



The effects of breakfast on cognitive and academic performance in children: Findings from two Systematic Research Reviews

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Why breakfast?



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- Modifiable
- Higher brain glucose metabolism
- Longer overnight fast
- Dietary habits



Breakfast & Cognitive Performance

SRR 1: Effects of breakfast consumption vs. omission and breakfast type on cognitive performance in children and adolescents

1. Acute effects of breakfast vs. no breakfast on cognitive performance
2. Acute effects of breakfast composition on cognitive performance
3. Chronic effects of SBPs on cognitive performance

Breakfast & Academic Performance

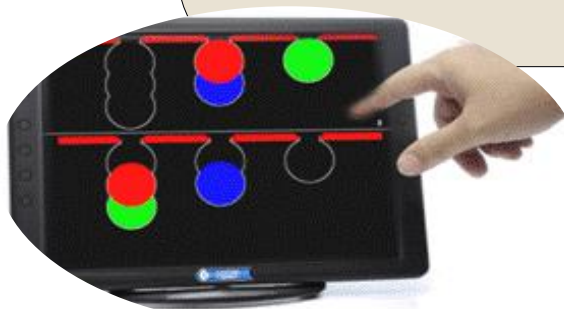
SRR 2: Effects of breakfast consumption vs. omission and breakfast type on academic performance in children and adolescents

1. Association between habitual breakfast consumption and academic performance
2. Chronic effects of SBPs on academic performance



Aim:

- Systematically review the evidence for the effects of breakfast on objective cognitive performance outcomes from intervention studies in both children and adolescents.





Methods: What was included?

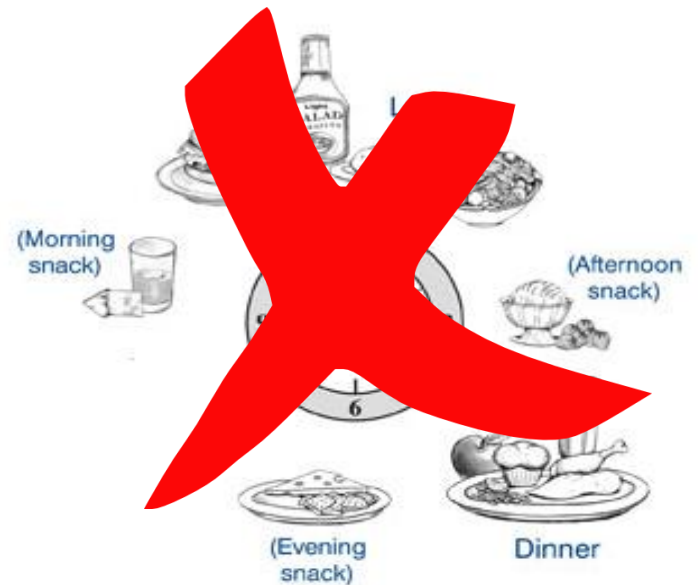
Design

Chronic human intervention studies

Acute human intervention studies

~~Human observational studies~~

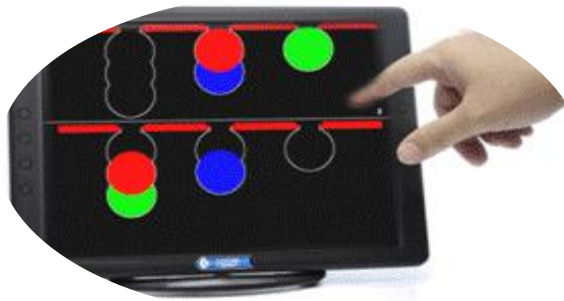
Interventions





Methods: What was included?

