

## The Potential Protective and Therapeutic Effects of Aloe Vera Juice Against Malathion Induced Haematological Changes in Rabbits

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### Abstract

**Background:** the potential protective and therapeutic effects of Aloe vera juice against malathion induced haematological changes in young rabbits (*Oryctolagus cuniculus*) were evaluated in this study.

**Material and methods:** Rabbits were allocated into two sets of experiments short (7 days) and long (21 days) periods. Animals of each set were divided into eight groups; four treated groups and each treated group had its own control. The animals of the first group were orally dosed with Aloe vera juice (0.84 ml/kg b. wt.). Rabbits of the second group were orally dosed with malathion (5 mg/kg b. wt.). In the third group (the protective group) animals were dosed orally with malathion concomitant with Aloe vera juice. Animals of the fourth group (the therapeutic group) were dosed orally with malathion; for 7 days followed by Aloe vera juice for the same period. All the animals were sacrificed, blood samples were collected and used to determine the levels of hematological indices: red blood cells (RBCs), white blood cells (WBCs), haemoglobin (Hb), haematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC).

**Results:** rabbits treated with **Aloe vera juice (group 1)** showed insignificant change in WBCs count, MCH and MCHC after treatment for both periods. On the other hand, other parameters exhibited significant (RBCs count) and highly significant (Hb and Hct values) change in rabbits treated for the short period. The rabbits of the **second group** (treated with **malathion**) exhibited a marked increase in WBCs count, MCV and MCH values, while, the values of RBCs, Haemoglobin and Hct were decreased.

The **protective group (Group3)** showed that the values of all the tested haematological parameters (except MCHC, in both periods of treatment, and WBCs count in the short period of treatment) recorded a significant change in rabbits treated for short (7 days) or long (21 days) periods. A marked recovery in RBCs count and MCH value was observed in rabbits treated for 21 days. Regarding to **group 4 (the therapeutic group)**, it was found that in both terms the rabbits exhibited insignificant changes in the values of all the tested haematological parameters compared to their corresponding controls, except three parameters in which they recorded significant (WBCs count, MCHC) and highly significant (Hct) increase compared to their control values after the long period only. These observations indicated the ability of Aloe vera juice to improve the deleterious effects caused by malathion administration.

**Keywords:** Haematology; Aloe vera juice; malathion; rabbits.

### INTRODUCTION

The international use of pesticides has increased food production in associated with population growth in many parts of the world. Many insect-borne diseases have also been eliminated or controlled by the use of insecticides. <sup>(1)</sup> The widespread use of these insecticides has led to some serious problems including toxic residues on grass and toxicity to non-target organisms such as mammals, birds

and fish. <sup>(2,3)</sup> Malathion is an organophosphate insecticide which is registered for agricultural uses and for landscape maintenance, vector control, and structural pest control. <sup>(4)</sup> This

assessment of potential dietary exposures addresses the residues that may occur as a result of agricultural uses of malathion. Several studies have shown that malathion induced various health effects on the haematological parameters of experimental animals <sup>(5-8)</sup>.

*Aloe Vera barbedinesis* Miller (Aloe vera) is a perennial succulent plant belonging to Liliaceae family and is called the “silent healer”. Aloe vera contains 75 potentially active biological constituents. <sup>(9)</sup> Administration of Aloe vera extract has been demonstrated to increase the phagocytic and proliferative activity of the reticuloendothelial system. <sup>(10&11)</sup> Aloe vera extracts possess immunological effects;

they modulate and stimulate proliferation of murine pluripotent haematopoietic stem cells<sup>(12)</sup> *Aloe vera* is recognized for its wound healing, anti-inflammatory, antiviral, gastro-protective and immune-stimulating properties.<sup>(13)</sup> Aloe vera ethanol and ethyl extracts may be used in eye drops to treat inflammation and other ailments of external parts of the eye such as cornea.<sup>(14)</sup> The present study was carried out to investigate whether aloe vera juice has any protective or therapeutic effects to ameliorate the deleterious effects of malathion on some the haematological parameters in rabbits.

