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An Exploration of Food Safety Risks Associated with Children's School Lunchboxes

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Introduction

Children are at an increased risk of foodborne disease as their immune and digestive systems are not fully developed[1], furthermore it takes a smaller quantity of pathogens to cause illness in a child than it would an adult[2]. Given that 40% of the foodborne disease burden is among children[3], implementation of domestic food safety practices are critical to reduce the risk of illness to children.

As many children take lunchboxes to school, there is a need to ensure the safety of such food. Although the majority of Governmental schemes focus on the nutritional standards of children's lunchboxes, the Welsh Government guidance for parents on "Healthy lunchboxes"[4] does not refer to any hygiene related practices, but does promote the importance of safe storage temperature in the home and at school suggesting:

- *Leftovers can be kept in the fridge and used for children's lunchboxes the next day.*
- *When using any foods that are normally kept in the fridge, an insulated lunchbox should be used with an ice pack or a frozen drink to help keep a lunchbox cool.*
- *If the lunchbox is prepared the night before, it should always be stored in the fridge overnight.*

Currently, data detailing the food safety perceptions and practices of parents regarding children's lunchboxes are lacking. Therefore, the purpose of this study was to explore parents' self-reported practices regarding children's lunchbox preparation and to pilot a method to establish lunchbox storage temperature in schools.

Methodology

The study consisted of two phases. Ethical approval was obtained from the Health Care and Food Ethics Committee at Cardiff Metropolitan University (Ref. No. PGT-2453).

Parents' perceptions and self-reported food safety practices:

- An online questionnaire, to establish parents' perceptions and practices regarding food safety risks associated with children's school lunchboxes was created using Qualtrics.
- The questionnaire was distributed via social media channels, and was completed by parents of children who take lunchboxes to primary school (*n*=130).

Pilot study: Temperature profiling of lunchbox storage in school:

- Dataloggers (Signatrol SL52T self-contained, temperature loggers) were placed on the inside and outside of a child's lunchbox (as illustrated in figure 1).
- The dataloggers were set to record the temperatures at a frequency of 1 per minute, with a range of -40 to +85°C and accuracy of ±0.5°C during a five day school week.
- The insulated lunchbox was packed with a sandwich, yoghurt, a piece of fruit, and an ice-pack each morning, 20 – 30 minutes before leaving for school.
- On arrival at the school the lunchbox was stored in the classroom until lunchtime (09.00 – 12.30).

Figure 1. Example of a datalogger on a child's insulated lunchbox.

Results

Parents' perceptions and self-reported food safety practices relating to children's lunchboxes (*n*=130)

Food safety concerns of parents:
Nearly two-thirds (64%) of parents reported being concerned about food safety when preparing children's lunchboxes. Many positive practices were self-reported by parents relating to hand hygiene and storage temperature of children's lunchboxes.

Hand hygiene:
Hand hygiene was perceived to be an important practice among parents in relation to ensuring the safety of children's lunchboxes with:

- 87% reporting to wash their hands before preparing their children's packed lunch.
- 75% reporting to encourage their child/children to wash hands before eating their packed lunch at school.

Temperature control:
More than half of the parents (62%) reported using insulated lunchboxes for their children's packed lunch, however, only 26% of parents reported using icepacks. Four parent stated that they used frozen foods such as yoghurts and fruit juice, a parent stated that they implemented the practices because *"keeps their lunch cold and defrosts by lunch time"*.

Storage of children's lunchboxes in schools:
The majority of parents that participated in this study (52%) reported not knowing where their children's lunchboxes would be stored whilst in school. Of the 61 parents that were aware of storage location of children's lunchboxes in schools:

- 97% reported lunchboxes would be stored on trolleys in corridors, cloakrooms and classrooms.
- Only two parents (2%) reported that lunchboxes would be stored in refrigerators.
- Only 45% of parent perceived there to be any risks associated with storing children's lunchboxes out of the refrigerator.

The findings from the first phase of the research identified the need to determine the storage temperature of children's lunchboxes in schools. Therefore a method was developed and piloted with a parent of a child attending a local primary school.

Pilot study: Time-temperature profiling of lunchbox storage in a school classroom

Temperature of the classroom where lunchboxes were stored:
The average temperature in the classroom between arrival at school and lunchtime was 20.0°C. This ranged from a minimum temperature of 13.4°C at 09:43 on the Wednesday to a maximum temperature of 25.4°C at 12:28 on the Tuesday. On average the temperature of the classroom increased by 2.2°C during the morning.

Internal temperature of the lunchbox:
The time-temperature profiling pilot study established that the internal temperature of the lunchbox was at an unsafe range (>5°C) each day:

- On average, the internal temperature of the lunchbox increased by 4.2°C between arrival at school and lunchtime.
- The lunchbox temperature ranged from 12.5°C at 09:00 on the Wednesday to 21.0°C at 12:31 Thursday.
- The average temperature in the lunchbox was 17.7°C.

Relationship between classroom temperature and lunchbox temperature:
Figure 2 illustrates the average internal temperature of the lunchbox and the classroom over the five day school week.

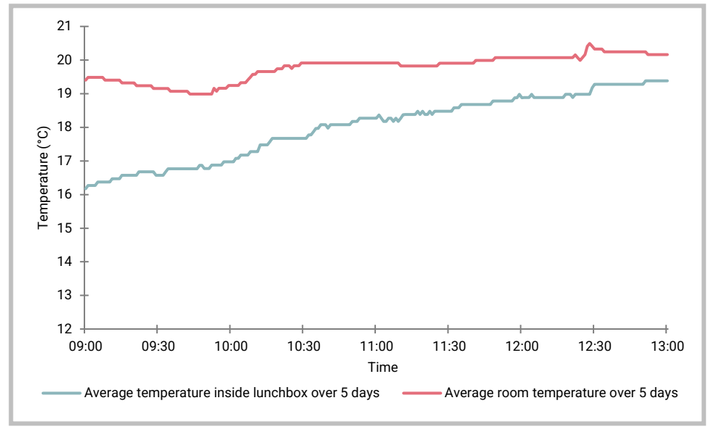

Figure 2. Average internal temperature of the lunchbox and of the classroom where the lunchbox was stored.

A Pearson product-moment correlation coefficient identified a strong positive correlation between lunchbox and classroom temperatures (r=0.526, n=1205, p<0.0005). The perfect positive correlation (+1.0) indicated the warmer the classroom the warmer the lunchbox temperature.

Conclusions

- This study has addressed a research gap detailing parents' food safety perceptions and practice regarding children's lunchboxes.
- Although the pilot study only presents data from one lunchbox; it has established a method to assess the storage temperature of children's lunchboxes in schools.
- Further research with schools is required to explore storage locations and temperatures.
- Although the study does not report on the core temperature of food products, it does demonstrate that children's lunchboxes are stored at unsafe temperature that can dramatically increase the growth rate of foodborne pathogens.

Literature cited and acknowledgments

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Further information

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