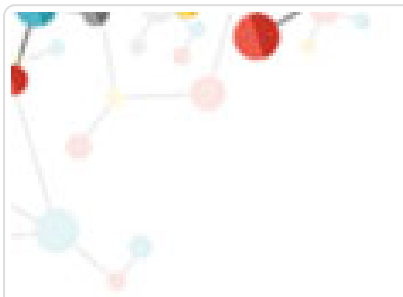




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Girth Anthropometric Variation: a cross-sectional study between Hausa, Igbo, and Yoruba ethnic groups of Nigeria

Girth anthropometry involves measuring the circumferences of various body parts, including the neck, upper arm, chest, mid-thigh, waist, and hips. These measurements are essential in numerous fields, impacting health, fitness, fashion, and forensic investigations. The study aims to evaluate grit...

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The Role of Palmar Dermatoglyphics in Preventive and Diagnostic Medicine: A Review

The study of the patterns of the epidermal ridges of the finger, palm, and sole can help screen a variety of diseases, especially those caused by chromosomal aberrations, which are frequently accompanied by pattern distortion, as well as other genetically and non-genetically determined diseases....

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Biochemical and Histomorphometric Response of Gallic Acid on Gene Expression Levels in Annular Puncture-induced Intervertebral Disc Degeneration using Rabbit Model

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Attenuating Roles of Curcuma longa on Ketamine-induced Neurotoxicity on Hypothalamic-Pituitary-Ovarian Axis of Wistar Rats

The hypothalamic-pituitary-ovarian (HPO) system is mostly affected by toxins, which can cause infertility in mammals. This research investigated the role of Curcuma longa on Ketamine toxicity in the HPO axis of rats. Twenty-five female Wistar rats were assigned into five groups of fi...

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Ameliorative Effects of Cymbopogon citratus Aqueous Leaf Extract on Dichlorvos–induced Hypersensitivity Pneumonitis in Wistar Rats

Occupational dichlorvos exposure can cause organophosphate poisoning, which can be fatal if left untreated. This study aimed to investigate the effects of aqueous leaf extract of Cymbopogon citratus on dichlorvos-induced hypersensitivity pneumonitis in Wistar rats. Thirty Wistar rats weighing b...

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Detrimental effects of prenatal combined delta-9 tetrahydrocannabinol and cannabidiol exposure on placental morphometry and neurodevelopment

(CBD) on the prefrontal cortex, neurodevelopmental indices, placental morphology, and fetal growth in Wistar rats. Pregnant rats received 150 mg/kg of ?9-THC and CBD from gestational day 6 to day 19 or until delivery. Placental morphometry was assessed using Vernier calipers, while the prefronta...

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Morphometry and Significance of the Carrying Angle of Elbow among 18-25 years Old Yorubas in Southwest Nigeria

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The body bequest program is fast becoming a significant source of cadavers for anatomical study. Due to the shortage of cadavers for dissections in institutions across Nigerians, there is a need to investigate untapped sources of cadavers. The objective of this study was to ascertain and determi...

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Anthropometric Predictors of Blood Pressure among Nigerian Children and Adolescents

Elevated blood pressure (Hypertension) is a well-established risk factor for cardiovascular disease. This cross-sectional study of one thousand (1000) Nigerian children and adolescents aged 7 to 18 years in Port-Harcourt City, Rivers State, Nigeria involved the measurements of anthropometric var...

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The "Screaming Woman" Mummy CIT8- A Living Anatomical Fossil?

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Comparative Study of the Thyroid Gland of Juvenile Male Guinea Pigs and Grass-cutters: Hematological and Hormonal Profile

This study presents a comparative examination of the hematological parameters, structure, and function of the thyroid gland between two rodent species: guinea pigs (Cavia porcellus) and grasscutters (Thryonomys swinderianus), which are taxonomically distinct. They are important for research and ...

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Adansonia digitata ameliorates lead-induced hepatic, renal, and bone toxicity in mice

Adansonia digitata (A. digitata) is used in many African and Asian countries for food, beverage and medicine. Lead is one of the toxic heavy metals whose widespread use has resulted in continuous environmental contamination. The current study evaluated the effect of lead acetate on mice's live...

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Estimating the Effect of Stabbing and Evisceration on Decomposition Timeline

This study aimed to evaluate the decomposition rate in pig models that were either stabbed or eviscerated. Six pigs were divided into two groups (A and B), each consisting of three pigs. After euthanizing the animals via stunning, pigs in group A were subjected to repeated stab wounds in the t...

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Ameliorative Effects of Nigella sativa Oil in Hepato renal Toxicity induced by Cyclophosphamide in Wistar Rats

Cyclophosphamide (CP) is a widely used chemotherapeutic and immunosuppressive agent, however, its clinical applications are often limited by its severe toxicity, particularly affecting the liver and kidneys. The search for natural protective agents against CP-induced toxicity has gained signific...

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Effects of Acute and Chronic Propoxur Insecticide Exposure on the Hypothalamic-pituitary-testicular axis in Rat

Propoxur is a carbamate insecticide widely used both in indoor and outdoor place to control insects. This present work was conducted to study the effect of acute and chronic exposure of propoxur (PPX) on hormonal and histological changes in the rat Hypothalamic-pituitary testicular axis. The c...

