Effect of dietary supplementation of neem oil (Azadirachtaindica) on the haematology, serum biochemistry and carcass characteristics of weaned rabbits

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Abstract: The objective of the present study was to determine the effect of dietary supplementation of neem oil (Azadirachtaindica) on the haematology, serum biochemistry, and carcass characteristics of weaned rabbits. A total of 50 weaned male crossbred rabbits between 5-6 weeks with an average weight of 565.4 g-566.8 g were divided into five dietary groups of ten (10) weaned rabbits each in a completely randomized design. The dietary treatments include a control, T1 (basal) diet with no neem oil (NOL), T2, T3, T4 and T5 were fed the basal diet supplemented with NOL at 0.1%, 0.2%, 0.3%, and 0.4% respectively. Feed and water were offered ad libitum throughout the experiment which lasted for 12 weeks. The data obtained was used to evaluate the haematology: packed cell volume, Haemoglobin, Red Blood Cell, White Blood Cell, Mean Corpuscular Volume, Mean Corpuscular Haemoglobin and Mean Corpuscular Haemoglobin Concentration., serum biochemistry: Total protein, Globulin, Cholesterol, Glucose, and Serum electrolytes (Sodium and chloride) and carcass characteristics, final weight, head, dressing percentage, liver, kidney, heart, lungs, and spleen were significantly (P˂0.05) different among the treatments. All the haematological parameters evaluated differ significantly (P˂0.05) except haemoglobin, red blood cell, mean corpuscular volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration which was not influenced (P>0.05) by the dietary supplementation of neem oil. The serum biochemistry parameters evaluated differ significantly (P<0.05) among the treatments, except total protein values which were not significantly affected (P>0.05) by neem oil (P>0.05). Results of carcass evaluation revealed that T5 had the highest weight gain (755.90 g) followed by T4 (734.0g), T3 (705.90g), T2(705.0g), and T1(621.80g) respectively. The highest mortality was recorded in T1 (2%) followed by T2 (1%), none was recorded in T3, T4, and T5. Neem oil significantly influenced (P<0.05) all the parameters measured. It was concluded that neem oil contains some essential nutrients and bioactive chemicals and could be included in the diets of rabbits at 0.4 % without causing any deleterious effect on the performance and health of the animal.

Keywords: Rabbits, neem seeds, Azadirachtaindica, haematology, serum biochemistry, carcass’ weaned rabbits, etc.

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Introduction:

With so many research carried out to find endogenous feed alternatives for rabbit production as the high cost of raw materials that are used for commercial feed increase the production cost, there is also an urgent need to embark on scientific findings on livestock’s natural growth promoter which will ensure increasing growth rate, enormous availability of meat, and other high-value bye-products for the entire populace at a relatively conservative cost. Producers use growth promoters to increase growth rates and improve overall efficiency and product quality without leaving any toxic residue in the body system of livestock. Their inclusion in feedstuffs should be designed so as to feature a pharmacological characteristic that enhances the immunity of the animal and to help in minimizing the use of conventional antibiotics in the prevention and treatment of diseases of livestock. The conventional artificial growth promoters are known to have a deleterious effect on humans who are the secondary consumers of residues of artificial growth promoter in the body of livestock (Sinniah, 1981).

Neem belongs to the kingdom: Plantae; Division: Magnoliophyta; Order: Sapindales; Family: Meliaceae; Genus: *Azadirachta*; Species: *indica*. It is a tropical evergreen related to mahogany. Native to East India and Burma, it grows in much of Southeast Asia and West Africa; a few trees have recently been planted in the Caribbean and several Central American countries, including México. The name *Azadirachtaindica* is derived from the Persian term “Axaddarakth” (free tree). In Ayurveda, it is known as the ‘Arishta’, which means “relieving sickness” in Sanskrit. It is a medium-sized or large evergreen tree with an irregularly rounded crown, attaining a height of 14m-20m. It is a hardy tree that grows well in sandy, stony shallow soil, and is tolerant to alkaline, saline, and acidic soil and it grows well on black cotton soil (Patnaik, 1993).