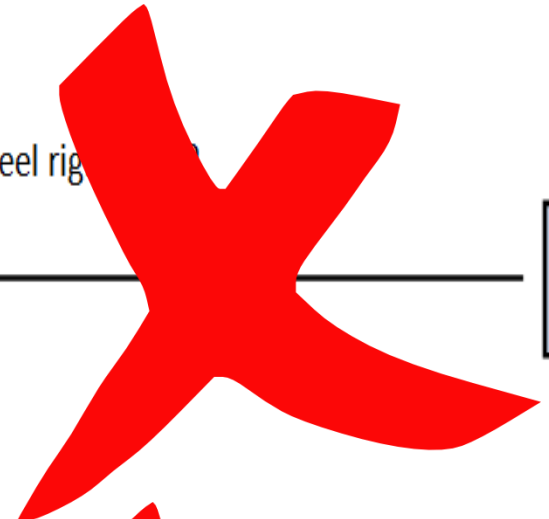
Measures



How alert do you feel right now?

Not at all

Very alert



Participants

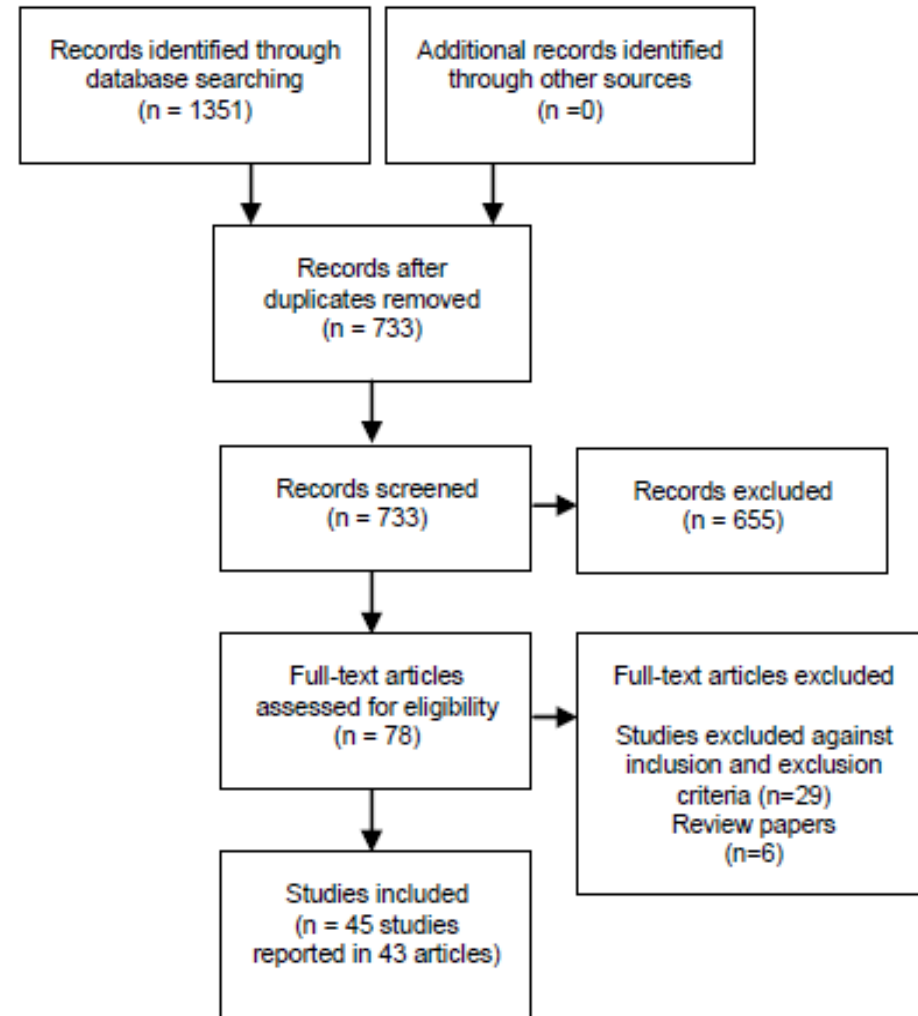




Methods: Study selection process

Studies included:

- **45 published studies**
- **34 acute intervention studies**
 - 19 breakfast vs. no breakfast
 - 10 breakfast composition
 - 5 both
- **11 chronic intervention studies**
 - All SBP vs. no SBP



