Full Length Research Paper

Haematological parameters, semen characteristics and sperm morphology of male albino rat (wistar strain) treated with Aloe vera gel

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Haemograms, semen characteristics and sperm morphology of the male albino rat (wistar strain) treated with Aloe vera gel was studied. A. vera gel has been widely used for both medicinal and non-medicinal purposes. Fifteen male clinically healthy albino rats weighing between 0.15 to 0.24 kg and 16 to 20 weeks of age were randomly assigned to three groups A, B and C. Groups A and B were the experimental groups while Group C was the control group. The experimental groups A and B were treated with A. vera gel at 300 and 200 mg/kg body weight, respectively for 10 days. The findings showed that the sperm motility from group A (64.00 ± 6.80) and B (66.00 ± 8.74) were lower (P < 0.05) than group C (89 ± 2.46). The percentage liveability of the sperm cells of group A (88.00 ± 6.74) and B (85.00 ± 4.48) were also lower (P < 0.05) than the control, 96.8 ± 0.74. The sperm concentration in the experimental group A (53.2 ± 2.27) and B (59.4 ± 2.43) were also lower (P < 0.05) than the control group 84.6 ± 2.14. The blood parameters across the groups were within the normal range of values in rats, and there was no significant difference (P>0.05). It was concluded that the use of A. vera gel for 10 days consecutively has an adverse effect on sperm cells characteristics and morphology, and can precipitate infertility in the male wistar strain albino rats when administered at concentration higher than 300 mg/kg body weight. However, it has no negative effect on the blood parameters.

Key words: Aloe vera gel, albino rats, semen characteristics, sperm morphology, haematology.

INTRODUCTION

Aloe vera is the name given to a variety of perennials of the families Liliaceae. There are over 325 species in this genus most of which are native to South Africa, Madagascar and Arabia. Examples of medicinal species are Aloe barbadensis, Aloe vulgaris, Aloe arborescens, Aloe ferox (Kathi and Chron, 1999). A. vera grows well in flower pots; it is light green in colour with white spots. It has long triangular fleshy leaves that have spike along the edges (Kathi and Chron, 1999).

A. vera gel is 99% water with pH 4.5 and the major carbohydrate fraction in the gel is a water soluble long chain mannose polymer which accelerates wound healing, modulate immune functions and demonstrate antiviral effects (Zhang and Tizard, 1996). The gel also contains bradykininase: an anti-inflammatory, magnesium lactate which helps to prevent itching, glucomannan a
good moisturizer, salicylic acid and other anti-prostaglandin compounds which relieve inflammation (Yagi et al., 1982).

The leaf lining contains anthraquinone glycosides that are potent stimulant and laxatives (Schilcher, 1997). These water soluble glycosides are split by intestinal bacteria into aglycones which affect the laxative action. The laxative effect from A. vera is stronger than any other herb, including senna, cascara or rhubarb root, it also has more severe side effects such as cramping, diarrhea and nausea (Schilcher, 1997). The juice is soothing to digestive tract irritations, such as colitis and peptic ulcers (Schilcher, 1997). The Chinese describe Aloe’s skin and the inner lining of its leaves as a cold, bitter remedy which is downward draining, and used to clear constipation due to accumulation of heat, the gel is considered cool and moist (Bensky et al., 1993).

In traditional medicine of India, A. vera is used internally as laxative, anthelmintic, haemorrhoid remedy and uterine stimulant. It is used topically, often in combination with licrocice root, to treat eczema or psoriasis (Ghazanfar, 1994). In Arabian medicine, the fresh gel is rubbed on the forehead as a remedy or rubbed on the body to cool it in case of fever, as well as being used for wound healing, conjunctivitis and as a disinfectant and laxative (Ghazanfar, 1994). A. vera gel is an active ingredient in hundreds of skin lotions, sun blocks and cosmetics (Grindlay and Reynolds, 1986). According to Danhof (1993), A. vera gel in cosmetics has a similar anti-ageing effect to vitamin A derivatives. Recently, A. vera extracts have been used to treat canker sores, stomach ulcers and even acquired Immune deficiency syndrome (AIDS). Some natural health enthusiasts promote gel as a cleaning juice (McGuffin et al., 1997).

Some nature-pathologists promote A. vera juice as a way to prevent and treat renal stone (Murray and Pizzorno, 1991). According to Cithra et al. (1998), topical application on the wound surface or by oral administration of the A. vera gel in diabetic rats may enhance the process of wound healing by influencing phases such as inflammation, fibroplasia, collagen synthesis, maturation and wound contraction.

