Effect of propofol on the haematological profile of pregnant Red Sokoto does


*Department of Veterinary Pharmacology and Toxicology, University of Ilorin, Ilorin, Nigeria*
*Department of Veterinary Surgery and Radiology, Usman Danfodiyo University Sokoto, Sokoto, Nigeria.*
*Department of Veterinary Microbiology, University of Ilorin, Ilorin, Nigeria.*
*Department of Veterinary Physiology and Biochemistry, University of Ilorin, Ilorin, Nigeria.*
*Department of Veterinary Theriogenology and Animal production, University of Ilorin, Ilorin, Nigeria.*

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**Abstract**

**Introduction:** Propofol (Diprivan®) is now a mainstay drug during anaesthesia in human and small animal surgeries and this is as a result of its good quality anaesthesia, rapid onset, and short duration of action with rapid recoveries. There is paucity of information in Nigeria as per the use of general anaesthesia to carry out procedures in pregnant red Sokoto Does. The aim of this study is to assess the haematological profile of pregnant red Sokoto doe following propofol anaesthesia and also ascertain the safety of the drug during gestation.

**Methods:** Ten apparently healthy pregnant Red Sokoto does were used for this study. The animals were acclimatised for two weeks and pregnancy was diagnosed using B-mode Real time® transcutaneous ultrasonography. The animals were grouped into two (A and B) comprising five animals each in their first and second trimesters respectively. Propofol at 4 mg/kg and 5 mg/kg was administered to the does in groups A and B respectively. Blood samples were collected via the jugular vein and analysed using full automated blood counter (Ehmma® PCE 210).

**Results:** The result showed that the onset and duration of propofol anaesthesia at the two doses in both groups were smooth and rapid without much excitation. There were no significant (p < 0.05) differences in the blood parameters in both group when compared with the control.

**Significance:** Our study lends credence to the fact that propofol anaesthesia is suitable and safe anaesthetic agents for induction and maintenance of general anaesthesia in pregnant red Sokoto does.

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**Introduction**

In Northern Nigeria, Red Sokoto goats are the most commonly reared breed. It is a distinct and an important breed in the sub-Saharan Africa. The economic importance of this breed is the production of quality hide and skin. Therefore, there is urgent need for research on Red Sokoto goats in order to ensure their proliferation and preservation through good management practices (FAO, 2000). The gestation period of this breed of goat ranges from 145 days to 150 days and they mostly kid twin and triplets serving as an advantage to other breeds of goats (FAO, 2000).

Several drugs are used intravenously alone or in combination with other drugs to achieve an anaesthetic state as components of balanced anaesthesia. These drugs include: barbiturates, benzodiazepines, opioids, propofol, ketamine and miscellaneous drugs such as medetomidine (Hall et al., 2001). Propofol is employed in this breed of goats because of its safety margin and its rapid speed of recovery after anaesthesia. Propofol (Diprivan®) is a phenolic compound that induces good quality anaesthetics, rapid onset, and short duration of action with rapid recoveries (Prassinos et al., 2005). It lacks analgesic property but when combined with xylazine which has analgesic, sedative, and muscle relaxant properties. Xylazine when used alone or in combination with other anaesthetic agent is reported to produce cardiovascular and respiratory depression, temporal hyperglycaemia in goats and cattle (Fayed et al., 1989). Propofol is used for induction and maintenance of anaesthesia, having largely replaced sodium thiopental (Miner et al., 2007). It can also be administered as part of an anaesthesia maintenance technique – total intravenous anaesthesia – using either manually-programmed infusion pumps or target-controlled infusion. The drug is rapidly distributed into peripheral tissues when used for intravenous sedation. The effect of a single dose of propofol typically wears off within minutes. These characteristics of rapid onset and recovery along with its amnestic effects have led to its widespread use for sedation and anaesthesia (Veselis et al., 1997). One of the frequent side effects of propofol is pain at the site of injection, especially in smaller veins. Less pain is experienced when infused at a slower rate in a large vein. Propofol has more pronounced haemodynamic effects relative to many intravenous anaesthetic agents (Sebel and Lowden, 1989). Reports of blood pressure drops of 30% or more are thought to
be at least partially due to inhibition of sympathetic nerve activity. Propofol can also cause decreased systemic vascular resistance, myocardial blood flow and oxygen consumption, possibly through direct vasodilation. There are also reports that it may cause green discoloration of the urine (Larijani et al., 2000). Propofol may produce significant decreases in respiratory rate and mean inspiratory flow rate (Sebel and Lowden, 1989). The persistence of apnoea can depend on factors such as premedication, dose administered, and rate of administration, possibly as the result of depression of the central inspiratory drive (Machata et al., 2008). Diminishing cerebral blood flow, cerebral metabolic oxygen consumption, and intracranial pressure are also characteristics of propofol administration (Bailey et al., 1996). This study is aimed at assessing the effect of propofol on the haematology profile of pregnant Red Sokoto does.