Methods: Assessment of strength of evidence



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Academy of Nutrition and Dietetics Evidence Analysis Manual

| Strength of evidence elements |
|--|
| Quality: <ul style="list-style-type: none">• Scientific rigor/validity• Considers design and execution |
| Consistency: <ul style="list-style-type: none">• Consistency of findings across studies |
| Quantity: <ul style="list-style-type: none">• Number of studies• Number of subjects in studies |
| Clinical impact: <ul style="list-style-type: none">• Importance of studied outcomes• Magnitude of effect |
| Generalizability: <ul style="list-style-type: none">• Generalizability to population of interest |



Results:

Acute effects of breakfast vs. no breakfast

24 Studies



vs.





Overall advantage of breakfast vs. no breakfast

- Transient beneficial effect on cognitive function
- Post-ingestion effects +10 min to +210 min
- Range of energy loads (95 Kcal – 590 Kcal) and foods
- Observed effects: enhancement and maintenance of performance

Domain specific effects

- Attention, memory, and executive function

Undernourished children

- Advantageous effects more apparent in undernourished children

Results: Acute effects of BF vs. no BF

Examples from the literature

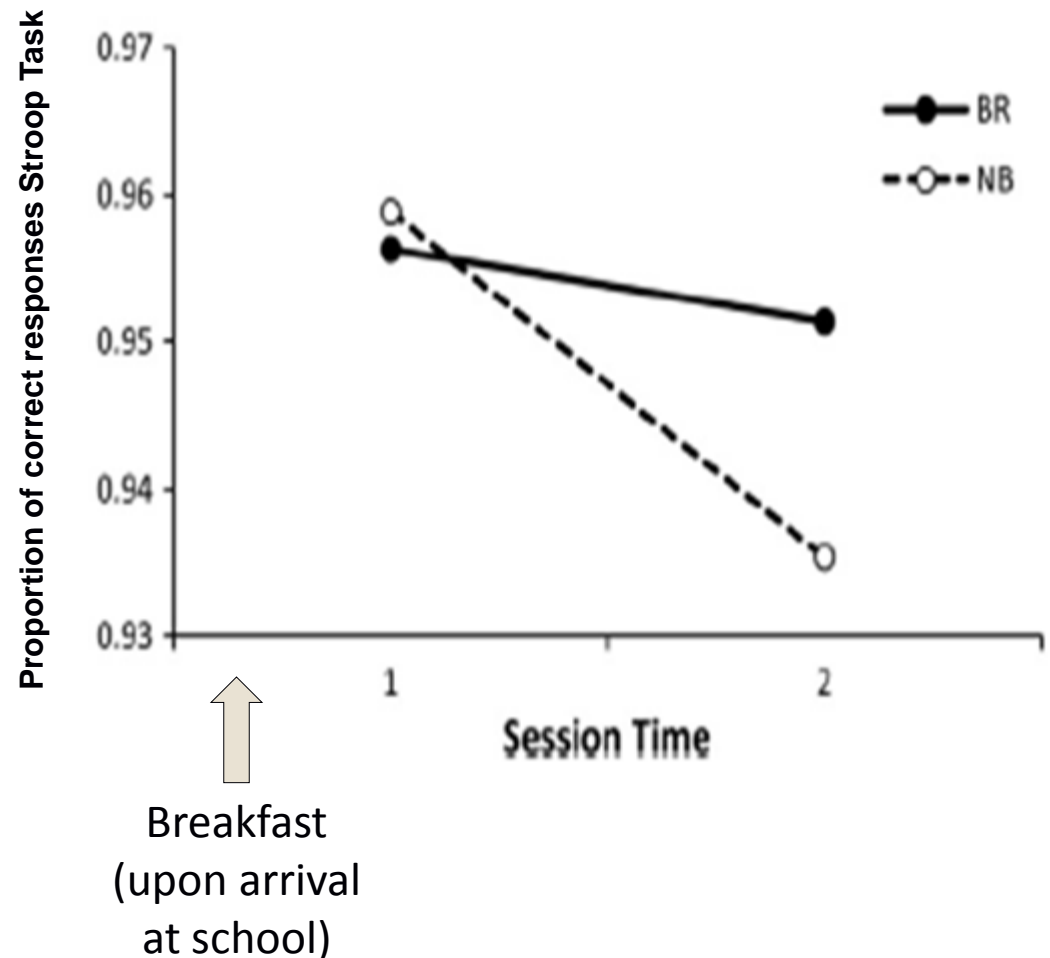


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Cooper et al. (2011)

- UK
- School based
- Crossover RCT
- n=96
- 12-15 year olds
- 55% HBC
- Ad-libitum breakfast: RTEC, bread, yoghurt, fruit, juice
- Mean intake: 500 kcals, 90g CHO; 11.6g PRO; 9.5g FAT