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Radiofrequency Electromagnetic Radiation from Cell Phones and Human Genetic Defects: Any link?

Cell phones are defined as devices emitting radiofrequency electromagnetic waves (RF-EMW). These waves transmit signals from the cell phones to the base stations and antennas. The number of cell phone users in the world has gone up to 6 billion being the most effective communication tools all ov...

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Mapping of Most-At-Risk Populations (MARPs) for HIV infection in Benue State, North-central Nigeria

Benue State has one of the highest HIV prevalence rates in Nigeria, driven by a combination of high risk sexual behaviors and the presence of most-at-risk populations (MARPs). The mapping exercise aimed to provide accurate information on the size, location and characteristics of MARPs for HIV in ...

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Emerging Buruli Ulcer Infection and Cultural Beliefs among the Tiv People in North-Central Nigeria

Buruli ulcer is a public health concern particularly where the knowledge about the disease is poor. An advent of an emerging wound ulcer epidemic was reported in North-central Nigeria in 2023. A study was then carried out between December 2023 to August 2024 to determine the prevalence and the ...

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Religiosity, Spirituality and Adolescent Substance Use in North-Central Nigeria

Religiosity and spirituality promote good mental health and prevent mental illness but can sometimes become risk factors for substance abuse. This study aimed to assess the associations between religiosity, spirituality and psychoactive substance use among in-school adolescents in Ilorin. The da...

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Depressive State Assessment of Pregnant Women Attending the Antenatal Clinic of University of Ilorin Teaching Hospital (UITH), Ilorin, Kwara State, Nigeria

Antenatal depression, with a global prevalence of between 15 and 65%, is a clinical condition characterised by persistent sadness, anxiety, and hopelessness during pregnancy. It is a strong predictor of postpartum depression, and it negatively impacts pregnancy outcomes, maternal-child bonding, ...

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Prevalence of Soil-Transmitted Helminths among Asymptomatic School Children in Selected Rural and Urban Communities in North-Central Nigeria

Soil-Transmitted Helminths (STHs) are a group of intestinal parasitic nematodes causing diseases in humans when exposed to their infective stages (eggs or larvae) thriving in warm and moist soil. This study ascertains the prevalence of STHs among school children in urban and rural communities in...

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Antihypertensive Potential of Azadirachta indica Methanolic Leaf Extract in Salt-induced Hypertensive Rat Model

Hypertension is a condition arising from persistently elevated blood pressure, leading to severe complications, including death. Factors such as high salt consumption and family history predispose individuals to hypertension. Azadirachta indica (AI) has shown potential in reducing ...

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Comparative Study of the Thyroid Gland of Juvenile Male Guinea Pigs and Grass-cutters: Hematological and Hormonal Profile

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ABSTRACT

This study presents a comparative examination of the hematological parameters, structure, and function of the thyroid gland between two rodent species: guinea pigs (*Cavia porcellus*) and grasscutters (*Thryonomys swinderianus*), which are taxonomically distinct. They are important for research and agriculture, yet little is known about their comparative thyroidal morphology, physiology, and hematological profiles. The study utilized six grasscutters and six guinea pigs with an average weight of 1800 ± 530 g and 210 ± 20 g, respectively. The thyroid gland of the guinea pigs is compact, while the grasscutters are bilobed without an isthmus joining the lobes. The average weight of the guinea pigs' and the grasscutters' thyroid gland weight was found to be 1.69 ± 0.26 g and 2.81 ± 0.37 g, respectively. The relationship between thyroid hormones (triiodothyronine [T3] and thyroxine [T4]) of the guinea pigs and grasscutters was found to be in line with that of most mammals, with the T4 concentration being significantly higher than the T3 concentration. The differences in the Red Blood cell properties of the guinea pigs and grasscutters were found to be significant at $P < 0.05$, being significantly higher in grasscutters. The differences in the guinea pigs' and grasscutters' white blood cell indices were not statistically significant at $P < 0.05$. This study contributes to a deeper understanding of the comparative endocrinology and hematology of guinea pigs and grasscutters, with implications for their use in physiological, toxicological, and pharmacological studies.

Keywords: grasscutters; guinea pigs; hematological parameters; thyroid gland

INTRODUCTION

Comparative anatomy explores the anatomical similarities as well as differences between various species, thereby understanding evolution and phylogeny across these species^{1,2}, as it indicates that various organisms share a common ancestor.

Moreover, it assists scientists in classifying organisms based on similar characteristics of their anatomical structures. Comparative anatomy supports Darwin's theory of descent with modification, also known as evolution. Virchow's statement is as wise today as it was over a century ago. various animal species, even Homo sapiens, are similar, such that knowledge gained in one species

benefits all, leading to the concept of “One Medicine.” Hence, knowledge of the comparative anatomy of different species can help develop certain therapies for humans^{3,4}. The one medicine modality leverages various species similarities as few diseases affect exclusively one group of animals. Thus, knowledge of a particular disease in the lower vertebrates, such as guinea pigs, can help manage or treat some diseases in humans.