There is dearth of information on the reproductive implication of A. vera gel administration especially on haematology, semen characteristics and morphology in the male wistar strain albino rats. This study, therefore, was designed to investigate the haemogram, semen picture, and sperm morphology of the male wistar strain albino rats treated with A. vera extract.

MATERIALS AND METHODS

Experimental animal

Fifteen male Albino rats (Wistar strain) were used for this study, each weighing between 0.15 to 0.24 kg and aged 16 to 20 weeks, they were housed in the experimental animal unit of the Faculty of Veterinary Medicine, University of Ibadan Oyo State, Nigeria. The rats were kept in circular plastic cages of about 60 cm in circumference with depth of about 20 cm, and these were covered with wooden and wire meshes. Beddings were provided using wood-shaven and replaced weekly. They were fed ad libitum with a purchased rat feed, a ration containing 21% crude protein, 3.5% fat, 3% crude fibre, and 0.8% phosphorus, from Ladokun Feeds Limited, Ibadan. Water was supplied ad libitum. The feed and water were given using earthen troughs. All the rats used in this study were handled in accordance with the Good Animal Practice requirements of the Animal Ethics Procedures and Guidelines and was approved by the Animal Ethics Committee of the University of Ibadan, Nigeria.

Aloe vera gel preparation

A. vera were harvested in the University of Ibadan, Botanical garden and identified at the herbarium unit of the Botany Department, University of Ibadan. These were thoroughly washed and followed by rising under flowing tap water and later with distilled water. The fleshy mass of the A. vera was carefully opened by cutting the sharp edges. The gel was funnelled into a sterile beaker. 2 and 3 g of A. vera gel were weighed using a digital micro-sensitive scale. Each of these was then diluted with 100 ml of distilled water (measured by the measuring cylinder) to constitute 200 and 300 mg/kg concentrations respectively. These were gently stirred with spatula to achieve homogenous solution.

Restraints of rats

The rats were picked up gently by the tail with the right hand placing the rat on a surface, the left hand was placed over the head and using the thumb and index finger to grasp the skin below the two ears firmly. The rat was then turned with the stomach towards the handler and the skin along the back is firmly grasped with the remaining three fingers.

Administration of gel

The rats were in three groups A, B and C of five rats each. Group C was used as the control. Group A and B were dosed with A. vera gel for 10 consecutive days. Each rat was marked for proper identification. The dosage used by McGuffin et al. (1997) was used as a guide. The dose range was between 50 to 300 mg in a single dose. In this study, the rats in Group A were dosed 300 mg of Aloe vera gel in a single dose per day while group B rats were dosed 200 mg of A. vera gel in a single dose per os by oral gavage.

Sample collection

Blood was collected from each rat post-treatment from the orbital sinus called the infraorbital lateral canthus method. This was done by using heparinised capillary tubes, a glass chamber, anaesthetic ether, cotton wool, 2.0 ml heparinised sample bottles and a recovery cage. Cotton wool was soaked in anaesthetic ether and placed in the glass chamber. Gauze was placed over the cottonwool and the rat was put in the glass chamber and allowed to be anaesthetized one at a time for about 2 min. The rat was then removed, placed on lateral recumbency and capillary tube inserted infraorbitally at the lateral canthus, the infraorbital groove is located and pressure is applied to puncture the infraorbital artery and blood flows through the capillary tube. This was collected into a heparinised sample bottle and was properly labelled.
Statistical package for social sciences (SPSS) were used to establish any significant difference at 95% confidence interval. P-values less than 0.05 were considered significant.

**RESULTS**

Table 1 shows that the percentage liveability of sperm cells of Group A (88.0±6.74%) and B (85.0±4.48%) were significantly lower (P<0.05) than the group C value (96.8±0.74%). The percentage liveability at group A (88.0±6.74%) compare to group B (85.0±4.48%) was not significant (P>0.05). The mean percentage motility followed the same trend. The sperm count for group A (53.2±2.27 × 10^6 sperm cells/ml) and group B (59.4±2.43 × 10^6 sperm cells/ml) are significantly lower (P<0.05) than group C value (84.6±2.14 × 10^6 sperm cells/ml). Table 2 presents the sperm morphological abnormalities of Male albino rats (Wistar Strain) in group A to C.

**Tailless head (Normal head without tail)**

There is a significant difference (P<0.05) between the values of tailless head in group A, 29 (1.43%) group B, 24 (1.18%) and group C, 23 (1.12%). However, there was no significant difference (P>0.05) between group B and group C.

