

**DETERMINING THE BEST HOUSING PRACTICES FOR RABBITS, RATS, AND  
GUINEA PIGS**

by

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A Signature Honors Project Presented to the

Honors College

East Carolina University

In Partial Fulfillment of the

Requirements for

Graduation with Honors

by

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May, 2024

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## **Abstract**

The importance of proper pet care has long been recognized by both the veterinary industry and the public. However, numerous major pet corporations sell products that are dangerous to the health and well-being of pets around the world and a large portion of the pet-owning population is unaware of this. Exotic pets such as rabbits, guinea pigs, and rats have been around for decades yet finding information about proper care for them from credible sources is difficult. This leaves pet owners in a situation where ignorance or false information about pet care can easily be spread. The long-term goal of the research is to inform pet owners, both current and future, about the harms that certain products advertised towards pets can cause so they can make knowledgeable decisions. The objective of the study is to provide a comprehensive review of literature and common practices in relation to dwarf rabbits, American guinea pigs, fancy rats, and other breeds from these species. A thorough review of literature on husbandry for rabbits, guinea pigs, and rats has been conducted. The literature shows that many of the enclosures sold to pet owners are not competent and could harm their pets. Multiple interviews of veterinarians have been completed. These interviews provided enclosure recommendations and highlighted some common issues with enclosures used by pet owners. A comparative analysis of the literature and the interviews was done to measure the alignment of recommendations. Additionally, a survey was sent out to pet owners to collect data about the health of their pets and their housing practices. This data was then analyzed to determine patterns of housing practices and health outcomes.

## **Introduction**

Exotic pets have been around for decades and the demand for them is continuously growing. Rabbits, rats, and guinea pigs are some of the popular exotic animals people keep as

pets. Even with their popularity, finding information about proper housing for these pets from credible sources is rather difficult. Every habitat is unique and provides an environment where an organism lives throughout its lifespan. Habitats must be composed of adequate shelter, water, food, and space for an organism to survive and thrive. According to Habitat, from National Geographic Society, “A habitat is said to have a suitable arrangement when it has the correct amount of all of these” (Rutledge et al., 2023). As a result, pet owners must provide the proper elements of habitat for their pets to live long healthy lives. Many of the pet products commonly provided to consumers are inadequate. The enclosures are not capable of providing animals with the necessary space needed to be considered a proper habitat and some have features that are dangerous to the animals being housed in them. Veterinarians are seeing the negative effects these improper enclosures and animal supplies used everywhere are having on the lives and health of pets. The importance of proper pet care has long been recognized by both the veterinary industry and the general public. The lack of credible information on proper housing for rabbits, rats, and guinea pigs leaves pet owners in a situation where ignorance or false information about pet care can easily spread. Pet owners should be able to access the information needed to make educated decisions regarding their pets’ lives. This is what this study will provide by determining the best housing practices based on veterinarian recommendations and literature.

## **Literature Review**

There is not much literature on the proper housing practices for rabbits, rats, and guinea pigs who are kept as small companion animals. Most available information is on housing these small mammals in research facilities. However, some sources do provide recommendations for each of these animals. In regards to small exotic animals like rabbits, rats, and guinea pigs looking at husbandry, housing, and environment specifically is one of the first things vets do to

help figure out what is wrong with the animal and what caused it because housing and an animal's environment can greatly affect their health. In their article, Palmeiro and Roberts (2013) state that a comprehensive evaluation of husbandry is crucial for the successful diagnosis and treatment of small mammal diseases or injuries. Palmeiro and Roberts (2013) emphasize the importance of considering environmental factors such as housing type, indoor or outdoor conditions, substrate or bedding, and diet when treating small mammals, highlighting the correlation between animal health and housing.