Neem is ubiquitous in Northern Nigeria. The Neem tree popularly referred to in Hausa language as *Dogonyaro* is a tree in the mahogany family with broad dark brown stem and widely spread branches. According to Subbalakshmi et al., (2012), all parts of neem like seeds, flowers, bark, and leaves are beneficial due to their medicinal properties. Research has shown that neem will boost the immune system by stimulating the production of T-cells when challenged by infections (Upadhyay, 1990). The role of medicinal plants in disease prevention or control has been attributed to the antioxidant properties of their constituents, usually associated with a wide range of amphipathic molecules, broadly termed polyphenolic compounds (Demiray et al., 2009). The bark of the neem has been reported to have higher phenolic and antioxidant activity compared to the leaf (Ghimeray et al., 2009; Olabinriet et al., 2009). Neem oil, bark, and leaf extracts have been therapeutically used as a folk medicine to control diseases like leprosy, intestinal helminthiasis, respiratory disorders, constipation, and skin infections (Biswas et al., 2002). The neem tree contains more than 100 bioactive ingredients and the most important bioactive compound is azadirachtin (Nahak and Sahu, 2010). The Neem leaves, neem oil, and de-oiled neem seed cake are used as animal feeds (Ogbuewu et al., 2010a). The neem leaves contain appreciable amounts of proteins, minerals, carotene, and an adequate amount of trace minerals (Ogbuewu et al., 2010). Neem tree as one of the most researched trees in the world has attracted worldwide prominence due to its vast range of medicinal properties like antibacterial, antiviral, antifungal, antiprotozoal, hepatoprotective, and other various properties without showing any adverse effect (Kale et al., 2003).

The compounds in neem have been divided into two major classes; isoprenoids and others (Singh et al., 1996). The isoprenoids include diterpenoids and triterpenoids containing protomeliacins, limonoids, azadirone and its derivatives, gedunin and its derivatives, vilasinin type
of compounds, and Csecomeliacins such as nimbin, salanin, and azadirachtin. The none-isoprenoids include proteins (amino acids) and carbohydrates (polysaccharides), sulphurous compounds, polyphenolics such as flavonoids and their glycosides, dihydrochalcone, coumarin and tannins, aliphatic compounds, and several fatty acids (dodecanoic, tetradecanoic, elcosanic, etc). (Zengin et al., 2016a, Zengin et al., 2016b).

**Experimental Site:**

The study was carried out at the University of Abuja Teaching and Research farm, Airport Road, Abuja., in the Gwagwalada area council of the Federal Capital Territory, Abuja. Gwagwalada is situated in the Northcentral zone of Nigeria., Lying at the latitude N 9.0765 and longitude E 7.3986 at an average elevation of 476 m above sea level.

**Collection and processing of neem oil (NOL):**

Neem seeds were collected from Gwagwalada, Abuja and identified at the department of biological sciences, University of Abuja, Nigeria. The seeds of Neem were separated from the seed coats manually and sundried for 2 weeks. The dried seeds were granulated into coarse particles using a blender (Model Ap-DKL, Samsung). Oil was extracted using the soxhlet extraction method; it was later poured into a well-labeled container for further analysis.

**Experimental animals and their management:**

Fifty (50) apparently healthy, crossbred weaned male rabbits with an average initial body weight of 565.4g-566.8g were used for the study and were randomly allotted into Five Treatments with ten (10) rabbits per treatment designated as treatment 1, 2, 3, 4 and 5 in a Completely Randomized Design (CRD), animals were kept in an all wired hutch measuring 35 × 35 × 55cm (width × length × height). All treatments have 5 replicates with two (2) rabbits per replicate. After 14 days of acclimatization, all rabbits were fed diets corresponding to their treatments and given prophylactic treatment with broad-spectrum medication (Kepromec®) against endoparasites and helminths infestation before the commencement of the experiment. Feed and water were given *ad libitum* and all other management practices were strictly adhered to.

**Experimental diets:**

Basal was formulated to meet the nutritional requirement for rabbits according to NRC (1977).

