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EFFECT OF MEDICINAL PLANTS ON HAEMATOLOGY AND SERUM BIOCHEMICAL PARAMETERS OF VILLAGE CHICKENS NATURALLY INFECTED WITH *Heterakis gallinarum*

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ABSTRACT

The effects of *Aloe ferox*, *Agave sisalana* and *Gunnera perpensa* on haematological and biochemical parameters of village chickens naturally infected with *Heterakis gallinarum* were evaluated. One hundred and twelve mature village chickens were randomly allotted into 14 groups of 8 chickens. Group 1 and 2 were orally administered 1 mL distilled water for 4 consecutive days and 1 mL mebendazole (once), respectively. Groups 3-6 received 1 mL orally of aqueous leaf extract of *A. ferox* for 4 consecutive days, groups 7-10 *A. sisalana* and 11-14 *G. perpensa* in graded doses of 50, 100, 200 and 400 mg/kg, respectively. Blood was collected into vacutainers in triplicate, from the wing veins on day 0, 7 and 14. Data was analysed using general linear model of statistical analyses system. Chickens offered *A. sisalana* (200 mg/kg) had highest alanine transaminase (ALT) value ($P < 0.05$; 7.50 ± 0.406 U/l) on day 0. On day 7 and 14, there was no difference in ALT values ($P > 0.05$). Significant differences among plants for aspartate transaminase on day 0, 7 and 14 were observed. Mean corpuscular haemoglobin concentration and mean corpuscular volume were maintained within the reference range. From day 0 to 14, haematocrit was reduced for chickens on *G. perpensa* (50, 100 and 400 mg/kg), *A. ferox* (100 and 400 mg/kg) and *A. sisalana* (50, 100, 200 and 400 mg/kg). Haemoglobin was out of range on day 0 and improved to be within the range on day 7 and 14. The medicinal plants enabled normal synthesis and functioning of haematological and biochemical parameters of village chickens and were maintained within the expected reference ranges. These plants are crucial phytomedicines for treating *H. gallinarum* infestations in village chickens.

Key words: Biochemical assay, chickens, full blood count; gastro-intestinal parasites, phytomedicine

INTRODUCTION

Medicinal plants have been used since ancient times for the control and treatment of human and livestock ailments (Ganesan and Bhatt, 2008). In particular, *Aloe ferox*, *Agave sisalana* and *Gunnera perpensa* are used in controlling gastro-intestinal parasites in village chickens (Dold and Cocks, 2001; van Wyk *et al*., 2008; Mwale and Masika, 2009). It has been observed that these plants are potentially toxic when used excessively (Mwale and Masika, 2011) but they have an invaluable efficacy against gastro-intestinal parasites in chickens (Brookes and Dutton, 2007; Yim *et al*., 2011), particularly *H. gallinarum* which is one of the most prevalence parasites in village chickens. Medicinal plants, however, contain some toxins that have multi-system effects, such as acute kidney injury accompanied by hepatitis and colitis (Swanepoel *et al*., 2008). In addition, plants may reduce levels of packed cell volume (PCV), red blood cells (RBC) and haemoglobin, significantly alter white blood cell value, and increase the levels of total protein, albumin and, aspartate transaminase (AST) and alanine transaminase (ALT) activity leading to impaired village chicken productivity (Adedapo *et al*., 2007). In some instances oral administration of plant extracts result in slight diarrhoea, catarrhal enteritis, degeneration of renal tubular cells, anorexia, ataxia, recumbence and death (Adam *et al*., 2001). These effects were related to serum lactic dehydrogenase and aspartate transaminase activities, concentrations of cholesterol, bilirubin, total protein, albumin, urea and haematological values (Adam *et al*., 2001).

In some cases, however, medicinal plants do not have harmful effects on haematological and serum biochemical parameters (Jaouad *et al*., 2004; Oduola *et al*., 2007). Haematological profiles both in humans and animals are an important index for the physiological state of an individual (Khan and Zafar, 2005). Haematology normally encompasses the evaluation of full blood count (FBC) and the organ involved in producing blood.

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The FBC parameters include RBC, platelets, haematocrit (packed cell volume), haemoglobin estimation, total and differential white blood cell counts and red blood cell indices; mean cell volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) (West and Haines, 2002). Full blood count gives information about the animal cells, providing its general health status. Abnormally high or low counts may indicate the presence of many forms of diseases, disease conditions or toxicity (West and Haines, 2002).

