

## Understanding standard for guinea pig production in Nigeria: A review

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Target Audience: Livestock farmers; meat scientists and researchers.

### Abstract

Guinea pig (*Cavia porcellus*) is a promising micro-livestock which though is indigenous to South America, is also well adapted to Nigerian ecosystem. The meat is nutritious, with a protein content of 21%, which is higher than that of poultry, pork, mutton or beef. About 65% of its meat is edible with a low fat content and low cholesterol, making it the ideal meat in an increasingly health-conscious population. The animal has a short gestation period of (58-72 days), low cost of production, matures early, easy to manage and requires relatively little capital to set up. Nigerians are among the least consumers of animal protein in Africa, consuming less than World Health Organization's (WHO) recommended 67 g per day. The commonly conventional livestock species reared cannot meet the protein deficiency because their multiplication rate is not commensurate with the rapid increase in human population. In Nigeria, if the challenges of availability of quality concentrate feeds, problem of numerous pests and diseases, problem of excessive heat and problem of obtaining fast growing species of pups can be overcome, then guinea pigs farming has the potential of bridging the present protein deficiency gap in Nigeria.

**Key words:** Micro-livestock, guinea pig and Nigeria ecosystem.

### Description of Problem

Guinea pig (*Cavia porcellus*), also known as cavy or cuy is a small stocky tailless rodent commonly used in biochemical research. They are not at all related to swine (1). Guinea pig originated in the Andes Mountains of South America, where they are still of importance as a meat animal and have a role in religious ceremonies and medicine (2). Its meat is an important source of animal protein in Peru for poor families whose basic diet is potatoes and rice (3). Vastly accumulated research started in the 1960s on guinea pig (4).

Its meats has a protein content of about 21%, which is higher than that of pork, chicken, beef or mutton, and lower fat

content of about 8%, with the presence of omega-3 fatty acid, low cholesterol level and high concentration of vitamin B (5, 6, 7). The animal has a body weight of between 700-1200 g and can measure up to 20-25 cm in length (8). The meat of guinea pig resembles that of rabbit in terms of colour, texture, consistency and taste (9, 10).

Guinea pig is a rodent considered as a very promising micro-livestock species for rural development because it requires little capital equipment, space and labour (7, 11, 12, 13). They are easily handled and rarely bite; however, when they are excited, they will stampede or circle their enclosure and likely scratch. The males are called boar while females are sow and young ones, pups.

The types of guinea pigs used for consumption differ from their experimental or pet counterparts and nutritional requirement in the laboratory-type or pet-type are thus different to extrapolate to meat-type.

Guinea pigs are popular as pets worldwide and hobby breeders have selected animals for coat characteristics over the past 40 years (2); varieties such as the English and American have smooth, short hair whilst, the Abyssinian has short hair including the Angora (smooth-haired) and Peruvian (rough-haired) (14).

The production of guinea pig has also gained some significance in countries of West Africa and Asia such as Ghana, Togo, Cameroon, Cote d'Ivoire and Philippines as source of meat (15). Nevertheless today guinea pig provides a better opportunity to help poor households to overcome the situation of severe food insecurity and poverty.

In Nigeria, the deficit of protein facing the populace is no longer news; it is on record that Nigerians are among the least consumers of animal protein in Africa (16) consuming less than 67 g of protein as recommended by World Health Organisation (WHO) (17). Despite more of conventional livestock species reared in larger number, they have not been able to meet the expectation and demand of the population. These manifest in the price of kilogram of meat ranging from 2,000 to 2,500 naira (18), which most citizens can't afford. Furthermore, demand for animal products continues to increase as the population increases. This present scenario calls for increased rearing of animals that could cushion rising demand for animals and their products. Exploiting and engaging in the keeping of the so called unconventional or micro-livestock, becomes necessary and handy in this condition (19). The review set

to provide a better understanding of guinea pig farming in order to boost livestock production in the country.

### **Origin and distribution of guinea pigs**

Common guinea pig was first domesticated as early as 500 BC. It was used by mountain tribes in the Andean region of South America. They were first brought to Europe by the Spaniard following the conquest of Peru in 1532 (2). During conquest in 1532, selective breeding resulted in a number of different varieties of domesticated guinea pig which form the basis for some of the modern domestic breeds such as Spanish, Dutch and English in the 1960s.