**Materials and methods**

**Ethical approval**

The Usman Danfodiyo University Ethical Committee approved this study with number: UDU/2013/112785.

**Animals**

Pregnant Red Sokoto does (n = 10) comprising five each at first and second trimesters with a mean ± SD body weight of 11.0 ±3.8kg (range, 15-20kg) were used for the study. They were fed with freshly cut grasses and allowed to graze in the field under controlled tethering. Water was also served *ad libitum*. Clinical examination and physiological parameters such as heart rate, rectal temperature, and respiratory rate were taken regularly throughout the period of acclimatization which lasted for 14 days. The goats’ health was assessed based on universal body scoring conditions. Blood samples were taken from jugular vein for haemoparasites screening to ensure the blood is free from parasites.

**Pregnancy diagnosis**

Pregnancy was diagnosed using B-mode real time® transcutaneous ultrasonography with 7.0 MHz electrical transcutaneous transducer as described by Stephen (1971). Food was withdrawn from all the does 6 to 8 hours before ultrasonography but water was provided to ensure clear image of the foetus as described by (Mannion, 2006). The animals were prepared, placed on dorsal recumbence and acoustic gel (Sonogel®, Trivitron Medical, India) was applied with the transducer was placed on the abdomen to view the foetal image on the monitor. The image contains the date, age (weeks) and area of gestational sac showing the foetus (Mannion, 2006).

**Anaesthesia**

Propofol (1%) using two different doses (4 mg/kg and 5 mg/kg), anaesthesia was induced aseptically via jugular venepuncture. It was maintained in the first (4 mg/kg) and second trimester (5 mg/kg) of pregnant does for a period of 60 minutes by repeated bolus injection (RBI) with hand held syringe (23-gauge needle) using the preplaced Cather of the left jugular vein at each time required. Oro-tracheal intubation to prevent aspiration pneumonia and placement of stethoscope was followed immediately to monitor the heart rate after induction of anaesthesia.

**Haematological analysis**

The blood samples were collected from the jugular vein prior to treatment into EDTA bottles serving as control or baseline parameter. During anaesthesia, blood samples (3ml) were also collected at interval in sterile 5ml EDTA bottles at 5 mins intervals for the first 15 mins, also at 15 mins interval for the next 60 mins i.e. 0, 5, 15, 30, 45, and 60 mins. and 60 mins after complete recovery. Haematological parameters determined were complete blood count (CBC), packed cell volume (PCV), haemoglobin concentration (Hb), total white blood cell count (WBC) and red blood cell count (RBC) and differential blood counts (Granulocytes, Lymphocytes and monocytes using full automatic blood counter (Ehmma® PCE 210, Coscharis Medical Ltd, UK). Mean Corpuscular Volume (MCV), Mean Corpuscular haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) values were calculated.