### ***Rabbits***

When researching rabbit housing, the recommendations for size, flooring, and types of cages varied. Rabbits need a sheltered area and an exercise area (Housing and Companionship for Your Rabbits, 2023). The sheltered area needs to be rather large because this is where rabbits typically spend most of their time. One recommended size for hutches or a sheltered area is six feet by two feet by two feet (Housing and Companionship for Your Rabbits, 2023). Two articles state that a rabbit enclosure should be large enough that the rabbit residing in it can complete three full hops in a single direction, this equates to around five feet long (Smith, M et al, 2009; Suitable Environment for Rabbits, 2022). Another article states that a rabbit enclosure should be four to six times the length of a rabbit when it is stretched out, which is between eight and ten feet long (Harriman, 2024). In addition to these sheltered enclosures, exercise areas are needed because of how active rabbits are. The exercise area provided for rabbits needs to be large enough that they can hop, jump, and crawl around (Smith, M et al, 2009; Suitable Environment for Rabbits, 2022). The recommended size of this exercise is anywhere from twenty-four square feet to seventy square feet, or as large as possible (Harriman, 2024; Housing and Companionship for Your Rabbits, 2023; Suitable Environment for Rabbits, 2022). Having this area is very

important for a rabbit's physical health; without proper space their muscles will atrophy and their bones can become weak and be easily broken (Suitable Environment for Rabbits, 2022). The flooring of the rabbit's cage can also impact their health. Rabbits do not have rough pads on the bottom of their feet like some other animals that protect them from surfaces like wire. To them, wire flooring is uncomfortable and can lead to sore hocks, injuries, or pododermatitis, which can be fatal (Harriman, 2024; Smith, M et al, 2009; The Anti-Cruelty Society, 2022; Vogelnest, n.d.). If possible it is best to avoid enclosures with a wired floor. If wire flooring is unavoidable, then it is best to use a resting board or rug so the rabbit can get off of the wire when necessary (Harriman, 2024; The Anti-Cruelty Society, 2022). Other recommendations for rabbit housing include keeping the enclosure well-ventilated, dry, and clean (Creating a Good Home for Rabbits, 2023; Suitable Environment for Rabbits, 2022). If a rabbit's enclosure is not well-ventilated, the build-up of ammonia from their urine can cause illnesses (Creating a Good Home for Rabbits, 2023; Housing Rabbits, 2024; Suitable Environment for Rabbits, 2022). A clean and dry enclosure helps promote a healthy life for rabbits (Creating a Good Home for Rabbits, 2023; Suitable Environment for Rabbits, 2022). The substrate used in a rabbit enclosure also has an impact on its health. Wood shavings can have oils in them that are harmful to the rabbit to smell or ingest (Housing and Bunny-proofing, 2024; Suitable Environment for Rabbits, 2022). Using safer substrates such as paper bedding, hay, or straw is recommended in place of wood pellets or shavings (Housing and Bunny-proofing, 2024; Suitable Environment for Rabbits, 2022).

### ***Rats***

When researching rat housing, the recommendations for size, flooring, and types of cages varied. Rats need a large cage that contains plenty of room for exercise; if they do not have

enough space within their enclosure they can get stressed and develop illnesses (Caring For Your Pet Rat, 2024; PDSA, n.d.). Recommendations for the minimum floor space in a rat enclosure are two and a half feet long, one and a half feet wide, and three and a half feet tall. Another article has similar recommendations regarding cage sizes, these recommendations being three and a half feet tall and three and a half feet wide (Neville et al, 2023). Along with these specific size recommendations, there are many less specific recommendations, the majority being that rat cages need to be large and tall (Blue Cross, 2024; PDSA, n.d.; RSPCA, 2023). Double-decker or multilayered enclosures are recommended to increase the height and provide more areas for the rats to climb (Blue Cross, 2024; Housing and Husbandry: Rat, 2020; Quesenberry et al, 2024). These recommendations take into consideration that rats are very active creatures who need a large area to run, climb, stretch, and explore (PDSA. n. d.; RSPCA 2023). The flooring of rat enclosures should be solid instead of wire mesh because wire flooring can cause injury to a rat's feet and legs (Quesenberry, et al 2024). Rats prefer solid flooring and often show signs of stress when housed on wire flooring for long periods, which can be detrimental to their health (Housing and Husbandry: Rat. 2020). If the shelves throughout a rat's enclosure are composed of wire, then it is recommended that the openings be no larger than half an inch by half an inch to reduce the risk of leg entrapment (Quesenberry et al, 2024). Other recommendations include the type of bedding that is used within rat enclosures. Using wood shavings is recommended by multiple articles, but they warn that using this is controversial because certain types contain certain oils that can cause skin ailments and respiratory infections (Blue Cross, 2020; Quesenberry et al, 2024; Quesenberry et al, 2020). Paper or cloth bedding is preferred because they do not pose the same health risks that wood shavings do (Quesenberry et al, 2020; Quesenberry et al, 2024).

