

A comparison of enrichment items for the promotion of natural gnawing behaviour in laboratory mice

1. Introduction

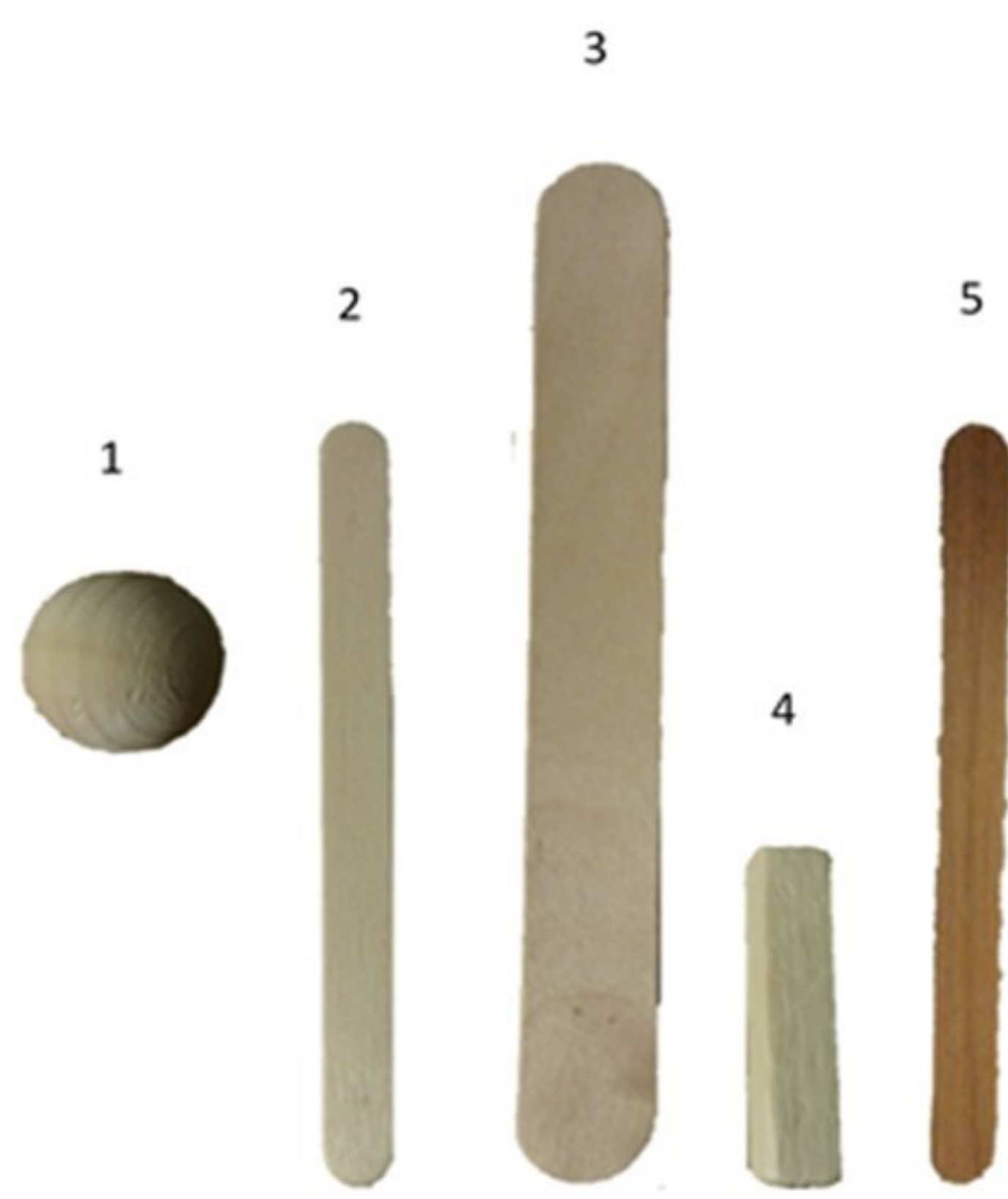
The Guide for the Care and Use of Laboratory Animals (1996)⁽¹⁾ states the goal should always be to maximise species-specific behaviours and minimise stress-induced behaviours. Malocclusion is a common problem within laboratory mice which occurs when the incisors overgrow because their jaws are misaligned⁽²⁾ and the mandibular and maxillary teeth do not properly occlude (Figure 1 and 2). Basic requirements for good rodent housing and husbandry are to provide material to gnaw such as wood blocks (Figure 3) for maintaining general wellbeing⁽³⁾. However, determining the amount or form of environmental enrichment needed to produce a positive impact without causing harm is a complex task⁽⁴⁾. The study compares five different chew items to decide which one is the most suitable as part of cage enrichment for fulfilling animals' gnawing natural need.