## MATERIAL AND METHODS

### ▪ *Experimental animals:*

One hundred twelve young male rabbits, *Oryctolagus cuniculus*, each weighing 1-1.2 kg, were chosen for the present study. The animals were housed in hygienic cages and maintained under suitable laboratory conditions for the duration of the experiment. Food and water was provided *ad libitum*.

### ▪ *Aloe vera juice:*

Aloe vera juice, certified by the International Aloe Science Council, and distributed by Lily of the Desert Company, Texas Department of Agriculture, USA was used. In 2005, Lily of the Desert was the first company to develop technology that allows USDA certified organic preservation free juice.<sup>(15)</sup> The Aloe vera juice was administered to rabbits at a dose of 0.84 ml/kg b.wt. This dose was calculated according to administration directions of the juice for daily human use, and was estimated according to the weight of the rabbit.

### ▪ *The applied insecticide:*

The used insecticide (malathion) was obtained from Kafr El-Zayat Pesticides & Chemicals Company, Kafr El-Zayat, Egypt. The insecticide was diluted in absolute ethyl alcohol and administered to rabbits at a dose of 5mg/kg b.wt. This dose equals to 1/50 of the oral LD<sub>50</sub> (250 mg/kg b.wt.) for rabbits.<sup>(16)</sup> The selected doses of the juice and the insecticide were given orally to rabbits via a sterilized feeding tube.

### ▪ *Experimental design:*

Rabbits were allocated into two sets of experiments included rabbits treated for a short (7days) and a long (21 days) terms (periods).

The number of animals used for each term was fifty six rabbits.

### ▪ **Design of short-term experiments (7 days):**

Animals of the first set of experiments were divided into eight groups (7 rabbits each). The eight groups consisted of four treated groups (treated groups 1-4) and four control groups (control groups 1-4); each treated group had its own control group.

- **Group (1):** Each rabbit in this group was orally given 0.84 ml/kg b.wt. Aloe vera juice for seven days.
- **Control (1):** Each rabbit in this group was orally administered 0.84 ml/kg b.wt. distilled water for seven days.
- **Group (2):** Each rabbit in this group was orally supplemented with 5 mg/kg b.wt. malathion for seven days.
- **Control (2):** Each rabbit in this group was orally received 0.52 ml/kg b.wt. absolute ethyl alcohol for seven days.
- **Group (3):** Each rabbit in this group was orally given 5 mg/kg b.wt. malathion in concomitant with 0.84 ml/kg b.wt. Aloe vera juice for seven days. This group served as the protective group.
- **Control (3):** Each rabbit in this group was orally supplied with 0.52 ml/kg b.wt. absolute ethyl alcohol in concomitant with 0.84 ml/kg b.wt. distilled water for seven days.
- **Group (4):** Each rabbit in this group was orally taken 5 mg/kg b.wt. malathion for seven days followed by 0.84 ml/kg b.wt. Aloe vera juice for the same period. This group served as the therapeutic group.
- **Control (4):** Each rabbit in this group was orally delivered 0.52 ml/kg b.wt. absolute ethyl alcohol for seven days followed by 0.84 ml/kg b.wt. distilled water for the same period.

### ▪ **Design of long-term experiments (21 days):**

Rabbits of the second set of experiments were divided into eight groups (7 rabbits each). The eight groups consisted of four treated groups (treated groups 1-4) and four control groups (control groups 1-4); each treated group had its own control group. The design of the long-term experiments was

exactly similar to that of the short term experiments except the duration of treatment which extended to 21 days. Animals in both treated and control groups were sacrificed at the end of the specified period.

**Methods:**

Blood was taken from the animals following decapitation and quickly collected into clean EDTA tubes for the counting of red blood cells, white blood cells, determination of haemoglobin content, and estimation of haematocrit value.