Blood is considered the fluid of life, growth, and health because it transports respiratory gases (oxygen and carbon dioxide), nutritive substances, hormones, and waste products, as well as protects the body against diseases⁵. The majority of these functions are carried out by the cells, which are the formed elements of the blood; for example, oxygen and carbon dioxide are transported by the hemoglobin found in the red cells, and the white blood cells protect the body against diseases⁶. The thyroid gland, however, is one of the major glands in the body in the sense that it produces the thyroid hormones, which regulate the overall metabolic rate of the body⁷. Adequate knowledge of hematology and thyroid functions in other mammals can help boost veterinary care and advance comparative biomedical research, which in turn can support the One Medicine approach emphasizing shared health principles across species. Moreover, hyperthyroidism has been reported to be common in guinea pigs⁸.

This study explored the hematological parameters, thyroid structure, and function in male juvenile guinea pigs and grass cutters to deepen our knowledge of their physiology as well as provide reference for further studies that involve these species.

MATERIALS AND METHODS

Animals

Six male juvenile grasscutters with an average weight of 1800 ± 530 g and six juvenile guinea pigs with an average weight of 210 ± 20 g were obtained in Ganmo (Kwara state) and Araromi (Oyo state), respectively. The grasscutters and guinea pigs were euthanized by the respective administration of 20 mg/kg of ketamine intramuscularly and

intraperitoneally. Animal handling was in line with guidelines recommended by the Animals Ethics Committee of the University of Ilorin.

Blood collection for hematological parameters, thyroid, and thyroid-stimulating hormonal assay

The euthanized animals were dissected to assess their hearts. Blood was collected from their right ventricle using a scalp vein needle connected to a 5ml syringe and immediately transferred into EDTA and heparinized bottles for hematological and hormonal analysis, respectively. Blood cells were counted manually using a Neubauer counting chamber. The blood collected into heparinized bottles was centrifuged immediately at 3000 rpm for 15 minutes. The plasma was collected and analyzed for thyroid (T3 and T4) and thyroid stimulating hormonal assay using a vast ELISA microwell kit with the code 8025-300 as described below. Furthermore, the animals were perfused with normal saline and 4% paraformaldehyde. The thyroid gland was removed and post-fixed in paraformaldehyde for gross study.

Analysis of the Hematological Parameters

Evaluation of the red blood cell count and its indices

The amount of red blood cells was determined using a Neubauer counting chamber. 20 μ l of the blood collected into the EDTA bottle was diluted with an isotonic fluid (mixture of 100 ml of 1% formalin with 3 g sodium citrate) to prevent blood lysis during analysis. After the dilution, the diluted blood was then used to charge the counting chamber and left for 3–5 minutes for the RBC to settle. The cells were then counted under the light microscope in five groups of 16 small squares in the central ruled area of the chamber; the cells in the upper horizontal line and right vertical lines were also counted⁹.

Some RBC absolute indices were further calculated to obtain more information from the RBC, as these indices are markers for RBC's functions; these indices are the mean cell volume (MCV); the average volume or size of individual red cells, mean cell hemoglobin concentration (MCHC); the quantity of hemoglobin in individual cells but in a

given volume of red cells, and mean cell hemoglobin (MCH); the average quantity of hemoglobin in an individual cell. They were calculated as shown below;

$MCH(pg) = Hb \text{ in g per litre} / RBC \text{ per litre.}$

$MCV (fl) = PCV \text{ in litres per liter} / RBC \text{ per litre.}$

$MCHC (g/dl) = Hb \text{ in g per litre} / PCV \text{ litre per litre.}$

Determination of packed cell volume

The packed cell volume (PCV) measures the RBC's percentage, which is a strong indicator of blood function in respiration. Briefly, three-quarters of hematocrit tubes (with one closed end) were filled with anticoagulated blood and centrifuged for five minutes. The PCV was then read on a microhematocrit reader.

Estimation hemoglobin concentration

The hemoglobin estimation was done using Sahli's method. 20 cu. mm of anticoagulated blood was diluted with 10 cu. mm of prepared 0.1N HCl, after which the diluted blood was allowed to sit for 5 mins for the formation of acid hematin. The mixture was then further diluted with drops of distilled water, after which the color was compared with the standard against a white background. Two readings were taken; the first was taken when the diluted blood was slightly darker than the standard, while the second was taken when the diluted blood was lighter than the standard. The average of these two readings was taken as the hemoglobin concentration.

Total and differential white blood cell count

The white blood cells were also counted using the Neubauer counting chamber. 20 µl of blood in anticoagulant was diluted with 0.4 ml of diluting fluid (2% acetic acid with about 2 drops of Gentian violet stain) and allowed to sit for 2-3 minutes for adequate lysis of RBC by the acetic acid in the dilution fluid. All the white cells in the four corners of a 1mm x 1mm large square were counted, and the average was taken. The differential WBC count

was done using a blood smear stained with a Leishman stain. The white cells were then counted under a high dry x40 objective lens until about 200 cells were counted, marking each as recognized in the appropriate column in a table from which the percentages of each type of cell present were then calculated.