### ***Guinea Pigs***

When researching guinea pigs' housing, the three topics of housing-related injuries, housing requirements, and substrates continued to reappear throughout the literature.

Pododermatitis, also known as bumblefoot in guinea pigs, is the inflammation of the skin on the paw of an animal. Pododermatitis can lead to amputation or even death in guinea pigs if not caught and treated quickly. One of the main causes of pododermatitis in guinea pigs is inadequate housing. According to Riggs, “uninterrupted time on wire mesh may predispose the guinea pig to pododermatitis” (Riggs, 2009). She also mentions that wired floors can cause guinea pigs' limbs to become entrapped which can lead to serious injuries. The authors of “Ferrets, Rabbits and Rodents” agree with Riggs and believe that solid flooring is superior to wired flooring because of how common foot and leg injuries are for guinea pigs who are kept on wire (Pignon and Mayer, 2020; Vogelnest, n.d.). Additionally, pressure from wired bottoms on the plantar surface of guinea pigs' feet is one of the main causes of pododermatitis (Schoemaker & van Zeeland, n.d.). This inflammatory disease is common in guinea pigs and can be deadly. There are many ways to prevent this which include avoiding wire floors as a whole and instead providing guinea pigs with a solid floor space or, if the use of a wired floor is unavoidable, provide a solid area where the animals can get off the wired section or cover the floor with adequate padding to create a barrier between the animal's foot and the wired mesh (Riggs, 2009; Schoemaker and van Zeeland, n.d.). In the literature, there were quite a few housing recommendations, although most were nonspecific when it came to size. These requirements include a well-ventilated area, wire sides, a solid bottom, and adequate space (Riggs, 2009). Ventilation in guinea pig cages is needed to prevent the build-up of ammonia from the guinea pig pee. A build-up of ammonia can cause health issues for the animals living in that area. A solid floor is recommended because it reduces the risk of pododermatitis developing in guinea pigs.

Adequate space is recommended because “lack of exercise, confinement to a small space” can increase the risk of various diseases. Exercise, unencumbered movement, and not being confined to small spaces are important in maintaining good health in guinea pigs (Riggs, 2009; Schoemaker and van Zeeland, n.d.). Guinea pigs also need enough space in their enclosure for multiple hide boxes because they are prey animals and, therefore, need areas to hide and feel secure which reduces the risk of stress-related diseases (Riggs, 2009). The substrates in guinea pig housing can also impact their health. Substrates that contain aromatic oils, such as cedar and pine shavings, can lead to the development of respiratory infections and should be avoided (Pignon and Mayer, 2020; Riggs, 2009). Instead, the use of foam rubber, towels, hay, fleece, and non-aromatic shavings is recommended (Schoemaker and van Zeeland, n.d.). These provide guinea pigs with a safe and non-harmful layer to walk and live on.

## **Methodology**

To determine the best housing practices for rabbits, guinea pigs, and rats, both qualitative and quantitative research methods including a survey, interviews, and literature reviews were employed. A survey was distributed through multiple small mammal Facebook groups to collect data. The survey asked pet owners about the species and number of pets they own, the number and details of their enclosures, their sources of information on pet care, and whether they take their pets to the vet. The questions aimed to gather information on the types and quantities of companion animals owned by the survey participants, as well as the specific supplies used to house them. Additionally, pet owners were surveyed about their pets' medical history, including past diagnoses and the cause of any injuries or illnesses. This provided statistical evidence of the housing and care of exotic pets from multiple primary sources. The decision to collect both qualitative and quantitative data through a survey was made to enable comparison with existing



literature and veterinarian recommendations. During the interviews, five veterinarians specializing in exotic animals were asked about their enclosure and bedding recommendations for different species, as well as their advice for pet owners. Additionally, they were questioned about any past medical cases involving rabbits, rats, or guinea pigs, particularly those related to enclosure or bedding injuries or diseases. This was aimed to gather insights from individuals with extensive knowledge and experience in pet care to provide the most informed recommendations. A comprehensive literature review was conducted to gather information on proper housing practices for rabbits, guinea pigs, and rats. The literature provided scientific data to support their recommendations as the best practices. This literature review broadened the sources of recommendations beyond solely relying on veterinarian advice, enabling a more comprehensive comparison of pet care recommendations.

