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Comparative evaluation of the sedative and analgesic effects of chlorpromazine, diazepam and xylazine in the Guinea fowl (*Numida meleagris*)

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Abstract

This study was conducted to determine the comparative effects of chlorpromazine, diazepam and xylazine in achieving analgesia and deep sedation in the Guinea fowl (*Numida meleagris)*. Nine apparently healthy adult guinea fowls of mixed sex (male and female) weighing between 0.65 to 1.15 kg were used in the study. The birds were randomly assigned to three groups of three birds each. Three dose range of diazepam (1 mg/kg, 2 mg/kg and 5 mg/kg), chlorpromazine (5 mg/kg, 7 mg/kg and 9 mg/kg) and xylazine (1 mg/kg, 1.5 mg/kg and 2.5 mg/kg) were intramuscularly administered to the birds in different groups. The experiments were conducted in three batches with interval gap of two weeks after each batch to enable the body systems of the birds get rid of the earlier administered drug. The onset of drug action, duration of analgesia and degree of sedation were recorded. Physiological parameters such as heart rate (HR), respiratory rate (RR) and rectal temperature were also measured before the treatment (pre-sedation value, t = 0 minute) and subsequently at ten minutes intervals following the onset of the action of the drugs till full recovery of the birds. Results showed that diazepam and xylazine caused dose-dependent analgesia, sedation and depression of the physiologic parameters. Xylazine was potent at all its three doses and caused deep sedation and sleep with analgesia at the dose of 2.5 mg/kg. In contrast, chlorpromazine caused dose-dependent excitement and elevation of the physiological parameters. Based on the results of the study, it was concluded that, to achieve analgesia and sedation in the Guinea fowl, xylazine should be considered as the first drug of choice among the three studied, followed by diazepam.

Keywords: Guinea fowl (*Numida meleagris*); Analgesia; Sedation; Chlorpromazine; Diazepam; Xylazine.

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Introduction

Guinea fowls (*Numida meleagris),* sometimes called 'pet-speckled' hen or 'Original Fowl' are birds of the family, Numididae in the order, Galliformes (Amaefule *et al*., 2022). They are among the oldest of the gallinaecious birds (Martinez, 1994). Wild Guinea fowls are strong fliers and their powerful breast muscles enable them to sustain themselves in flight for considerable distances (Martinez, 1994; Maina, 2023). They are known for their resilience, hardiness and ability to survive in a wide variety of habitats, as both wild and domesticated birds (Maina, 2023; Lever, 2005).

Guinea fowl farming and domestication has increased worldwide and in Northern Nigeria over the last few years (Yakubu *et al*., 2004; Salgado, 2026). As a consequence of the higher numbers, the demand for veterinary services for guinea fowls has also increased (Yakubu *et al*., 2004). In commercial Guinea fowl rearing, chemical restraint is needed for many procedures such as sample collection, pluming, surgical procedures and placement of oesophageal probes; therefore improvements in anaesthetic and sedative techniques are required in order to allow the accomplishment of clinical procedures with minimal cardiopulmonary depression and hypothermia (Barreiro *et al*., 2002). Extensive and invasive procedures like orthopaedic or intestinal surgeries are not frequently performed in these species; therefore, the development of techniques that allow short-time chemical restraint might be more useful than general anaesthetic techniques (Mans, 2015).

Chemical restraint in birds can reportedly be achieved using benzodiazepines, alpha-2 adrenergic agonists and phenothiazines (Creighton and Lamont, 2024; Hawkins and Pascoe, 2025). Diazepam (benzodiazepine), chlorpromazine (phenothiazine) and xylazine (alpha-2 adrenergic receptor agonist) are commonly used as premedicants and for their sedative properties (Plumb, 2008; Ko, 2024). Diazepam, chlorpromazine and xylazine are drugs that act on the central nervous system; they also affect vital parameters such as temperature, heart rate and respiratory rate (Sarwar *et al*., 2022).

Considering the facts that guinea fowls are easily agitated and 'unfriendly/unkind' to strangers, without proper restraint, safety of the clinician as well as the birds is not guaranteed. Proper chemical restraint will ensure safety of the clinicians and minimize stress and injury to the bird (Johnson-Delaney and Bennett, 2024). Deep sedation is required in most of the procedures in avian cases rather than general anaesthesia due to anaesthetic related risks in this specie (Abreu *et al*., 2024; Ludders and Guzman, 2024). The present study compared and determined the clinically useful doses of diazepam, xylazine and chlorpromazine that can be used to achieve sedation in Guinea fowls.