Evaluation of thyroid stimulating hormone and thyroid hormones

Thyroid hormones and TSH were assayed using VAST ELISA kits, a product of Monobind Inc. Lake Forest, CA 92630 USA (8025-300). The procedure includes the arrangement of the microplate wells for the control, calibrators, and samples. 25 µl of calibrator, samples, and control were dispensed into T4 designated wells, while 50 µl were added to the T3 and TSH wells. 50 µl of T3 or T4 enzyme conjugate solution were then added to the appropriate wells, while 100 µl of TSH enzyme reagent was added to TSH wells. Furthermore, 50 µl of biotinylated T4 or T3 - antibody conjugates were added to the respective wells and allowed to incubate for 60 minutes at room temperature, after which the contents were aspirated and washed using wash buffer. 100 µl of working substrate solution was then added to each well and gently mixed for 15-20 seconds. Finally, absorbance was read at 450 nm using a microplate reader.

Statistical analysis

Charts were plotted as the mean ± standard error of the mean (SEM). Differences between the groups were considered significant if the p-value was less than 0.05, using an unpaired t-test. The statistical analysis was performed using GraphPad Prism version 7.0.

RESULTS

Physical observations

The grasscutters appeared stronger and bigger than the guinea pigs. The grasscutters have scanty furs on their ventral surface compared to their dorsal surface, while the guinea pigs have abundant furs on their ventral and dorsal surfaces (Figure 1). The

guinea pigs are tailless rodents, while the grass cutters have short and fragile tails. The grass cutters have well-developed muscles when compared to the guinea pigs.

The guinea pigs' thyroid gland is a compact structure located in the anterior part of the neck. The grasscutters' thyroid gland lacks

isthmus, each (right and left) occupying its compartment anterior to the trachea. The grasscutters' thyroid glands are located more superficially than guinea pigs, which lie deep in certain neck muscles.



Figure 1: Physical observation of the animals and thyroid gland; the upper left image depicts the abundant fur and the size of the guinea pigs while the upper right image shows the ventral surface of the grasscutter with scanty fur. The lower images (left) show the compact thyroid gland of a guinea pig while the (right) shows the bilobed grasscutter's thyroid gland.

Guinea pigs have a higher thyroid gland weight-body-weight ratio.

To explore the influence of the thyroid-body weight ratio on thyroid hormonal levels and TSH levels on juvenile guinea pigs and grass cutters, the body and thyroid weights were measured, and the thyroid

gland weight-to-body weight ratio was assessed. It was observed that grass cutters had significantly higher total body weight and thyroid gland weight (Figure 2(a) and (b). however, juvenile guinea pigs' thyroid gland to body weight ratio was significantly higher (Figure 2c) than that of the grasscutters ($p < 0.05$).

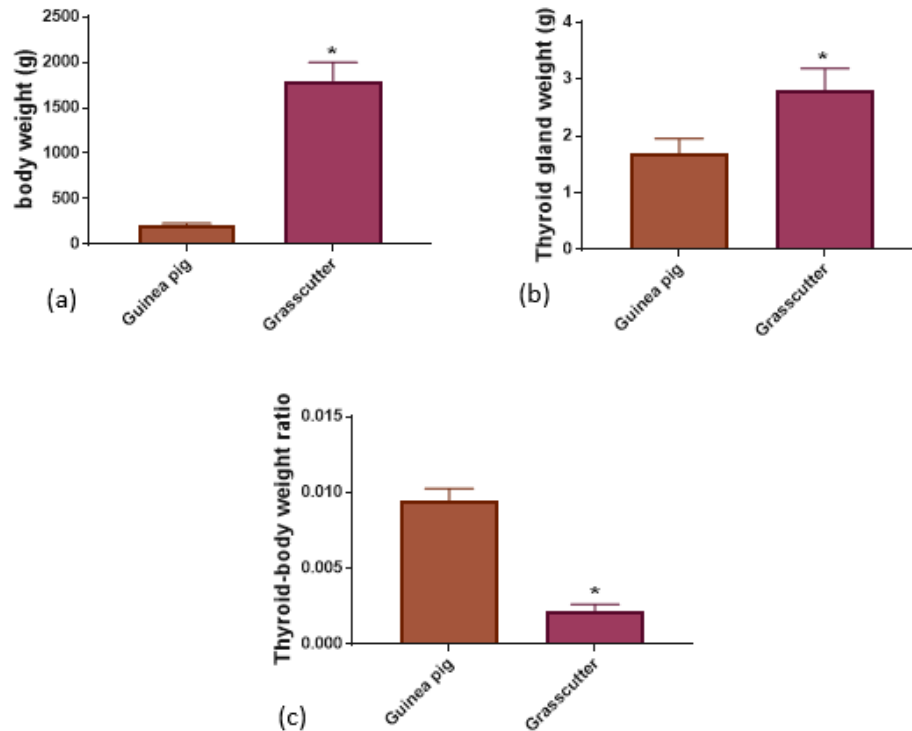


Figure 2: (a) body weight (b) thyroid gland weight (c) thyroid gland-body weight ratio. * indicates a significant difference from guinea pigs at $p < 0.05$.