The origin of guinea pig is even harder to explain; one theory is that the animals were brought to Europe by way of Guinea leading people to think that they had originated there. Another theory suggests that "guinea" in the name is a corruption of "Guiana" an area in South America though, the animal are not native to the region. A common misconception is that they were so named because they are sold as the closest thing to pig one could get for a guinea pig coin.

Guinea pig is not found naturally in the wild. It likely descended from some closely related species of cavies, such as *Cavia operea*, *Cavia fulgida* which are still commonly found in various regions of South America. Wild guinea pig inhabits a variety of environments including rocky, mountain terrains, forest margins, swamps and grasslands (20). They avoid extremes of light preferring subdued light (21), and appear to have activity patterns described as either polyphasic or crepuscular. Guinea pig meat is used as important source of animal protein given that it is a product of excellent quality, and low in fat compared to other meats.

### **Management system of guinea pig**

In the simplest forms of management, a small number of animals (10 – 30) are kept unconfined as a single group in a part of the house, usually the kitchen, or in dedicated shed. They are fed on a mixture of household scraps such as raw vegetables and weeds, together with a small daily ration of good quality cut forage. Under these conditions, in the complete absence of vaccinations or veterinary treatment, animals of unimproved lines suffer from surprisingly few problems of health. They receive no veterinary treatment or special care, except for some protection from predators and the extremes of climate. Under such systems, they are tended by the women and children of the family and used mainly for subsistence and food security. Almost all animals are eaten on the farm. There is little trade in guinea pig, although males are occasionally swapped between families on an attempt to avoid the problems of inbreeding. There may be occasional sales of animals in times of need, but this is not a common practice at the subsistence level, even in the poorest households (22).

To prevent losses due to predators, some families build simple cases for the animals from wood and wire. These are raised stilts, about 0.9 m above ground level, and located at a place where they are protected from the prevailing winds, especially in the cold season. They have slatted or mesh floors, so that the droppings can fall through onto the ground below; and roofs of palm thatch to protect the animals from rain. They are usually sub-divided, so that the adult male can be separated from the immature animals to prevent fights. Females and young animals can be kept together without signs of aggression, until the young males become sexually mature (22).

### **Housing in guinea pig production**

Guinea pig is sensitive to certain climatic conditions and is more tolerant of cold than heat. In traditional breeding to maintain the best condition, it is believed that smoke is needed to reproduce at optimum condition. This belief is not true since they are bred in protected areas, mainly to avoid mortality among breast feeding pups (5). Guinea pig does not burrow, climb or jump to any great degree. this makes them relatively easy to contain in floor opens, battery enclosures and metal or plastic boxes without lids; as long as the minimum height of the wall is 40 cm (19) often wall heights of 18 cm will contain younger animals and most females, but not sexually active males (14).

The animals are messy; they kick food and bedding materials out of cages and pens, defecate and urinate in open food and water containers, and spit and sipper tubes. Water bottle bungs need to be protected with metal chew guards and sipper tubes or nipples should be made of stainless rather than brass (20).

Room temperature should be in the range of 63-79<sup>0</sup>F (17-26<sup>0</sup>C) with 30-70% humidity a relatively constant environmental temperature is more important than a particular temperature within this range (1, 23).

### **Types of housing in guinea pig**

#### **Floor pens**

They are commonly used for harem mating systems and for maintaining large groups of 20-40 animals. The floor is generally concrete, with concrete or metal partitions for walls. The pens should be free of draughts, easily cleanable, and the floor surface kept dry .A pen with a gently sloping floor and floor drain is generally most successful. The watering system should be positioned close to the drain because guinea

pigs are messy drinkers the animals tend to congregate around the edges of the pen and avoid the centre. Bedding such as straw, sawdust and straw, or hay is often used. Although relatively cheap to construct and maintain, floor pens can be an inefficient use of valuable floor space (1).

