Association of Primate Veterinarians
Food Restriction Guidelines for Nonhuman Primates in Biomedical Research

The Association of Primate Veterinarians has developed these guidelines to provide information to research teams, animal caregivers, veterinarians, and institutional animal care and use committees (IACUCs) on how to manage food restriction that may be used to modulate motivation in macaques. These guidelines are not applicable to nutritional studies whose primary goal is to study the effects of various degrees of food restriction.

APV RECOMMENDATIONS FOR USING FOOD RESTRICTION AS A BEHAVIORAL MODULATOR FOR NONHUMAN PRIMATES IN BIOMEDICAL RESEARCH

Protocol Review and Justification

The use of food restriction as a technique to modulate motivation is potentially a highly invasive procedure and the IACUC must reflect and consider whether the use has been adequately justified. Appropriate questions to consider during the review stage include:

- Is food restriction essential for the research? Is it scientifically justified to restrict food? If yes, references should be provided that illustrate how food restriction has been used as a behavioral motivator for similar studies.
- If not essential but justified, the least amount of restriction should be used. Typically during introduction and training, restriction is used to motivate the animals learning a task. Once proficient, positive reinforcement should be used to maintain behavior with the goal of eventually eliminating restriction.

Methods of Feeding

1. The individual animal’s optimum food ration for growth, development, and weight maintenance must be assessed prior to initiating food restriction to develop a baseline pattern. A growth curve must be produced for each animal after a period of stable housing. The period will depend on whether an animal is newly received, is an established member of the colony, and whether the animal is still growing and this period can vary between several weeks to 6 months. The individual growth curve should take the animal’s starting weight and body condition into consideration and should follow published normograms.¹
2. The recommended amount of food for each animal should be based on nutritional
guidelines and/or diet manufacturer recommendations. This may be used as a
basis for initiating a specific amount of food (ration) or baseline food ration. The
daily ration should be adjusted for each individual based on consumption, body
condition, rate of gain and life-stage.

3. An animal’s baseline food ration should be calculated to support the anticipated
growth or maintenance for the next year. The proportion of positive
reinforcements, such as fruit or other food treats, which will be allowed to
contribute to full ration should be determined. For example, if nutritionally
complete, 100% of positive reinforcements would contribute to a full ration vs.
only 25% if non-nutritional reinforcements used.

4. Preferred treats, as positive reinforcements, should be determined for each animal
and used for positive motivation as the levels of food restriction are decreased.

5. Food consumption, body weight, and body condition must be evaluated
periodically and at intervals appropriate to the life stage, i.e., young developing
animals require more frequent monitoring (e.g., 2-3x weekly) than older mature
animals who are performing stably (e.g., semi-monthly).

6. The amount of food ration that any animal can be restricted to safely and
humanely will vary by individual animal. Unless empirical data are established,
no less than 85% of the NRC-determined full ration should be fed.

7. Food restriction should be introduced gradually, such as 5% per month, if the
individual animal is not performing as expected on the tests. This assumes that
the tasks are not too complex for the age or ability of the animal. It should be
noted that not all animals will perform well with food restriction as a behavioral
motivator.

8. Regardless of the restriction, the number of feedings should be twice daily, given
at least 6 hours apart, and with a minimum of 25% of the daily food ration given
in the morning prior to testing.

9. On days that animals are not tested, they should receive a full food ration divided
into two equal meals.

10. If an animal is not completely consuming the restricted ration, no further
restriction should be instituted, and the animal should be closely monitored for
signs of illness and/or behavioral changes.

11. Vitamins and supplements may be beneficial to maintain body condition.
Ongoing Monitoring During Food Restriction Studies

The following parameters should be monitored daily by the research team and evaluated on a monthly basis:

- The amount of food provided and the amount of food consumed at each meal.
- The amount of positive food reinforcements awarded and consumed.
- The animal’s body weight should be obtained, at minimum, once every two weeks. The weight should always be obtained at the same time each day, prior to feeding and watering.
- Body condition should be evaluated and scored at each physical examination.
- Ethograms should be completed at least quarterly or more often if there are behavioral abnormalities.
- Clinical chemistry profiles (serum chemistry and complete blood count and differential) should be reviewed every 6 to 12 months.

Endpoints

Any animal should be temporarily removed from a food restriction motivational regime if s/he has lost more than 15% of their projected optimal body weight, has an unsatisfactory body condition score (<3/5), has significant abnormal behaviors that have not improved with intervention, or has abnormal laboratory data (APV, 2010). The animal may be returned to study when improvements in body weight or behavior have been made.

Animals should be permanently removed from a food restriction motivational regime if they continue to have significant problems in any of the above identified areas after being returned to food restriction more than twice.

Considerations for Using Food Restriction as a Motivator

Between the ages of four to six years, rhesus macaques experience a growth spurt, during which their body weight may normally increase by 2 kg in a 12 month period. Animals in this age range may be at increased risk of not maintaining body condition if they are concurrently on a food restriction regime. This period should be approached with increased vigilance. Species-specific growth and development patterns exist for other species and should be considered prior to beginning a food restriction regime.

Depending on the time of day and whether a sub-adult rhesus macaque has just been fed or watered, their weight can vary by as much as 1 kilogram (15%). It is important that body weights be obtained early in the morning, always at the same time, and prior to receiving food or water.

Typically animals will consume more food if offered meals twice a day than once a day. An animal fed an entire day’s ration in one feeding may become satiated prior to consuming the entire ration and be more likely to waste food, resulting in reduced overall consumption.
Individual animals will have different abilities to learn tasks. This must be accounted for and lack of expected performance should not be automatically attributed to a lack of motivation.

Animals that are comfortable in their environment are usually better able to concentrate on the tasks. Animals that are nervous or agitated do not concentrate as well. Once an animal has been trained to accomplish the task, often a behavioral modifying substance is introduced as an experimental variable, which may impact the desire or ability to consume the food ration. This may result in the need for additional monitoring.

Record Keeping

Records must be maintained to include:

- the proposed individual full ration of food;
- the degree of restriction from full ration;
- the length of time for the restriction and results of monitoring parameters, such as body weight, BCS, behavioral assessments, laboratory data;
- the individual animal’s preferred positive food reinforcements; and
- the results of behavioral training and testing such as poor, satisfactory, or good, including the length of time required to acquire specific skills.

Records must be available for review by the IACUC, clinical veterinarian, and animal caregivers.5,7

Reporting

The clinical veterinarians should review records regularly to ensure that animals are maintaining weight and condition. The IACUC should evaluate the animal records every 6 months or more often if there are problems or concerns. Animals that are food restricted to the degree that they lose satisfactory body condition and are removed from study should be reported as experiencing more than momentary pain or distress, and should be reported to the IACUC.

References


