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## School lunch and learning behaviour in primary schools: an intervention study

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### Key Findings

Primary school pupils were more alert and over three times more likely to be 'on-task' working with the teacher in the classroom after lunch, following an intervention to improve the dining environment and the nutritional quality of the food served

- Six primary schools in Sheffield took part in a 12-week intervention study to assess the impact on learning-related behaviours of improvements to the dining environment and to the nutritional quality of the food served. There were four intervention schools, and similar two control schools in which no intervention took place.
  - Food interventions included: introducing new menus compliant with the food-based standards; holding healthy eating workshops, taster sessions and themed weeks; introducing vegetable and fruit packs; providing better marketing materials (e.g. menus with pictures); introducing halal foods. Changes to the dining environment included: changing the layout and queuing system; redecorating the dining room, including artwork and murals; and buying new furniture.
  - Behaviours were observed in pupils in the classroom in the hour after lunch, at baseline and again at the end of the 12 week intervention. 'On-task' behaviours (that reflect concentration) and 'off-task' behaviours (that reflect disengagement and/or disruption) were recorded in 3 social modes: pupil-teacher interaction; pupil-pupil interaction; and working alone. Overall, levels of on-task behaviours were high (80%) and levels of off-task behaviours were low (11%).
  - Following the intervention, pupils in the intervention schools were 3.4 times more likely to be on-task in the teacher-pupil social mode compared with pupils in the control schools. However, in the pupil-pupil social mode, pupils in the intervention schools were 2.3 times more likely to be off-task than those in the control schools.
  - This study provides some objective evidence that an intervention in primary schools to improve school food and the dining environment has a positive impact on pupils' alertness and their ability to learn in the classroom after lunch. However, if this raised alertness is not appropriately channelled and supervised, it may result in increased off-task behaviour when pupils are asked to work together.
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## Background

The role of school food in promoting children's nutrition, growth and development, and health, is clear<sup>1</sup>. The re-introduction of standards for school food, and significant government investment into this policy area in recent years has therefore been warranted.<sup>2 3 4</sup> The wider educational benefits of improved school food in terms of readiness to learn, pupil mood, behaviour, and thus learning and attainment, are also of key interest. Anecdotes from teachers and parents describe dramatic improvements in children's concentration, behaviour, learning and academic performance when healthier school food is introduced. Case studies and best practice guidance also suggest that improvements to the school dining environment support children's behaviour, well being and learning.<sup>5</sup> However, these wider benefits are not well supported by research. A recent systematic review<sup>6</sup> concluded that no firm inferences can be drawn on the relationship between nutrition, including school food, and educational outcomes due to a lack of clear evidence. To date however, outcomes relevant to the classroom setting, such as learning behaviours and mood, have not been measured in a valid, consistent and comparable manner and there have been no direct measures of learning-related behaviours in the classroom.

## Aims

The aim of the study was to determine in a primary school setting whether the introduction and promotion of healthier school food and improvements to the dining room environment had a positive impact on learning behaviours in the classroom after lunch.

## Methods

**Study design:** The study was a controlled intervention trial involving years 3, 4 and 5 pupils in six Sheffield primary schools, carried out over 2 sequential six-week phases. Schools were randomly assigned to three groups: *Nutrition first*: introduction and promotion of healthier school food at lunchtime over six weeks followed by changes in the school dining environment over six weeks; *Environment first*: changes in the school dining environment over six weeks followed by the introduction and promotion of healthier school food at lunchtime over six weeks; *Control*: wait-listed control schools in which there was no intervention for 12 weeks (but which had support with nutrition and dining room changes at the end of the study).

**Food interventions included:** introducing new menus compliant with the food-based standards; holding healthy eating workshops, taster sessions and themed weeks; introducing vegetable and fruit packs; providing better marketing materials (e.g. menus with pictures); introducing halal foods. **Changes to the dining environment included:** changing the layout and queuing system; redecorating the dining room, including artwork and murals; and buying new furniture.

Behaviour related to learning outcomes was measured using systematic observation techniques by trained observers in the classroom in the hour immediately after lunch. This differs from subjective impressions reported in previous studies. On-task and off-task behaviours were observed and used as proxy measures for concentration and disengagement (disruption), respectively. Twenty four pupils in each school were randomly selected and measured at 3 time points; at baseline (pre-intervention), after 4-6 weeks, and after 10-12 weeks.

Although the original study design was intended to assess the influence of the nutrition phase and the environment phase separately, in practice it was difficult to

introduce one without the other. The analyses therefore assess the impact of the interventions overall by comparing behaviours measured at baseline with those measure after 10-12 weeks.

## Results

72 girls and 74 boys took part in the study. Intervention schools were similar to control schools with regard to size (average 435 pupils), English as an additional language (average 98%), and special educational needs (average 30%), but differed in relation to free school meal eligibility (24%-27% in the intervention schools, 7% in control schools). Other characteristics of the pupils taking part (height and weight, for example) were very similar.

The relative frequency of on-task behaviours in the intervention schools were compared with their frequency in the control schools (Odds Ratio (OR), adjusted for school characteristics) (Table 1). When all of the on-task or off-task behaviours were considered without reference to the social mode, there was no apparent impact of the intervention on behaviour (on-task behaviours, all social modes: OR=1.14, p=0.86; off-task behaviours, all social modes: OR=0.83, p=0.31). When analyzed by social mode, however, there were clear impacts of the intervention. Pupils in the intervention schools were more than three times as likely to be on-task when interacting with the teacher compared with pupils in the control schools. Unexpectedly, when pupils were working with other pupils, they were less likely to be on-task (OR=0.45) and more likely to be off-task (OR=2.28) in the intervention schools than in the control schools.

**Table 1. Occurrence of on-task and off-task behaviour overall and for each social mode separately for the intervention schools combined relative to the control schools**

	Intervention vs. Control		
	Odds Ratio*	95% CI	p
<b>On-task behaviours</b>			
All social modes	1.14	0.87, 1.49	0.86
By social mode:			
• Individual on-task	1.27	0.94, 1.74	0.14
• Pupil-pupil on-task	<b>0.45</b>	<b>0.28, 0.70</b>	<b>&lt;0.001</b>
• Teacher-pupil on-task	<b>3.40</b>	<b>1.56, 7.36</b>	<b>0.009</b>
<b>Off-task behaviours</b>			
All social modes	0.83	0.74, 1.19	0.31
By social mode:			
• Individual off-task	0.71	0.37, 1.35	0.29
• Pupil-pupil off-task	<b>2.28</b>	<b>1.25, 4.17</b>	<b>0.007</b>
• Teacher-pupil off-task	1.09	0.35, 3.45	0.89

\*Statistical analysis adjusted for class size, presence of additional adults in the classroom, English as an additional language (EAL), FSM eligibility, SEN status ethnicity and lunch type (school meal or packed lunch)

## Discussion

A combined nutrition-environment intervention in four primary schools in Sheffield had a beneficial impact on pupils' learning behaviours compared with pupils in two control schools. This was evident in the social mode in which teachers were directly engaged with pupils in a learning activity. This is consistent with subjective anecdotal

evidence from teachers that pupils are more likely to be on-task following a healthier lunch in school.

The surprise finding that pupils working together without teacher supervision were less likely to be on-task can be explained by generally increased alertness and the need to interact with others in pupils who have eaten a healthier lunch in a nicer dining environment. Where teachers were interacting with pupils, they were more likely to direct their work and in consequence pupils were more likely to be observed to be on-task. When pupils were asked to work together without direct teacher supervision, pupil-pupil interaction was less likely to be controlled and in consequence they were less likely to be observed to be on-task and more likely to be observed to be off-task.

It is important to put these findings in context: 80% of behaviours in all social modes were observed to be on-task, and only 11% were observed to be off-task. Thus, there is a substantial net gain in improved learning-related behaviour as a consequence of eating a healthier lunch in a nicer dining environment.

## Conclusion

This is the first time that improvements in learning-related behaviour in school children in a developed country have been objectively assessed following a well-controlled nutrition and dining environment intervention. The underlying causes of the improvements and their associated mechanisms need to be further evaluated. Interventions *per se* (rather than changes in nutritional status) may have been responsible for the observed changes. A study in secondary school pupils begun in 2008 will explore these issues further.

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## References

- <sup>1</sup> School Meals Review Panel (2005). Turning the Tables – Transforming School Food: The Development and implementation of nutritional standards for school lunches. [www.schoolfoodtrust.org.uk/UploadDocs/Library/Documents/SMRP\\_Report\\_FINAL.pdf](http://www.schoolfoodtrust.org.uk/UploadDocs/Library/Documents/SMRP_Report_FINAL.pdf)
  - <sup>2</sup> Statutory Instrument 2000 No. 1777. *Education (nutritional standards for School Lunches) (England) Regulations 2000*. London: TSO.
  - <sup>3</sup> Statutory Instrument 2007 No. 2359. *The Education (Nutritional Standards and Requirements for School Food) (England) Regulations 2007*. London: TSO.
  - <sup>4</sup> Statutory Instrument 2006 No. 2381. *The Education (Nutritional Standards for School Lunches) (England) Regulations 2006*. London: TSO.
  - <sup>5</sup> North Yorkshire Business & Education Partnership, Business & Education South Yorkshire. (2004). The Dining Room Environment Project. Food in Schools Programme (DfES, DH).
  - <sup>6</sup> Centre for Food, Physical Activity and Obesity Research. A systematic review of the effect of nutrition, diet and dietary change on learning, education and performance of children of relevance to UK schools. [www.food.gov.uk/multimedia/pdfs/systemreview.pdf](http://www.food.gov.uk/multimedia/pdfs/systemreview.pdf)
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