## Survey Results

| Survey Results for Rabbits: | Enclosure(s) information:                                                                                                                                                                                                                        | Bedding:                            | Medical history for 2023: | Where they get their pet care information:                          | Do they meet the recommendations:                                |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|---------------------------|---------------------------------------------------------------------|------------------------------------------------------------------|
| Response 1                  | Rabbit Hutch Indoor<br>Outdoor Rabbit Cage<br>Bunny Cage with Run,<br>No Leak Pull Out Tray,<br>Wire Fence <ul style="list-style-type: none"> <li>- 2 levels</li> <li>- 8.3 squared ft</li> <li>- Wired sides</li> <li>- Wired floors</li> </ul> | Paper                               | None                      | Internet<br>Facebook Groups                                         | Size: No<br>Ventilation: Yes<br>Flooring: No<br>Substrate: Yes   |
| Response 2                  | EveryYay Rabbit Hutch Habitat <ul style="list-style-type: none"> <li>- 11.425 squared ft</li> <li>- Wired sides</li> <li>- Solid floor</li> </ul>                                                                                                | Fleece and Care fresh paper bedding | None                      | Internet<br>Facebook Groups                                         | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: Yes |
| Response 3                  | Free roam in my room.                                                                                                                                                                                                                            | Blankets and Carpet                 | None                      | Internet<br>Facebook Groups<br>Veterinarians<br>Youtube<br>Articles | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes                   |

|            |                                       |              |                               |                                 |                                                                                      |
|------------|---------------------------------------|--------------|-------------------------------|---------------------------------|--------------------------------------------------------------------------------------|
|            |                                       |              |                               |                                 | Substrate: Yes                                                                       |
| Response 4 | Homemade Enclosure<br>- 27 squared ft | Towels       | One visit to get one neutered | Internet<br>Youtube<br>Articles | Size: Yes<br><br>Ventilation: Unknown<br><br>Flooring: Unknown<br><br>Substrate: Yes |
| Response 5 | Unknown<br>- 9 squared ft             | Wooden floor | None                          | Internet                        | Size: No<br><br>Ventilation: Unknown<br><br>Flooring: Unknown<br><br>Substrate: Yes  |

| Survey Results for Rats: | Enclosure(s) information:                                                                                                                                                             | Bedding:                 | Medical history for 2023:           | Where they get their pet care information:                          | Do they meet the recommendations:                                           |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Response 1               | Prevue Pet Products Earthtone Dusted Rose Rat & Chinchilla Cage<br>- Multileveled<br>- 14.69 cubic feet<br>- L: 2.58 ft, W: 1.71 ft, and H: 3.33 ft<br>- Wired sides<br>- Wired floor | Towels                   | One visit for an injured leg.       | Internet<br>Facebook Groups                                         | Size: No<br><br>Ventilation: Yes<br><br>Flooring: No<br><br>Substrate: Yes  |
| Response 2               | Prevue Pet Products Feisty Ferret Home, Black Hammertone<br>- Multileveled<br>- 14.98 cubic ft<br>- L: 2.58 ft, W: 1.66 ft and H: 3.5 ft<br>- Wired sides<br>- Wired floor            | Care fresh paper bedding | None                                | Internet<br>Facebook Groups<br>Veterinarians<br>Youtube<br>Articles | Size: Yes<br><br>Ventilation: Yes<br><br>Flooring: No<br><br>Substrate: Yes |
| Response 3               | Full Cheeks Chew Proof Small Pet Habitat<br>- Multileveled<br>- 9.79 cubic ft<br>- L: 2.558 ft, W: 1.683 ft,                                                                          | Fleece and Paper         | One visit for an injured foot/nail. | Internet<br>Facebook Groups<br>Youtube                              | Size: No<br><br>Ventilation: Yes<br><br>Flooring: No<br><br>Substrate: Yes  |