Materials and Methods

Animals: Ten apparently healthy adult Guinea fowls of mixed sex (male and female) were purchased from Kano Central Market in Northern Nigeria. They were brought to Department of Veterinary Surgery and Radiology, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike and kept in well ventilated animal house facility already prepared for them. They were cared for and provided with adequate feed and water for the period of four weeks for proper acclimatization in the new environment before the commencement of the study. All the Guinea fowls were physically examined before the study and only healthy ones were used in the study.

Experimental Design: Nine apparently healthy adult Guinea fowls of mixed sex (male and female) weighing between 0.65 to 1.15 kg were used in the study. Three dose ranges of

each of diazepam (1 mg/kg, 2 mg/kg, and 5 mg/kg), chlorpromazine (5 mg/kg, 7 mg/kg and 9 mg/kg) and xylazine (1 mg/kg, 1.5 mg/kg and 2.5 mg/kg) were used for the study. The experiments were conducted in three batches with interval gap of two weeks after each batch to enable the body systems of the birds get rid of drug residue. The experimental protocol was approved by the Ethics Committee of the College of Veterinary Medicine, Michael Okpara University of Agriculture Umudike, Nigeria, in accordance with institutional and national guidelines (Approval No. – MOUAU/CVM/REC/202621).

Drug Administration: The drugs were administered by the intramuscular route (thigh muscle) in all the birds, using sterile 1 ml syringes. The site of injection was cleaned with methylated spirit using cotton wool.

Onset of Drug Action: The onset of action of the drugs was recorded as the time range (in minutes) from the initial injection of the drugs (*t*0) to the time of discoloration of the wattle (Maiti *et al*., 2006).

Duration of Analgesia: The duration of analgesia was calculated by noting the difference in the time of disappearance of toe-pinch pain reflex following the drug injection and the time of reappearance of toe-pinch pain reflex (Maiti *et al*., 2006).

Degree of Sedation: A scale to assess the degree of sedation was modified and adopted from the one earlier reported by Day and Roge (1996). Grades/ranks were assigned to the observed signs of sedation as follows: 0 – Standing alert; 1 – Drooping of wings; 2 – Standing with tired look; 3 – Sternal recumbency; 4 – Lateral recumbency and sleep.

Degree of Muscle Relaxation: The degree of muscle relaxation was ranked/graded using jaw reflex scale (Maiti *et al*., 2006), as follows: 0 – Tightly closed jaw (full tone); 1 – Moderate resistance to opening the jaw; 2 – Mild resistance to opening of jaw; 3 – No resistance to opening of jaw.

Physiological Parameters*:* The heart rate (HR), respiratory rate (RR), and rectal temperature (RT) were measured before treatment to ascertain the baseline values (t = 0 minutes) and subsequently at every ten minutes interval following the onset of the action of the drugs till the recovery of each bird. Respiratory rate was recorded by observing and counting the sternal movements of the birds. Heart rate was recorded with the aid of stethoscope placed on left costal area, while rectal temperature was recorded using digital thermometer placed on the cloacal wall of each bird.

Other signs: Other signs of sedation and side effects were observed and recorded.

Data Analysis: Data generated from the groups were compared using analysis of variance (ANOVA). Variant means were separated using the least significant difference (LSD) method. A probability value less than or equal to 0.05 was considered statistically significant. Summary of the data were expressed as mean ± standard error of mean (± SEM) for each group.

Results

Onset of Drug Action: The onset of action of the three drugs used for the study is presented in Figure 1. The onset of action for Guinea fowls that were treated with diazepam ranged between 2.00 ± 0.57 minutes to 5.00 ± 0.57 minutes with the higher dose having a shorter onset of action of 2.00 ± 0.57 minutes. The onset of action of xylazine ranged between 2.00 ± 0.00 to 4.00 ± 0.57 minutes; its onset of action was dose-dependent, with the highest dose (2.5 mg/kg) having a significantly ($p < 0.05$) shorter onset when compared to other doses, as well as when compared with diazepam and chlorpromazine. The onset of action of chlorpromazine

occurred between 3.33 ± 0.88 to 5.00 ± 0.57 minutes; the onset of action of chlorpromazine increased significantly with increase in dose. Diazepam and xylazine had significantly ($p < 0.05$) shorter onset of action (2.00 ± 0.00 minutes) at doses of 5 mg/kg and 2.5 mg/kg, respectively when compared to chlorpromazine at the dose of 9 mg/kg.