- **The red blood cell (RBC) count** (million/mm<sup>3</sup>) and **white blood cell (WBC) count** (thousand/mm<sup>3</sup>) were estimated according to **Dacie and Lewis**.<sup>(17)</sup>
- **The haemoglobin concentration** was determined by using cyanomethaemoglobin method.<sup>(18)</sup>
- **Haematocrit value (Hct)** or packed cell volume (PCV) was estimated by using microhaematocrit method according to **Alexander and Griffiths**.<sup>(19)</sup>
- **The mean corpuscular volume (MCV)**; the average volume of the individual red blood cell was determined according to **Dacie and Lewis**.<sup>(20)</sup>
- **The mean corpuscular haemoglobin (MCH)** expresses the average haemoglobin content of a single red cell in picograms (pg) and was measured as described by **Dacie and Lewis**.<sup>(20)</sup>
- **The mean corpuscular haemoglobin concentration (MCHC)**; the mean cell haemoglobin concentration was estimated according to **Dacie and Lewis**.<sup>(20)</sup>

The obtained data were presented as mean ± standard deviation. Statistical analysis was performed using Student *t*-test.<sup>(21)</sup> A probability value of <0.05 was considered significant.

**RESULTS**

▪ **Group1: Aloe vera juice treated rabbits.**

The results of the present investigation showed that oral administration of Aloe vera juice to rabbits produced various effects on the measured hematological parameters. Some parameters (WBCs count, MCV, MCH and MCHC) did not show significant change in

rabbits treated with the juice for short period (7days). On the other hand, other parameters exhibited significant (RBCs count) and highly significant (Hb & Hct values) change in rabbits treated for the same period (Tables 1&3).

The significant increase in the percentage of change in RBCs count recorded 19.13% increase over control value and highly significant increase in the percentage of change in Hb and Hct values recorded 17.09 and 14.21% over their control values, respectively. It is a worth to mention that rabbits treated with the juice for long period (21 days) exhibited insignificant change in the values of WBCs count, MCH and MCH (Table 2). Simultaneously, Aloe vera juice administration produced significant increase in the percentage of change in Hb and Hct values; which recorded 5.52 and 4.59%, respectively (Table 2). Moreover, the treatment for the long period caused highly significant increase in the percentage of change (11.72%) of RBCs count in treated rabbits. It is noteworthy that MCV and MCH values were the exception in these results, since they recorded significant and non-significant decrease with percentages of change of 6.22 and 5.36%, respectively (Table 4).

▪ **Group 2: Malathion- treated rabbits**

The administration of malathion to rabbits for short or long periods produced a highly significant decrease in RBCs count, Hb content and Hct value (Tables 1 & 2). On the other hand, a highly significant increase was recorded in WBCs count, MCV and MCH values in rabbits treated for both periods (Tables 1-4). In rabbits treated for the short period the RBCs count, Hb content and Hct value recorded 46.32, 15.01 and 14.12 percentage of decrease compared to their controls, respectively (Table 1). On the other hand, in rabbits treated for the long period the values of these three parameters recorded 63.13, 9.43 and 7.08 percentage of decrease, compared to their corresponding controls, respectively (Table 2). In rabbits treated with malathion for short period the highest percentage of increase recorded 61.35 and 59.49 % in MCV and MCH compared to their corresponding controls, respectively (Table 3). The lowest percentage of change (7.67) was recorded in WBCs count of rabbits treated for short period, compared with

its control (Table 1).

In rabbits treated with malathion for the long period (21 days) the highest percentages of increase was observed in the value of MCV (155.03%) and MCH (148.4%) (Table 4).

▪ **Group 3: The protective group (rabbits treated with Aloe vera juice concomitant with malathion)**

The obtained results showed that the values of all the tested hematological parameters (except MCHC in both periods of treatment and WBCs count in short period of treatment) recorded a significant change in the rabbits of the protective groups treated for short (7 days) or long (21days) periods (Tables 1-4). A marked recovery in RBCs count and MCH value was observed in rabbits treated for 21 days. They recorded percentage of change 22.29 & 23.96 % in rabbits of the protective group, compared to 63.13 & 148.4 % in those of malathion treated group (Tables 2&4).

It was noticed that rabbits of the protective group which were treated with the juice concurrent with malathion for a short period showed a highly significant decrease in RBCs count, while they showed a marked increase in MCV and MCH values compared to their controls (Tables 1&3). The percentage of changes in these parameters was lower than that observed in malathion treated rabbits. It was noticed that treatment with malathion caused an increase in the percentage of WBCs counts equal to 7.67 and 21.91 % in short and long periods, respectively. In the protective group, administration of Aloe vera juice to rabbits concurrent with malathion lowered these percentages to 6.27 and 13.95%, respectively.

This indicated that the Aloe vera juice produced an ameliorative effect on these parameters.