Haematological and biochemical parameters are, however, influenced by factors that include age, gender, feed, drugs, toxic compounds, diseases and parasite infestations (Agbede and Aletor, 2003; Huff *et al*., 2008; dos Santos Schmidt *et al*., 2009). Some medicinal plants are basically used as feed supplements for chickens or for medicinal purposes thereby becoming involved in a cascade of physiological reactions, that in turn lead to the alteration of haematological and serum biochemical parameters (Ewuola and Egbunike, 2008). This is necessitated by toxic substances that might be present in the plants in cases of lowering or elevating the haematological and biochemical values or non-toxic invaluable compounds that maintain the values in the expected reference ranges for chickens (Simaraks *et al*., 2004). In view of this, the toxicological effects of *A. ferox*, *A. sisalana* and *G. perpensa* on haematological and serum biochemical parameters of village chickens naturally infected with *Heterakis gallinarum* was evaluated. The hypothesis tested was that *A. ferox*, *A. sisalana* and *G. perpensa* do not elevate or lower the haematology and serum biochemical parameters of village chickens naturally infested with *H. gallinarum*.

MATERIALS AND METHODS

Study site

The study was conducted at Fort Cox College of Agriculture and Forestry (32˚ 46′ 23″ S and 027° 02′15″ E; elevation 552 m) in the Eastern Cape Province of South Africa. The college is in the False Thorn grassland that is associated with the semi-arid environment and the area receives an average annual rainfall of 480 mm. Rain falls predominantly in the summer months (November-April) while June and July are the driest winter months. The Temperature ranges from 7°C in the cool dry season to 35°C in the hot dry season and the mean annual temperature is 18.7°C. The vegetation is a mixture of trees, shrubs and grass species. The predominant grass species are *Acacia karroo*, *Themeda triandra*, *Panicum maximum*, *Digitaria erientha*, *Eragrostis* species and *Cynodon dactylon*. At the college livestock species reared include chickens, cattle, sheep and goats.

Collection of plant material

About 2 kg of fresh leaves of each of *A. ferox, A. sisalana* and *G. perpensa* were collected from Centane district (32° 38' 63" S and 28° 24' 36" E; elevation 50 m) in the Eastern Cape Province of South Africa in October 2007. The plant materials were identified at Selmar Schonland Herbarium at Botany Department, Rhodes University, in South Africa. Voucher specimens (MMAN 2007/01), (MMAN 2007/02) and (MMAN 2007/03) for *A. ferox, A. sisalana* and *G. perpensa,* respectively were deposited in the Giffen Herbarium at the University of Fort Hare.

Preparation of plant extracts

The collected leaves were washed using cold water to remove dirt, following the smallholder farmers' procedures. Spines around the leaves of *A. ferox* and *A. sisalana* were removed using a knife. The leaves from the three medicinal plants were sliced before blending. Following the resource-poor farmers and herbalists' procedures, 200 g of each of the sliced *A. ferox, A. sisalana* and *G. perpensa* leaves were mixed with 100, 200 and 400 ml of distilled water, respectively. The mixture for each of the plant material was blended with an electric blender for 3 minutes to obtain 200, 100 and 50% (w/v) extract for *A. ferox, A. sisalana* and *G. perpensa,* respectively (Githiori *et al*., 2003). The blended material was squeezed through a muslin cloth. The extract from the three plants, recovered after squeezing through a muslin cloth was freeze-dried at -50 ºC under vacuum using a lyophilizer (Savant Refrigerated Vapor Trap, RVT 4104, USA) and kept in a freezer at -20ºC until use. One percent concentration was used to reconstitute the extracts to make *A. ferox, A. sisalana* and *G. perpensa* stock solutions. Thus, the extracts were reconstituted into 50, 100, 200 and 400 mg/kg doses.

Animals used

A total of 112 mature village chickens of either sex, aged between 6 and 12 months, were acquired from farmers at Zixenene village in Amatola basin (32º 42´ 89´´ S and 027 02´36´´ E; elevation 541 m). Only infected chickens were used and the modified quantitative McMaster (floatation) technique was used to determine faecal egg counts of H. *gallinarum* (MAFF, 1986). The average live weight of the chickens was 1.36 kg ± 0.667.

Ethical procedures for using village chickens were according to the University of Fort Hare ethics committee's and international standards (Austin *et al*., 2004; Marie, 2006) as well as in accordance with the Helsinki, 1964 ethical standards declared (World Medical Organization, 1996).