Duration of Sedation: The highest ($p < 0.05$) duration of sedation was observed in Guinea fowls treated with xylazine (47.00 ± 0.57 minutes), followed by diazepam (28.33 ± 4.40 minutes), while shortest duration of sedation was recorded in Guinea fowls treated with chlorpromazine (00.35 ± 0.00 minute) (Figure 2).

Degree of Sedation: The degree of sedation (Figure 3) in birds treated with diazepam ranged between 1.00 ± 0.00 to 3.33 ± 0.33; this indicated moderate degree of sedation. While the degree of sedation for Guinea fowls treated with xylazine ranged between 2.33 ± 0.66 to 4.00 ± 0.00, this indicated a higher degree of sedation, with the degree of sedation being dose dependent. There was little or no sedation in Guinea fowls treated with chlorpromazine even at higher doses (Figure 3).

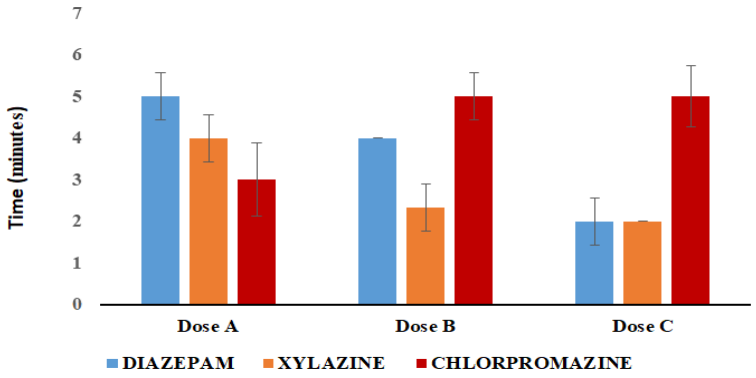

Figure 1. Mean (SEM ±) Onset of action following administration of different doses of Diazepam, Xylazine and Chlorpromazine in guinea fowl. [Dose A – Diazepam 1 mg/kg, Xylazine 1 mg/kg and Chlorpromazine 5 mg/kg; Dose B – Diazepam 2 mg/kg, Xylazine 1.5 mg/kg and Chlorpromazine 7 mg/kg; Dose C – Diazepam 5 mg/kg, Xylazine 2.5 mg/kg and Chlorpromazine 9 mg/kg]

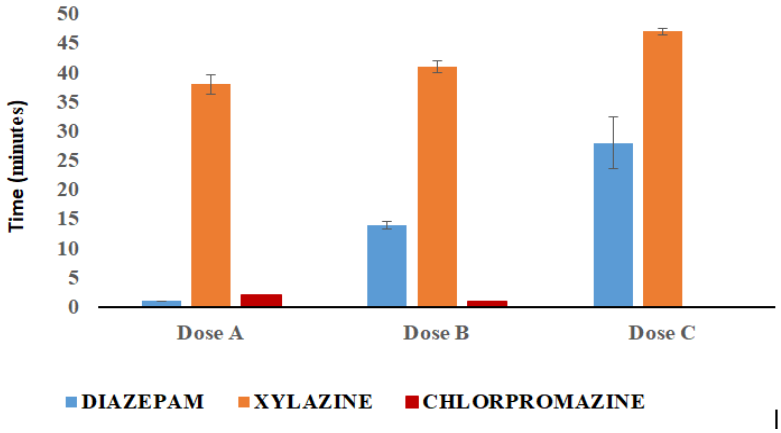

Figure 2. Mean (SEM ±) duration of sedation following administration of different doses of Diazepam, Xylazine and Chlorpromazine in guinea fowl. [Dose A – Diazepam 1 mg/kg, Xylazine 1 mg/kg and Chlorpromazine 5 mg/kg; Dose B – Diazepam 2 mg/kg, Xylazine 1.5 mg/kg and Chlorpromazine 7 mg/kg; Dose C – Diazepam 5 mg/kg, Xylazine 2.5 mg/kg and Chlorpromazine 9 mg/kg]