**Table 1. Effect of propofol anaesthesia at 4 mg/kg on some haematological indices of pregnant Red Sokoto does.**

<table>
<thead>
<tr>
<th>Blood Parameters/ Time</th>
<th>Before R (0 min)</th>
<th>5min</th>
<th>10min</th>
<th>15min</th>
<th>30min</th>
<th>45min</th>
<th>60min</th>
<th>120min</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCV (%)</td>
<td>22.14±0.25</td>
<td>21.68±2.76</td>
<td>21.74±2.35</td>
<td>21.90±1.41</td>
<td>21.98±1.74</td>
<td>22.20±2.96</td>
<td>22.78±1.95</td>
<td>23.10±1.64</td>
</tr>
<tr>
<td>Hb (g/dl)</td>
<td>8.67±1.74</td>
<td>8.18±1.01</td>
<td>7.96±2.26</td>
<td>8.30±2.87</td>
<td>8.30±2.87</td>
<td>8.52±2.64</td>
<td>8.46±2.96</td>
<td>8.52±1.95</td>
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<tr>
<td>RBC (x10³/µl)</td>
<td>11.89±1.37</td>
<td>11.52±1.25</td>
<td>11.27±1.74</td>
<td>11.56±1.81</td>
<td>11.40±1.70</td>
<td>11.60±1.61</td>
<td>11.58±1.90</td>
<td>11.86±1.86</td>
</tr>
<tr>
<td>WBC (x10³/µl)</td>
<td>56.30±12.99</td>
<td>55.24±15.50</td>
<td>54.14±21.41</td>
<td>55.64±17.72</td>
<td>55.68±16.51</td>
<td>55.44±16.02</td>
<td>55.64±17.00</td>
<td>57.98±17.29</td>
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<tr>
<td>Granulocytes (x10³/µl)</td>
<td>17.06±6.72</td>
<td>16.54±10.48</td>
<td>16.12±9.18</td>
<td>17.10±2.87</td>
<td>16.70±4.41</td>
<td>17.68±4.41</td>
<td>19.04±3.85</td>
<td>19.42±5.62</td>
</tr>
<tr>
<td>Lymphocytes (x10³/µl)</td>
<td>34.10±8.87</td>
<td>34.32±7.03</td>
<td>34.04±11.18</td>
<td>33.42±6.63</td>
<td>33.06±16.26</td>
<td>35.22±18.01</td>
<td>36.38±21.41</td>
<td>38.92±13.75</td>
</tr>
<tr>
<td>Monocytes (x10³/µl)</td>
<td>4.60±3.20</td>
<td>4.62±1.90</td>
<td>4.70±4.26</td>
<td>4.76±2.26</td>
<td>4.52±3.96</td>
<td>4.70±3.61</td>
<td>5.28±3.20</td>
<td>4.90±2.87</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>16.62±5.17</td>
<td>16.40±6.07</td>
<td>16.36±5.51</td>
<td>16.50±5.31</td>
<td>16.36±5.11</td>
<td>16.70±6.03</td>
<td>16.74±6.18</td>
<td>16.92±5.06</td>
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<tr>
<td>MCH (pg)</td>
<td>7.24±0.69</td>
<td>7.02±1.09</td>
<td>7.00±1.05</td>
<td>7.12±1.16</td>
<td>7.20±1.46</td>
<td>7.27±1.34</td>
<td>7.24±1.46</td>
<td>7.20±1.01</td>
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<tr>
<td>MCHC (g/dl)</td>
<td>43.60±9.92</td>
<td>43.60±9.43</td>
<td>43.50±9.74</td>
<td>43.60±9.59</td>
<td>44.42±8.98</td>
<td>44.16±9.48</td>
<td>43.82±8.98</td>
<td>43.28±8.27</td>
</tr>
</tbody>
</table>

**Table 2. Effect of propofol anaesthesia at 5 mg/kg on some haematological indices of pregnant Red Sokoto does.**
Blood Parameters/Time

| Parameter                  | Before R (
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>---------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>PCV (%)</strong></td>
<td>19.84±0.81</td>
</tr>
<tr>
<td><strong>Hb (g/dl)</strong></td>
<td>8.18±0.21</td>
</tr>
<tr>
<td><strong>RBC (x10^6/µl)</strong></td>
<td>11.48±0.17</td>
</tr>
<tr>
<td><strong>WBC (x10^3/µl)</strong></td>
<td>52.70±3.72</td>
</tr>
<tr>
<td><strong>Granulocytes (x10^3/µl)</strong></td>
<td>16.60±1.45</td>
</tr>
<tr>
<td><strong>Lymphocytes (x10^3/µl)</strong></td>
<td>29.90±2.59</td>
</tr>
<tr>
<td><strong>Monocytes (x10^3/µl)</strong></td>
<td>4.24±0.48</td>
</tr>
<tr>
<td><strong>MCV (fl)</strong></td>
<td>17.22±0.55</td>
</tr>
<tr>
<td><strong>MCH (pg)</strong></td>
<td>7.24±0.20</td>
</tr>
<tr>
<td><strong>MCHC (g/dl)</strong></td>
<td>43.22±1.98</td>
</tr>
</tbody>
</table>

**Statistical analysis**

All data obtained were expressed as mean ± SD. The differences between the groups were analysed by one-way analysis of variance (ANOVA) followed by Dunnett’s post-hoc multiple comparison test using GraphPad Prism 5.03 statistical package, San Diego, California, U.S.A. A p-value considered was (p < 0.05).