Effect: Maintenance of performance



Results: Acute effects of BF vs. no BF

Examples from the literature

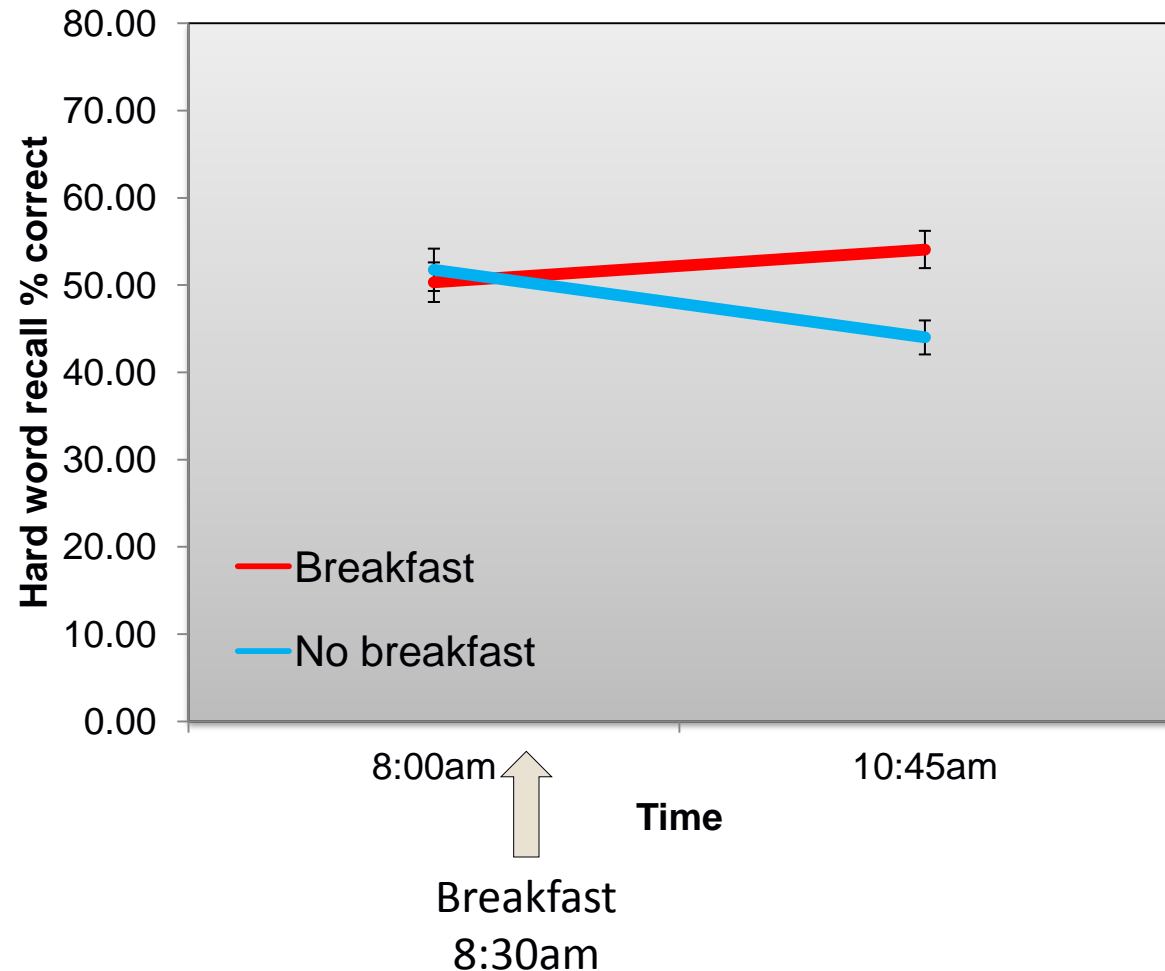


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Defeyter & Russo (2013)

- UK
- School-based
- Crossover RCT
- n=40
- 13-15 year olds
- Breakfast skippers
- Fixed RTEC breakfast:
All bran and milk
- 162 kcals, 22.7g CHO;
9.4g PRO; 1.2g FAT

Effect: Enhancement of performance





Results: Acute effects of breakfast composition 15 studies