▪ **Group 4: The therapeutic group (rabbits treated with malathion followed by Aloe vera juice)**

The rabbits of this group which were treated for 7 days showed insignificant changes in the values of all the tested hematological parameters (RBCs & WBCs counts; Hb content; Hct, MCV & MCH values; MCHC) compared to their controls (Tables 1&3). These observations could justify the ability of Aloe vera juice to improve the effect on these parameters recorded in malathion treated rabbits. Similar results were observed in rabbits of this group which were treated for 21 days, except three parameters in which they recorded significant (WBCs count, MCHC) and highly significant (Hct) increase compared to their control values (Tables 2&4). An important observation was recorded in RBCs count of rabbits of Aloe vera treated group, or those of the protective and therapeutic groups, treated for short period. The percentage of change in RBCs count in rabbits of these groups recorded 19.13, 38.04 & 5.59 % compared to their corresponding controls, respectively. It is noteworthy to indicate that Aloe vera itself caused a significant increase in RBCs count, while the protective group in which rabbits treated with Aloe vera concomitant with Aloe vera produced a highly significant decrease in the percentage of change compared to its control. On the other hand, treatment with Aloe vera for 7 days post treatment with the insecticide for the same period (therapeutic group ) improved RBCs counts in rabbits of this therapeutic group compared with rabbits of the protective group (treated with Aloe vera concomitant with malathion).

**Table (1):** Modulatory influence of Aloe vera juice and malathion administration to rabbits for short period (7 days) on RBCs, WBCs, Hb and Hct levels. (Mean ± S.D.)

Groups Parameters	Group (1)		Group (2)		Group (3)		Group (4)	
	Control 1	treated	Control 2	treated	Control 3	Treated	Control 4	treated
RBCs million/mm <sup>3</sup>	2.30 ±0.32	2.74 ±0.15*	1.90 ±0.16	1.02 ±0.16**	1.84 ±0.17	1.14 ±0.17**	2.86 ±0.23	2.70 ±0.42
% of change		19.13		46.32		38.04		5.59
WBCs thousand/mm <sup>3</sup>	6.52 ±0.60	6.00 ±0.30	7.04 ±0.21	7.58 ±0.48*	7.02 ±0.29	6.58 ±0.41	6.26 ±0.43	5.82 ±0.48
% of change		7.98		7.67		6.27		7.03
Hb g/dl	7.96 ±0.21	9.32 ±0.25**	7.06 ±0.30	6.00 ±0.41**	7.14 ±0.29	6.56 ±0.40*	7.98 ±0.35	7.92 ±0.36
% of change		17.09		15.01		8.12		0.75
Hct %	23.50 ±0.62	26.84 ±0.56**	20.96 ±1.12	18.00 ±1.13**	21.26 ±0.98	19.24 ±1.33*	23.68 ±0.55	23.38 ±0.98
% of change		14.21		14.12		9.50		1.27

G1=Aloe vera

G2=Malathion

G3=Malathion+Aloe vera (Protective group)

G4=Malathion then Aloe vera (Therapeutic group)

\* P<0.05 significant

\*\* P<0.0 Highly significant

**Table (2):** Modulatory influence of Aloe vera juice and malathion administration to rabbits for long period (21 days) on RBCs, WBCs, Hb and Hct levels. (Mean ± S.D.)

Groups Parameters	Group (1)		Group (2)		Group (3)		Group (4)	
	Control 1	treated	Control 2	treated	Control 3	Treated	Control 4	treated
RBCs million/mm <sup>3</sup>	4.78 ±0.19	5.34 ±0.27**	3.20 ±0.24	1.18 ±0.18**	3.14 ±0.17	2.44 ±0.32**	4.90 ±0.23	4.48 ±0.46
% of change		11.72		63.13		22.29		8.57
WBCs thousand/mm <sup>3</sup>	6.94 ±0.50	7.00 ±0.39	7.94 ±0.40	9.68 ±0.55**	7.74 ±0.59	8.82 ±0.76*	7.70 ±0.66	8.66 ±0.36*
% of change		0.87		21.91		13.95		12.47
Hb g/dl	10.88 ±0.36	11.48 ±0.34*	10.18 ±0.26	9.22 ±0.33**	10.56 ±0.36	10.06 ±0.29*	10.98 ±0.26	10.72 ±0.19
% of change		5.52		9.43		4.74		2.37
Hct %	31.36 ±1.24	32.80 ±0.51*	29.36 ±0.75	27.28 ±0.97**	30.42 ±0.91	28.70 ±1.06*	32.36 ±0.72	30.42 ±0.81**
% of change		4.59		7.08		5.65		5.99