Grass cutters have higher red blood cell indices.

Blood was analyzed for the RBC indices of juvenile guinea pigs and grass cutters to compare the RBC indices. It was observed that grasscutters had

significantly higher RBC indices compared to guinea pigs (Figure 3 (a) to (e) except for the mean cell hemoglobin concentration that was higher in guinea pigs (Figure 3 (f))

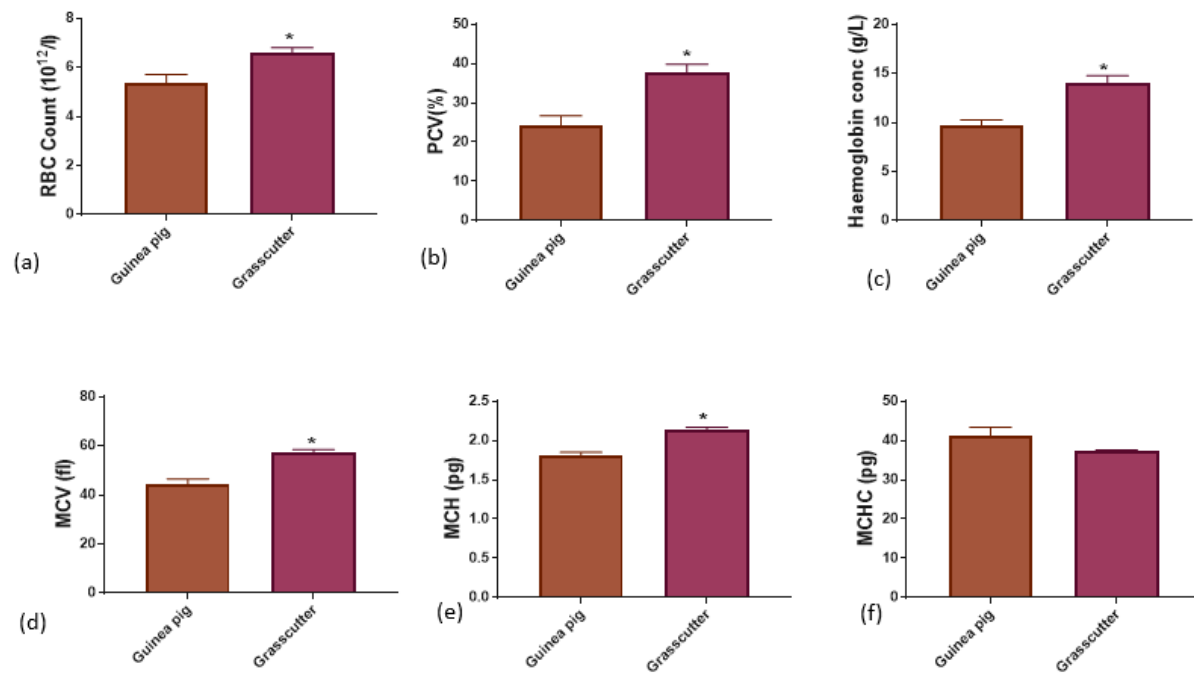


Figure 3: Red blood cell indices of guinea pigs and grasscutters. *indicates a significant difference from guinea pigs at $p < 0.05$.

The total white blood cell counts and differential counts of guinea pigs and grass cutters

The WBC indices were not significantly different between the two species of animals (Figure 4 (a) to (d)), though most of them were slightly higher in guinea pigs than in grass cutters.

