Effect of prolong consumption of crude *Aloe barbadensis* (*Aloe vera*) gel on haematological indices in rats

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ABSTRACT

Background: Aloe vera is a succulent perennial plant that belongs to the liliaceae family and to a large family called xeroids. It is a magical plant with vast healing properties, but there is paucity in scientific literature on it effects on haematological parameters. The effect of persistent consumption of crude aqueous extract of *Aloe vera* on haematological indices of albino Wistar rats was investigated in this study. Methods: Twenty four rats were randomly assigned into three groups of eight rats each. Group 1 (control) received 0.26 mL of normal saline o.p. Group 2 received 0.26 mL of aloe vera extract for 2 weeks while group 3 received 0.26 mL of aloe vera extract for 4 weeks p.o. once daily. All animals received drinking water and normal rat chow *ad libitum*. Results: Results revealed that the control group had a mean PCV of 37.50 ± 0.98%; Hb, 11.40 ± 0.39g/dL; RBC, 6.91 ± 0.35 x 10⁶ cells/μL; WBC, 4.36 ± 0.54 x 10³ cells/μL and platelet count, 670.13 ± 41.01 x10³ cells/μL. These blood parameters were not significantly different in group 2 animals compared with controls, but were significantly higher in group 3 rats compared with controls. Differential WBC counts were as follows for control values: neutrophils, 23.25 ± 2.39%; lymphocytes, 72.88 ± 2.55%; monocytes, 0.13 ± 0.13%; eosinophils, 3.00 ± 0.71% and basophils, 0.13 ± 0.12%. Lymphocytes were significantly (p<0.05) higher in group 3 compared with control group. Conclusion: Aloe vera extract contains phytochemicals that boost blood parameters and immunity on prolong consumption.

Key words: Aloe vera, blood cells, rats

INTRODUCTION

Aloe vera is a succulent perennial plant that belongs to the liliaceae family and to a large family called xeroids.¹,² It grows wild in Madagascar and large portion of the African continent. The genius contains at least 324 species of herbs, shrubs and trees primarily in African, with some in Madagascar and the Arabian Penninsula,³⁴ of the over 324 species, only four are recognized as being of nutritional value to humans and animals. *Aloe barbadensis miller* species is significantly top of these four species.⁵ It is a popular house plant and has a long history as a multipurpose folk remedy.⁶ Several names have been ascribed to it relative to its numerous properties and uses which include names like “the potted physician” the wind of heavens and “the medicine plant”.⁷,⁸

The *aloe vera* contains 96 percent water and the remaining 4 percent formed by a mixture of more than 20 substances such as anthraquinone, glycosides, resin, salicylates, glucosannan, enzymes, minerals, acemannan,⁹ sterols and glycoprotein.¹⁰ Other active ingredients include vitamins such as vitamins A, C, E, B₁, B₂, B₉, B₁₂, and B₁₂.¹¹ Reports indicate that *aloe* exhibit immune boosting activity and the gel is thought to speed recovery from wounds by enhancing the activity of macrophages and fibroblasts.¹²,¹³ In recent decades, there has been rising health claims on the effectiveness of aloe vera in nearly all aspects of body function.¹⁴,¹⁷ This has led to the increase use of aloe vera especially by alternative medical practitioners. However, few studies have demonstrated its influence on the haematological system.
MATERIALS AND METHODS

Experimental plant
We obtained fresh aloe vera plant from a local market in Calabar, Nigeria. Dr. Owolabi of Department of Botany, University of Calabar, Nigeria identified it as Aloe barbadensis miller.

Experimental animals
Twenty four (24) female albino Wistar rats weighing between 250 g to 270 g obtained from the animal house of Pharmacology Department, University of Calabar, Nigeria were used for this study. The animals housing maintained at controlled environmental temperature and a 12 hour dark and light.

