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FEEDING MANAGEMENT OF LABORATORY ANIMALS

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Abstract

Feeding management is a critical determinant of laboratory animal health, welfare, and the reliability of scientific outcomes. The present study summarizes species-specific feed intake patterns, nutrient requirements, and dietary formulations for commonly used laboratory animals, including mice, rats, hamsters, guinea pigs, and rabbits. Average daily feed intake varied markedly among species and physiological states, with intake increasing from growth to adulthood and reaching the highest levels during pregnancy and lactation. Lactating animals showed the greatest feed consumption, reflecting elevated energy and nutrient demands associated with milk production. Among rodents, mice consumed the least feed, whereas rats exhibited substantially higher intake, particularly during lactation. Guinea pigs and rabbits demonstrated considerably higher feed intake overall, consistent with their body size and digestive physiology. Nutrient requirement analysis revealed significant interspecies variation. Protein and metabolizable energy requirements were higher in mice and rats, while guinea pigs and rabbits required increased dietary fiber, reflecting their herbivorous nature and reliance on hindgut fermentation. Vitamin C was required exclusively by guinea pigs due to their inability to synthesize it endogenously. Dietary formulations varied accordingly, with cereal- and legume-based diets used for rodents and higher-fiber, green-fodder–supplemented diets for rabbits and guinea pigs. These findings emphasize that *feeding practices must be tailored to species, physiological status, and metabolic characteristics to prevent nutritional imbalances and experimental variability. Adoption of standardized, species-appropriate diets in accordance with established guidelines is essential to safeguard animal welfare and enhance the validity, reproducibility, and scientific integrity of biomedical research.*

Keywords: *Animal Health, Laboratory, Adulthood, Feed Consumption, Animal Welfare.*

INTRODUCTION

The nutritional management of laboratory animals is a fundamental component of their overall care, welfare, and scientific utility. Adequate nutrition is essential for maintaining normal physiological, biochemical, and behavioral functions, all of which directly influence the validity and reproducibility of experimental outcomes (National Research Council [NRC], 2011). Diets that are inadequate or imbalanced in terms of quantity or quality can lead to metabolic disturbances, altered immune responses, impaired growth or reproduction, and abnormal behavior, thereby introducing confounding variables into research studies (Fox et al., 2015).

Laboratory animals are widely used in biomedical research, toxicological studies, and diagnostic testing, where even minor nutritional inconsistencies may significantly affect experimental data. Nutritional deficiencies or excesses can modify drug metabolism, disease progression, and physiological responses, ultimately compromising the accuracy and reliability of scientific findings (Harkness et al., 2010). Consequently, the provision of nutritionally complete and standardized diets is critical not only for ensuring animal health and well-being but also for maintaining experimental control and data integrity.

Well-formulated laboratory animal diets must meet species- and strain-specific nutritional requirements and provide essential nutrients in bioavailable forms. These diets should be carefully manufactured, stored, and handled to prevent degradation, microbial contamination, or exposure to chemical residues such as pesticides or mycotoxins (Smith & Mangkoewidjojo, 2012). Standardized commercial diets are therefore preferred in most research settings, as they help minimize dietary variability and improve reproducibility across studies (Tuckermann et al., 2019).

In addition to diet composition, several biological and environmental factors influence the nutritional requirements of laboratory animals. These include species and strain differences, age, sex, reproductive status, physiological condition, health status, environmental conditions, activity level, and experimental manipulations. Genetic modifications and disease models may further alter metabolic demands, necessitating customized dietary formulations (NRC, 2011). Recognizing and accommodating these factors is essential for optimizing animal welfare and ensuring that nutritional variables do not interfere with experimental objectives.

By implementing scientifically sound feeding management practices, researchers can safeguard laboratory animal health, uphold ethical standards of animal care, and enhance the reliability, reproducibility, and translational value of scientific research.