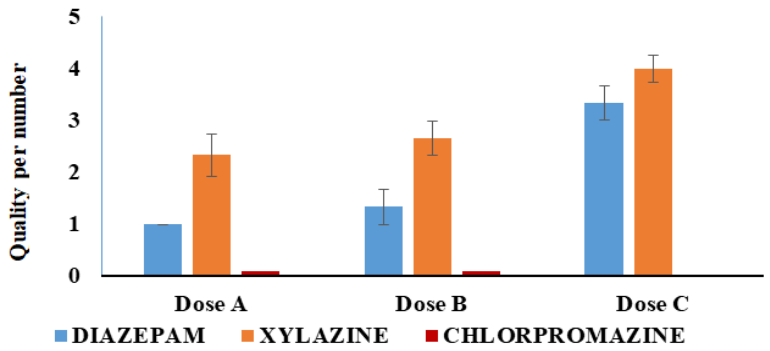

Figure 3. Mean (SEM ±) degree of sedation following administration of different doses of Diazepam, Xylazine and Chlorpromazine in guinea fowl. [Dose A – Diazepam 1 mg/kg, Xylazine 1 mg/kg and Chlorpromazine 5 mg/kg; Dose B – Diazepam 2 mg/kg, Xylazine 1.5 mg/kg and Chlorpromazine 7 mg/kg; Dose C – Diazepam 5 mg/kg, Xylazine 2.5 mg/kg and Chlorpromazine 9 mg/kg]

Table 1. Mean (± SEM) duration of analgesia and degree of muscle relaxation following administration of different doses of diazepam, xylazine and chlorpromazine.

Drugs	Degree of muscle relaxation	Duration of analgesia (minutes)
Dose A		
Diazepam (1 mg/kg)	0.00 ± 0.00 ^{a}	0.00 ± 0.00 ^{a}
Xylazine (1 mg/kg)	2.66 ± 0.33 ^{cd}	17.66 ± 1.45 ^{d}
Chlorpromazine (5 mg /kg)	0.00 ± 0.00 ^{a}	0.00 ± 0.00 ^{a}
Dose B		
Diazepam (2 mg/kg)	1.00 ± 0.00 ^{b}	8.00 ± 0.57 ^{b}
Xylazine (1.5 mg/kg)	2.66 ± 0.33 ^{cd}	22.33 ± 1.20 ^{e}
Chlorpromazine (7 mg/kg)	0.00 ± 0.00 ^{a}	0.00 ± 0.00 ^{a}
Dose C		
Diazepam (5 mg/kg)	2.00 ± 0.57 ^{c}	11.00 ± 0.57 ^{c}
Xylazine (2.5 mg/kg)	3.00 ± 0.00 ^{d}	23.33 ± 1.66 ^{e}
Chlorpromazine (9 mg/kg)	0.00 ± 0.00 ^{a}	0.00 ± 0.00 ^{a}

The superscripts indicate statistically significant differences ($p < 0.05$) among the groups in the dergeee of muscle relaxation and duration of analgesia.

Duration of Analgesia: The duration of analgesia for the three different drugs at the varied doses is presented in Table 1. There was no analgesia in Guinea fowls treated with diazepam and chlorpromazine at Dose A. The highest duration of analgesia was 11.00 ± 0.57 minutes recorded for diazepam and 23.33 ± 1.66 minutes recorded for xylazine at Dose C. The duration of analgesia in the xylazine treated Guinea fowls was significantly ($p < 0.05$) longer when compared to that of diazepam and chlorpromazine-treated Guinea fowls.

Degree of Muscle Relaxation: Diazepam treated Guinea fowls had moderate to high degree of muscle relaxation (0.00 ± 0.00 to 2.00 ± 0.57), while Guinea fowls treated with

xylazine showed a degree of muscle relaxation that ranged between 2.66 ± 0.33 to 3.00 ± 0.00, which indicated very high degree of muscle relaxation, but there was no muscle relaxation following the administration of chlorpromazine (Table 1).

Heart Rate: The heart rates of the Guinea fowls treated with diazepam, xylazine and chlorpromazine are shown in Figures 4, 5 and 6. Before sedation (baseline), heart rates were between 283.33 ± 3.33 to 295 ± 21.79 beats/minute. Xylazine administration led to significantly lower heart rate when compared to diazepam and chlorpromazine in all the dose ranges, 10 – 40 minutes following administration. However, the heart rate following the administration of chlorpromazine was higher in most of the dose ranges when compared to xylazine and diazepam.