**Results**

The result of haematological parameters at 4 mg/kg dose of propofol is shown in Table 1. The onset of anaesthesia was 30.2±10.5 seconds with immediate salivation and prolapse of the 3rd eyelid. All the blood parameters were non-significant (p > 0.05) when compared with the baseline values serving as control. Table 2 shows the result of does in group B dosed with 5 mg/kg propofol. The onset of anaesthesia was 28.2 ± 9.5 seconds with immediate salivation and prolapse of the 3rd eyelid. All the blood parameters were non-significant (p > 0.05) when compared with the baseline values serving as control observed in 4 mg/kg.

There was slight decrease in all the blood parameters from 5-30 minutes before an increase from 45 mins towards recovery as observed in both groups (Tables 1 and 2). Administration of propofol at 4 mg/kg and 5 mg/kg did not cause significant difference (p > 0.05) in PCV, RBC, WBC and the differential white blood count (granulocytes, lymphocytes and monocytes) and MCV, MCH, MCHC across all the time interval as shown in Tables 1 and 2.

**Discussion**

Propofol is a drug which can be given for short or prolonged period for sedation as well as general anaesthesia. The study revealed that the onset and duration of anaesthesia caused by propofol at 4 mg/kg and 5 mg/kg doses in Red Sokoto does were smooth and rapid recovery without much excitation in the animals. The recovery of anaesthesia from both groups was rapid and the animal attained sterna recumbence immediately. This agreed with a previous work carried out by Bettschart et al. (2002) who had shown that propofol produces faster onset of action when pre-medicated drugs such as meditomidine and is used in achieving balanced anaesthesia.

The animals in both groups (4 mg/kg and 5mg/kg) showed decrease values in blood parameters from the baseline to about 30 mins before rising to the normal baseline level over the course of the recovery (120 mins). This is as result of the pharmacokinetic properties of most injectable anaesthetic agent like barbiturates that are highly bound to protein and redistributed from vessel-rich organs to peripheral tissues like the adipose tissues (Langely and Heel, 1998).

The animals at first trimester (group A) treated with 4 mg/kg showed smooth induction and recovery but the animals in the second trimester (group B) treated with 5 mg/kg showed vocalization and vulva discharges and ataxia during propofol induction. These observations may be explained by propofol concentration at wakening patient. It has been documented that following both single and multiple infusions of propofol (5 mg/kg), approximately double threshold concentration is achieved. This indicates that acute tolerance to propofol develops on exposure above a threshold concentration. A similar observation has been reported by Cockshott et al. (1990); waking concentration in man following a 2 h infusion at 6 mg/kg per h were about 70% higher than those at 3 mg/kg per hour.

Administration of propofol at 4mg/kg and 5mg/kg did not cause significant difference (p < 0.05) in PCV, RBC, MCV, MCH, MCHC, WBC and the differential white blood count (granulocytes, lymphocytes and monocytes). This was in line with the reports of Kelawala et al. (1991) and Brezeski and Chyczewski (1994) indicating that propofol did not cause significant changes in the haematological parameters of goats and sheep respectively. The animals were more sensitive to 5 mg/kg compared to 4 mg/kg. The 4 mg/kg is considered safer because of the doubled acute threshold that is observed in the wakening animals treated with 5 mg/kg.

The haematological parameters of Red Sokoto goat is not significantly altered when propofol anaesthesia was administered at 4mg/kg in first trimester with the pregnancy progressing to the second trimester suggesting the safety and suitability of this anaesthetic agent during pregnancy. The foetus of first and second trimester does were monitored until parturition without showing any sign of anomalies or physical deformities.
Conclusion

The study concluded that propofol anaesthesia is suitable and safe anaesthetic agents for induction and maintenance of general anaesthesia with smooth and rapid recovery without much excitation in the animals. This study affirms that 4mg/kg is more suitable and safer when using propofol in pregnant goat.

Conflicts of interest

There is no conflict of interest regarding the publication of this paper.

Acknowledgements

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References