|            |                                                                                                                                                                                                                                                              |                                         |                                                                                                                     |                                                         |                                                                             |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------|
|            | <ul style="list-style-type: none"> <li>- and H: 2.275 ft</li> <li>- Wired sides</li> <li>- Wired floor</li> </ul>                                                                                                                                            |                                         |                                                                                                                     |                                                         |                                                                             |
| Response 4 | Midwest Double Critter Nation <ul style="list-style-type: none"> <li>- Multileveled</li> <li>- 24 cubic ft <ul style="list-style-type: none"> <li>- L: 3 ft, W: 2 ft, and H: 4 ft</li> </ul> </li> <li>- Wired sides</li> <li>- Solid floor</li> </ul>       | Reptisoil, CocoFiber, and Sphagnum Moss | Several trips for upper respiratory infections and a trip for a tumor.                                              | Facebook Groups Veterinarians Youtube                   | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: No             |
| Response 5 | Unknown                                                                                                                                                                                                                                                      | Paper and Wooden shavings               | Several visits because one rat couldn't gain weight and had tumors. Another one has an upper respiratory infection. | Internet Facebook Groups Veterinarians Youtube Articles | Size: Unknown<br>Ventilation: Unknown<br>Flooring: Unknown<br>Substrate: No |
| Response 6 | Midwest DCNx1, Japanese enclosure <ul style="list-style-type: none"> <li>- Multileveled</li> <li>- 15 cubic ft <ul style="list-style-type: none"> <li>- L: 3 ft, W: 2 ft, and H: 2.5 ft</li> </ul> </li> <li>- Wired sides</li> <li>- Solid floor</li> </ul> | Shredded paper                          | Monthly vet visits for Mites, URI, HLD, Fight wounds, etc.                                                          | Internet Facebook Groups Veterinarians Articles         | Size: No<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: Yes             |
| Response 7 | Unknown                                                                                                                                                                                                                                                      | Hemp                                    | None                                                                                                                | Unknown                                                 | Size: Unknown<br>Ventilation: Unknown<br>Flooring: Unknown<br>Substrate: No |
| Response 8 | Midwest Critter Nation <ul style="list-style-type: none"> <li>- Multileveled</li> <li>- 15 cubic ft <ul style="list-style-type: none"> <li>- L: 3 ft, W: 2 ft, and H: 2.5 ft</li> </ul> </li> <li>- Wired sides</li> <li>- Solid floor</li> </ul>            | Bioactive coco fiber                    | None                                                                                                                | Internet Facebook Groups Veterinarians Youtube Articles | Size: No<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: No              |
| Response 9 | Critter Nation<br>Prevue Pet Products <ul style="list-style-type: none"> <li>- Multileveled</li> <li>- 23.96 cubic ft <ul style="list-style-type: none"> <li>- L: 3.08</li> </ul> </li> </ul>                                                                | Fleece                                  | None                                                                                                                | Internet Facebook Groups Veterinarians Youtube          | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes                              |

|  |                                                                           |  |  |  |                |
|--|---------------------------------------------------------------------------|--|--|--|----------------|
|  | ft, W:<br>1.93 ft,<br>and H:<br>4.03 ft<br>- Wired sides<br>- Solid floor |  |  |  | Substrate: Yes |
|--|---------------------------------------------------------------------------|--|--|--|----------------|

| Survey Results for Guinea Pigs: | Enclosure(s) information:                                                                                                                   | Bedding:      | Medical history for 2023:                                       | Where they get their pet care information:                          | Do they meet the recommendations:                                |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------|
| Response 1                      | Kaytee My First Home Guinea Pig or Rabbit Starter Kit 30" x 18" x 16.5"<br>- 3.75 squared ft<br>- Wired sides<br>- Solid floor              | Paper         | One visit for an injured paw.                                   | Internet<br>Facebook Groups                                         | Size: No<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: Yes  |
| Response 2                      | Guinea pigs: Piggy Condo C&C Cage 2x6<br>- 12 squared ft<br>- Wired sides<br>- Solid floor                                                  | Fleece        | None                                                            | Internet<br>Facebook Groups<br>Veterinarians<br>Youtube<br>Articles | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: Yes |
| Response 3                      | AIR10 Outdoor and Indoor Bunny Hutch (Inner Space 8.3ft <sup>2</sup> ) - Rabbit Hutch<br>- 8.3 squared ft<br>- Wired sides<br>- Wired floor | None          | Two visits for foot injuries.                                   | Facebook Groups<br>Youtube                                          | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: No  |
| Response 4                      | 5x2 C&C Cage<br>- 10 squared ft<br>- Wired sides<br>- Solid floor                                                                           | Fleece        | None                                                            | Internet<br>Facebook Groups<br>Veterinarians<br>Youtube<br>Articles | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: Yes |
| Response 5                      | Full Cheeks™ Easy Build Spacious Home.<br>- 7.53 squared ft<br>- Wired sides<br>- Solid floor                                               | Paper bedding | One visit for an upper respiratory infection and a foot injury. | Internet                                                            | Size: Yes<br>Ventilation: Yes<br>Flooring: Yes<br>Substrate: Yes |
| Response 6                      | Hagen Living World Deluxe Habitat, Medium<br>- 4.03 squared ft<br>- Wired sides<br>- Solid floor                                            | None          | Two visits for upper respiratory infections.                    | Internet<br>Facebook Groups                                         | Size: No<br>Ventilation: Yes<br>Flooring: Yes                    |

