/3 - Baseline



- (3 x 2 x 3) ANOVA  
(assessment x breakfast x age group)



# Results

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- Older children perform better than younger children



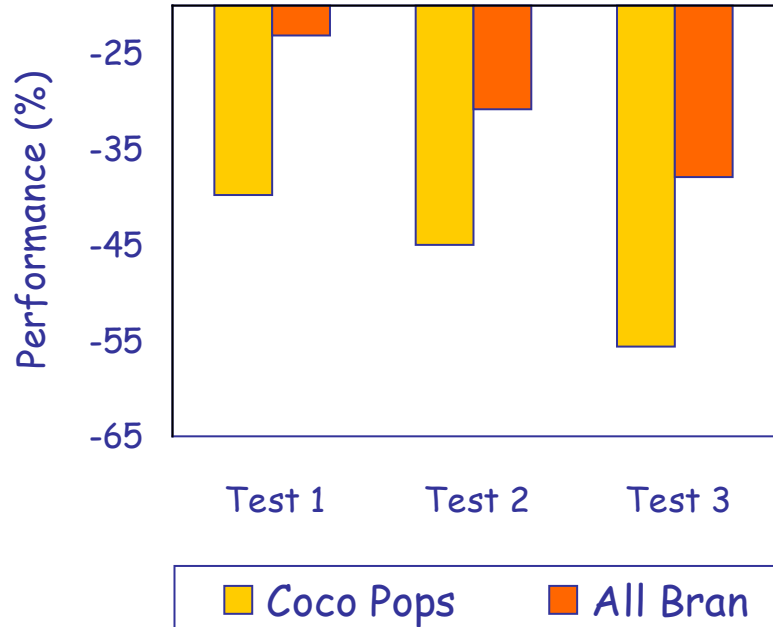
- Decline in performance throughout the morning





# Results

## Episodic Memory



Main effect of Breakfast  
 $F(1,61) = 5.313, p < 0.05$

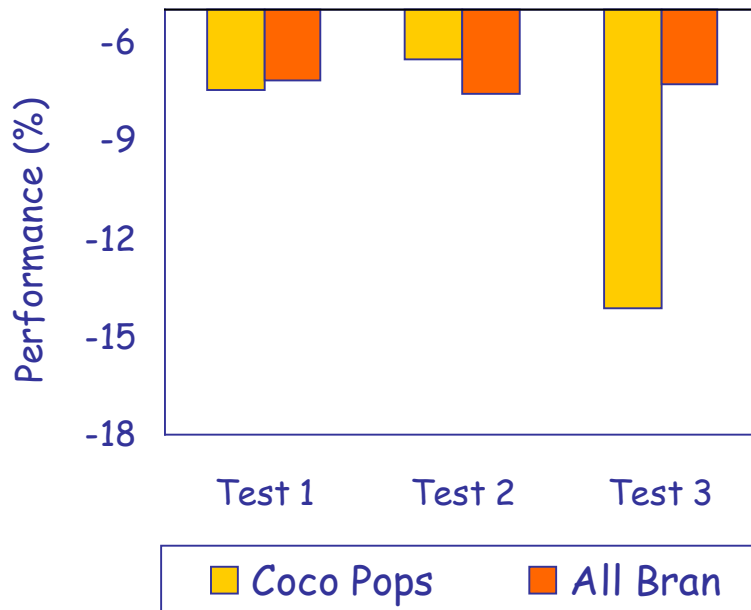
Significantly smaller decline in performance after consumption of low GI All Bran compared to high GI Coco Pops

Fig. 3: Performance on Episodic Memory

# Results



## Sustained Attention



Breakfast \* Assessment Time  
 $F(2,122) = 3.820, p < 0.05$

Significantly decline in performance on Test 3 after consumption of high GI Coco Pops compared to low GI All Bran

Fig. 4: Performance on Sustained Attention

# Discussion

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## Aims

- a) Can the Glycaemic Index of breakfast affect children's cognition?
- b) Are the effects found across all cognitive functions or restricted to particular processes?



# Discussion

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- Significantly less decline on Episodic Memory and Sustained Attention across the morning after consumption of Low GI (All Bran) compared to high GI (Coco Pops)
- Changes in cognitive performance may be a reflection of changes in blood glucose levels, in this case triggered by glycaemic index

# Discussion



- Effect of GI may be different for different cognitive processes



- Micronutrients and other macronutrients can also influence cognitive performance (Lieberman et al, 1986)



## Plans for Future Research:

- To investigate the effects of lunch and mid-morning snack



# Acknowledgments

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