**Headless tail (Normal tail without head)**

There is a significant difference (P<0.05) between the values of headless tail in group A, 30 (1.48%) group B, 21 (1.04%) and group C, 23(1.12%). However, there was no significant difference between group B and group C.

**Rudimentary tail**

There is a significant difference (P<0.05) between the values of rudimentary tail in group A, 33 (1.63%), group B, 28 (1.38%) and group C, 19 (0.92%). However, the difference between the values of group A and group B was not significant (P>0.05).

**Bent tail**

There is a significant difference (P<0.05) between the

**Table 1. Semen characteristics of male albino rats (Wistar strain) in A. vera gel treated rats.**

<table>
<thead>
<tr>
<th>Identification</th>
<th>Motility (%)</th>
<th>Percentage liveability (%)</th>
<th>Sperm count (X10^6 cells/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (300 mg)</td>
<td>64.0±6.80^a</td>
<td>88.0±6.74^a</td>
<td>53.2±2.27^a</td>
</tr>
<tr>
<td>Group B (200 mg)</td>
<td>66.0±8.74^a</td>
<td>85.0±4.48^a</td>
<td>59.4±2.43^a</td>
</tr>
<tr>
<td>Group C (control)</td>
<td>89.0±2.46^c</td>
<td>96.8±0.74^c</td>
<td>84.6±2.14^c</td>
</tr>
</tbody>
</table>

^a, b, c: Mean difference is significant at (P<0.05).
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Table 2. Sperm morphological characteristics of male albino rats (Wistar Strain) in A. vera gel treated rats.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Tailless head</th>
<th>Headless tail</th>
<th>Rudimentary tail</th>
<th>Bent tail</th>
<th>Curved tail</th>
<th>Curved mid piece</th>
<th>Bent mid piece</th>
<th>Coiled tail</th>
<th>Looped tail</th>
<th>Total abnormal Cells</th>
<th>Total normal Cells</th>
<th>Total Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>29.00*</td>
<td>30.00*</td>
<td>33.00**</td>
<td>41.00*</td>
<td>43.00*</td>
<td>39.00*</td>
<td>43.00*</td>
<td>7.00*</td>
<td>4.00*</td>
<td>269.00</td>
<td>1756.00</td>
<td>2025.00</td>
</tr>
<tr>
<td>(%)</td>
<td>(1.43%)</td>
<td>(1.48%)</td>
<td>(1.63%)</td>
<td>(2.03%)</td>
<td>(2.12%)</td>
<td>(1.93%)</td>
<td>(2.12%)</td>
<td>(0.35%)</td>
<td>(0.19%)</td>
<td>(13.28%)</td>
<td>(86.72%)</td>
<td>(100%)</td>
</tr>
<tr>
<td>Group B</td>
<td>24.00**</td>
<td>21.00**</td>
<td>28.00**</td>
<td>29.00**</td>
<td>36.00**</td>
<td>33.00</td>
<td>32.00**</td>
<td>0.00**</td>
<td>1.00**</td>
<td>204.00</td>
<td>1824.00</td>
<td>2028.00</td>
</tr>
<tr>
<td>(%)</td>
<td>(1.18%)</td>
<td>(1.04%)</td>
<td>(1.38%)</td>
<td>(1.43%)</td>
<td>(1.78%)</td>
<td>(1.63%)</td>
<td>(1.58%)</td>
<td>(0%)</td>
<td>(0.05%)</td>
<td>(10.06%)</td>
<td>(89.94%)</td>
<td>(100%)</td>
</tr>
<tr>
<td>Group C</td>
<td>23.00**</td>
<td>23.00**</td>
<td>19.00*</td>
<td>29.00**</td>
<td>31.00**</td>
<td>29.00**</td>
<td>32.00**</td>
<td>0.00**</td>
<td>0.00**</td>
<td>186.00</td>
<td>1869.00</td>
<td>2055.00</td>
</tr>
<tr>
<td>(%)</td>
<td>(1.12%)</td>
<td>(1.12%)</td>
<td>(0.92%)</td>
<td>(1.41%)</td>
<td>(1.51%)</td>
<td>(1.41%)</td>
<td>(1.56%)</td>
<td>(0%)</td>
<td>(0%)</td>
<td>(9.05%)</td>
<td>(90.95%)</td>
<td>(100%)</td>
</tr>
</tbody>
</table>

* Mean difference is significant at (P<0.05), **Mean with the same superscript are not significantly different at P<0.05 level. Morphological exadffcffgg vp[;[;;[;];;];mination.

values of bent tail in group A, 41 (2.03%), group B, 29 (1.48%) and group C, 29 (1.41%), but the difference between the values of group B and group C was not significant (P>0.05).