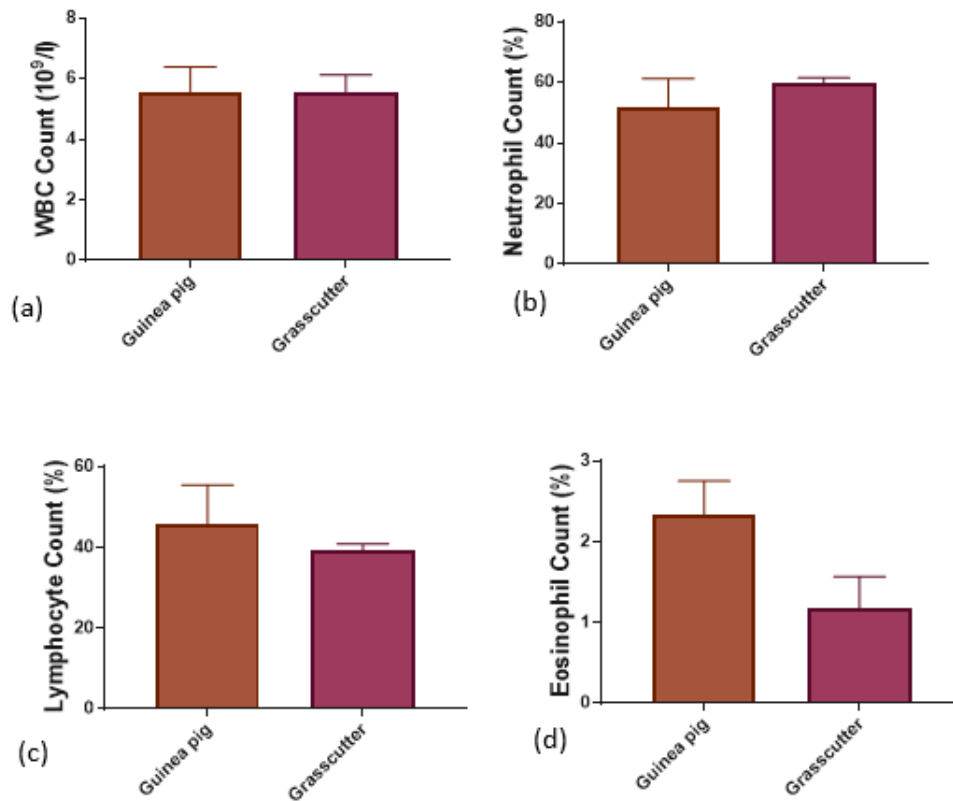


Figure 4: White blood cell indices of guinea pigs and grass cutters. There was no significant difference between the indices of the two species of animals.

The evaluation of thyroid stimulating hormone and thyroid hormones of grasscutters and guinea pigs

The guinea pigs' T3 and T4 concentrations, as well as thyroid-stimulating hormones, appeared to be higher. However, these differences were not statistically significant (Figure 5).

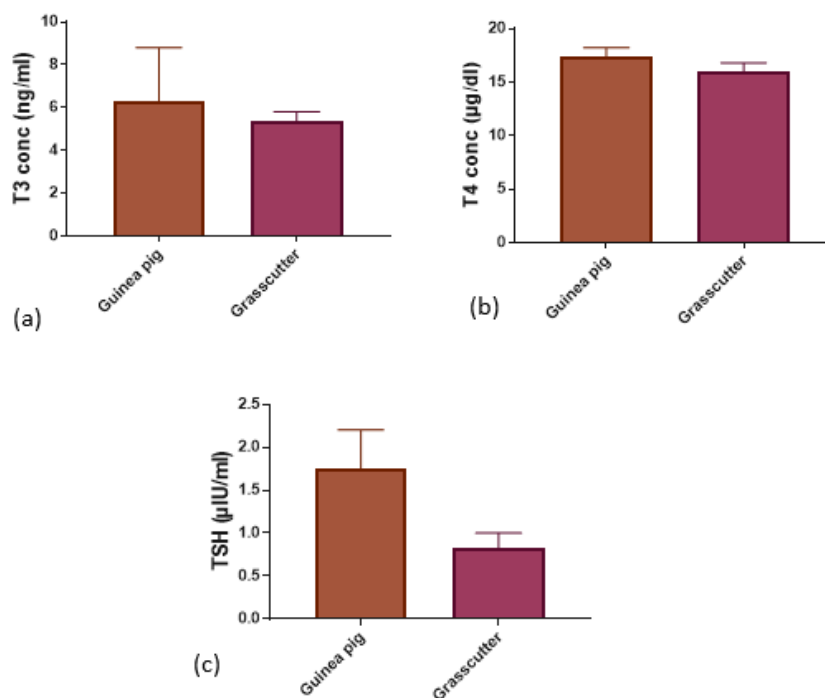


Figure 5: The levels of thyroid hormones and thyroid stimulating hormones.

Histological Observations

The representative photomicrographs of the blood smear of the animals. Their observation

supported the findings from the blood cell count, as the blood smear of the guinea pigs had fewer red blood cells and abnormally shaped red blood cells (Figure 6) when compared to that of the grass cutters.

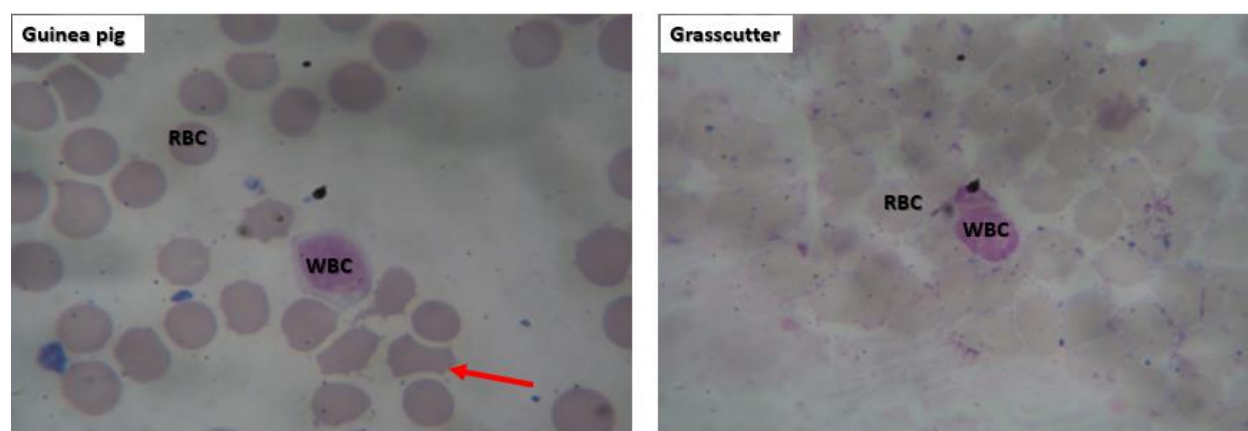


Figure 6: Representative photomicrographs of the blood smears of guinea pigs and grass cutters. $\times 400$. Leishman stain. RBC: Red blood cells, WBC: White Blood Cells (WC), red arrow points to abnormally shaped RBC