### **Battery-style caging**

The cage usually consists of vertical rows of long, large metal cages held in a metal framework. The floor may be perforated plastic sheets, wire, or solid plastic or metal with bedding. This style of caging is a more efficient use of limited floor space, but is more difficult to maintain or keep clean due to the restricted vertical height between rows.

Metal or plastic cages are used to house groups or individual animals. This style of housing is most suitable for animals maintained for experimental purposes, or for housing a sow and litter. It is also the most expensive form of caging. Lids are not necessary if the sides of the cage and high enough (40 cm high). Solid floor cages with bedding retain heat, which may be an advantage or disadvantage depending on the sophistication of ventilation and temperature control in the facility. This system is labour intensive due to the more frequent need to clean the cage and change the bedding and the tendency for guinea pigs to kick bedding materials out of the cage. Automatic watering systems for solid floor cages should be located outside the cage to minimise the danger of flooding. Wire floored cages reduce the labour requirement for cleaning, although there are more problems with leg and foot injuries and with draughts (1).

### **Feeding requirement of guinea pig**

Guinea pigs are herbivorous and in the wild live on a variety of green foods, seeds and nuts. In the laboratory, they are usually

fed a commercially prepared pelleted diet. Pelleted rations for guinea pigs are usually both smaller and softer than those for other rodents. The guinea pig eats an average of 6 g of food per 100 g of body weight every day. There is some evidence that food preference is established by experience early in the life of the cavy, and it has been suggested that this is associated with the particular microorganisms that become established in the intestinal tract. Nevertheless, personal experience suggests that cavies can acquire new preferences. They are much more likely to adopt a new food when they are very hungry, and with time may acquire a taste for it. Cavies need large amounts of vitamin C, and this is best acquired through fresh foliage. Cavies will tire of the same food given continuously. Guinea pigs should always be supplied with clean fresh food. Commercially prepared guinea pig diets contain an average of 18-20% protein, 4% fat and 16% fibre along with recommended levels of vitamins and minerals (23). Nutrient composition and nutrient requirements of guinea pigs are shown in Tables 2 and 3 respectively.

Guinea pigs, like monkeys and man must have a dietary source of vitamin C. On a weight to weight basis, the guinea pig requirement for vitamin C is about ten times that of man. Examples of the sources are shown in Table 4. The guinea pig cannot store vitamin C to any significant extent. The dietary requirement for ascorbic acid is due to lack of the enzymes L-gulonolactone oxidase (14). L-gulonolactone oxidase is an enzyme that produces vitamin C, but is non-functional in humans and guinea pigs.

Calcium and phosphorus are important in all diets for normal growth and bone metabolism. In the guinea pig, calcium, phosphorus and magnesium also have an important role in regulating acid-base balance, and their complex interrelationship

can affect the occurrence of metastatic calcification of soft tissues. The dietary calcium: phosphorus ratio may safely vary considerably if magnesium is provided in sufficient amounts. The nutritional Research Council recommended dietary level of 0.8-1.0% calcium, 0.4-0.7% phosphorus, and 0.1-0.3% magnesium (23).

Guinea pigs have a high dietary fibre requirement, approximately 35% (24), which is best met by supplying them with good

quality Lucerne hay. Hay can be autoclaved if this is considered necessary for infection control reasons (1). Other well preserved leafy hay could also be used. The guinea pig does not adapt well to abrupt changes in diet (taste, odour, texture, form) or feeder type, either of which may cause in appetite. Dietary changes should be introduced gradually over several days. Experimental diets should ideally be initiated within a few days after birth (23).

**Table 2: Guinea pig nutritional requirements**

Nutrients	Stage		
	Gestation	Breast-feeding	Growing
Proteins (%)	18.0	18.0-22.0	13.0-17.0
Digestible energy (Kcal/kg)	2800.0	3000.0	2800.0
Fibre (%)	8.0-17.0	8.0-17.0	10.0
Calcium (%)	1.4	1.4	0.8-1.0
Magnesium (%)	0.1-0.3	0.1-0.3	0.1-0.3
Potassium (%)	0.5-1.4	0.5-1.4	0.5-1.4
Vitamin C (mg)	200.0	200.0	200.0

Source: (5).