Curved tail

The values obtained for group A, group B, and group C were 39 (1.93%), 33 (1.63%) and 29 (1.41%) respectively. When compared, there was a significant difference (P<0.05) between the values obtained for group A, group B and group C, but there was no significant difference (P>0.05) between the values of group B and group C.

Curved midpiece

There was a significant difference (P<0.05) between group A value 39 (1.39%) and group C value 29 (1.41%).

Loped tail

There was a significant difference (P<0.05) between group A: 4 (0.19%) and group C: 0 (0%).

Bent midpiece

There was a significant difference (P<0.05) between the values of group A, 43 (2.12%) when compared with Group B: 32 (1.58%) and Group C: 32 (1.56%). However, there was no significant difference (P>0.05) between the values of group B and group C.

Total abnormal cell

There was a significant difference (P<0.05) between group A: 269 (13.28%), group B: 204 (10.06%) and group C: 186 (9.05%). However, there was no significant difference (P>0.05) between the values of group B and group C.

Result of haemogram

The PCV of group A (300 mg/kg) was 43.6±1.200%, higher than that of group B (200 mg/kg) 41.8±0.5% and group C (control) 40.8±0.80%. However, these PCV values as well as other blood parameters are within the normal range.

DISCUSSION

The semen picture observed in this study showed that the percentage progressive motility of group A rats treated with 300 mg/kg body weight and group B rats treated with 200 mg/kg body weight of A. vera gel were significantly (P<0.05) lower than the control group. This indicates that increased treatment with A. vera adversely affect sperm motility. This finding supports the report of Oyeyemi et al. (2011) in which treatment with A. vera gel significantly (P<0.05) reduced the sperm motility of West African Dwarf bucks.

The mean percentage liveability of sperm cells decreased significantly (P<0.05) from control group C to group B treated with 200 mg/kg body weight of A. vera gel, and further decreased significantly (P<0.05) in group A rats treated with 300 mg/kg body weight of A. vera gel. This implies that the continuous administration of A. vera extract would result in decreased fertility in the male wistar strain albino rats. The reports of
Table 3. Haematological result of of male albino rats (Wistar strain) in A. vera gel treated rats.

<table>
<thead>
<tr>
<th>Identification</th>
<th>PCV (%)</th>
<th>Hb (%)</th>
<th>RBC ($\times 10^{12}$/l)</th>
<th>WBC ($\times 10^{9}$/l)</th>
<th>LYM (%)</th>
<th>NEUT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>43.6±1.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.08±0.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.9±0.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20.9±2.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>48.6±4.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>51±4.38&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>B</td>
<td>41.8±0.56&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.7±0.20&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.9±0.32&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.9±2.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>48.6±4.27&lt;sup&gt;a&lt;/sup&gt;</td>
<td>52±2.50&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>C</td>
<td>40.8±0.80&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.4±0.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.9±0.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20.9±2.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>48.6±4.29&lt;sup&gt;a&lt;/sup&gt;</td>
<td>53.4±3.0&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Mean with the same superscript are not significantly different at (P<0.05) level.

Oyeyemi et al. (2011) alluded to this fact. The percentage liveability value across the groups was higher than 47.50% reported by Oyeyemi et al. (2006) when 50 mg of Clomiphene citrate was administered to male Albino rats but Farombi et al. (2007) had a higher percentage in their reports when male Albino rats were treated with Curumin and kolaviron.

The sperm cell concentration value (84.6±2.14×10<sup>4</sup> sperm cells/ml) of control group C was higher than the value of group A and group B value. The difference in the experimental values are significant (P<0.05). This indicates that A. vera gel administration reduces sperm count in a fertile male Albino rats (Wistar strain). The total abnormal cells value 186 (9.05%) of control group A rats and the value of group B rats, and there was a significant difference (P<0.05) within the experimental values. This indicated that there was an increase in total percentage spermatozoa abnormalities for group A, B and C 186 (9.05%) when compared to the values reported by Farombi et al. (2007) when curcumin and kolaviron were administered in rats. The blood analysis result obtained for the haemogram are within the normal range of values in rats as reported by Harkness and Wagner (1989), and there was no significant difference (P>0.05) in the blood parameters.

**Conclusion**

It was concluded that the use of A. vera gel for 10 days consecutively will induce a deteriorative effect on sperm cells characteristics and morphology, and can precipitate infertility in the male wistar strain albino rats when administered at concentration higher than 300 mg/kg body weight. However, it has no negative effect on the blood parameters.

**Conflicts of interest**

The authors declare that they have no conflicts of interest.

**REFERENCES**