vs.



vs.





Results: Acute effects of BF type

Inconclusive

- Comparisons: differing GI/GL, energy, high CHO vs. high PRO
- Few studies and inconsistent findings

Possible GI effects?

- Emerging evidence that low GI/GL is more beneficial
- Suggests that the post-prandial blood glucose profile may mediate the effects
 - But problematic study designs, few and inconsistent findings

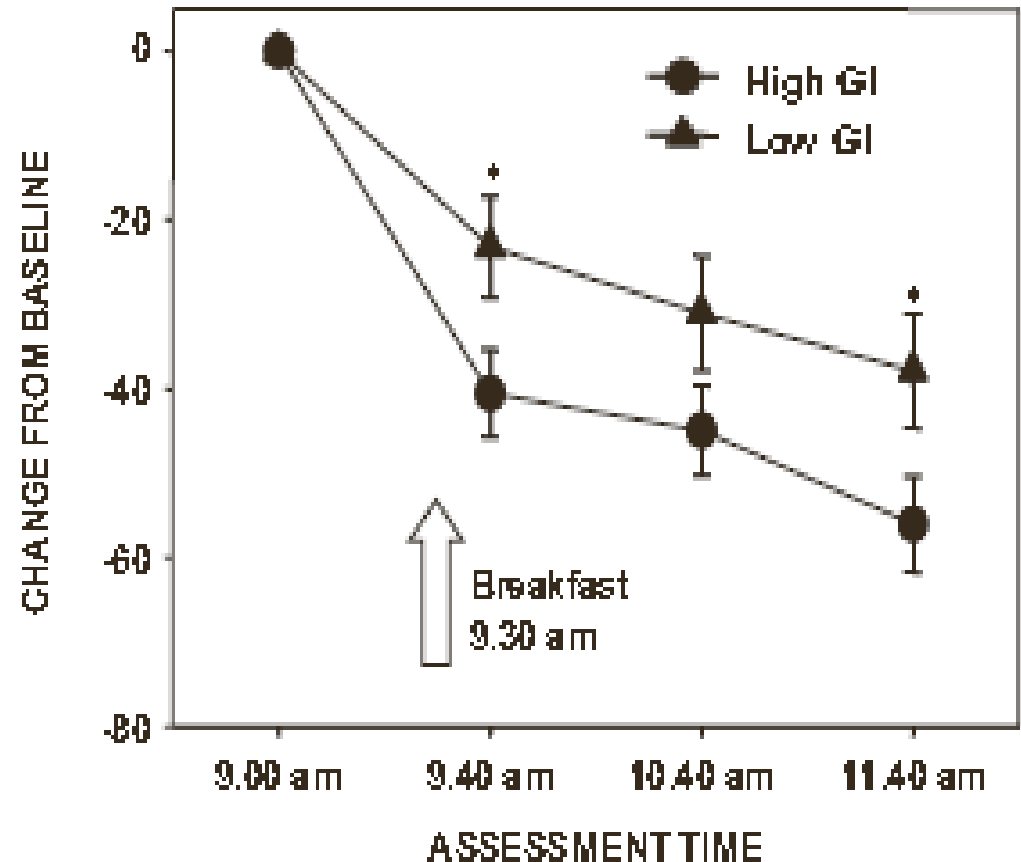


Results: Acute effects of BF type

Ingwersen et al. (2007)