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Figure 1-3.– Figure 1: first stage incisors overgrowing. Figure 2: mandibular and maxillary teeth do not properly occlude. Figure 3: Wood blocks provided as environmental enrichment to gnaw. (Pictures taken by Irene Lopez)

2. Methods and Materials



- Five wooden chew items (1. aspen ball; 2. aspen chew stick; 3. flat chew stick; 4. aspen brick; 5. lolly stick)
- Four cages per group: same strain per group and similar number of mice housed (regardless of the sex)
- One item provided to each cage in the morning, weighed and recorded
- Trial period/length: 28 days

* **Phase 1:** every day for a period of 14 days, item weighed and recorded on the data sheet (if an item completely disappeared, it was replaced).

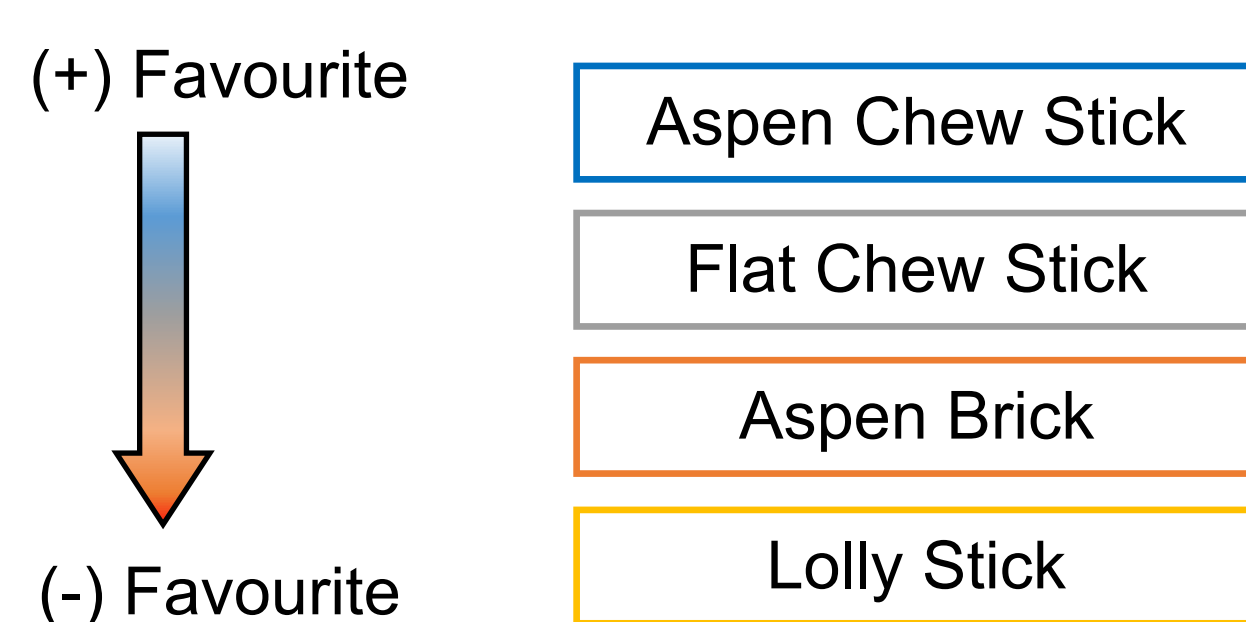
* **Phase 2:** original cages kept and groups randomised. The previous wooden chew was removed and a new item given, weighed and recorded. Data collection as in part 1 for a further 14 days.

Item	Dimensions	Material
1 Aspen Ball	30 mm (diameter) x 100 mm (perimeter)	aspen wood
2 Aspen Chew Stick	112 mm (length) x 10 mm (width) x 2 mm (height)	aspen wood
3 Flat Chew Stick	150 mm (length) x 18 mm (width) x 1.6 mm (height)	birch wood
4 Aspen Brick	50 mm (length) x 10 mm (width) x 10 mm (height)	aspen wood
5 Lolly Stick	112 mm (length) x 10 mm (width) x 2 mm (height)	unknown wood

3. Results: gnawing activity

Data collection based on the chew item's weight loss is a simple way to identify signs of gnawing:
more weight loss = more gnawing activity