DISCUSSION

The knowledge of the comparative anatomy of other mammals has deepened our understanding of evolution and improved the care and the use of these animals as pets, livestock, and human disease models. This study supports that grasscutters are mammals with well-built muscles as opposed to guinea pigs, which are tailless and, of course, have significantly lower body weight when compared to grasscutters. However, the ratio of thyroid weight to body weight was higher in guinea pigs compared to grass cutters.

The use of blood examination as a way of assessing the health status of an individual has been documented ¹⁰. This is because it is vital for the physiological, nutritional, and pathological status of organisms ¹¹. They range from giving the level of the blood to detecting ailments or disorders through them. Hematological profiles, both in humans and in animal sciences, are an important index of the physiological state of the individual. The ability to interpret the state of blood profile in normal and diseased conditions is among its primary tasks. Many researchers have seen that there is a definite change in the profile of the blood cells throughout life ¹². Not only does the blood change with the advancement of age, but it also varies with certain conditions such as stress, bacterial infection, viral infection, and intoxication ¹³.

One of the important components of the blood is its formed element, i.e., the blood cells. The differences in the means of the RBC properties (PCV, Hemoglobin estimation, RBC count, and red cell indices) of guinea pigs and grasscutters were found to be statistically significant ($p < 0.05$) excluding the MCHC. In summary, RBC properties are considerably higher in grasscutters compared to guinea pigs; this can be ascribed to the fact that grasscutters are more active; hence, their well-built muscles require an adequate supply of oxygen compared to guinea pigs, which are less active. This study supports the fact that PCV has lower RBC indices compared to other mammals ¹⁴ emphasizing their suitability for anemia research and adding to their suitability for scurvy research. The differences in the means of the WBC properties

(total WBC count, neutrophils count, lymphocyte count, etc.) of guinea pigs and grasscutters demonstrate no statistical significance. However, the lymphocyte and eosinophil counts appeared to be slightly higher in guinea pigs. From this observation, it is revealed that guinea pigs have more capability to fight against parasites than grass cutters since eosinophils have a unique defense mechanism against parasites. As reported by Richardson, guinea pigs are often infected by parasites such as lice and mites, hence there is a need for adequate intrinsic defense against parasites which might account for the reason why there is a considered high eosinophilic count in guinea pigs compared to grasscutters¹⁵.

In addition to the quantitative hematological parameters, the shape of the blood cells is also vital for their function, which can be deduced from blood smears. Evidence from the blood smears of the guinea pigs and grasscutters indicate that the guinea pigs have scanty RBCs when compared to that of grasscutters, supporting the RBC indices, particularly the PCV. This finding is in line with previous findings ¹⁶. Additionally, certain irregularly shaped RBCs are seen in the guinea pigs' blood smear in contrast to those of the grasscutters which appeared uniform ¹⁶. The higher lymphocyte count in guinea pigs can be linked to their mode of life in the sense that guinea pigs are timid, easily handled, and rarely bite and are therefore prone to both physical hazards and viral infections¹⁷. Hence, the high lymphocytic count serves as a defense mechanism against viral infection ¹⁴.

The thyroid glands of the two animals are located in the anterior part of the neck. That of the guinea pig has a compact structure, while the grass cutters lack isthmus, unlike most other mammals, such as humans, which are joined by an isthmus. Hence, each thyroid gland of a grasscutter (right and left) occupies its compartment lateral to the trachea. This is in line with the findings of Igbokwe ¹⁸. The thyroid gland of the grasscutter is more superficial in contrast to that of the guinea pig, which is located deep in the anterior neck muscles.

The thyroid gland is the body's largest endocrine gland. It produces thyroid hormone, which controls

the rate of metabolism, and calcitonin, a hormone controlling calcium metabolism¹⁷. An optimal thyroid hormone level is, therefore, important for the overall health of an animal. The difference in means concentration of the thyroid hormones and thyroid stimulating hormone of guinea pigs and grasscutters are not statistically significant. However, these hormones were higher in the guinea pigs despite the difference in their mean thyroid gland weights and their total body weight. Hence, it can be deduced that more thyroid hormones are required and secreted by the thyroid gland of the guinea pigs. This might be linked to the fact that guinea pigs feed on their feces¹⁷. They produce special soft pellets from their feces called cecotropes, which recycle B vitamins, fiber, and bacteria required for proper digestion; in essence, more thyroid hormones are required to metabolize their feces for proper digestion. Additionally, the fact that guinea pigs are prone to hyperthyroidism¹⁹ also supports our results as the thyroid function of less active guinea pigs is similar to that of active grass cutters. Lastly, from this study, the concentration of thyroxine was found to be more than that of tri-iodothyronine, which is also in line with that found in humans, where thyroxine forms about 90% of the total thyroid secretion²⁰.

