Standard Operating Procedures for Oral Gavage in Mice and Rats

1.0 Introduction:

1.1 Oral gavage (dosing) is used when a specific volume of an agent needs to be administered directly into the stomach. Whenever possible, alternatives such as purchasing custom-made chow containing the experimental agent, providing a palatable mixture (e.g. flavored gelatin or nut butter) that is voluntarily consumed or dosing with a water bottle should be considered. Some materials can be introduced only into the animal's mouth and voluntarily swallowed.

1.2 Gavage may only be performed by trained personnel.

2.0 Oral Gavage:

2.1 Supplies needed: See size chart and image of gavage needles below.

2.1.1 The choice of whether to use a rigid or flexible gavage needle or to use a straight or curved gavage needle is according to operator preference and the needs of the study. Gavage needles are available in disposable plastic or re-usable stainless steel. Flexible plastic gavage needles (mice or rats) or red rubber feeding tubes (for rats) have less chance of damaging the esophagus than stainless steel gavage needles, but animals may bite through them and they require some practice to use effectively. All gavage needles have a ball or pear-shaped smooth rounded tip to prevent injury to the esophagus and other tissues. Gavage needles may be also called feeding needles or feeding tubes.

2.1.2 Mouse Gavage Needle Sizes

Weight range (g)	Gauge	Length (inches)	Ball Diameter (mm)	Shape
to 14 gms	24	1"	1 1/4 mm	Straight, Curved
15-20 gms	22	1", 1 1/2"	1 1/4 mm	Straight, Curved
20-25 gms	20	1", 1 1/2",2"	2 1/4 mm	Straight, Curved
25-30 gms	18	1", 1 1/2",2"	2 1/4 mm	Straight, Curved
30-35 gms	18	2", 3"	2 1/4 mm	Straight, Curved

2.1.3 Rat Gavage Needle Sizes

Weight (g) of rat	Gauge	Length (in)	Ball Diameter (mm)	Shape
50-75	20	1-1.5	2.25	Straight/Curved

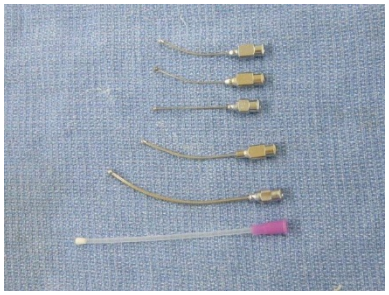
75-100	18	1-1.5	2.25	Curved
100-200	18	2-3	2.25	Curved
200-300	16	3-4	3	Curved

2.1.4 Mouse: 18-20 gauge gavage needle about 1 to 1.5 inches in length with a rounded tip. If gavage is performed on young mice a smaller tube is used (see chart).

2.1.5 Rat: 16-20 gauge gavage needles about 2-3 inches in length (see chart) or an 8 French rubber feeding tube

2.1.6 Permanent Marker

2.1.7 Scale



Assorted sizes and types of gavage needles. Note that the end of the gavage needle is blunted with a round or tear-drop shaped tip to prevent esophageal trauma during insertion

Red rubber feeding tubes can be used for rats.

2.2 Procedure

2.2.1 Weigh the animal and determine the appropriate gavage needle size and maximum dosage volume. The maximum dosing volume is 10 ml/kg of animal although smaller volumes (e.g. 5 ml/kg, equivalent to 0.15 mL for a 30 g mouse or 1 mL for a 200 g rat) are recommended as volumes of 10 ml/kg and higher can result in rapid shunting of the compounds to the duodenum and/or increase the chances of aspiration pneumonia associated with passive reflux of the material into the esophagus[3]. The maximum amount that can be given is less for pregnant animals. Dosing may be repeated up to 3 times within a 24-hour period. If additional dosing is necessary, it must be justified in the protocol.

2.2.2 Check the length of the gavage needle by measuring from the tip of the animal's nose to the xyphoid process (bottom of the sternum). If the needle is longer than the length from the nose to the xyphoid process, then mark the needle shaft/tubing at the level of the nose and do not pass the needle/tubing into the animal past that point to avoid perforation of the stomach. See image #1 below for measuring technique

2.2.3 Restrain the animal

2.2.3.1 Mouse: scruff the mouse, grasping the skin over the shoulders with the thumb and middle fingers. Grasp the skin over the shoulders so

that the forelegs are extended out to the sides, keeping the front feet from pushing the gavage tube away.

2.2.3.2 Rat: hold the rat near the thoracic region and support the lower body. A small towel can be used to wrap around the rat's body. Do not squeeze the thorax tightly and restrict respiration.

2.2.4 Hold the animal's head in place by gently extending the head back—this extension of the head creates a straight line through the neck and esophagus.

2.2.5 Place the gavage needle in the mouth. The needle is then gently advanced along the upper palate until the esophagus is reached. The tube should pass easily into the esophagus. The animal may swallow as the tube is passed. Pass the needle smoothly in one motion. Note: If there is any resistance, **DO NOT FORCE** the needle. Pull the gavage needle out and try again.

2.2.6 Once proper placement is verified, the material can be slowly administered by a syringe attached to the end of the needle. Do not rotate the needle because the tip may rupture the esophagus. After dosing, gently remove the needle following the same angle as insertion. See image 2 below.

2.2.7 Return the animal to the cage and monitor for 5-10 minutes, looking for signs of labored breathing or distress. Monitor animals again between 12-24 hours after dosing.

2.2.8 Videos demonstrating oral gavage in mice and rats can be found at:

2.2.8.1 https://researchanimaltraining.com/articles/oral-gavage-in-the-mouse/

2.2.8.2 https://researchanimaltraining.com/articles/oral-gavage-in-the-rat/

2.2.8.3 https://www.youtube.com/watch?v=oYCmKIhveFY&feature=youtu.be

2.2.8.4 https://www.youtube.com/watch?v=TO3i_q74ftM&feature=youtu.be

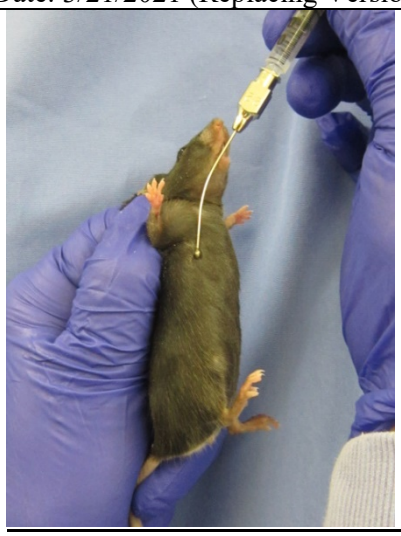


Image 1: Measure the length of the gavage needle from the tip of the nose to the level of the xyphoid process

Image 2: Administer the solution upon verification of proper placement

3.0 Potential Adverse Effects to be Considered:

3.1 Perforation of the esophagus or stomach with the gavage needle or respiratory distress associated with administration of fluid into the lungs, as well as physical and/or psychological stress to the animals (training and habituation to handling may decrease this).

4.0 Reference:

4.1 Braintree Scientific, Inc. at http://www.braintreesci.com/

4.2 AALAS.org https://www.aalas.org/

4.3 Turner, Patricia V et al. "Administration of Substances to Laboratory Animals: Routes of Administration and Factors to Consider." *Journal of the American Association for Laboratory Animal Science : JAALAS* 50.5 (2011): 600–613. Print.