|  |  |  |  |  |               |
|--|--|--|--|--|---------------|
|  |  |  |  |  | Substrate: No |
|--|--|--|--|--|---------------|

Due to limited survey results, it is difficult to accurately determine the pet practices of current rabbit, rat, and guinea pig owners. From what was gathered, 40% of the survey respondents who own rabbits had enclosures that met all of the recommendations from the veterinarians and the literature. These enclosures were ten square feet or larger. They have proper ventilation, solid flooring, and a substrate that will not cause harm to the rabbits. The other 60% had one or two areas that did not meet the veterinarian and literature recommendations. Only 11.11% of the survey respondents who own rats house their pets in enclosures that meet all of the recommendations from the veterinarians and the literature. These enclosures have a minimum height of three and one-half feet, are at least two and one-half feet long, and are one and one-half feet wide. They also have proper ventilation, solid flooring, and safe bedding. The other 88.89% of enclosures had potential hazards. However, most rat enclosures did not meet the recommendations due to their wired floors. Since pet owners were not asked to submit a photo of their enclosures, it is impossible to know how or if they used their bedding to cover the wired floors. If the pet owners are completely covering the wire with adequate bedding to protect their rat's feet, then the wired floor would not be an issue. Since how these owners are specifically setting up their cages is unknown, the safety of their cages can not accurately be determined. Based on the results, 66.66% of the guinea pig enclosures met the veterinarian and literature recommendations. These enclosures are four square feet or larger, they have good ventilation, solid floors, and guinea pig safe substrates. The other 33.34% of the guinea pig enclosures did not meet the recommendations.

## **Comparative Discussion**

### ***Rabbits***

Based on the literature review, the recommended rabbit cage is large, well-ventilated, with scent-free substrate and solid floors that is connected to a very large free-roam area that contains items the rabbit can use for exercise and play. Based on the veterinarian interviews, the recommended enclosure for rabbits is a large, well-ventilated enclosure with a scent-free soft substrate and solid floors that has an attached free-roaming area. The literature provided many different size recommendations and, when combined, it was determined that the minimum hutch size for a rabbit should be ten square feet while the free-roam or exercise area should be a minimum of twenty square feet. Veterinarian 3 stated that a rabbit hutch “should be big enough for them to hop at least two hops in either direction from the center”, which is around seven feet long (Veterinarian 3, 2024). This, along with the two-foot width recommendation, makes the minimum recommended hutch size for pet rabbits fourteen square feet. Veterinarians 1, 2, and 4 did not provide an exact cage size and, instead, stated that a rabbit hutch should be large enough that “they can comfortably move around, hop, stretch, and “flop” down, which is just laying down completely spread out and that “they should be able to hop around and have room to run” (Veterinarian 1, 2024; Veterinarian 2, 2024; Veterinarian 4, 2024). All four veterinarians recommended providing pet rabbits with an area to free roam. Veterinarian 2 recommends that this area contain things for them “to play with, run through, and jump off of” to help keep them happy and entertained (Veterinarian 2, 2024). Similarly, the literature and veterinarians recommend an enclosure that is well-ventilated to keep the space safe for rabbits. If a rabbit's enclosure is not well-ventilated the build-up of ammonia from their urine can cause illnesses (Creating a Good Home for Rabbits 2023; Housing Rabbits 2024; Suitable Environment for Rabbits 2022). The recommended substrate is another aspect of housing that the literature and Veterinarians 1 and 3 agreed on. The literature recommends substrates like paper bedding, hay,

or straw because wood shavings can have oils in them that are harmful for the rabbit to smell or ingest (Housing and Bunny-Proofing, 2024; Suitable Environment for Rabbits, 2022).

