Comparing Milk Packaging Options for Pembrokeshire Primary Schools

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Summary

The research summarised in this case study was borne from the desire by several schools in Pembrokeshire to move from plastic to alternative materials for the dispensing of milk to primary school children on a daily basis.

It investigated the environmental impact in terms of greenhouse gas (GHG) emissions and costs associated with the different packaging types for milk. These included:

- a plastic bottle (the current packaging format that acted as a baseline);
- a glass bottle alternative; and
- a pergal alternative (bulk storage of milk in a container that fits in a refrigerated dispenser).

The research revealed that glass bottles and pergals are less costly per serving than the plastic alternative, with pergals offering the most cost-effective solution.

Furthermore, pergals were found to have the lowest GHG emissions per serving, followed by the plastic bottle and then the glass bottle. The environmental impact of glass bottles was shown to be have been significantly influenced by the GHG emissions of transport. Both the distances from farm to bottling plant and bottling plant to school, were much larger than the local supply chain of the plastic bottles and pergals.

To understand the transport impact further, a scenario was modelled for glass bottles with the same local supply chain as plastic bottles and pergals. This demonstrated that if local supply chains could provide glass bottling, the environmental impact of this packaging format would be greatly reduced. This was still slightly higher than pergals, but significantly lower than plastic bottles.

Although the data and assumptions are based on the experiences of two schools, where possible they have been adapted to be more generalised. As noted above, one of the key drivers for the results is the proximity of the milk supply chain. Where the supply chain significantly differs from this case study, the results and therefore the conclusions are also likely to differ.

Key Facts

- Glass bottles and pergals offered cost savings in the region of 15-20% over the current plastic bottle used, with pergals being the most cost-effective solution.
- The proximity of the supply chain had a significant influence on the overall environmental impact.
- If the impacts of supply chain logistics were the same, glass bottles and pergals would offer reduced environmental impacts in the region of 25-30% over the current plastic bottle used, with pergals having the lowest impact.

Background

Across Wales, many public sector bodies have initiated plans and proposals in response to the plastics challenge. As a consequence of increased awareness and media attention regarding the impact of plastics, school children and parents across Pembrokeshire have campaigned for the replacement of plastic milk bottles in schools with alternatives. It wasn't clear, however, which packaging format was the most suitable alternative, and so WRAP Cymru provided support for research to support decision-makers.

Study Scope

Pembrokeshire County Council (PCC) piloted the supply of milk in primary schools through the introduction of:

- glass bottles; and
- pergals (bulk storage of milk in a container that fits in a refrigerated dispenser).

This case study summarises the investigation into the environmental impact (measured in lifecycle GHG emissions) and costs associated with the different milk packaging types against the baseline position of supplying milk using a high density polyethylene (HDPE) bottle, segregated on site and sent for recycling.

Plastic Bottle

The baseline plastic bottle (12g) and lid (1g) were made from HDPE, with the bottle made from 30% recycled material. Each bottle contained 190ml of milk (1/3 pint) and one was required per child per day. Some children were given the option of using a straw (2g) and therefore this was also included in the assessment.

The milk came from farms local to the South Wales area, within 64km by non-refrigerated tanker, and the full bottles were delivered within 30km in refrigerated vehicles. For waste management, it was assumed that the bottles travelled 30km and were recycled. Both the lid and straw were assumed to go to an energy from waste facility.

Glass Bottle

Each glass bottle contained 568ml of milk (one pint) and therefore one was required for three children. The glass bottles were rinsed at the school (assuming 100ml of cold water being required) and returned to the supplier at the same time as the next delivery was made. Due to supply chain issues for the trial, deliveries came from a bottling plant in West London, with significantly greater tanker transport distances from farm to bottling plant; and refrigerated delivery of bottled milk to the schools.

An aluminium top was used as a closure, but not returned. Current evidence suggests that although this is recyclable, it is most likely to end up in residual waste.

The milk was dispensed into re-usable polycarbonate beakers. The impact of these, their washing and ultimate disposal was also included in the assessment.

Pergal

The pergal was made from a plastic low density polyethylene (LDPE) inner container, which was supported by a card outer and LDPE shrink wrap. Each pergal contained 13.6 litres of milk and, assuming a 2% wastage, provided 70 x 190ml servings.

As with the glass bottle, the milk was dispensed into re-usable polycarbonate beakers, and the associated impacts were included in the assessment.

The milk dispenser was a small refrigerated unit that contained one pergal. These were assumed to be running constantly and energy use assumptions were included in the assessment.

In terms of delivery logistics, the same assumptions were made as those for the plastic bottle. For waste management, it was also assumed that the pergal travelled 30km and that the card was recycled, with the plastic being sent to residual treatment at an energy from waste facility.

Cost Assessment

A cost assessment was made of the provision of a 190ml serving in each packaging format.

This included costs associated with the procurement, cleaning water and energy where required. Table 1 provides a cost comparison of the three different milk container formats.