Management of the chickens

The village chickens (n=112) were randomly alienated into 14 groups of eight chickens, and the initial weight of the chickens was recorded using a digital scale (August Sauter GmbH D-7470 Albstadt-Ebingen, Switzerland). Numbered plastic tags clipped onto the thighs of the chickens were used for identifying the chickens. The weight of chickens was uniform across treatments and was used for the calculation of doses (50, 100, 200 and 400 mg/kg). Chickens in group 1 (negative control) and 2 (positive control) were *per os* administered 1 mL distilled water for 4 consecutive days and 1 mL mebendazole (once), respectively. The other measurements and management were done for the negative control group except that instead of being given the plant extract under test, it was given distilled water. As for the positive group, the chickens received the same management as all the other chickens but *H. gallinarum* was controlled using mebendazole instead of any of the plant material extracts. The rest of the chickens were administered with 1 mL *per os* of the graded levels of the aqueous leaf extracts of the 3 medicinal plants for 4 consecutive days. Groups 3-6 received 50, 100, 200 and 400 mg/kg of *A. ferox*, respectively, groups 7-10 received 50, 100, 200 and 400 mg/kg of *A. sisalana*, respectively and groups 11-14 received aqueous leaf extract of *G. perpensa* in the same respective doses.

The chickens were fed a mixture of maize and wheat bran at a ratio of 3:1 (EPOL Feeds Ltd, South Africa). Clean water was provided *ad libitum.* Each chicken received 100 g of feed per day. Feed offered and refusals were weighed daily using a digital scale (August Sauter GmbH D-7470 Albstadt-Ebingen, Switzerland), to avoid underfeeding the chickens.

Blood parameter analyses

Blood was collected pre-feeding in triplicate per treatment on day 0, 7 and 14 using a syringe and a needle from the wing vein (Akhtar and Riffat, 1985; Hoque *et al*., 2006). Heparinised vacutainer tubes were used for the collection of blood for FBC while non-heparinised vacutainer tubes were used to collect blood for serum biochemical assay (AST and ALT). The haematological and serum biochemical parameters were determined using Advia 2120 (Bayer, Germany) for haematology and Beckman DXC 00 (USA) for serum chemistry, respectively. Haematological parameters assayed for were red blood cells (RBC), red cell distribution width, platelets, haematocrit, haemoglobin estimation, MCV, MCH and MCHC. Aspartate transaminase and ALT concentrations were assayed for from the serum (Burger *et al*., 2005). The reference range for haematological and serum biochemical parameters was according to Simaraks *et al*. (2004).

Data analyses

Data were tested for normality using proc univariate of the statistical analyses system (SAS, 2008). To confer normality data was transformed using square root. Data was analysed using the general linear model (GLM) procedure (SAS, 2008) to test the effect of *A. ferox*, *A. sisalana* and *G. perpensa* leaf extracts on haematological and serum biochemical parameters of village chickens.

RESULTS

The findings for biochemical assays obtained are reported as follows. There was a difference in ALT concentrations across the medicinal plants on day zero. Chickens offered *A. sisalana* (200 mg/kg) had the highest ALT value (7.50 ± 0.406 U/l) followed by *A. ferox* (400 mg/kg) with 6.00 ± 0.406 U/l, while the rest of the chickens had low levels of ALT. Chickens in group 1 and 2 had the least ALT value of 4.00 ± 0.406 U/l. On day 7, there was no difference in the ALT values of the chickens (P >0.05) on all the treatments.

For AST, on day 0 chickens on *A. ferox* 50 mg/kg dose had the highest AST value (1 416.50 ± 93.590 Ul) and those on distilled water had the least value of 222.33 ± 93.590 Ul, while the rest of the chickens had insignificantly different values from the positive control which had 200± 93.590 Ul. On day 7 and 14 the AST values were not different from the positive control (P >0.05), except for chickens that were on distilled water which had a least AST value of 222.33 ± 93.590 Ul. For all dose levels, AST values did not change over time; from day 0 to 14 (P >0.05), except for *A. ferox* 50 mg/kg where AST changed from 1 416.50 ± 93.590 Ul at day 0 to 174.00 ± 93.590 and 175.00 ± 93.590 Ul at day 7 day 14, respectively.