RESULTS

FEED INTAKE OF LABORATORY ANIMALS

Average daily feed intake differed markedly among laboratory animal species and physiological states, as summarized in ***Table 1****. Across all species, feed intake increased from the growing stage to adulthood and was highest during pregnancy and lactation. Lactating animals exhibited the greatest feed consumption, indicating significantly increased nutritional demands associated with milk production.*

Among rodents, mice showed the lowest average intake (3–5 g/day during growth, increasing to 7–15 g/day during lactation), whereas rats demonstrated substantially higher intake, particularly during lactation (35–65 g/day). Hamsters exhibited moderate intake levels, while guinea pigs consumed comparatively large quantities of feed, reaching up to 130 g/day during lactation. Rabbits recorded the highest intake overall, ranging from 120–200 g/day in growing animals to 300–400 g/day during lactation. These results support the practice of ***ad libitum feeding****, particularly for rodents, to accommodate physiological variability and metabolic demand.*

TABLE-1: AVERAGE FEED INTAKE (G/DAY) OF DIFFERENT SPECIES OF LABORATORY ANIMALS :-

Species	*Growing*	*Adult*	*Pregnant*	*Lactating*

Mouse	*3–5*	*5–7*	*6–8*	*7–15*
Rat	*8–25*	*25– 30*	*25– 35*	*35– 65*
Hamster	*6-12*	*10-12*	*12-15*	*20-25*
Guinea pig	*35-45*	*45-70*	*70-80*	*100-130*
Rabbit	*120-200*	*200-300*	*300*	*300-400*

Laboratory rodents are usually fed ad libitum. (https://royalsociety.org)

NUTRIENT REQUIREMENTS ACROSS SPECIES

*The basic nutrient composition required by common laboratory animals is presented in **Table 2**, and detailed nutrient requirements per kilogram of diet are shown in **Table 3**. Protein requirements were highest in mice and guinea pigs, while rabbits and rats showed moderate protein needs. Crude fiber requirements were significantly higher in guinea pigs and rabbits compared to mice and rats, reflecting species-specific digestive physiology.*

TABLE-2: BASIC NUTRIENTS REQUIRED FOR DIFFERENT SPECIES OF LABORATORY ANIMALS :-

Nutrients	***Mice***	***Rat***	***Guinea pig***	***Rabbit***
Crude protein (% min)	*20.0*	*20.0*	*24.0*	*20.0*
Ether extract (% min)	*4.0*	*4.0*	*3.5*	*3.5*
Crude fiber (% max)	*4.0*	*4.0*	*12.0*	*12.0*
Ash (% maximum)	*8.0*	*8.0*	*8.0*	*8.0*
Calcium (% minimum)	*1.0*	*1.0*	*1.2*	*1.2*
Phosphorus (% min)	*0.6*	*0.6*	*0.6*	*0.6*
Nitrogen free extract (%)	*55.0*	*53.0*	*43.0*	*47.0*
Metabolisable energy (Kcal/K g)	*3600*	*3600*	*3000*	*3000*

(CPCSEA Guidelines)

Metabolizable energy requirements were higher for mice and rats (3600 *kcal/kg) compared to guinea pigs and rabbits (3000 kcal/kg). Vitamin C was required exclusively by guinea pigs, while other species did not require dietary supplementation. These findings indicate statistically relevant interspecies variation in nutrient requirements, emphasizing the need for species-specific diet formulation.*

TABLE:3 NUTRIENT REQUIREMENTS FOR COMMON LABORATORY ANIMALS (PER KG OF DIET, AS-FED BASIS)

Nutrient (Units)	Mouse	Rat	Guinea Pig	Rabbit
Crude Protein (g)	180 - 240	120 - 150	180 - 200	120 - 180
Lipid (Fat) (g)	50 - 70	50 - 60	30	20 - 40
Fiber (g)	30 - 50 (ADF)	30 - 50 (ADF)	250 - 300 (NDF)	140 - 200 (ADF)
Calcium (g)	5.0 - 6.5	5.0 - 6.3	8.0	8.0 - 10.0
Phosphorus (g)	3.0 - 4.0	3.0 - 3.8	4.0	6.0
Vitamin A (IU)	2,500 - 4,000	2,500 - 4,000	7,500 - 12,500	6,000 - 10,000
Vitamin D (IU)	1,000 - 1,500	1,000 - 1,500	800 - 1,500	800 - 1,200
Vitamin E (IU)	30 - 50	30 - 50	50	40 - 50
Vitamin C (mg)	**Not Required**	**Not Required**	**100 - 500**	**Not Required**
Choline (mg)	1,000 - 2,000	1,000 - 1,300	1,000 - 1,500	1,200

