



Public Health  
England

# **Breakfast and Cognition**

## Review of the literature

# About Public Health England

We were established on 1 April 2013 to bring together public health specialists from more than 70 organisations into a single public health service.

Our mission is to protect and improve the nation's health and to address inequalities through working with national and local government, the NHS, industry and the voluntary and community sector.

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Published November 2013

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# Review of the literature

## Introduction

There is widespread interest in the link between nutrition and mental health. The most convincing evidence relates to the impact of skipping breakfast and short term cognition and memory. This literature is summarised below.

## Methods

This paper took the review by Ells *et al*<sup>1</sup> on school food and attainment as the starting point. In 2013 the same search strategy was utilised to identify additional papers published between 2006 and 2013. Included studies had to be primary studies reporting empirical research from controlled trials, include exposure or intervention focussing on nutrition or diet and cognition (using validated methodology, include a nutritional or dietary exposure achievable through the normal diet), include children aged 4-18 years, undertaken in a developed country, with sufficient duration to have reasonable benefit.

The search was supplemented by personal communication.

## Results

The updated literature search identified 37 potentially relevant publications. Six were excluded on the basis of not including empirical research, one on the basis of not being peer reviewed, 18 were excluded on the basis of topic (ie not having relevant, sufficient or validated measurements), and seven were excluded owing to being duplicate papers from the same authors/studies. This left five additional papers, one RCT, two cross-sectional studies and one controlled study. A systematic review was also included.

The Ells *et al* review<sup>1</sup> included 29 studies. Fifteen of these examined the effect of breakfast. Ells *et al* noted some short comings within these papers. Four of six studies looking at breakfast consumption vs fasting identified some improvement in problem solving, attention and episodic memory after consuming cereal-based breakfasts and complex visual display following consumption of breakfast. Two studies were unable into identify differences.

The systematic review<sup>2</sup> included 41 papers published between 1950 and 2008. Twenty-eight of the 41 papers included examined of the acute effects of breakfast vs no breakfast. Twenty-one of these were in well-nourished children (likely to be similar to children in the UK). Thirteen examined effects of school breakfast programme on

cognitive performance. Six of these studies were in the UK and four were from the same two research groups. The majority of studies reported positive effects of breakfast compared to skipping breakfast but these varied over cognitive domains. Benefits were most evident in relation to memory and fewer errors on attention tasks, especially in later morning. Impact on verbal memory was less clear with four of 10 studies showing benefit. Of six studies of spatial memory, three demonstrate benefit of breakfast, two show better performance in the no- breakfast condition and one no difference. The authors concluded that consumption of breakfast was associated with some positive benefits particularly if testing occurs later in the morning with the effect more easily discernible when tests are more demanding and consider error rates.

In a cross-over RCT Widenhorn-Muller *et al*<sup>3</sup> assessed impact of a standardised breakfast vs no breakfast on cognitive performance and mood in 104 high school boarding students aged 13-20 years. Breakfast had no effect on sustained attention but visuospatial memory improved in male students. Self-reported alertness improved in all students.

Pivik *et al*<sup>4</sup> assessed effects of breakfast on brain functions said to be important for learning in children. They used time-frequency analyses of EEG activity recorded while children solved simple maths problems to study how brain processes are influenced by eating or skipping breakfast in 82 8-11 year olds. The authors suggested greater mental effort was needed by those skipping breakfast when dealing with addition and subtraction problems.

Gajer *et al*<sup>5</sup> assessed impact of breakfast consumption in 379 11-13 middle class students in Hyderabad. Regular breakfast consumption vs no breakfast was associated with improved letter cancellation scores and higher immediate memory recall. Multivariate analysis determined that a breakfast eating habit explained 1.4% variation in the letter cancellation score and 4.3% variation in the immediate recall score. However, there were strong associations with maternal education and employment.

Further corroborative evidence is provided from Ask *et al*<sup>6</sup> who investigated two classes of 15 year olds in a lower secondary school in Norway. One class received free breakfast at the beginning of the school day for four months with the second class acting as control. Questionnaires recorded school performance and dietary intake four weeks prior to and one week after the study. Although no improvement in school performance was found in the intervention group teacher reports included an improvement in attention and social behaviour in intervention students. This difference did not attain statistical significance given the structure of the intervention (ie only two teachers).

## Conclusion

This literature confirms current advice that breakfast is an important meal and should be encouraged. The literature provides convincing evidence that consuming breakfast compared to skipping breakfast has positive impacts on short term cognition and memory but that these effects may depend on the type of assessment. As such, it is not possible to comment upon the implications for specific learning and longer term attainment.

We do know, however, that the diet of children, particularly teenagers, is less than ideal with many eating too much salt, saturated fat, and sugars<sup>7</sup> and with between one in three and one in six being overweight or obese<sup>8</sup>. These patterns of dietary intake and overweight are associated with poor health now and in the future. Helping children achieve and maintain a healthy diet as visually shown in the eatwell plate<sup>i</sup> will have lasting health benefit regardless of any potential impact on attainment and should remain our key rationale for promoting a better diet.

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<sup>i</sup> The eatwell plate is the UK National Food Model. It visually demonstrates the types and proportions of food in the four main food groups that constitute a healthy balanced diet; namely bread, rice potatoes, pasta and other starchy foods, fruit and vegetables, milk and dairy foods, and meat, fish, eggs, beans and other non-dairy sources of protein. The fifth group, foods and drinks high in fat and/or sugar, should be consumed infrequently and in small amounts. See [www.nhs.uk/Livewell/Goodfood/Pages/eatwell-plate.aspx](http://www.nhs.uk/Livewell/Goodfood/Pages/eatwell-plate.aspx)

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