Cloacal Temperature: The cloacal temperatures (Figures 7, 8 and 9) before sedation were between the ranges of 42.06°C to 41.60°C. Administration of xylazine (1mg/kg) led to significantly ($p < 0.05$) lower cloacal temperature when compared with administration of diazepam and chlorpromazine, 10 to 20 minutes post administration. Diazepam (2 mg/kg) administration led to significantly ($p < 0.05$) lower cloacal temperature when compared to xylazine and chlorpromazine, 10 – 20 minutes post administration, with significantly higher values at 30 minutes and 50 minutes post-administration. At the highest dose of xylazine (2.5 mg/kg), there was a significant ($p < 0.05$) increase in temperature 10 minutes post-administration with a significant depression observed at 30 minutes post administration. In Guinea fowls treated with diazepam at 5mg/kg, there was significant ($p < 0.05$) depression of cloacal temperature at 10 minutes and 30 minutes post-administration. The cloacal temperature of Guinea fowls treated with chlorpromazine was significantly ($p < 0.05$) higher at the first and second doses (Figure 7 and 8).

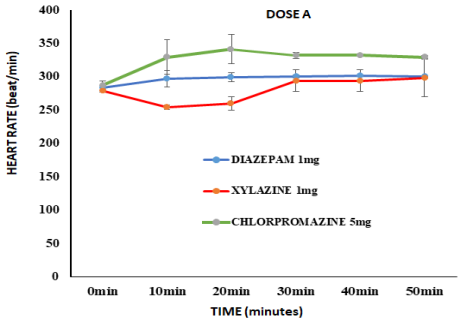

Figure 4. Heart rates of Guinea fowls following the administration of Diazepam (1 mg/kg), Xylazine (1 mg/kg) and Chlorpromazine (5 mg/kg).

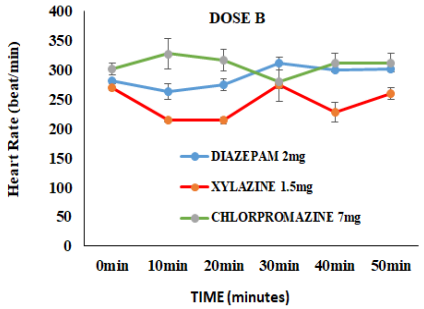

Figure 5. Heart rates of Guinea fowls following the administration of Diazepam (2 mg/kg), Xylazine (1.5 mg/kg) and Chlorpromazine (7 mg/kg)

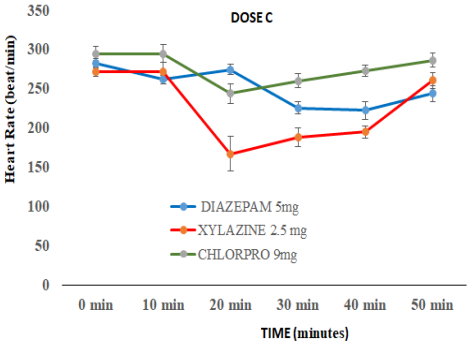

Figure 6. Heart rates of Guinea fowls after administration of Diazepam (5 mg/kg), Xylazine (2.5 mg/kg) and Chlorpromazine (9 mg/kg)

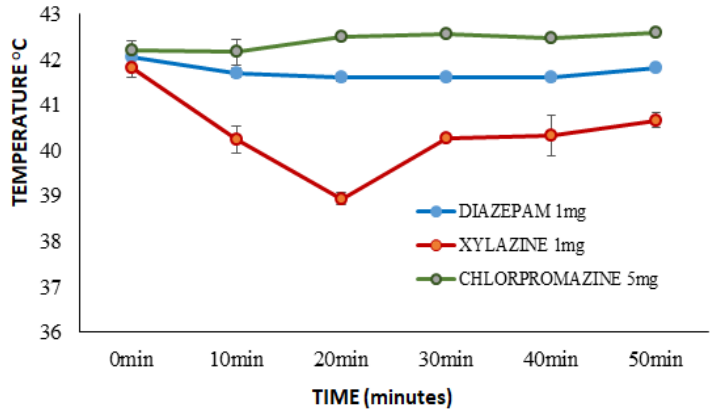

Figure 7. The cloacal temperatures of Guinea fowls after administration of Diazepam (1 mg/kg), Xylazine (1 mg/kg) and Chlorpromazine (5 mg/kg)