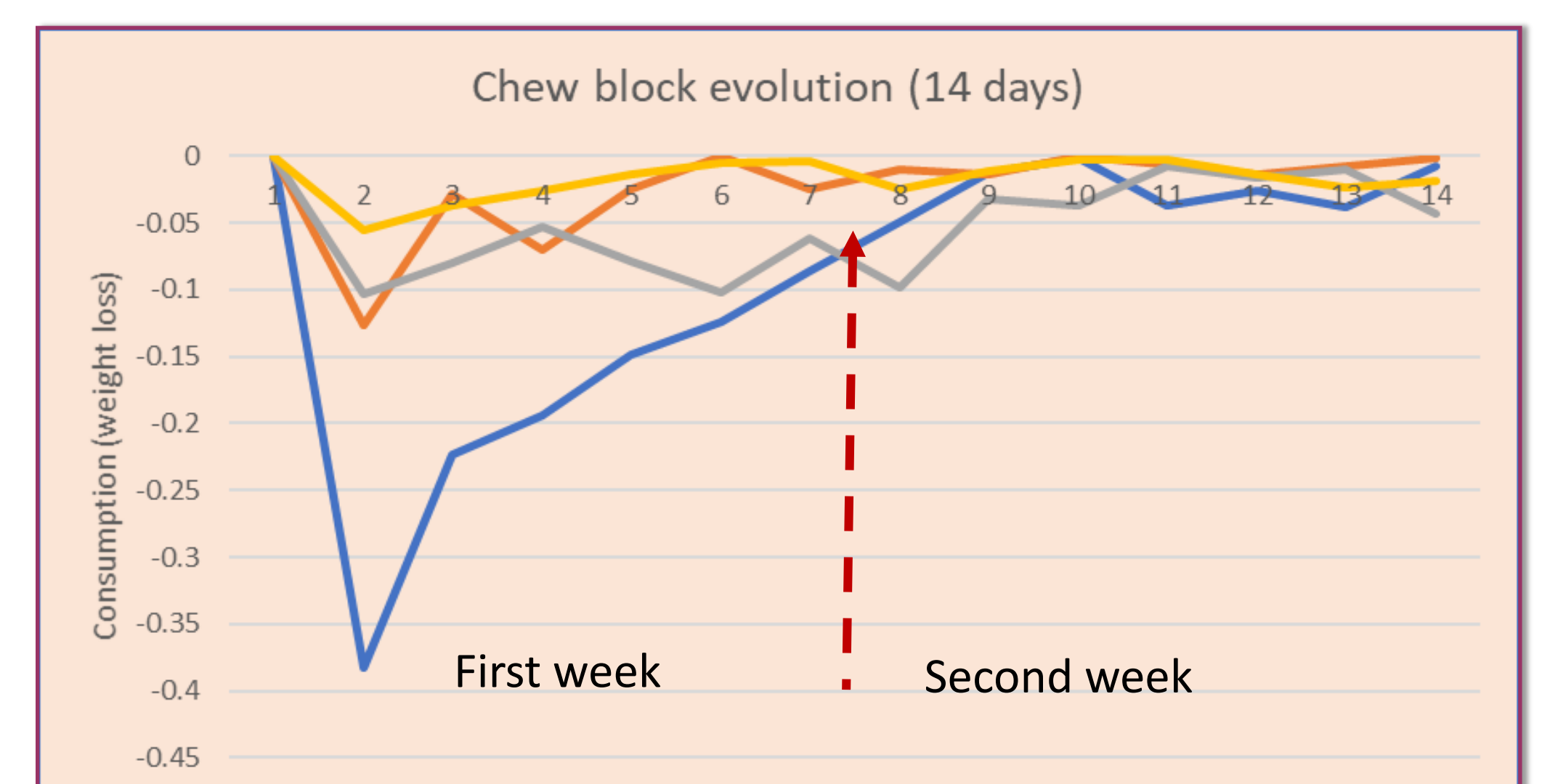
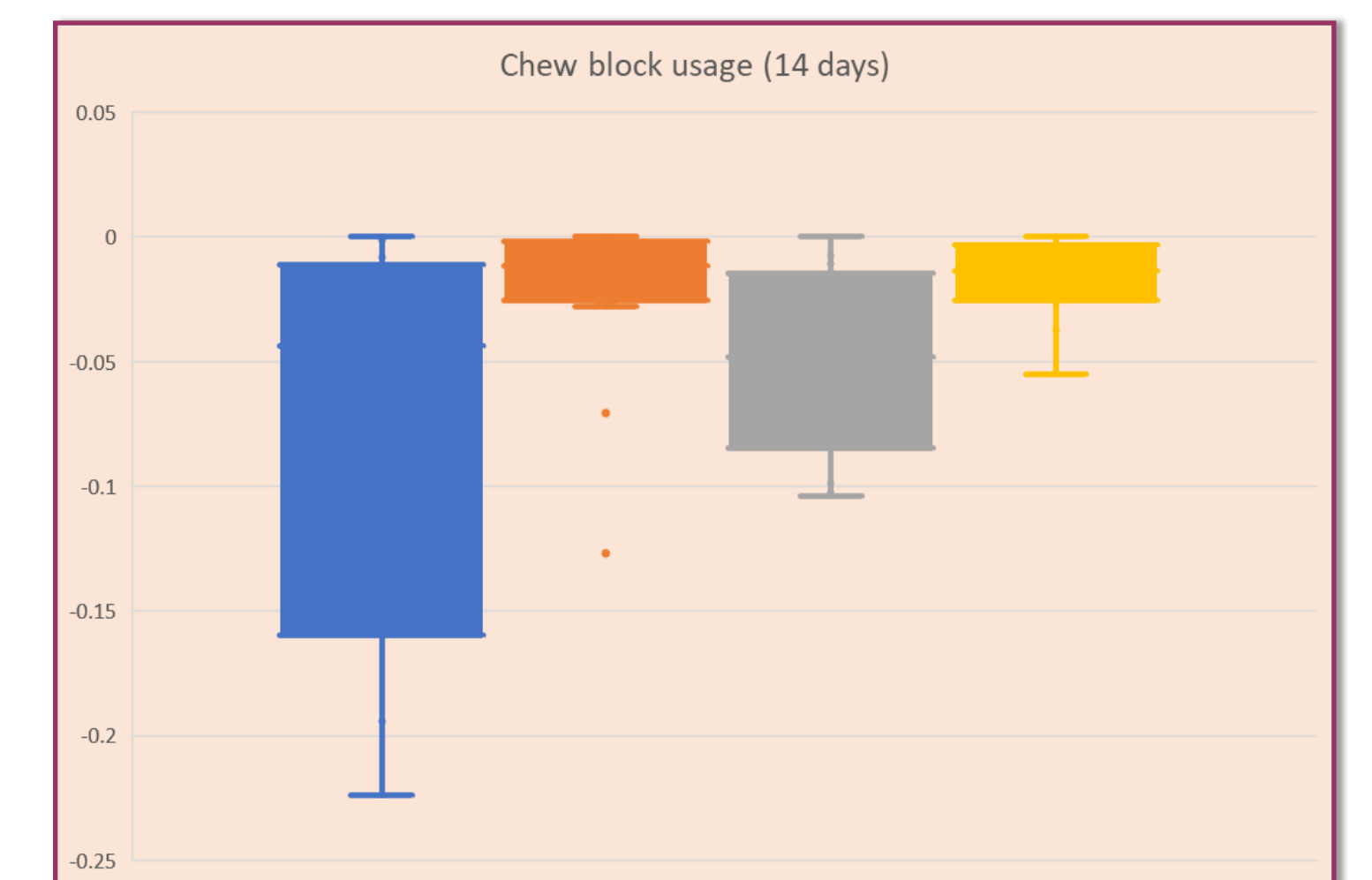
Ranking of preference:



*Aspen Ball removed from the analysis due to a lack of evidence of usage as chew item

There is a statistically significant difference between the four groups tested* (**p-value (=0.004108) < 0.05**). Considering aspen chew stick was replaced in 70% of the cages (sometimes more than once), this has a significant impact on the results when conducting a Tukey HSD ("Honest Significant Difference") test.

Chew item usage/weight loss along 14 days suggest a constant rate of usage for all the items during the first week. However, throughout the second week it slows down.



4. Discussion and conclusions

	Aspen chew stick	Flat chew stick	Aspen brick	Lolly stick
Usage (gnawn activity)	The most chewed	The second most chewed	Highly used during first week	Highly used during first week
Costs (for the unit)	High usage. (need constant replacement) Larger stock for the animal facility	No extra costs	No extra costs	No extra costs
Practicality (How often the technician needs to replace the chew item?)	The technician must monitor the cage more often and replace it when disappear it (disturb the animals too often)	No replacement	No replacement	No replacement
Grade of safety (Reliable supplier for animal products)	Safe	Safe	Safe	No reliable supplier

5. Recommended strategy

Considering both cost and disturbance factors for the best animal welfare :

- Rotate wooden items to keep animal's interest in gnawing between:

Flat Chew Stick + Aspen Brick

- Swap items when cleaning cage to avoid unnecessary disturbances

6. References

- Guide for the Care and Use of Laboratory Animals (1996). Chapter: 2 *Animal Environment, Housing, and Management*.
- Garcia-Arocena, D. (2016). *How to spot and manage malocclusion in research mice*. The Jackson Laboratories.
- Baumans, V and Van Loo, PL (2013). *How to improve housing conditions of laboratory animals: the possibilities of environmental refinement*. *The Veterinary Journal* 195: 24-32.
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7. Acknowledgements

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