Refining the use of animals
in scientific research

Oil emulsified gels

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Refining the use of animals in scientific research

When there is no reasonable alternative to the use of animals in research, testing and teaching, ensuring the welfare of the animals continues to be of great importance. Scientists around the world are working to develop methods to replace the use of animals in scientific research (like organs on a chip). However, for those researchers who do not yet have an alternative, the principles of refinementand reduction of the number of animals used are even more crucial. Non-invasive and less invasive research methods continue to become available, which can improve animal welfare and research outcomes.

refinement: *minimising potential suffering and improving animal welfare*

What problem are scientists trying to solve?

Selecting the most appropriate method to orally administer drugs and nutritional substances is a common problem in animal research. Incorporating them into food and water may be simple, but it can alter animal behaviour, and the ingested dose will change with appetite or thirst. Importantly, some substances, such as polyunsaturated fats, deteriorate over time if not rapidly consumed. Oral gavage (introducing the substance through a tube down the throat and toward the stomach) solves these problems as it allows rapid and accurate dosing, but it requires the animal to be restrained. It can also cause stress and is associated with risk of internal injury, especially when it is repeated during a study. This could confound study outcomes, and oral gavage is not recommended in toxicity studies. As an alternative to oral gavage, research groups have used flavoured gels as a vehicle to administer substances to animals. However, these gels were water based and couldn't be mixed with oil-based substances that are often used in experimental studies. The current study addressed this limitation by developing a new type of gel with broader compatibility.

A solution

Emulsified gels: a refined vehicle for accurate and rapid oral administration of lipid-based preparation in rats

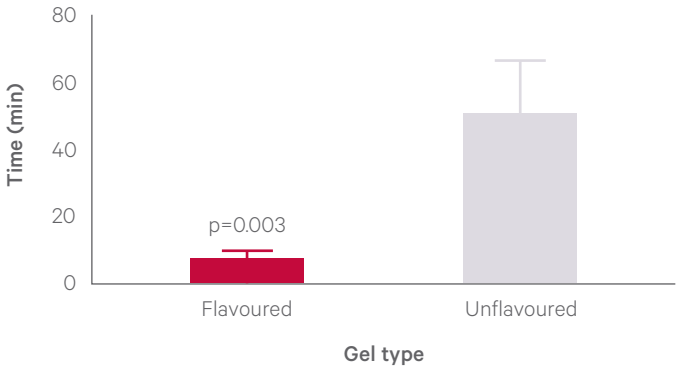
A team at the University of Auckland has produced a palatable emulsified gel that rats will readily eat.

Gels were created by combining a starch emulsifier with an oil-based treatment. The gels were flavoured using raspberry jelly powder, and additional gelatine was added to firm it up, which led to faster consumption. This ensured the quality of the oil, which would have deteriorated if the gel was not eaten quickly.

Oil emulsified gels were highly acceptable to the rats. They retained the benefits of oral gavage (i.e., rapid, and accurate dosing) but avoided the use of an invasive procedure to administer the dose. The emulsified gels had minimal impact on nutrition, and no effect on food consumption or weight gain. The scientists found that, compared to their previous experience using oral gavage, the animals seemed to interact with researchers more positively when using gel treatments.

Importantly, as gel administration is safer for rats than oral gavage, the reduced risk of injury also means fewer animals may be required to complete a study.

Oil emulsified gels containing raspberry jelly powder were consumed faster



Gels represent a versatile vehicle as it is possible to alter the volume, dose and concentration of the oil treatment, and quantity of raspberry flavouring. Raspberry jelly powder only needs to be included where time to consume is critical. Even without raspberry flavouring gels were still eaten completely (but more slowly).

This is an important refinement over oral gavage, improving animal welfare by replacing a potentially stressful and risky procedure with an enriching one.

Pros

- Avoids the need to handle and restrain animals
- Avoids the potential for internal injury to the animal
- Ensures rapid and accurate dosing
- Has the potential to reduce the number of animals required to conduct a study
- An enriching experience that reduces stress and minimises potential confounding effects related to other modes of substance administration

Cons

- Difficult to apply to multi-housed animals (more than 2)
- Will not be suitable for all treatments

References

Emulsified gels: a refined vehicle for accurate and rapid oral administration of lipid-based preparations to rats. Satokar VV, Vickers MH, Bridge-Comer P, Cutfield WS, Albert BB (2021). *Animal Technology and Welfare journal* 20, 95-103.

Stress produced by gavage administration in the rat.
Brown AP, Dinger N, Levine BS (2000). *Contemporary Topics in Laboratory Animal Science* 39, 17-21.

Should oral gavage be abandoned in toxicity testing of endocrine disruptors?
Vandenberg, L.N., Welshons, W.V., Vom Saal, F.S., et al. (2014) *Environmental Health* 13, 1-7.

Refining procedures for the administration of substances.
Morton D, Jennings M, Buckwell A, Ewbank R, Godfrey C, Holgate B, et al. (2001) *Laboratory Animals* 35, 1-41.

For further information

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