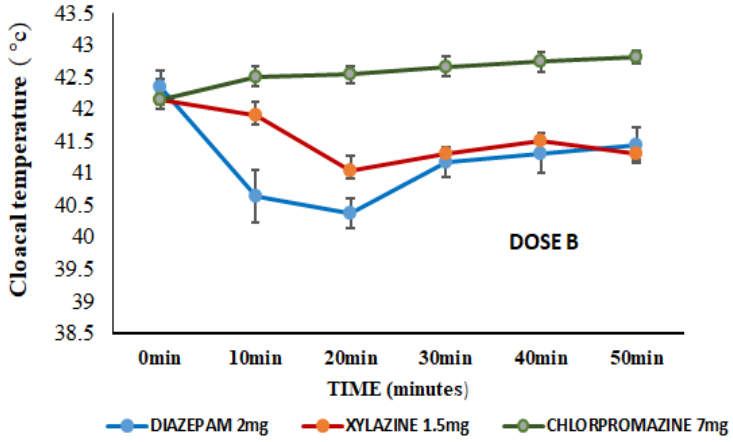

Figure 8. The cloacal temperatures of Guinea fowls after administration of Diazepam (2 mg/kg), Xylazine (1.5mg/kg) and Chlorpromazine (7 mg/kg)

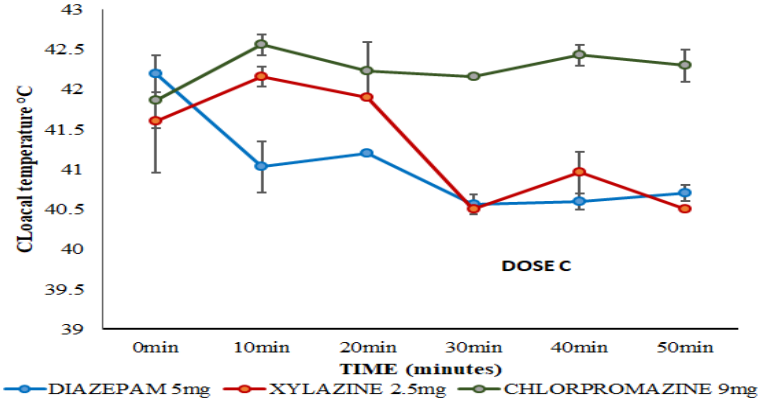

Figure 9. The mean cloaca temperatures of Guinea fowls after administration of Diazepam (5 mg/kg), Xylazine (2.5 mg/kg) and Chlorpromazine (9 mg/kg).

Respiratory Rate: At low doses, administration of diazepam (1 mg/kg) and chlorpromazine (5 mg/kg) caused a depression of respiratory rate 20 and 30 minutes, respectively when compared to xylazine (1 mg/kg) (Figure 10). Both diazepam (2 mg/kg) and xylazine (1.5 mg/kg) caused significant ($p < 0.05$) depression of respiratory rate at 10 minutes and then at 20 minutes post-administration when compared to chlorpromazine (Figures 11 and 12). Administration of chlorpromazine led to significantly higher respiratory rate at the Doses B (7 mg/kg) and C (9 mg/kg) doses (Figures 11 and 12)

Other Signs Observed: In the Guinea fowls treated with diazepam, blinking of the eye, drooping wings and defecation were observed. Blinking of the eye, vocalization while closing the eyelids and defecation were observed in birds treated with xylazine. In Guinea fowls treated with chlorpromazine, excitement, marked flapping of the wings, hyperactivity and marked vocalization were observed (Figure 13). These signs were dose dependent in chlorpromazine treated birds.

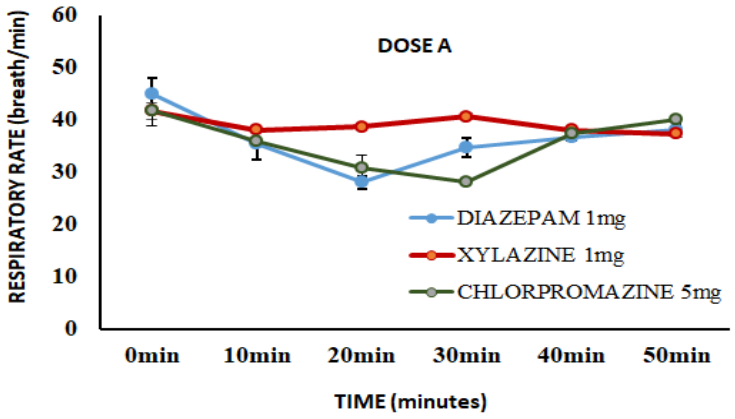

Figure 10. The respiratory rates of Guinea fowls after administration of Diazepam (1 mg/kg), Xylazine (1 mg/kg) and Chlorpromazine (5 mg/kg)