The findings for the full blood count observed are as follows. The MCHC value was high for chickens on mebendazole on day 0 and 7, respectively but was within the reference range for day 14 (Table 1). For *A. sisalana* 200 mg/kg, MCHC was higher than the reference range on day 0 and within the range for day 7 and 14. As indicated in Table 1, the same trend was noticed for *A. ferox* 400 mg/kg dose and *G. perpensa* 50, 100 and 400 mg/kg doses. Chickens on *G. perpensa* 200 mg/kg on day 0 had the highest MCHC value of 47.00 ± 0.885 g/dl but it decreased to 33.40±0.885 g/dl on day 7 and increased to 40.07 ± 0.885 g/dl on day 14. Chickens on *A. ferox* in all doses tested, together with *A. sisalana* 200 and 400 mg/kg had least MCHC values that were within the range at day 7.

The MCH values for chickens under treatment were not affected by the aqueous extracts of *A. ferox, A. sisalana* and *G. perpensa*; they were maintained within the reference range (33.0-47.0 pg) except for *A. sisalana* 100 mg/kg (day 7), *G. perpensa* 200 mg/kg (day 0), *A. ferox* 50 (day 14) and 200 mg/kg (day 0) doses that were higher than the reference range. On day 7, *A. ferox* (50 and 100 mg/kg) and *A. sisalana* (400 mg/kg) were lower than the expected range. The aqueous leaf extracts of the test plants did not affect the MCV of chickens; they were all maintained within the reference range of 90.0-140.0 fl. *Aloe ferox* 50 mg/kg dose at day 14 exerted the highest MCV value (116.50 ± 1.563 fl) while *G. perpensa* 50 mg/kg at day 0 exerted the least value (99.30 ± 1.563 fl).

Table 1. The effect of *Aloe ferox*, *Agave sisalana* and *Gunnera perpensa* on mean corpuscular haemoglobin concentration in g/dl (n=24)

Test material	Dose (mg/kg)	MCHC[1] (±SE[2])			Standard error
		Day 0	Day 7	Day 14	
Distilled water	-	36.77^{bc}	36.77^{bc}	36.77^{bc}	0.511
Mebendazole	50 mg/mL	40.60^{b}	40.87^{b}	33.90^{cd}	0.511
Aloe ferox	50	31.90^{cd}	28.07^{d}	41.20^{b}	0.885
	100	30.80^{cd}	30.80^{d}	36.57^{bc}	0.885
	200	43.60^{ab}	29.97^{d}	41.27^{b}	0.885
	400	40.60^{b}	30.70^{cd}	37.43^{bc}	0.885
Agave sisalana	50	38.00^{bc}	35.07^{c}	43.30^{ab}	0.885
	100	34.50^{c}	43.30^{ab}	37.20^{bc}	0.885
	200	36.30^{bc}	32.27^{cd}	33.90^{cd}	0.885
	400	35.50^{c}	27.47^{d}	42.30^{ab}	0.885
Gunnera perpensa	50	38.40^{bc}	34.80^{c}	35.07^{c}	0.885
	100	39.30^{bc}	39.40^{bc}	37.60^{bc}	0.885
	200	47.00^{a}	33.20^{cd}	40.07^{b}	0.885
	400	39.60^{bc}	35.30^{c}	36.57^{bc}	0.885
Reference range			**26-35**		

[a, b, c, d] Values with different superscripts are different at P <0.05. MCHC[1] : Mean corpuscular haemoglobin concentration. SE[2]: Standard Error

There was a difference in the haematocrit (packed cell volume) values of chickens treated with aqueous extracts of the test materials (P <0.05) and that of the positive control. From day 0 to 14, the values were mostly maintained within the range for chickens on distilled water, reduced for chickens on mebendazole, *G. perpensa* (50, 100 and 400 mg/kg), *A. ferox* (100 and 400 mg/kg) and *A. sisalana* (50, 100, 200 and 400 mg/kg doses); and increased for the rest of the doses. However, the values were within the reference range (Table 2).