Table 1: Cost comparison

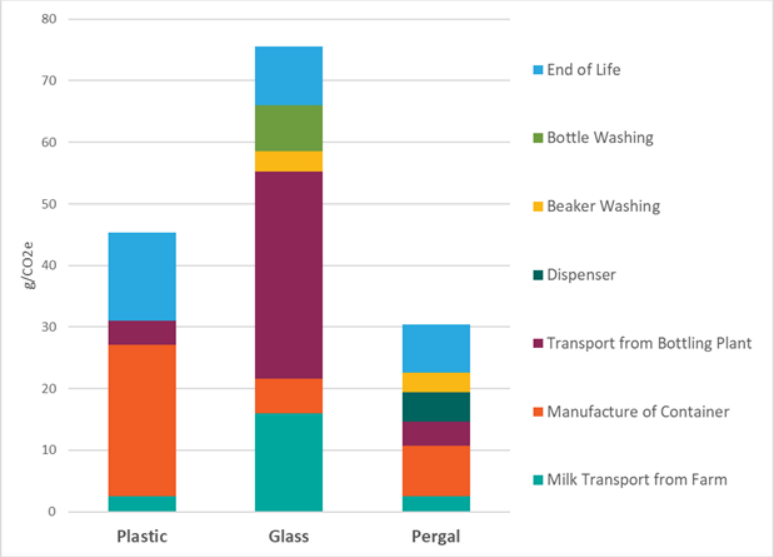
Milk Container	Cost per 190ml Serving	Cost per Child per Year
Plastic bottles	£0.198	£37.58
Glass bottles	£0.165	£31.43
Pergals	£0.143	£27.16

This demonstrated that both the glass bottle and pergal are less costly than the plastic alternative. The costs of the additional labour required for the use of glass bottles or pergals were not included and would need to be considered if rolled out on a wider basis. Current trials indicate that this labour is absorbed into existing workloads, but the sustainability of this should be investigated. For context, a simple example would be: for a £20,000 salary where one week per year is devoted to this process, this would result in an increase in £0.01 per serving for a school of 200.

Environmental Assessment

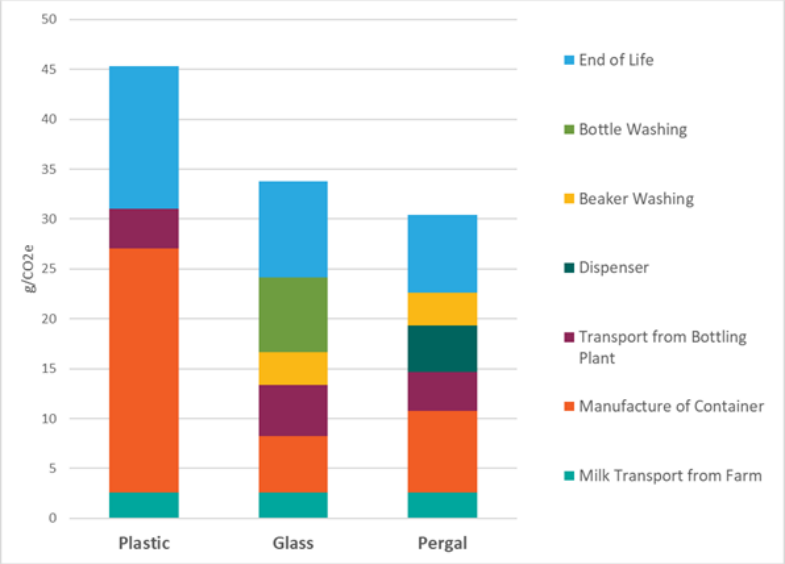
The results of the lifecycle environmental assessment (Figure 1) show that the pergal had the lowest GHG emissions at 30.4g CO2e per serving. This is followed by the plastic bottle at 45.3g and the glass bottle at 75.6g. The impact of the glass bottle was significantly influenced by the GHG emissions of transport.

Figure 1: GHG emissions per serving by milk container type



In order to investigate this transport impact further, a local glass bottling scenario was modelled. This reflected local sourcing of milk, similar to the proximity of the plastic bottle and pergal supply chain. Figure 2 illustrates the GHG emission results from this scenario.

Figure 2: GHG emissions per serving by milk container type - local glass bottling scenario



This demonstrated that if existing local supply chains could adopt glass bottling then the environmental impact of this packaging format would be greatly reduced. It would reduce glass bottle GHG emissions from 75.6g to 34g, which is still slightly higher than the pergal at 30.4g.

Conclusions

This case study demonstrates that both glass bottles and pergals have the potential to deliver cost savings in the region of 15-20% over the current plastic bottle used, with pergals offering the greatest cost-saving opportunity.

In terms of environmental impact, the proximity of the supply chain has a significant influence. Where the impacts of supply chain logistics are the same then pergals, followed by glass bottles, offer lower environmental impacts, potentially leading to a 25-30% reduction of GHG emissions.