This study has been able to demonstrate the relationship between certain hematological parameters, structure, and function of the thyroid glands of these two species. These two animals belong to a class of mammals and show certain features that are common to the mammalian class; this is evident in some of their features, such as the proportion of their thyroid hormones, where thyroxine concentration is considerably higher than that of tri-iodothyronine. This study also reveals the similarities between the hematological parameters of guinea pigs and grasscutters. Correction: "Hence, this study hopes to serve as a guide for further biomedical research studies involving guinea pigs and grasscutters."

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REFERENCES

1. Campbell NA, Reece JB. Biology. 7th ed. San Francisco: Pearson, Benjamin Cummings; 2005. 1231 p.
2. Danos N, Staab KL, Whitenack LB. The core concepts, competencies, and grand challenges of comparative vertebrate anatomy and morphology. *Integr. Org. Biol.* 2022;4(1): doi: 10.1093/iob/obac019
3. Zinsstag J, Schelling E, Waltner-Toews D, Tanner M. From "one medicine" to "one health" and systemic approaches to health and well-being. *Prev. Vet. Med.* 2011;101(3–4):148–56.
4. Zangerl R. The methods of comparative anatomy and its contribution to the study of evolution. *Evolution.* 1948;2(4):351–74.
5. Lakshmi P Vara, Malleswari K, Brahmareddy D Rama. Research Article on Fluid of Life: Blood and Disease Alterations. *IOSR-JPBS.* 2021;16(4):23–39.
6. Weiss Ch, Jelkmann W. Functions of the Blood. In: Schmidt RF, Thews G, editors. *Human Physiology* [Internet]. Berlin, Heidelberg: Springer Berlin Heidelberg; 1989;402–38. Available from: http://link.springer.com/10.1007/978-3-642-73831-9_18 Accessed November 2024.
7. Chiasera JM. Back to the basics: thyroid gland structure, function and pathology. *Clin Lab Sci.* 2013;26(2):112–7.
8. Mayer J, Wagner R, Taeymans O. Advanced diagnostic approaches and current management of thyroid pathologies in guinea pigs. *Vet Clin North Am Exot Anim Pract.* 2010;13(3):509–23.
9. Giri D, Khothai E, Chowhan DA, Hayat F. Manual cell counting with Neubauer chamber [Internet]. 2022. Available from: <https://laboratoryinfo.com/manual-cell->

- counting-neubauer-chamber/?form=MG0AV3. Accessed November, 2024.
10. Watson J, Whiting PF, Salisbury C, Hamilton WT, Banks J. Blood tests in primary care: A qualitative study of communication and decision-making between doctors and patients. *Health Expect.* 2022;25(5):2453–61.
11. Alexy T, Detterich J, Connes P, Toth K, Nader E, Kenyeres P, *et al.* Physical properties of blood and their relationship to clinical conditions. *Front Physiol.* 2022;13:906768.
12. Khan KS, Zamora J. Systematic Reviews to Support Evidence-Based Medicine: How to appraise, conduct and publish reviews [Internet]. 3rd ed. Boca Raton: CRC Press; 2022. Available from: <https://www.taylorfrancis.com/books/9781003220039>, Accessed November 2024.
13. Broxmeyer HE, Liu Y, Kapur R, Orschell CM, Aljoufi A, Ropa JP, *et al.* Fate of hematopoiesis during aging. What do we really know, and what are its implications? *Stem Cell Rev Rep.* 2020;16(6):1020–48.
14. Shomer NH, Holcombe H, Harkness JE. Biology and diseases of guinea pigs. In: *Laboratory animal medicine* [Internet]. Elsevier; 2015;247–83. Available from: <https://linkinghub.elsevier.com/retrieve/pii/B9780124095274000067>. Accessed November, 2024.
15. Richardson VCG. Diseases of domestic guinea pigs [Internet]. 1st ed. Wiley; 2000; Available from: <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470693773> Accessed November 2024.
16. Zimmerman K, Moore DM, Smith SA. Hematological Assessment in Pet Guinea Pigs (*Cavia porcellus*). *Vet Clin North Am Exot Anim Pract.* 2015;18(1):33–40.
17. Elfers K, Armbrrecht Y, Mazzuoli-Weber G. Good to know: Baseline data on feed intake, fecal pellet output and intestinal transit time in guinea pig as a frequently used model in gastrointestinal research. *Animals.* 2021;11(6):1593.
18. Igbokwe CO. Gross and microscopic anatomy of thyroid gland of the wild African grasscutter (*Thryonomys swinderianus*, Temminck) in Southeast Nigeria. *Eur J Anat.* 2010;14(1):5–10.
19. Girod-Rüffer C, Müller E, Marschang RE, Müller K. Retrospective study on hyperthyroidism in guinea pigs in veterinary practices in Germany. *J Exot Pet Med.* 2019;29:87–97.
20. Junqueira LCU, Mescher AL, editors. *Junqueira's basic histology: text & atlas*. 12. ed. New York: McGraw-Hill Medical; 2010. 467 p.