- Treatment 1 – Basal diet + 0 % NOL
- Treatment 2 – Basal diet + 0.1 % NOL
- Treatment 3 – Basal diet + 0.2 % NOL
- Treatment 4 – Basal diet + 0.3 % NOL
- Treatment 5 – Basal diet + 0.4 % NOL

**Haematology and serum biochemistry:**

Blood samples were collected from the ear vein of each animal with a sterilized disposable syringe and needle. In order to minimize the standard error in values, the animals were fasted for
12 hours prior to blood collection. Five milliliters of blood sample were collected into bottles containing anticoagulant Ethylene Diamine Tetra Acetate (EDTA) for haematological analysis while the blood samples for serum analysis were collected into sterile bottles for analysis at specific days intervals of 0, 35, and 70 days of the study and were accurately labeled. Samples were let to coagulate and centrifuged for 15 min and serum was separated and stored immediately at −20°C till analyzed. The haematological parameters which were measured include packed cell volume, Haemoglobin, Red Blood Cell, White Blood Cell, Mean Corpuscular Volume, Mean Corpuscular Haemoglobin and Mean Corpuscular Haemoglobin Concentration. The serum biochemical constituents observed were Total protein, Globulin, Cholesterol, Glucose, and Serum electrolytes (Sodium and chloride). All the parameters were estimated in an automated biochemical analyzer (Accurex — Sphera Automated Clinical Chemistry Analyzer Italy), using commercial kits according to manufacturer instruction.

**Carcass characteristics:**

At the end of the experiment, fifteen rabbits (i.e 3 rabbits per treatment) across the treatments were randomly selected for slaughtering. They were deprived of feed for 12 hours as recommended by Joseph et al., (1994). Withholding feed for 12 hours before slaughter reduces the volume of gut contents and hence, bacteria and therefore reduces the risk of contamination of the carcass during dressing without adversely affecting meat yield and quality (FAO, 1991; Joseph et al., 1994). The rabbits were weighed and slaughtered humanely (Mann, 1960). After slaughtering, an incision was carefully made around the abdomen with a pen knife to create space through which the visceral were removed. The weight of the kidney, heart, liver, lungs, and pancreas was taken. The organs were weighed using the electronic sensitive weighing scale and their respective weights were recorded and expressed as a percentage of fasted live weight. The dressed carcass is the portion of the rabbit remaining after the removal of the head, feet, fur, tail, and visceral organs. The dressed carcasses were splits into retail cuts such as shoulder/forelegs, thigh/hind leg, rack, and loin as described by Blasco et al. (1993).

\[
\text{Dressed percentage} = \frac{\text{Dressed carcass weight (g)}}{\text{Live weight (g)}} \times 100
\]

**Statistical Analysis:**

All data were subjected to one-way analysis of variance (ANOVA) using SPSS (18.0) and significant means were separated using Duncan multiple range tests (Duncan, 1955). Significant was declared if \( P \leq 0.05 \).

**Results and Discussion:**

**Proximate composition of experimental diet:**

Table 1 shows the proximate composition of the experimental diet. The proximate components contained crude protein (18.22 %), crude fibre (13.22 %), ether extract (3.20 %), ash (6.15 %) and energy (2566.5 kcal/kg). The crude protein, crude fiber, and energy values reported in this experiment are in agreement with the findings of Ahmed et al. (2018); Alagbe and Oluwafemi (2019) but contrary to the reports of Ahmed et al. (2019) when thyme oil was fed to growing rabbits. However, all values were within the nutritional requirement of growing rabbits.
according to NRC (1977). Adequate intake of dietary fiber lowers the serum cholesterol level, risk of coronary heart disease, constipation, and colon and breast cancer (Fashola, 2011; Alagbe, 2019; Olanipekun et al., 2016). Ash content gives an indication of the number of minerals present in a feed, which are important in many biochemical reactions functioning as co-enzyme and aid physiological functioning of the major metabolic processes in the body (Ojewuyi et al., 2014).