G1=Aloe vera

G2=Malathion

G3=Malathion+Aloe vera (Protective group)

G4=Malathion then Aloe vera (Therapeutic group)

\* P<0.05 significant

\*\* P<0.0 Highly significant

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**Table (3):** Modulatory influence of Aloe vera juice and malathion administration to rabbits for short period (7 days) on **MCV**, **MCH** and **MCHC** levels. (Mean ± S.D.)

Groups Parameters	Group (1)		Group (2)		Group (3)		Group (4)	
	Control 1	treated	Control 2	treated	Control 3	Treated	Control 4	treated
<b>MCV (fl)</b>	103.52 ±12.4 4	98.12 ±4.06	110.90 ±10.37	178.94 ±21.43* *	116.58 ±15.13	171.10 ±22.37* *	83.24 ±7.38	88.02 ±11.79
<b>% of change</b>		5.22		61.35		46.77		5.74
<b>MCH (pg)</b>	35.06 ±4.07	34.06 ±1.87	37.38 ±3.76	59.62 ±6.85**	39.16 ±5.09	58.30 ±7.17**	28.00 ±1.96	29.92 ±4.81
<b>% of change</b>		2.85		59.49		48.88		6.86
<b>MCHC %</b>	33.86 ±0.78	34.70 ±0.99	33.68 ±0.86	33.30 ±0.57	33.58 ±0.73	34.12 ±0.41	33.72 ±1.81	33.88 ±1.24
<b>% of change</b>		2.48		1.13		1.61		0.47

G1=Aloe vera

G2=Malathion

G3=Malathion+Aloe vera (Protective group)

G4=Malathion then Aloe vera (Therapeutic group)

\* P<0.05 significant

\*\* P<0.0 Highly significant

**Table (4):** Modulatory influence of Aloe vera juice and malathion administration to rabbits for long period (21 days) on **MCV**, **MCH** and **MCHC** levels. (Mean ± S.D.)

Groups Parameters	Group (1)		Group (2)		Group (3)		Group (4)	
	Control 1	treated	Control (Blank) 2	treated	Control (Blank) 3	Treated	Control (Blank) 4	treated
<b>MCV (fl)</b>	65.60 ±1.24	61.52 ±3.10*	92.20 ±7.97	235.14 ±33.17* *	97.02 ±4.01	119.04 ±13.73* *	66.16 ±2.90	68.48 ±7.44
<b>% of change</b>		6.22		155.03		22.69		3.51
<b>MCH (pg)</b>	22.78 ±0.61	21.56 ±1.26	31.92 ±1.68	79.30 ±9.59**	33.72 ±2.13	41.80 ±5.43*	22.42 ±0.65	24.10 ±2.37
<b>% of change</b>		5.36		148.4		23.96		7.49
<b>MCHC %</b>	34.70 ±0.52	34.98 ±1.10	34.70 ±1.32	33.78 ±1.07	34.72 ±1.02	35.04 ±0.63	33.92 ±0.91	35.28 ±1.14*
<b>% of change</b>		0.81		2.65		0.92		4.01

G1=Aloe vera

G2=Malathion

G3=Malathion+Aloe vera (Protective group)

G4=Malathion then Aloe vera (Therapeutic group)

\* P<0.05 significant

\*\* P<0.0 Highly significant

## DISCUSSION

Haematological and biochemical profiles of blood can provide important information about the internal environment of the organism. <sup>(22)</sup> Results of the present investigation revealed that malathion caused a highly significant decline in the percentage change of erythrocyte (RBCs) count, haemoglobin (Hb) content and haematocrit (Hct) value. It also caused a marked elevation in the total leucocyte (WBC) count, mean corpuscular (MCV) volume, and mean corpuscular haemoglobin (MCH) in the experimental animals compared to their control groups. It is noteworthy to show that the haematological values of control rabbits recorded in the present study (Tables 1-4) were in accordance and within the reference range for haematological reference values in rabbits reported by several laboratories. <sup>(23,24)</sup>