**Table 3: Sources of vitamin C for guinea pig**

Vegetables	Fruits	Fresh Herbs
Celery	Banana	Parsley
Radish	Pears	Coriander
Cucumber	Apple	rocket leaves
Carrots	Grapes	water cress
Tomatoes	Pawpaw	Basil
Capsicum	Watermelon	Chives
Cabbage	kiwi-fruit	
Cauliflower	Strawberries	
Spring green		
Spinach		
Snow peas		
Corn on the cob		

Source: (25).

### Reproduction and breeding in guinea pig

Guinea pigs are most commonly bred in a polygamous (harem) system. In this system one male is housed with four to 20 females (20). When the guinea pigs reach puberty, they are able to reproduce. It is called

puberty when the female has her first period and the male can cover the female. Females reach puberty within 6 to 8 weeks. This depends on its lineage and the food that they are given. The males reach puberty 1 to 2 weeks after the females (5).

Male guinea pigs may exhibit several behaviour as early as 30 days of age, but fertile mating are usually not achieved until 3-4 months of age. The average age of first estrus in the female is 68 days, although first breeding usually is not until 3 months. Delay of first breeding past 7 months has been associated with incomplete relaxation of the pubic symphysis during parturition, resulting in dystocia and potential fetal and material death (23).

The estrus cycle has an average length of 16 days (2, 21). In the female, the vaginal opening is closed by a membrane except during estrus, parturition and days 20-25 of gestation (21). Estrus is characterized by behavioural changes such as the lordosis posture of the female in the presence of the male (20), rupture of the vaginal membrane and mucus secretion. During estrus, which usually occurs in the evening (21) and lasts 6-11 hours, the female is receptive to the male. Ovulation occurs spontaneously, approximately 10 hours after the onset of estrus. Typically, two to four ova are released (20), however, litters of up to eight have been recorded (2).

In the 5-10 minutes period following copulation, coital completion is indicated by grooming, scooting and perineal marking by the boar sperm in the vagina and a copulatory plug protruding from the vulva. The vaginal plug is composed of largely of secretions from the male's accessory sex gland, and usually fills the vagina from cervix to vulva. The waxy plug will fall out of the vagina in several hours and may be detected in or under the cage (23).

Litters can contain up to seven young, although three or four are commonly born at a time. They are born fully-formed and will suckle immediately. They are capable of eating cut pasture within few hours of birth, so clean, high-quality forage should be provided at all times. The mothers produce

milk for a period of about 14 days, after which the young should be fully weaned (22).

Certain production periods exist in guinea pig breeding. To be successful in guinea pig breeding, you should be careful with the phases of mating, gestation, birth, breast feeding, weaning, breeding and selection of repositioning nurseries.

### **Monogamous pair**

Guinea pig mating system often involves maintaining the male and female together. Presence of the male at parturition takes advantage of the usually fertile postpartum estrus of the female. In a monogamous mating system, a sow is placed with one boar. Monogamous pairing is used most commonly for the propagation of inbred strains, but is relatively inefficient because of the relatively large numbers of boars that must be maintained.

### **Polygamous group**

The most efficient method of breeding guinea pigs is with polygamous groups of one boar to 4-20 sows. One boar per 12 females seems to be the optimal ratio, provided the adequate space is available. Most often the male is left with the females for the breeding life of the group, which is usually about 18 months. The females can be removed from the group for farrowing if accurate dating of births is required (20, 23).

### **Health care management in guinea pig**

Good animal husbandry, combined with knowledge and understanding of the biology and behaviour of the guinea pig, are the keys to prevention of most animal health problems. Well-designed housing which is easy to maintain and clean for the comfort and wellbeing of the animal is essential. Animal care staff must be adequately trained, observant, and follow good animal

husbandry principles. The day-to-day observations of the animal by the care staff is the most important part of a health monitoring programme. Familiarity of the animal care staff with the normal appearance and behaviour of healthy animals is essential; any deviation should be investigated promptly since it may be the earliest sign that a problem exists. Hand-in-hand with good observation is good record-keeping; production data can indicate changes in colony health status which might otherwise pass undetected (1).