Table 1: Chemical composition of experimental diet

<table>
<thead>
<tr>
<th>Materials</th>
<th>Quantity (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>30.0</td>
</tr>
<tr>
<td>Wheat offal</td>
<td>20.0</td>
</tr>
<tr>
<td>Soya meal</td>
<td>16.25</td>
</tr>
<tr>
<td>Groundnut cake</td>
<td>10.0</td>
</tr>
<tr>
<td>Palm kernel meal</td>
<td>20.0</td>
</tr>
<tr>
<td>Bone meal</td>
<td>2.00</td>
</tr>
<tr>
<td>Limestone</td>
<td>1.00</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.01</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.01</td>
</tr>
<tr>
<td>*Premix</td>
<td>0.25</td>
</tr>
<tr>
<td>Salt</td>
<td>0.25</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Calculated analysis

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<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Crude protein (%)</td>
<td>17.22</td>
</tr>
<tr>
<td>Crude fibre (%)</td>
<td>13.20</td>
</tr>
<tr>
<td>Ether extract (%)</td>
<td>3.02</td>
</tr>
<tr>
<td>Ash (%)</td>
<td>6.15</td>
</tr>
<tr>
<td>Energy (Kcal/kg)</td>
<td>2566.5</td>
</tr>
</tbody>
</table>

*Premix supplied per kg diet: Vit A, 7,000 IU; Vit E, 5mg; Vit D3, 3000IU, Vit K, 3mg; Vit B2, 5.5mg; Niacin, 25mg; Vit B12, 16mg; Choline chloride, 120mg; Mn, 5.2mg; Zn, 25mg; Cu, 2.6g; Folic acid, 2mg; Fe, 5g; Pantothenic acid, 10mg; Biotin, 30.5g; Antioxidant, 56mg.

Effect of different levels of neem (Azadirachtaindica) oil on the haematological parameters of weaned rabbits:

Table 2 shows the haematological indices of growing rabbits fed diets containing neem oil. The blood indices show normal physiological ranges as established by Kronfield and Mediway (1975); Mitruka and Rawnsley (1977) and Hewitt et al., (1989). With respect to PCV, there was no significant difference (P>0.05) when T4 and T5 were compared. Similarly, there was no significant difference (P>0.05) between T2 and T3., PCV values recorded for T2 and T3 were significantly (P<0.05) different when compared to the values obtained for T4 and T5 but PCV values for T1 (diet + 0% neem oil) is significantly (P<0.05) different when compared to T2, T3, T4, and T5. With respect to Hb, a significant difference occurred when T2 and T3 were compared to T4 and T5 but not the same (P>0.05) among T2 and T3 so also, T4 and T5. However, T1 is significantly (P<0.05) different when compared to T2, T3, T4, and T5.

There was no significant difference (P>0.05) among treatments with respect to RBC. The WBC showed that there was a significant difference (P<0.05) comparing T2 to T3 and T4 to T5. But the mean value obtained in T1(0%) was significantly (P<0.05) different compared to other treatment groups. The MCV, MCH, and MCHC were not significantly different (P>0.05) among
the treatments. Okoli et al., (2002); Omokore and Alagbe (2019) reported that neem leaf was traditionally used as a human blood-building tonic, especially for weak toddlers. The results of this study disagree with the findings of Biu et al., (2009) and Gowda et al., (1998) that neem preparations fed to laying birds significantly reduced the content of haemoglobin, erythrocyte, and Packed Cell Volume.

Therefore, the results of these haematological parameters support that 0.40% neem oil could be included in rabbit diet to enhance growth performance and haematological values in rabbits without endangering the animal productive potentials.