- GI comparison, not isocaloric
- UK
- School-based
- Crossover RCT
- n=40
- 6-11 year olds
- Coco-pops (HGI) and milk: 133 kcal, 1.6g PRO, 0.9g fat, 29.8g CHO
- All bran (LGI) and milk: 98kcal, 4.9g PRO, 1.6g fat, 16.1g CHO

Secondary memory factor scores





Results: Chronic effects of SBPs 11 studies





Results: Chronic effects of SBPs

Inconclusive

- Few studies and inconsistent findings
- Limited effects on cognitive outcomes
- Unclear if effects are related to breakfast or the SBP regimen. Not a true test of breakfast *per se*.



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Results: Chronic effects of SBPs

Cueto and Chinen (2008)

- Peru
- Matched school comparison – 20 schools
- n=590, 70% undernourished
- 12 year olds
- Government SBP
- Fortified milk-like drink and 6 biscuits
- 600 kcal, 19.5 g PRO, 20 g fat
- 60%-100% of daily requirement of various micronutrients

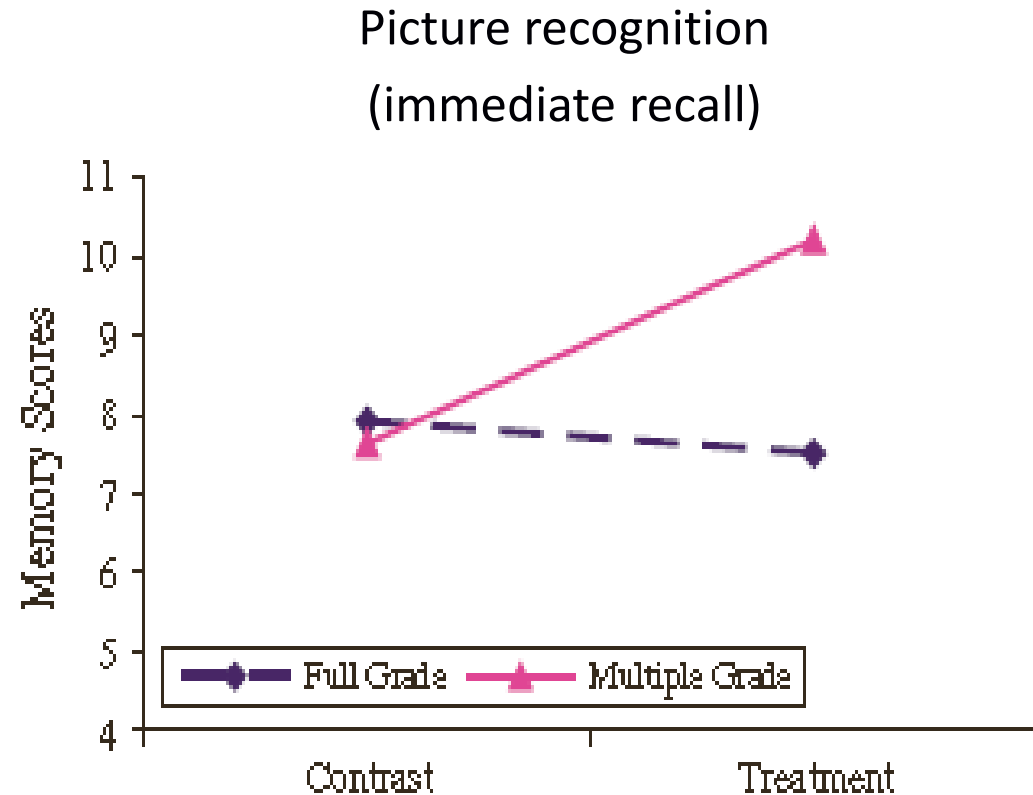


Fig. 1. Memory test: interaction between treatment and type of school.

Strength of evidence

Best evidence



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| Strength of evidence elements | Acute effect of breakfast vs. no breakfast | Acute effect of breakfast type | Chronic effect of SBP vs. no SBP |
|-------------------------------|--|--------------------------------|----------------------------------|
| Quality | Grade II Fair | Grade III Limited | Grade III Limited |
| Consistency | Grade II Fair | Grade III Limited | Grade III Limited |
| Quantity | Grade I Good | Grade III Limited | Grade III Limited |
| Clinical impact | Grade II Fair | Grade III Limited | Grade III Limited |
| Generalizability | Grade III Limited | Grade III Limited | Grade I Good |



The Effects of Breakfast and Breakfast Composition on Cognition in Children and Adolescents: A Systematic Review^{1–3}

Katie Adolphus,* Clare L Lawton, Claire L Champ, and Louise Dye

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ABSTRACT

Breakfast is thought to be beneficial for cognitive and academic performance in school children. However, breakfast is the most frequently skipped meal, especially in adolescents. The aim of the current review was to systematically review the evidence for the effects of breakfast on cognitive performance in children and adolescents from intervention studies. The effects of breakfast were evaluated by cognitive domain and breakfast manipulation. A total of 45 studies reported in 43 articles were included in the review. Most studies considered the acute effect of a single breakfast ($n = 34$). The acute studies were breakfast compared with no breakfast ($n = 24$) and/or comparisons of breakfast type ($n = 15$). The effects of chronic school breakfast program interventions were evaluated in 11 studies. The findings suggest that breakfast consumption relative to fasting has a short-term (same morning) positive domain-specific effect on cognition. Tasks requiring attention, executive function, and memory were facilitated more reliably by breakfast consumption relative to fasting, with effects more apparent in undernourished children. Firm conclusions cannot be made about the acute effects of breakfast composition and the effects of chronic breakfast interventions because there are too few studies and these largely report inconsistent findings. This review also highlights methodologic limitations of the existing research. These include a lack of research on adolescents, few naturalistic breakfast manipulations or testing environments, small samples, and insensitive cognitive tests. *Adv Nutr* 2016;7:15–235.

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Breakfast & Academic Performance

SRR 2: Effects of breakfast consumption vs. omission and breakfast type on academic performance in children and adolescents

1. Association between habitual breakfast consumption and academic performance
2. Chronic effects of SBPs on academic performance



Aim: Systematically review the evidence for the effects of breakfast on ecologically valid academic performance outcomes in both children and adolescents





Methods: What was included?

Design

Chronic human
intervention studies

Acute human intervention
studies

Human observational
studies

Interventions or dietary assessment





Methods: What was included?