Guinea pigs are susceptible to a wide range of bacterial, viral, fungal and parasitic diseases. Most of these diseases are treatable but expensive. Before making the decision to acquire a guinea pig, consider whether or not you are willing to meet these potential expenses. Sick guinea pigs tend to become less active, with ruffled hair coats and decreased consumption of food or water. If changes in bowel movements, urination, hair loss, discharges or swellings are noted, a veterinarian should be consulted. A wide variety of antibiotics cause toxicity in guinea pigs, so caution should be taken when selecting them for treatment. Respiratory infections including pneumonia are some of the most common diseases. Some of the infectious agents may also cause swelling of the lymph nodes and abscesses. Diarrhoea may be caused by infectious agents, parasites or protozoa. Hair loss can be due to ringworm or parasitic lice or mites, as well as cannibalism or barbering of hair by cage mates. They are also susceptible to the development of bladder stones and bladder infections. Pregnant females may develop toxæmia of pregnancy, which is an emergency situation. In late pregnancy or after giving birth, affected females become depressed, anorexic and generally have an unthrifty appearance. Death occurs rapidly if untreated. This disease can be minimised by

supplying adequate fresh food and water and avoidance of stress and fasting in late pregnancy (14). Some infectious diseases of guinea pigs, such as salmonellosis or ringworm may be contagious to humans. People may also develop allergies to them. If a human disease is suspected due to contact with guinea pigs, the advice of a physician should be sought.

### **Problems and constraints of guinea pig production**

1. Availability of quality feed: The guinea pig is a monogastric herbivore with a large capacity for forage consumption. It can also be given concentrate feed. Combining forage with concentrate is also good for the animal. The challenge is in the production of quality feed mostly concentrates to meet the nutritional requirement of the animal. Commercial feed millers can be encouraged in this regard to consider looking into this area of production particularly now that the interest seems to be on the exploitation of the animal as a source of protein. Such feed need to be of high quality, digestible, readily available and at affordable price (19).

2. Pest and Diseases: This is a great challenge for prospective guinea pig farmers. The animal is attacked by a plethora of diseases and pests. Infection easily leads to reduced productivity. Some of the diseases affecting guinea pigs are; salmonellosis, bordetella, pneumonia, streptococcal pneumonia, antibiotics induced enterotoxemia, haemorrhagic typhilitis, cervical lymphadenitis (lumphs), pod dermatitis (bumble foot), mastitis, dermatophytosis, tyzzers diseases, coccidiosis and scurvy. It is also affected by external parasites such as fleas, mites, lice, mange and bedbugs, internal parasite such as nematodes and *Fasiola hepatica*. The challenge is to know how to prevent, treat or control such diseases or pest infestation.

Adequate feeding and sound sanitation could be of help while veterinarians can assist farmer through education and enlightenment campaign (19). There is also problem of excessive heat especially in the northern part of the country. Due to its stout and compact conformation, the animal more easily tolerates excessive cold than excessive heat (26). Guinea pig normal body temperature is 38.5-40°C (27) and its ideal ambient air temperature is similar to that of human, which is 18-24°C (26). Extreme of humidity outside the range of 30-70% is also not suited to the guinea pig. The maintenance of ideal temperature and humidity in the farm is therefore of paramount importance for good production (26, 27).

3. Obtaining correct breed or species of guinea pigs that are fast-growing and can attain market weights early is also a challenge. Most, if not all of the guinea pig currently reared in the country, are of mixed percentage. This is a great challenge for animal breeders. There is the need to meet this challenge in order to produce breeds that can be more tolerant to the hotter parts of the country, that are diseases or pest resistant and at the same time highly productive (19).

### Conclusion and Application

1. With potentials and opportunities guinea pig production has in Nigeria, guinea pig production will not only enhance livestock farming, it will also help to bridge the protein deficiency gap in the country, reduce the price of other conventional livestock animal and increase the income of the farmers.
2. To achieve these, efforts should be geared towards selecting and developing promising breeds, exploring their nutrient needs, improving the general husbandry of

guinea pigs and fashioning effective disease prevention and control measures.

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