Veterinarian 1 stated that they “recommend staying away from any scented substrates because they can cause respiratory issues” (Veterinarian 1, 2024). Veterinarian 3 stated that pet owners should “avoid anything with a pointy edge or things that could be ingested. Things like cedar or pine shavings can lead to eye injuries if they get poked by a sharp edge” (Veterinarian 3, 2024).

Veterinarian 3 then states that “my favorite substrate is CareFresh, it’s easily cleaned and soft and does not cause any injury or harm” (Veterinarian 3, 2024). CareFresh is a paper bedding brand.

Veterinarian 4 recommended fleece mats and rugs for free-roaming areas and fleece or paper bedding in their main enclosure to provide a soft cushion under their paws that won't cause injury (Veterinarian 4, 2024). Veterinarian 2 did not provide any substrate recommendations.

Finally, the literature and all four veterinarians agreed that solid flooring is what is best for rabbits, not wired flooring (Veterinarian 1, 2024; Veterinarian 2, 2024; Veterinarian 3, 2024; Veterinarian 4, 2024).

### ***Rats***

Based on the literature, the recommended enclosure for rats is a large, tall, well-ventilated enclosure that is multi-layered, has solid floors, and has a scent-free substrate. Based on the veterinarian's recommendations, rats do best in large, tall, multi-layered enclosures that have solid floors, and a scent-free substrate. When compared, the veterinarian recommendations and literature recommendations are identical. Although none of the veterinarians gave exact enclosure size recommendations they all stated that rats do best in “large”, “big”, and “tall” cages. Most of the literature also lacked a specific cage size; two stated that the recommended minimum height for a rat enclosure is “3.5 feet” (Caring for your pet rat: Advice & guidance,

2024; Neville et al, 2023). Other literature recommended “large” and “tall” enclosures for rats. Throughout the literature, wired sides are recommended for rat cages because they allow adequate ventilation. The veterinarians also recommend cages that have wired sides instead of solid sides because, according to Veterinarian 3, “wired sides help with increased ventilation” (Veterinarian 3, 2024). Veterinarian 4 said that like in guinea pigs, respiratory infections are common with rats and that good ventilation can lower a rat's risk of respiratory issues (Veterinarian 4, 2024). Veterinarians 1 and 2 also recommended well-ventilated cages for rats (Veterinarian 1, 2024; Veterinarian 2, 2024). The literature recommends multi-leveled or double-decker enclosures for rats. All four veterinarians also recommend multi-layered cages for pet rats. According to Veterinarian 4, “Rats are smart animals, and having multiple levels to explore and climb on can help provide stimulation and exercise” (Veterinarian 4, 2024). Similarly, the literature and veterinarians agree that solid flooring is better for rats than wired flooring. All four veterinarians mentioned the increased risk of injuries that rats face when housed on wire flooring. Literature also recommends solid flooring for rats because wired flooring can lead to “pododermatitis” and “leg injuries.” Finally, both the literature and the veterinarians recommend using scent-free substrates when housing rats. The literature states that scented substrates can cause “ skin ailments” and “respiratory infections” (Caring for Pet Rats and Mice, 2020; Quesenberry et al, 2024; Quesenberry et al, 2020). The veterinarians recommended scent-free substrates due to the health risks posed by scented substrates, such as “respiratory issues” or “injuries.”