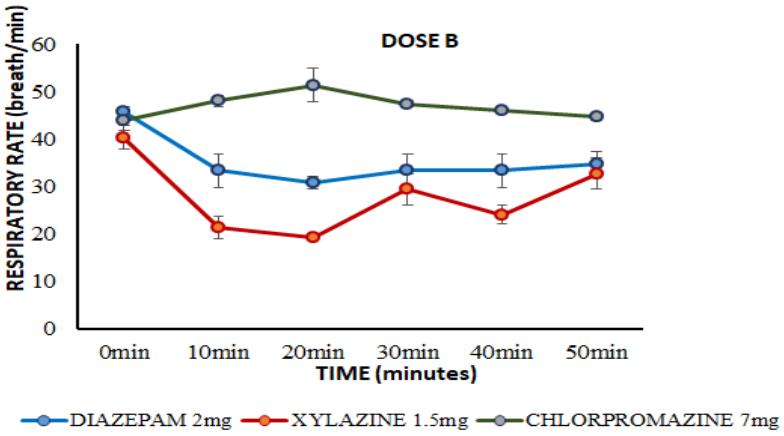

Figure 11. The respiratory rates of Guinea fowls after administration of Diazepam (2 mg/kg), Xylazine (1.5 mg/kg) and Chlorpromazine (7 mg/kg)

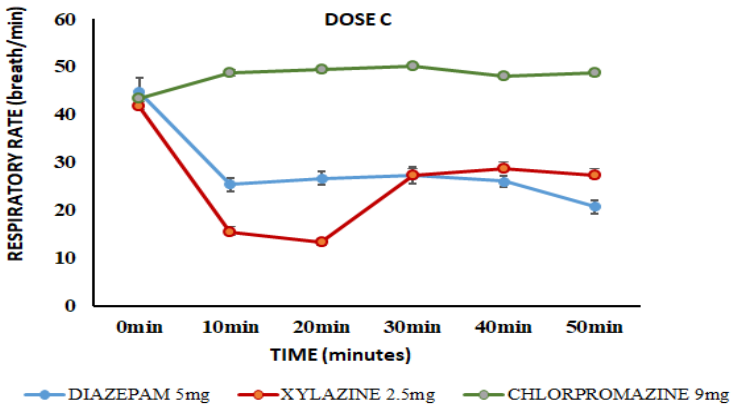

Figure 12. The respiratory rates of Guinea fowls after administration of Diazepam (5 mg/kg), Xylazine (2.5 mg/kg) and Chlorpromazine (9 mg/kg).

Figure 13. Picture of (1). Guinea fowl sedated with Chlorpromazine at 7 mg/kg showing no sedation; (2). Guinea fowl sedated with 2 mg/kg of Diazepam showing moderate sedation; and (3). Guinea fowl sedated with 2.5 mg /kg of Xylazine showing deep sedation.

Discussion

The short onset of sedation in the Guinea fowls treated with xylazine may be attributed to the earlier reported stimulating effect of xylazine on central alpha-2 receptors, the blocking of norepinephrine production, and the lowering of activity in certain neurons in the central nervous system, leading to sedation and amnesia (Debnatt and Chawla, 2023). This finding in the present study concurs with earlier reports in ducks by Saqib *et al*. (2017) and in budgerigars by Sadegh (2013). However, Uzun *et al*. (2006) reported shorter onset of action with diazepam when compared with double dose of xylazine in rock partridges, which could be due to species differences that influence the doses of drugs that can be used to achieve sedation in avian species. The onset of action was also inversely proportional to the doses of the drugs used; the higher the dose of the drug used, the shorter the onset of action, except in chlorpromazine-treated guinea fowls, in which no sedation occurred at any of the doses used in the study. The wattle discoloration which indicated the onset of action, was observed at the dose of 5 mg/kg, but sedation was not obvious. It is thought that it could have been possible to induce sedation if a dose far lower than 5 mg/kg of chlorpromazine had been

used instead. Acepromazine, a closely related analogue to chlorpromazine, was reported to have caused sedation at a lower dose of 0.25 mg/kg in ducks (Abbasi *et al*., 2014).

The duration of sedation observed in the Guinea fowls treated with xylazine and diazepam was dose-dependent in direct proportion; the higher the dose, the longer the duration. However, xylazine was more potent, and the sedation lasted longer than that of diazepam at all doses. It is believed that the multiple actions of drowsiness, amnesia, muscle relaxation and analgesia produced by xylazine contributed to the longer duration of sedation and effective immobilization (Sadegh, 2013; Jakhrai *et al*., 2021). The sedative effect of diazepam at Dose C was as effective as that of xylazine at Dose B. However, Guinea fowls treated with chlorpromazine showed no sedation; instead, excitement and elevation of physiological parameters were observed. It may also be as a result of species differences or idiosyncrasies.