Table 2. Mean haematocrit values (±SE) for village chickens administered with *Aloe ferox, Agave sisalana* and *Gunnera perpensa*

Test material	Dose (mg/kg)	Mean haematocrit values			Standard error
		Day 0	Day 7	Day 14	
Distilled water	-	0.28^{de}	0.28^{de}	0.28^{de}	0.007
Mebendazole	50 mg/mL	0.47^{a}	0.30^{d}	0.32^{c}	0.007
Aloe ferox	50	0.31^{d}	0.33^{c}	0.40^{b}	0.012
	100	0.40^{b}	0.31^{d}	0.27^{de}	0.012
	200	0.26^{de}	0.30^{d}	0.34^{c}	0.012
	400	0.35^{c}	0.25^{de}	0.27^{de}	0.012
Agave sisalana	50	0.31^{d}	0.29^{d}	0.27^{de}	0.012
	100	0.45^{ab}	0.22^{e}	0.28^{de}	0.012
	200	0.38^{bc}	0.29^{d}	0.37^{bc}	0.012
	400	0.40^{b}	0.28^{de}	0.29^{d}	0.012
Gunnera perpensa	50	0.33^{c}	0.25^{de}	0.27^{de}	0.012
	100	0.42^{b}	0.27^{de}	0.28^{de}	0.012
	200	0.21^{e}	0.24^{de}	0.28^{de}	0.012
	400	0.33^{c}	0.25^{de}	0.26^{de}	0.012
Reference range			**0.22-0.35**		

$^{a, b, c, d, e}$ Values with different superscripts are different at P <0.05. SE: Standard Error

Table 3. The effect of *Aloe ferox, Agave sisalana* and *Gunnera perpensa* on red blood cell count ($x10^6$ µl) (n=24)

Test material	Dose (mg/kg)	Red blood cell count (±SE[1])			Standard error
		Day 0	Day 7	Day 14	
Distilled water	-	2.64^{c}	2.64^{c}	0.64^{c}	0.048
Mebendazole	50 mg/mL	4.21^{a}	2.68^{c}	3.05^{bc}	0.048
Aloe ferox	50	2.93^{c}	2.96^{c}	3.46^{bc}	0.083
	100	3.75^{ab}	2.93^{c}	2.61^{c}	0.083
	200	2.42^{cd}	2.67^{c}	3.36^{bc}	0.083
	400	3.36^{bc}	2.29^{cd}	2.56^{c}	0.083
Agave sisalana	50	3.12^{bc}	2.67^{c}	2.63^{c}	0.083
	100	3.97^{ab}	1.93^{d}	2.72^{c}	0.083
	200	3.55^{ab}	2.85^{c}	3.43^{bc}	0.083
	400	3.44^{bc}	2.62^{c}	2.80^{c}	0.083
Gunnera perpensa	50	3.28^{bc}	2.32^{cd}	2.63^{c}	0.083
	100	3.85^{ab}	2.42^{cd}	2.65^{c}	0.083
	200	2.06^{cd}	2.27^{cd}	2.75^{c}	0.083
	400	3.10^{bc}	2.31^{cd}	2.52^{c}	0.083
Reference range			**2.5-3.5**		

$^{a, b, c, d}$ Values with different superscripts are different at P <0.05. SE[1]: Standard Error

On day 0, blood platelets were higher than the reference range for mebendazole, *G. perpensa* 100 mg/kg, *A. ferox* 100 mg/kg and *A. sisalana* 100, 200 and 400 mg/kg doses. At day 14 platelets were higher than the reference range only for *A. ferox* 50 mg/kg. The least platelet value for the chickens was 3.00 ± 0.993 x 10^9/ l for mebendazole and *A. ferox* 50 mg/kg at day 0 and this increased to 11.00 and 17.00±0.993 x10^9/l for mebendazole and *A. ferox* 50 mg/kg dose, respectively at day 7 and 14. The highest value was 19.00±0.993 x10^9/l for *A. sisalana* 50 mg/kg. *Agave sisalana* 200 mg/kg dose exhibited a decrease from 10.00 and 10.50 to 3.00 x10^9/l from day 0, 7 and 14, respectively.

The haemoglobin values of chickens were less than the expected range on day zero and improved to be within the range (7-13 g/dl) for day 7 and 14, for mebendazole, *G. perpensa* 100 mg/kg, *A. ferox* 400 mg/kg and *A. sisalana* 100 and 400 mg/kg. For *A. ferox* 50 and 200 mg/kg haemoglobin was higher than the reference range on

day 14. The red cell distribution width was not affected by the test medicinal plants ($P > 0.05$). As illustrated in Table 3, almost all the tested doses were within the reference range (2.5-3.5 x 10^6 µl) for red blood cell counts, except for mebendazole and the 100 mg/kg dose for *A. sisalana*, *A. ferox* and *G. perpensa* at day 0, that were higher than the reference ranges.