Several investigators observed similar haematological changes in animals (chickens, pigeons, fish and rats) treated with organophosphorus insecticides. <sup>(25-29)</sup> The present data are in contrast with those **Areechon** and **Plumb** <sup>(30)</sup> who found that the erythrocytes count and haemoglobin content were increased in catfish treated with malathion. **Hughes et al.** <sup>(31)</sup> also stated that organophosphorus insecticide methidathion caused an increase in the haematocrit value in carp. **Mosaad and Azab** <sup>(32)</sup> observed that propoxur increased the Hct, while the MCH was significantly unaffected in rock pigeons.

The present significant decrease in erythrocytes count of rabbits after malathion administration may reflect the abnormalities of cell production in bone marrow as recorded by **Huang.** <sup>(33)</sup> He reported that malathion inhibits the proliferation of mouse bone marrow cells *in vivo* and inhibits the growth of human haematopoietic cell lines. It also may be attributed to the destruction of erythrocytes as said by **Laji** and **El-Elaimy** <sup>(34)</sup> who observed lysis in the erythrocyte membranes of fish exposed to the organophosphorus insecticide dursban. Similarly, **Szabartowska et al.** <sup>(35)</sup> reported that the organophosphate insecticide foschlor caused ruptures in the plasma membranes of the erythrocytes in *Rana esculenta* and this

stimulated the erythropoiesis and appearance of immature erythrocytes in the blood.

In the present work the decrease of the haemoglobin content accompanied by the decrease in the erythrocyte count may be due to the elimination of erythrocytes from the circulation as a result of extravasation of blood. <sup>(25)</sup> In addition, it may be due to the effect of pesticides on blood forming organs (bone marrow and liver), and inhibition of many steps of haem biosynthesis in rabbits, as the result of pesticides exposure. <sup>(36)</sup> This conclusion is supported by **Finlayson et al.** <sup>(37)</sup> who stated that these changes might be attributed to the decreased storage of iron in the liver as a result of liver damage. Poisoning by pesticide residues may lead to the development of anemia resulting from the interference of Hb biosynthesis and the shortening of the life span of the circulating erythrocytes as mentioned by **Betrosian** <sup>(38)</sup> and **Jyostana et al.** <sup>(39)</sup>

The present decrease in haematocrit value can be attributed to the haemolysis of red blood cells. This was also evidenced by **Tasheva and Hristeva** <sup>(40)</sup> who reported that the decrease in Hct value was mainly due to the haemolysis of erythrocytes induced by the insecticide.

In the present study the observed increase in the MCV level may be attributed to excessive erythropoiesis. This concurred with that mentioned by **Saleh and El-Saify** <sup>(25)</sup> who recorded that the values of the mean corpuscular volume and mean corpuscular haemoglobin were raised after chicken treated with methomyl (organophosphorus). In the same direction, **Abdelgadir and Adam** <sup>(41)</sup> suggested that the considerable increase in MCV without significant effects on MCHC in rats treated with malathion, indicates macrocytic normochromic anemia. The present results are in conflict with those of **Hasheesh et al.** <sup>(27)</sup>, **John** <sup>(42)</sup> and **Zidan and Galal** <sup>(7)</sup> who found that the organophosphorus insecticides (triazophos, metasystox and malathion) caused a significant decrease in MCV and MCH in fish *Mystus vittatus* and rats.

White blood cells (WBCs) are the mobile defenses of the body against pathogenic infection. They also aid in the detoxification of