Measures



Sample

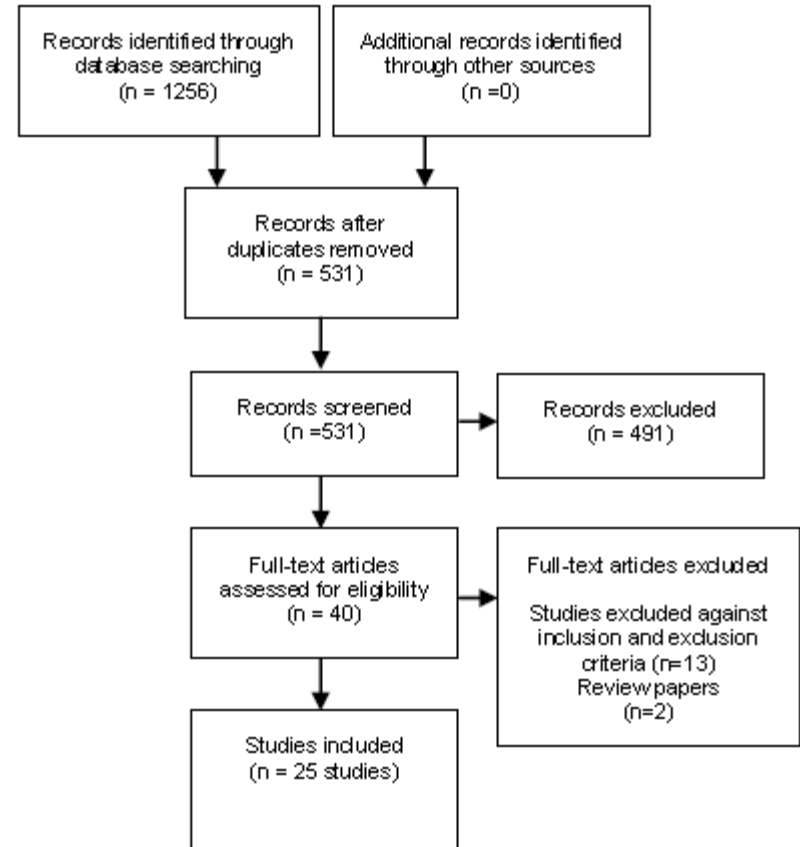




Methods: Study selection process

Studies included:

- **25 published studies**
- **15 observational studies**
 - 10 HBC frequency
 - 4 HBC composition
 - 1 HBC undefined
- **10 chronic intervention studies**
 - All SBP vs. no SBP





Results: Associations between HBC and academic performance 15 studies





Positive association between HBC and academic performance

- HBC frequency was positively associated with academic performance
- Some evidence that HBC composition is related to academic performance

Subject specific effects

- Mathematics grades or test scores

Consistent across all socio-demographic groups

- The effects were not modulated by socio-demographic characteristics

Results: HBC and academic performance



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Lien (2007)

- Norway
- Cross-sectional study
- n=7306, 15-16 years
- Questionnaire to assess HBC frequency (days/week)
- Self report school grades

Table 4 Crude and adjusted* association between school grades and eating breakfast across gender

| | Boys | | Girls | |
|------------------|---------------|---------------|---------------|---------------|
| | Crude | Adjusted | Crude | Adjusted |
| Eating breakfast | | | | |
| Seldom/never | 3.5 (2.5–4.8) | 2.0 (1.3–3.1) | 4.0 (2.9–5.5) | 2.0 (1.3–3.0) |
| 1–2 times a week | 3.1 (2.0–4.1) | 1.9 (1.3–2.8) | 2.3 (1.6–3.3) | 1.3 (0.9–2.0) |
| 3–4 times a week | 2.2 (1.4–3.0) | 1.1 (0.7–1.7) | 1.5 (0.9–2.3) | 0.9 (0.5–1.6) |
| 5–6 times a week | 1.5 (1.1–2.2) | 1.1 (0.7–1.7) | 1.0 (0.6–1.6) | 0.8 (0.5–1.4) |
| Every day | 1.0 | 1.0 | 1.0 | 1.0 |

*Adjustment made for parental educational level, family structure, dieting, smoking and drinking soft drinks.



Results: Chronic effects of SBPs 10 studies





SBPs have a positive effect on children's academic performance

- SBPs tended to have positive effects on academic performance,
- However, few good quality studies
- Can not attribute the effects directly to the breakfast meal

Advantageous effects were not universal

- Type of school
- SBP model



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Nutritional influences on human neurocognitive functioning

REVIEW ARTICLE

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Cognitive performance

- Breakfast consumption (vs. no breakfast) has a modest short-term beneficial effect on cognitive function measured within 4 hours post-ingestion.

Academic performance

- Habitual breakfast consumption frequency is positively related to academic performance
- SBPs are associated with better academic performance.
- The findings need to be treated with caution until they are supported by further observational studies or well controlled RCTs to verify possible causal relationships



Thank you

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