The degree of sedation in all the dose ranges studied was significantly higher in Guinea fowls treated with xylazine than those treated with diazepam; diazepam had a moderate degree of sedation: this is in agreement with previous findings on budgerigars and rock partridges (Sadegh, 2013; Uzun *et al*., 2006). Earlier reports showed that xylazine induced deep sedation that permitted only minor procedures to be carried out in the different species of birds used in their respective studies (Doss and Mans, 2021). It is worthy to note that chlorpromazine failed to produce any degree of sedation in the treated birds, which were obviously alert and hyperactive instead of being sedated.

The duration of analgesia was significantly longer in Guinea fowls treated with xylazine when compared with those treated with diazepam and chlorpromazine; this was in contrast with earlier reports of Saqib *et al*., (2017) in ducks, where diazepam treated ducks had the highest duration of analgesia, followed by acepromazine treated ducks, while xylazine treated ducks had the least duration of analgesia at doses of 2.5 mg/kg, 0.25 mg/kg and 0.125 mg/kg respectively.

The degree of muscle relaxation recorded in the present study was significantly higher in xylazine-treated Guinea fowls in all the groups than in diazepam and chlorpromazine treated Guinea fowls. Muscle relaxation was not observed in Guinea fowls treated with chlorpromazine because sedation did not occur, and opening of the jaw was resisted by the birds which were not sedated.

The significant depression of heart rate caused by xylazine at all the doses when compared with diazepam and chlorpromazine is believed to be due to the earlier reported physiologic consequence of the administration of alpha-2-adrenergic agonists, and these consequences includes normo- or hypotension and bradycardia. (Maiti *et al*., 2006; Saqib *et al*., 2017). The effect of diazepam on the heart rates of treated Guinea fowls was minimal; this concurs with the finding of Uzun *et al*. (2006) when diazepam was compared with xylazine in rock partridges. Chlorpromazine caused an initial significant increase but later depression of heart rates. This could be due to the blockade of peripheral vasculature alpha-1-receptors (Hsu, 2008).

Diazepam caused a significant depression in respiratory rate, and it is almost equivalent to that caused by xylazine. The depression of respiratory rate by xylazine and diazepam is believed to be as a result of their depressant effects on the respiratory centre in the brain, especially when diazepam and xylazine are administered at higher doses (Vodavar *et al*., 2022; Cline, 2025). Chlorpromazine caused a significant respiratory depression at the lowest dose used in this study, while at higher dose, there was a significant increase in respiratory rate. The depression in respiratory rate recorded for chlorpromazine at a lower

dose in this study agrees with the findings of Saqib *et al*. (2017) in ducks, in which acepromazine depressed respiratory rate at the lowest dose used in the study.

Xylazine caused a significant depression of cloacal temperature when compared with diazepam. This depression could be due to the depressant effects of xylazine on the thermoregulatory centre of the brain (Hsu, 2008), as well as hypothermia due to lack of muscular activity. It has also been suggested by Kaya *et al*. (2019) in a study on pheasants that it is imperative to have measures to prevent extreme hypothermia in avian species when sedatives are used. In Guinea fowls treated with chlorpromazine, there were minimal changes in cloacal temperatures from the pre-sedative values.

Conclusion: The present study recorded a range of clinically useful doses of diazepam (2 – 5 mg/kg) and xylazine (1 - 2.5 mg/kg) that caused significant dose-dependent sedation and provided varying degrees of analgesia in the Guinea fowl. These doses of both diazepam (2 mg/kg and 5 mg/kg) and xylazine (1.5 mg/kg and 2.5 mg/kg) were enough to sedate Guinea fowls for medical examination and some diagnostic procedures. However, 2.5 mg/kg of xylazine caused deep sedation enough to permit some minor painful surgical procedures.

Recommendations: Based on the result of this study, diazepam (2 – 5 mg/kg) and xylazine (1.5 mg/kg) at these doses can be used to sedate Guinea fowls for medical examination and some diagnostic procedures, while xylazine at dose of 2.5 mg/kg should be used for minor painful surgical procedures. Hence, xylazine is more reliable and effective for multipurpose sedation in Guinea fowl.

Conflict of Interest

The authors declare that they have no potential conflict of interest with respect to the authorship and/or publication of this article.

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