DISCUSSION

Although, ALT and AST that represent serum glutamic-pyruvic transaminase (SPGT), which indicates how stressed the animal is due to parasite infestations among other factors like diseases, and integrity of the liver (Akhtar *et al*., 1985), were significantly different among the test materials throughout the experimental period, the values were within the reference range. This indicates that the plant extracts had constituents that assisted in relieving the chickens from stress caused by *H. gallinarum* infestation (Mungube *et al*., 2008; Shahadat *et al*., 2008). Khan and Zafar (2005) stated that changes in blood parameters signify stress, infection and intoxication. However, the current findings show that there was no possibly for acute and chronic liver damage as indicated by AST and ALT values which were not elevated or lowered beyond the expected reference range. This concurs with the findings for organs and biochemical values of rats where *A. ferox* and *G. perpensa* did not damage the livers of rats, or alter AST and ALT values (Mwale and Masika, 2011; 2012). However, *A. sisalana* caused an elevation of the AST and ALT levels in (Mwale *et al*., 2013).

The MCHC of the chickens was mainly within the range, although initially it was high and out of range, indicating that the aqueous leaf extracts of the test medicinal plants enabled the MCHC of the chickens to normalise. This indicates that the plants consist of invaluable compounds that lead to the improvement of haematological values of chickens. Improvement in the MCHC values could be that the plants were making the vitamin available that could have been depleted due to parasite infection. Similar findings were obtained for MCH and MCV blood components. In addition, the plants could have been providing iron necessary for the synthesis of haemoglobin, thereby enhancing MCHC levels. This indicates that the studied medicinal plants are pivotal in alleviating the effects of *H. gallinarum* that include anaemia, inflammation and pain. This supports the wide use of the plants by resource-limited farmers in controlling gastro-intestinal parasites in village chickens (Mwale and Masika, 2009). Findings of the current study are contrary to the findings by Fasuyi and Aletor (2005a) where in their study MCV were reduced and RBC increased in broiler chickens.

Similar to other medicinal plants which are rich in nutrients including minerals such as calcium, zinc and potassium (Fasuyi and Aletor, 2005b), the currently studied plants might be constituting essential nutrients especially zinc and iron that are essential for blood synthesis; therefore it is important to evaluate the nutritional profile of *A. ferox*, *A. sisalana* and *G. perpensa*. The authors alleged that RBC is the most consistently affected blood parameter since their cells are easily and rapidly broken down. However, in our study, RBC levels improved from day 0 to day 7 and 14, an indication that the plants may positively influence the synthesis of RBC levels in chickens thereby ameliorating the problem of anaemia due to parasite infestation. The current findings could be attributed to the anti-oxidant property that has been reported for *A. ferox* (Chun-hui *et al*., 2007; Loots *et al*., 2007) and *G. perpensa* (Steenkamp *et al*., 2004) that lead to minimised damage, prevention and repair of damage done by these free radicals of cells that produce RBC through the scavenging of free radicals and enhancement of the immune defence. This supports the assertion by the resource-limited farmers that these medicinal plants are effective in controlling gastro-intestinal parasites in village chickens (Dold and Cocks, 2001). It is therefore, paramount to scientifically validate and authenticate these assertions so as to add value and to preserve views of resource-limited farmers.

The observation that haemoglobin, haematocrit and platelets were within the expected range signifies that the plants under study could importantly influence the replenishment of lost blood thereby curbing anaemia that may be caused by *H. gallinarum* (Liebhart and Hess, 2009). The histomonas can cause liver damage leading to protein deficiency and hence anaemia (Sentíes-Cué *et al*., 2009), therefore synthesis and maintenance of haematological values within the reference range, is crucial as necessitated by the studied plants. The results are, however, contrary to those of Hoque *et al*. (2006) where haemoglobin and packed cell volume (haematocrit) increased in the study for testing the anthelmintic efficacy of pineapple leaf extract against natural ascariasis in indigenous chickens.

Aloe ferox, *A. sisalana* and *G. perpensa* positively influenced the haematological and biochemical values of village chickens. The parameters were maintained within the reference ranges and those that were higher than the

reference range improved to be within the reference range. These medicinal plants are potentially useful phytomedicines for controlling and maintaining haematological effects impaired by *H. gallinarum* infestation in village chickens.

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