Preparation of crude aloe vera gel
The fleshy leaves were plucked from the nodes and washed with clean water at room temperature. They were sliced open with a clean sharp kitchen knife along the mid vein, exposing the gel which was then scraped into a container and homogenized. The resultant crude extract of aloe vera gel was stored in a refrigerator at -4ºC afterwards.

Experimental design
Twenty four albino Wistar rats were randomly assigned into 3 groups of 8 rats each and kept in separate cages. Group 1 (control) was administered with 0.26 mL of normal saline. Group 2 (subchronic group) received 0.26 ml of aloe vera gel orally and once daily for 2 weeks. Group 3 received 0.26 ml of aloe vera gel orally and once daily for 4 weeks. All the animals received normal rat feed and drinking water ad libitum.

The administered dose (0.26 ml) of aloe vera was derived from a log dose response curve conducted on aloe vera where an ED50 value of 0.1 ml/100 g was obtained.

Collection of blood samples
After the expiration of the feeding regimens, the animals were made unconscious and blood was collected via cardiac puncture under chloroform inhalation in a desiccator. About 4 ml of blood was obtained from each animal into a well labelled capped EDTA (ethylene diamine tetra acetate) sample bottles. Samples were immediately used for the estimation of the different haematological parameters.

Analysis of blood samples
Red blood cell count, total white blood cell count, packed cell volume (PCV), and differential WBCs were estimated using standard methods while haemoglobin concentration was also determined by the standard method. Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated using standard formula.

RESULTS

Comparison of RBC count, PCV, Hb, total WBC count and platelet count among the different experimental groups
The control group had the following mean values: RBC, 6.91 ± 0.35 x 10^6 cells/mm³; PCV, 37.50 ± 0.98%; Hb, 11.40 ± 0.39 g/dl; WBC, 4.36 ± 0.54 x 10³ cell/mm³; and platelet count, 670.13 ± 41.01 x 10³ cells/mm³. RBC count, PCV, Hb, WBC and platelet counts of group 2 animals were not significantly different from these control values. On the other hand, they were significantly (p<0.05) higher in group 3 animal compared with the control, (Table 1).

Comparison of absolute values of red blood cells among the different experimental group
As summarized in Table 2, the mean values of MCV, MCH and MCHC in the control group were 54.27 ± 0.72 fl, 16.50 ± 0.20 pg, and 30.40 ± 0.08 g/dl respectively. The MCV was significantly (p<0.05) lower in group 2 compared with control. MCH and MCHC of both groups 2 and 3 were not significantly different among the groups.

Comparison of absolute values of differential white blood cell count among the different experimental group
The differential WBC count of the different experimental groups are shown in Table 3. The mean counts in the control group were 23.25 ± 2.29%; 72.88 ± 2.55%; 0.13 ± 0.13%; 3.00 ± 0.71% and 0.13 ± 0.12% for...
neutrophils, lymphocytes, monocytes, eosinophils and basophils respectively. Neutrophils and eosinophils were slightly reduced in groups 2 and 3 compared with control while lymphocytes were significantly (p<0.05) increased in group 3 (80.50 ±1.35%) compared with control group.

**DISCUSSION**

The determination of haematological indices provides information about the general blood picture and the immune system. From this study, the sub-chronic consumption of crude aloe vera gel by rats has been observed to cause insignificant increases in RBC, Hb, PCV, total WBC counts, MCV, MCH, MCHC and differential WBC counts, but chronic administration of the extract increased significantly the RBC count, Hb, PCV, total WBC and lymphocyte counts in rats.

This increase might have been due to the reported stimulation of the bone marrow by aloe vera gel leading to increased erythropoiesis. It could be linked to stimulation of the growth and differentiation inducers such as the interleukins which help to induce the growth and differentiation of the RBCs. In addition, aloe vera is known to contain vitamin like A, C, E, B1, B2, B5, B6, and B12 and minerals such as iron, copper, folic acid etc. which are essential elements for the formation of blood cells.

The observed increase in the WBC count following the administration of crude aloe gel is in line with previous studies. Researchers have demonstrated that the polysaccharides and acemannan, in the gel stimulate the formation of all types of WBCs from both the spleen and bone marrow with the effect being specific for the generation of the T-lymphocyte. Acemannans stimulate immunologically active interleukins and interferons which induce growth of the cells and boost the immune system of which the RBCs are central. Hence, increase production of interferons, interleukins and other mediators of the immune system through stimulation of macrophages activity is another probable reason for increase in blood cells produced by extensive ingestion of aloe vera gel.

Aloe vera gel was observed to decrease the number of neutrophils and eosinophils in this study, this may be due to interference of aloe emodin and aloin (barbaloin) present in the crude gel with processes of activated polymorphonuclear white blood cells has been reported. Although, the mechanism by which this occur in not well understood.

The increase in lymphocytes and monocytes counts could be linked mainly to the immune boosting activities of the gel constituents, since they are the major cells of the immune system. It has earlier been demonstrated that aloe vera gel increases production of lymphocytes and macrophages and also stimulates lymphocyte cell division (blastogenesis).

Oral administration of aloe vera and β-glucan has been observed to affect various aspects of the canine immune system, including the effects on haematologic parameters, the composition of lymphocyte subsets, and serum immunoglobulins.

The findings demonstrate that aloe vera and β-glucan may stimulate both cellular and humoral immune responses after vaccination in dogs.

**CONCLUSION**

Persistent consumption of aloe vera gel increases Hb concentrations, PCV, RBC, platelets, total WBC counts, as well as lymphocytes count in rats. This action of Aloe vera extract is probably due to its phytochemical constituents like Acemannans that stimulate interleukins and interferons which induce cells growth. It therefore implies that, in human prolonged consumption of aloe vera gel...

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**Table 2: Comparison of absolute values of red blood cell among the different experimental groups**

<table>
<thead>
<tr>
<th>Variable</th>
<th>MCV (fl)</th>
<th>MCH (pg)</th>
<th>MCHC (g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>54.27±0.72</td>
<td>16.50±0.20</td>
<td>30.40±0.08</td>
</tr>
<tr>
<td>Group 2 (Subchronic)</td>
<td>50.40±0.89*</td>
<td>15.49±0.19</td>
<td>30.74±0.09</td>
</tr>
<tr>
<td>Group 3 (Chronic)</td>
<td>52.09±0.56</td>
<td>15.87±0.23</td>
<td>30.47±0.10</td>
</tr>
</tbody>
</table>

*significantly different from control at p<0.05

**Table 3: Comparison of differential WBC counts among the different experimental groups**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Neutrophils (%)</th>
<th>Lymphocytes (%)</th>
<th>Monocytes (%)</th>
<th>Eosinophils (%)</th>
<th>Basophils (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>23.25±2.39</td>
<td>72.88±2.55</td>
<td>0.13±0.13</td>
<td>3.00±0.71</td>
<td>0.13±0.12</td>
</tr>
<tr>
<td>Group 2 (Subchronic)</td>
<td>20.00±1.68</td>
<td>76.75±2.09</td>
<td>0.00±0.00</td>
<td>1.88±0.44</td>
<td>0.13±0.12</td>
</tr>
<tr>
<td>Group 3 (Chronic)</td>
<td>21.13±2.97</td>
<td>80.50±1.35*</td>
<td>0.38±0.18</td>
<td>2.25±0.55</td>
<td>0.13±0.12</td>
</tr>
</tbody>
</table>

*significantly different from control at p<0.05
Aloe vera gel could boost blood parameters and immunity, and could be useful to anaemic and immune-suppressed patients or as blood tonic.

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REFERENCES

Authors Contribution: 
CON – Designed the study, wrote the initial draft of the manuscript; OEO – Analysed the data and edited the manuscript; UAO – Reviewed the manuscript and contributed to the study design.

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