toxic proteins and the development of immunity. Any alterations in their numbers are of great significance for diagnostic and prognostic purposes. <sup>(43)</sup> The current increase in the total leucocytes count (WBCs) in malathion treated rabbits could be attributed to the immunological response of the rabbits which produced more and more antibodies to counteract the stress caused by the malathion. This was explained by **Jha et al.** <sup>(44)</sup> who suggested that this increase might be a defensive mechanism to withstand profound exposure to the pesticide. This is supported by **Zidan and Galal** <sup>(7)</sup> who reported that malathion caused a significant increase in the WBCs count in rats. The results of the present work disagree with those of **Areechon and Plumb** <sup>(30)</sup>, **Pathak et al.** <sup>(45)</sup>, **Magar et al.** <sup>(6)</sup>, **Al-Ghanim** <sup>(46)</sup> and **Zubair** <sup>(8)</sup> who observed a significant decrease in the total leucocyte count in Fish (*Labeo rohita*, *Channa punctatus*, *Oreochromis niloticus* and *Clarias gariepinus*) treated with malathion. From another angle **Thaker & Garg** <sup>(47)</sup> reported that total and differential leukocyte counts were not affected in male chickens treated with malathion.

With regard to the role of *Aloe vera* juice in the protection against the toxicity of malathion, the present study revealed that most of the haematological parameters (RBCs count, Hb content and Hct value) returned toward near normal in the therapeutic group. This was specifically evident after the short term of treatment rather than in the long treatment. However, the rabbits of *Aloe vera* treated group showed a marked elevation in RBCs, HB and Hct values after the short and long periods of treatment. A significant decrease in MCV was recorded following the long period of administration, when compared with its control group during the experiment.

The percentage of change in the values of WBCs, MCH & MCHC of blood sampled from rabbits exposed to *Aloe vera* juice were not significantly different compared to their corresponding control. These finding agree with those of **Sembratowicz et al.** <sup>(48)</sup> and **Ognik and Sembratowicz** <sup>(49)</sup> who detected no difference in the WBCs count in turkeys given higher doses of *aloe* preparation. **Iji et al.** <sup>(50)</sup> and **Wintola et al.** <sup>(51)</sup> concluded that chronic administration of *Aloe vera* gel extract had insignificant effect on the

haematological parameters of rats. Absence of significant alteration in the haematological parameters of rats may be an indication that the extract has no adverse effects on the haematological system.

In addition, the results showed that administration of *Aloe vera* juice to rabbits concurrent with malathion lowered the percentage of increase in WBCs counts illustrated in malathion treated rabbits. This indicates that *Aloe vera* juice possesses an ameliorative action on the tested haematological parameters in young rabbits.

Finally, the present results are in accordance with those of **Rajasekaran et al.** <sup>(52)</sup> who found that *Aloe vera* Leaf Gel, used with treated diabetic rats, significantly increased the total hemoglobin content. This may be the result of an improvement in the glucose metabolism. **Mude et al.** <sup>(53)</sup> reported that the administration of *Aloe vera* extract brought the values of Hb, WBCs and RBCs to near normal in diabetic rats. **Farahi et al.** <sup>(54)</sup> also discovered that the number of WBCs and the Hct values were enhanced in Rainbow Trout supplemented with *Aloe vera*. In addition, **Sham et al.** <sup>(55)</sup>, **Esonu et al.** <sup>(56)</sup>, **Rehman et al.** <sup>(57)</sup> and **Ognik and Sembratowicz** <sup>(49)</sup> concluded that treatment with medicinal plants including *Aloe vera* improved the hematological parameters in mice, laying hens, broiler chicks and turkeys.

Contrarily, **Helal et al.** <sup>(58)</sup> found that *Aloe vera* showed a significant decrease in RBC count, Hb concentration and Hct values when compared with control groups after the treatment period in rats.

The administration of *Aloe vera* may increase the antioxidant enzymes, such as superoxide dismutase (SOD) and catalase (CAT) levels, which may indicate the antioxidant and free radical scavenging property of *Aloe vera* <sup>(13)</sup>. It is generally known that some *Aloe* species may stimulate erythropoiesis; however, the available literature offers little information on the erythropoietic properties of *Aloe*. <sup>(49)</sup>

Oral administration of *aloe vera* extracts affected the composition of lymphocyte subsets (CD<sup>4</sup> & CD<sup>8</sup>) and serum immunoglobulins positively in rabbits. <sup>(59)</sup> The authors added that these findings demonstrated that *aloe vera* may stimulate both cellular and humoral immune

responses after immunization. Immunostimulating action of Aloe vera was reported to be induced by potentiation of syntheses and release of several cytokines such as TNF -  $\alpha$  and IL-6<sup>(60,61)</sup>

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