Table 2: Haematological parameters of rabbits fed diets containing neem oil

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1 (0%)</th>
<th>T2 (0.10%)</th>
<th>T3 (0.20%)</th>
<th>T4 (0.30%)</th>
<th>T5 (0.40%)</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCV (%)</td>
<td>36.80a</td>
<td>37.62b</td>
<td>38.42b</td>
<td>39.03a</td>
<td>39.60a</td>
<td>0.28</td>
</tr>
<tr>
<td>Hb(g/dl)</td>
<td>11.00c</td>
<td>13.47b</td>
<td>13.97b</td>
<td>14.18a</td>
<td>14.34a</td>
<td>1.13</td>
</tr>
<tr>
<td>RBC (x 10^6 µL)</td>
<td>4.65</td>
<td>4.73</td>
<td>4.89</td>
<td>5.10</td>
<td>5.92</td>
<td>0.13</td>
</tr>
<tr>
<td>WBC (x 10^9 µL)</td>
<td>7.80c</td>
<td>9.18b</td>
<td>10.12a</td>
<td>9.34b</td>
<td>10.62a</td>
<td>0.23</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>76.46</td>
<td>81.23</td>
<td>80.98</td>
<td>83.94</td>
<td>86.00</td>
<td>2.76</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>27.38</td>
<td>28.14</td>
<td>29.97</td>
<td>29.33</td>
<td>30.04</td>
<td>1.43</td>
</tr>
<tr>
<td>MCHC (pg)</td>
<td>35.79</td>
<td>35.79</td>
<td>35.81</td>
<td>36.21</td>
<td>37.10</td>
<td>0.68</td>
</tr>
</tbody>
</table>

abc means with different superscripts on the same row are significantly different (P < 0.05)

Key:

PCV = Packed Cell Volume; Hb = Haemoglobin, RBC = Red Blood Cell, WBC = White Blood Cell, MCV = Mean Corpuscular Volume, MCH = Mean Corpuscular Haemoglobin, MCHC = Mean Corpuscular Haemoglobin Concentration

Serum biochemistry of rabbits fed graded levels of neem oil:

Data on the effects of neem oil on serum biochemical constituents of rabbits are presented in Table 3. The total protein was not significantly (P>0.05) different among the treatments. Considering globulin, there was a significant (P<0.05) difference when T1 and T2 were compared to T3, T4, and T5. However, there was no significant difference (P>0.05) between T1 and T2, also similarly to T3, T4, and T5. The cholesterol level decreases with an increase in neem oil inclusion level across the treatment. There was a significant difference (P<0.05) in cholesterol levels among T1, T2, and T3. Meanwhile, there was no significant (P>0.05) difference between T4 and T5. The serum glucose level obtained is inversely proportional to increasing neem oil inclusion across treatments T3, T4, and T5. There were significant (P<0.05) differences when T3, T4, and T5 were compared to T1 and T2. Although, there was no significant (P>0.05) difference between T3, T4, and T5 also similarly to T1 and T2.

The non-significant difference observed in serum protein in this study could be compared to earlier reports of protein retained in animals. Awosanya et al., (2002); Oluwafemi et al. (2020) reported the dependence of blood protein on the quality and quantity of dietary proteins. The reduction in serum cholesterol value of the rabbits fed diets containing neem oil is an indication that neem oil could reduce the deposition of cholesterol in the skin and muscles. The reduction in serum cholesterol is a positive development since low cholesterol meat is healthier for consumption.
Table 3: Serum biochemical characteristics of weaned rabbits fed graded levels of neem oil

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein (g/dl)</td>
<td>6.10</td>
<td>6.90</td>
<td>6.10</td>
<td>6.20</td>
<td>6.20</td>
<td>0.50</td>
</tr>
<tr>
<td>Globulin (g/dl)</td>
<td>2.49</td>
<td>2.53</td>
<td>3.00</td>
<td>3.02</td>
<td>4.70</td>
<td>0.06</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>174.60</td>
<td>115.20</td>
<td>95.40</td>
<td>56.50</td>
<td>54.10</td>
<td>2.45</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>80.00</td>
<td>83.10</td>
<td>78.30</td>
<td>76.80</td>
<td>75.80</td>
<td>1.10</td>
</tr>
<tr>
<td>Chloride (mmol/l)</td>
<td>117.10</td>
<td>112.00</td>
<td>119.20</td>
<td>129.30</td>
<td>134.50</td>
<td>3.88</td>
</tr>
<tr>
<td>Sodium (mmol/l)</td>
<td>155.50</td>
<td>198.60</td>
<td>203.40</td>
<td>232.20</td>
<td>269.20</td>
<td>11.3</td>
</tr>
</tbody>
</table>

abcd means with different superscripts on the same row are significantly different (P < 0.05)

Carcass characteristics of weaned rabbits fed diets graded levels of neem oil:

The carcass characteristics of weaned rabbits fed diets with different graded levels of neem oil inclusion are shown in Table 4. The mean final weight of the experimental animals fed a diet containing 0.40% (T5) neem oil had the highest final body weight and the final body weight of rabbits in treatment 4, fed diet containing 0.30% neem oil was also better (1322.1a and 1300.5a respectively) and not significantly (P>0.05) different but significantly (P<0.05) higher than the final body weight of rabbits in the control treatment (T1). Rabbits in treatment 2 (0.10%) and 3 (0.20%) respectively had similar final body weight and not significantly (P>0.05) different. There were significant (P<0.05) differences in the statistical values of the liver, kidney, heart, lungs, and spleen of the rabbits fed diets containing different inclusion levels of neem oil.

The dressing percentage of rabbits fed a diet containing 0.40% (T5) neem oil inclusion level and that fed diet including 0.30% (T4) neem oil was higher and similar to each other (56.33a and 56.00a respectively)., both values were however not statistically (P>0.05) different. The dressing percentage values obtained for rabbits in T2 (0.10%) and T3 (0.20%) were not significantly (P>0.05) different. There was significant difference (P<0.05) when T4 (0.30%) and T5 (0.40%) were compared to T2 (0.10%) and T3 (0.20%). Rabbits in treatment 3 fed diets containing 0.20% neem oil had dressing percentage better than the dressing percentage of rabbits in treatment 1 (0%) and 2 (0.10%) but lower than the dressing percentage of rabbits in treatments 4 (0.30%) and 5 (0.40%).

The result for dressing percentage increases across the treatments as the inclusion level of neem oil in diets increases. This could be attributed to the phytosterols in neem oil which might render the nutrients available for the animals’ utilization (Alkweet al., 2014; Musa et al., 2020). Other carcass parameters; head, liver, kidney, heart, lungs, and spleen increases with increasing levels of neem oil in diets which may be as a result of the appreciable levels of Azadirachtin in neem oil which positively affects the final product (carcass). This result contradicts the report by Obun et al., (2013); Olutunji et al. (2015) that a decrease in the relative organs weights of liver, heart, pancreas, and gizzard with increasing neem leaf inclusion in the diets could be an indication of residual bioactive components (Azidirachtins, tannins, and limonoids) in the leaf meal which may have depressed these parameters.
Table 4: Carcass characteristics of weaned rabbits fed diets containing graded levels of neem oil

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final wgt (g)</td>
<td>1188.40&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1270.40&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1272.70&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1300.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1322.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>23.45</td>
</tr>
<tr>
<td>Head</td>
<td>4.87&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.61&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.12&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.98&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.56</td>
</tr>
<tr>
<td>D.P (%)</td>
<td>48.56&lt;sup&gt;c&lt;/sup&gt;</td>
<td>51.34&lt;sup&gt;b&lt;/sup&gt;</td>
<td>53.56&lt;sup&gt;b&lt;/sup&gt;</td>
<td>56.00&lt;sup&gt;a&lt;/sup&gt;</td>
<td>56.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.11</td>
</tr>
<tr>
<td>Liver (%)</td>
<td>2.11&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.67&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.88&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.79&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.66&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.04</td>
</tr>
<tr>
<td>Kidney (%)</td>
<td>0.09&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.36&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.31&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.30&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.10</td>
</tr>
<tr>
<td>Heart (%)</td>
<td>0.29&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.40&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.42&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.41&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.49&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.03</td>
</tr>
<tr>
<td>Lungs (%)</td>
<td>1.01&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.04&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.06&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.09&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.04&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.01</td>
</tr>
<tr>
<td>Spleen (%)</td>
<td>0.26&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.31&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.35&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.02</td>
</tr>
</tbody>
</table>

D.P: dressing Percentage

a,b,c: means along the same row with different superscripts are significantly different (P<0.05)

Conclusion:

Bioactive chemicals in neem oil may have acted singly or in synergy with one another to produce the effects observed. A. indica diets of growing rabbits increase some haematological parameters which were within the normal range. And also, A. indica showed positive effects on the carcass with a reduction in serum cholesterol.

References:


