
School lunch and behaviour: systematic observation of classroom behaviour following a school dining room intervention

Summary

- **Aim** Evidence that improvements in school food benefit pupils' behaviour is patchy and anecdotal. The aim of this study was to determine whether a) improvements in school food provision at lunchtime to meet the new food-based standards and b) changes to the school lunchtime dining room environment to meet best practice, improved pupils' concentration and made them more alert and calm in the classroom in the learning period after lunch.
 - **Methods** Six primary schools in Sheffield were matched in triplets by school and neighbourhood characteristics. The intervention was in two six-week phases: in two of the matched schools, changes in food provision were followed by changes in the dining room environment; in two schools, changes in environment were followed by changes in food provision; and two schools acted as controls (no intervention). Observers blinded to the type of intervention made objective measurements of learning-related behaviours in the classroom during the teaching session immediately after lunch at three time points (baseline (pre-intervention), after 4-6 weeks, and after 10-12 weeks) in 146 randomly selected pupils aged 8-10. In total, 25,750 10-second observations of behaviour were made. Outcomes were assessed over the 12-week period as a whole, and by phase (nutrition or environment), taking into account school characteristics, class size, presence of additional adults in the classroom, English as an additional language, FSM eligibility, SEN status ethnicity, and lunch type (school meal or packed lunch).
 - **Results**
 - 90% of the study pupils were White British, 97% spoke English as a first language, 26% were eligible for free school meals (FSM), 29% had special educational needs (SEN).
 - 'On-task' behaviours (measure of concentration) and 'off-task' behaviours (measure of disengagement (disruption)) were observed within three settings (pupil-teacher interaction, pupil-pupil interaction, working alone). Overall levels of on-task were high (80%) and levels of overall off-task were low (11%).
 - When the 12-week intervention was assessed as a whole, pupils in the intervention schools were 3.4 times more likely to be on-task in the teacher-pupil setting compared with pupils in the control schools. However, in the pupil-pupil setting, pupils in the intervention schools were 2.3 times more likely to be off-task than those in the control schools.
 - When the effect of the intervention was compared group by group (nutrition first vs. environment first vs. control), pupils in the nutrition first group were 5.4 times as likely to be on-task in the teacher-pupil setting compared with the control schools. They were also 3.6 times as likely to be off-task in the pupil-pupil setting in the nutrition first intervention schools compared with the control schools.
 - **Conclusion** A combined nutrition-environment intervention in primary schools had a beneficial impact on pupils' behaviour in the teacher-pupil setting, but was associated with increased off-task behaviours when pupils were being asked to work together without direct teacher supervision. The nutrition-first intervention was more powerfully associated with this effect than the environment-first intervention. The findings are consistent with the more subjective anecdotal evidence from teachers that pupils are more on-task following a healthier lunch in school.
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Background

The role of school food in promoting children's nutrition, growth and development, and health, is clear¹. The re-introduction of standards for school food, and significant government investment into this policy area in recent years has therefore been warranted.^{2 3 4} 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. However, there is little robust research in this area. 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 support improving the school dining environment to support children's behaviour, well being and learning.⁵ However, a recent systematic review⁶ 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.

Only two previous studies have explored school lunches and educational outcomes.⁶ Other studies in schools have focused on breakfast, snacking, single foods, nutrients or nutrient supplementation, food insufficiency, or general dietary advice. Few studies on nutrition and educational have accounted for key confounders such as family circumstance, habitual diet, physical activity levels and school lunch environment. Outcomes relevant to the classroom setting (i.e. learning behaviours and mood) that can be assessed in a valid, consistent and comparable manner have also not been measured. Studies have also focused on the benefits for children in special circumstances or with special needs (e.g. ADHD, nutritionally at risk), limiting generalisability of study results to all school children. Finally, much of the existing research focuses on the role of nutrition *per se* (e.g. individual nutrients, meal composition, or nutrition promotion) in mediating educational improvements. It has failed to address the way in which nutrition interventions themselves alter the environment in which children's behaviour is being evaluated, and the potential interactions between nutritional and environmental interventions. The environmental changes and interactions with nutrition may also influence children's behaviour, mood and readiness to learn, and their possible impact needs careful evaluation.

Methods

Study design: A two-phased controlled intervention trial involving six primary schools which were matched in triplets and randomly assigned to three groups: Nutrition first: introduction 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 introduction 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).

The school-based intervention aimed to ensure a) that the food provided in school at lunchtime met the new food-based standards,⁴ and b) that the dining room environment in which food was served promoted best practice.⁷ Behaviour related to learning outcomes was measured objectively by observers in the classroom during the afternoon teaching session in randomly selected individual pupils at baseline (pre-intervention), after 4-6 weeks, and after 10-12 weeks. Parents and pupils provided a detailed study information sheet. Pupils whose parents did not want them to participate in the study, or who had anaemia, acute or chronic illness were not included in the pupil selection process.

Six primary schools in Sheffield were matched in triplets by school and neighbourhood characteristics (meal environment scores, catering provider, school roll, free school meal eligibility, Healthy School status, participation in the Social and Emotional Aspects of Learning (SEAL) program, and school lunch take up). Observers blinded to the type of intervention made objective measurements of learning-related behaviours in the classroom during the teaching session immediately after lunch at three time points in 2007 (baseline (pre-intervention), January/ February, prior to spring half term; after 4-6 weeks, in March, prior to the Easter holiday; and after 10-12 weeks in May, prior to the summer half term) in

146 randomly selected pupils aged 8-10. In total, 25,750 10-second observations of behaviour were made. Outcomes were assessed over the 12-week period as a whole, and by phase (nutrition or environment), controlling either for school group ('unadjusted') or taking into account school characteristics including 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) ('adjusted').

Results

The three groups of schools (nutrition first, environment first, and control) were similar in relation to size (average 435 pupils), EAL (98%), and SEN (30%), but differed in relation to FSM eligibility (7% in control schools vs. 24%-27% in the intervention schools). The characteristics of the pupils taking part, however, were very similar: 90% ($\pm 5\%$) White British, 97% ($\pm 2\%$) EAL, 26% ($\pm 12\%$) FSM, and 29% ($\pm 0.6\%$) SEN.

The relative occurrence (Odds Ratios (OR)) of on-task behaviours in the intervention schools versus the control schools in the adjusted model (Table 1) shows that overall, there were apparently no statistically significant differences (total on-task OR=1.14, $p=0.86$; total off-task OR=0.83, $p=0.31$). When broken down by setting, however, pupils were over three times more likely to be on-task with the teacher in the intervention schools than in the control schools. Surprisingly, pupils engaged with other pupils were less likely to be on-task (OR=0.45) and more likely to be off-task (OR=2.28) in the intervention schools compared with the control schools.

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

	Intervention vs. Control		
	Odds Ratio*	95% CI	p
Total on-task (concentration)	1.14	0.87, 1.49	0.86
On-task by setting:			
<i>Individual on-task</i>	1.27	0.94, 1.74	0.14
<i>Pupil-pupil on-task</i>	0.45	0.28, 0.70	<0.001
<i>Teacher-pupil on-task</i>	3.40	1.56, 7.36	0.009
Total off-task (disengagement)	0.83	0.74, 1.19	0.31
Off-task by setting:			
<i>Individual off-task</i>	0.71	0.37, 1.35	0.29
<i>Pupil-pupil off-task</i>	2.28	1.25, 4.17	0.007
<i>Teacher-pupil off-task</i>	1.09	0.35, 3.45	0.89

* Model 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)

When assessed by intervention groups separately (nutrition-first vs. control and environment-first vs. control), the nutrition-first group showed greater individual on-task (OR=2.04) and teacher-pupil (OR=5.37) on task behaviour compared with the control group. Again, pupil-pupil on-task behaviour was less likely in the intervention group (OR=0.34) and off-task behaviour was more likely (OR=3.57). The environment-first school showed no statistically significant differences from the control group, although the on-task behaviour showed trends similar to the nutrition-first group.

Discussion

A combined nutrition-environment intervention in primary schools had a beneficial impact on pupils' behaviour in the setting in which teachers are directly engaged with pupils in a learning activity. When analysed according to whether the intervention was nutrition-first or environment first, the nutrition first intervention was more powerfully associated with the observed differences in behaviour compared with the control schools. This is consistent with the more subjective anecdotal evidence from teachers that pupils are more on-task following a healthier lunch in school.

Generally increased arousal in pupils who have eaten a healthier lunch may help to explain the increased off-task behaviours when pupils were being asked to work together without

direct teacher supervision. When pupils were working on their own in the nutrition-first group, they were significantly more likely to be on-task than pupils in the control schools (OR=2.04), but no more likely to be off-task.

Table 2. Occurrence of on-task and off-task behaviour overall and for each setting separately for the nutrition-first vs. control schools and environment-first vs. control schools

	Nutrition-first vs. Control			Environment-first vs. Control		
	Odds Ratio [*]	95% CI	p	Odds Ratio [*]	95% CI	p
Total on-task (concentration)	1.22	0.89, 1.67	0.21	1.06	0.78, 1.45	0.69
On-task by setting:						
<i>Individual on-task</i>	2.04	1.04, 4.01	0.04	1.02	0.56, 1.85	0.62
<i>Pupil-pupil on-task</i>	0.34	0.20, 0.58	<0.001	0.59	0.35, 1.01	0.06
<i>Teacher-pupil on-task</i>	5.37	3.70, 12.0	<0.001	1.86	0.82, 4.23	0.14
Total off-task (disengagement)	0.94	0.64, 1.39	0.76	0.71	0.47, 1.08	0.11
Off-task by setting:						
<i>Individual off-task</i>	0.53	0.25, 1.12	0.10	0.93	0.43, 1.98	0.84
<i>Pupil-pupil off-task</i>	3.57	1.84, 6.92	<0.001	1.08	0.53, 2.21	0.82
<i>Teacher-pupil off-task</i>	0.77	0.24, 2.50	0.67	2.07	0.61, 7.05	0.25

^{*} Model 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)

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. It is likely that the interventions *per se* rather than changes in nutritional status are responsible for the observed changes. A study in secondary school pupils to be started in 2008 will address these issues.

A full version of the report entitled: **School lunch, behaviour and mood: systematic observation of classroom behaviour following a school dining room intervention** by R Golley, E Baines, P Bassett, L Wood, M Nelson is in preparation. Copies of the findings will be available on the Trust website in October: www.schoolfoodtrust.org.uk

References

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- ⁶ 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
- ⁷ Meal experience guide