NRC (1995)

FEED COMPOSITION

Dietary formulations for different laboratory animals are shown in ***Table 4****. Diets for rats, mice, and hamsters were primarily cereal- and legume-based with added protein and fat sources, while diets for rabbits and guinea pigs included higher fiber content and green fodder supplementation. Vitamin C supplementation was included exclusively for guinea pigs.*

TABLE:4-DIETARY FEED COMPOSITION FOR DIFFERENT SPECIES OF LABORATORY ANIMALS

	Ingredients	***Composition***	
		Rat, Mice, Hamster	*Monkey, Rabbit, G. pig*
	Wheat flour	*22%*	*61%*
	Roaster Bengal gram flour	*60%*	*28%*
	Ground nut flour	*10%*	*-*
	Casein	*4%*	*1%*
	Refined oil	*4%*	*5%*
	Salt mixture with starch	*4.8%*	*4.8%*
	Vitamins &choline mixture with starch	*0.2%*	*0.2%*
	Vitamin C(For Guinea pig)	*-*	*50 mg/100 g diet*

	Extra Diet for Some Laboratory Animals			
	Ingredients	*Monkey*	*Rabbit*	*Guinea pig*
	Roaster Bengal gram flour	*20g*	*20g*	*25g*
	Ground nut flour	*15g*	*-*	*-*
	Plantain	*1g*	*-*	*-*
	Lucerne grass	*-*	*100g*	*50g*

(CLTRI, 1987)

DISCUSSION

The present findings demonstrate clear interspecies and physiological-stage differences in feed intake and nutrient requirements among laboratory *animals. The consistent increase in feed intake observed during pregnancy and lactation across all species reflects the substantially elevated energy, protein, and micronutrient demands required to support fetal growth and milk synthesis. Similar physiological trends have been well documented in laboratory animal nutrition guidelines and standard reference texts, supporting the biological plausibility of the observed patterns and their alignment with established nutritional standards (National Research Council [NRC], 1995, 2011).*

Higher protein and metabolizable energy requirements in rodents such as mice and rats can be attributed to their relatively high metabolic rates and rapid tissue turnover. In contrast, guinea pigs and rabbits exhibit markedly higher fiber requirements, reflecting their herbivorous feeding behavior and dependence on hindgut fermentation for efficient digestion and nutrient absorption (Harkness et al., 2010; Fox et al., 2015). These species-specific differences highlight the importance of tailoring diets according to digestive physiology rather than applying uniform feeding strategies across laboratory animal species.

The exclusive requirement for dietary vitamin C in guinea pigs further emphasizes the necessity of species-specific nutritional planning. Unlike most laboratory rodents, guinea pigs lack the enzyme L-gulonolactone oxidase and are therefore unable to synthesize vitamin C endogenously. Inadequate supplementation can result in scurvy, impaired immune function, poor wound healing, and increased experimental variability (NRC, 1995). Failure to account for such unique nutritional needs may lead to deficiency-related disorders that compromise both animal welfare and research outcomes.

From an experimental perspective, improper or inconsistent feeding practices can act as significant confounding variables. Nutritional imbalances may influence metabolic pathways, immune responses, disease progression, and drug metabolism, thereby affecting the validity, reliability, and reproducibility of experimental data (Fox et al., 2015). The descriptive statistical trends observed in this study, although not subjected to inferential analysis, demonstrate consistent directional changes across species and physiological states, strongly suggesting biologically meaningful differences *in nutritional demand.*

Adherence to standardized feeding protocols and established recommendations from regulatory and advisory bodies such as CPCSEA, NRC, and CLTRI is therefore essential. Standardized diets, appropriate feed storage, and controlled feeding environments minimize nutritional variability and enhance experimental control (CPCSEA, 2003; CLTRI, 1987). Overall, these findings reinforce that nutritional management is not merely a husbandry concern but a critical determinant of experimental validity, ethical animal care, and scientific rigor. The adoption of species-appropriate, well-formulated diets under controlled conditions remains fundamental to improving animal welfare and strengthening the reliability and reproducibility of biomedical research.

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