### ***Guinea Pigs***

Based on the literature review, the recommended guinea pig enclosure is an enclosure that has wired sides, a solid floor, enough room for the animal to run around in, enough room for



multiple houses or hide boxes, and a scent-free substrate. Based on the veterinarian interviews the recommended guinea pig enclosure is an enclosure that has wired sides, a solid floor, is a minimum of four squared feet, and has soft, non-sharp substrates. When compared, the literature recommendation and veterinarian recommendations are almost identical. The literature review did not provide an exact size recommendation for guinea pig enclosure; instead, they stated that the cage should be large enough for exercise and hide boxes. All four veterinarians supported this with their recommendations. Neither Veterinarian 4 nor 2 provided an exact enclosure size recommendation; however, Veterinarian 2 did state that the cage should provide “enough room to run around” and enough space for “multiple houses or hiding places” because guinea pigs are “prey animals and feel safe if they have many places to hide and rest” (Veterinarian 2, 2024). Veterinarian 3 provided a more exact cage size recommendation, which is four to six square feet for a single female guinea pig with an extra two square feet for each additional guinea pig (Veterinarian 3, 2024). Veterinarian 1 stated that the guinea pig enclosure should be four times the length of the guinea pig and the width should be three times the length of the guinea pig (Veterinarian 1, 2024). This comes out to a minimum of six square feet of space, depending on the guinea pig sizes used as a measuring tool. The literature and veterinarians both support and endorse the use of solid floors instead of wired floors. One piece of literature states that “uninterrupted time on wire mesh may predispose the guinea pig to pododermatitis” (Riggs, 2009). Both Veterinarians 1 and 3 stated something similar. Veterinarian 1 stated “Some cage-related injuries I have seen during my time as a vet for all three of these animals are foot injuries such as pododermatitis, broken legs, and damaged toes. These are usually due to cages that have wired floored bottoms. The pads on their feet don't do well if they are in constant contact with the wire and sometimes their toes or nails can be caught in the wire

which causes them to panic and get injured trying to escape” (Veterinarian 1, 2024). Veterinarian 3 said that “with wired bottoms, these animals get a lot of secondary foot issues, plastic flat bottom cages are ideal” and that “some common injuries happen when they get their feet stuck between the bars or pododermatitis or pressure sores from being on the improper floors” (Veterinarian 3, 2024). Enclosures that are well-ventilated are another recommendation from both the literature, Veterinarian 3, and Veterinarian 4. Both the veterinarians and the literature agreed that a lack of ventilation can lead to ammonia building up within the enclosures, which can be harmful to a guinea pig's physical health. Veterinarian 4 stated that “Guinea pigs have sensitive respiratory tracts and if they do not have good ventilation, they can easily develop respiratory issues like an upper respiratory infection” (Veterinarian 4, 2024). Finally, both the literature and all four veterinarians insisted that substrates without a smell are best for guinea pigs. Veterinarian 3 added that “soft substrate is less likely to cause harm or injury than substrates like wooden shavings or pellets”, which could cause eye injuries if the animal gets poked, due to their sharpness (Veterinarian 3, 2024).

### **Limitations**

There are a few limitations in this study that centered around the survey and gaps in literature. The first limitation concerns the survey that was posted in multiple Facebook groups. The responses were less than anticipated, which provided an insufficient sample size for accurate statistical measurements. There are many reasons that can explain why this occurred. People may be potentially nervous about providing information about their enclosures to studies that are examining proper care and enclosures. If someone thinks their enclosure will not meet the recommendations, they may not want to be involved in the study to ensure their enclosure choices are not used as an example of an improper enclosure. Another reason for the lack of

responses could be that some people rarely check their Facebook accounts and, therefore, did not see the survey. A way to avoid these issues in the future is to post the survey in more diverse locations so more people can view it. More visualization could gather more responses. The second limitation involves the questions in the survey. The survey asked subjects to provide the make and model of their enclosure. This provided a way to determine the exact aspects of the enclosures but failed to show what pet owners included inside the enclosure. This made it difficult to determine if some of the enclosures truly failed to meet the veterinarian and literature recommendations. Many of the rat enclosures had wired flooring. These floors can be made safe for rats if the wire is covered by bedding. However, without seeing the exact setup of the rat enclosures it was impossible to see if pet owners took the steps necessary to make the wired floors safe. To overcome this, future surveys should request photographs of pet owners' enclosures. The third limitation involves the lack of previous research on this topic. There were many sources that provided valuable information, but most provided vague recommendations when it came to enclosure sizes. Only a few gave specific size recommendations. This made it difficult to determine exact cage size recommendations for rabbits, rats, and guinea pigs.

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