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Research Article

Effects of Drinking Water Containing *Aloe vera* Extracts on Growth and Palatability of Black Austrolop and Koekoek Ecotype Chickens

Sakadzo N* and Chibi Rindirai M

Faculty of Natural Sciences, Department of Soil and Plant Sciences, Great Zimbabwe University, Zimbabwe

***Corresponding Author:** Sakadzo Nyasha, Faculty of Natural Sciences, Department of Soil and Plant Sciences, Great Zimbabwe University, Zimbabwe.

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Abstract

Use of ethno chemicals in controlling poultry diseases and their mode of action is a major concern since most communal farmers are using these without knowing suitable concentration. Ethno chemicals provide relatively cheaper and readily available alternative drugs. In this study the effects of Aloe barbadensis (*Aloe-vera*) on growth and palatability of Black Austrolop and Koekoek chickens were investigated. The experiment was a completely randomized design (CRD) with three replications. The experiment had two factors, the two chicken strains and four levels of *Aloe vera* concentrations (0%, 2%, 6% and 10%) as a ratio of *Aloe-vera* extract powder to 100ml distilled water. Treatment units were twenty four having six birds in each treatment unit hence a total of one hundred and forty four birds. Growth rate in terms of weight was determined after two weeks of drinking water containing *Aloe-vera* extract powder. The birds were housed in a deep litter system. Roadrunner starter mash was fed for up to eight weeks of age. From the ninth week up to slaughter road runner finisher mash was given. The feeds contained no coccidiostat, growth promoter, antibiotics nor artificial additives. Palatability in terms of tenderness, juiciness and chicken flavour intensity tested after slaughter at week twenty five. Results showed that there was a significant difference ($P<0.05$) on starter and finisher phase gains, interaction between the concentration and strain on overall gain and a significant difference on the palatability of the two strains of indigenous chickens. Use of *Aloe-vera* is cheaper, user friendly and readily available therefore can be used to increase growth and weekly weight gain of indigenous chickens.

Keywords: *Aloe vera*; Ethno Botanicals; Black Austrolop; Koekoek; Roadrunner; Palatibility

Introduction

Sub-therapeutic dosages of antibiotics have been used more than 50 years in poultry nutrition to promote growth performance and prevent diseases [1]. However, continuous use of in-feed antibiotics is suspected to result in common problems such as increasing resistance of pathogens to antibiotics, accumulation of antibiotic residues in animal products and the environment, and imbalance of normal microflora, thus, efforts have been made to substitute antibiotic growth promoters (AGPs) with alternative growth promoters. Phytogenic and herbal products have received increased attention as natural additives in recent years because they have been accepted by consumers as natural additives [2].

Aloe vera (*Aloe barbadensis Miller*) is a well-known medicinal herb and it has been used for commercial and therapeutic properties in many parts of the world. It is a tropical plant of the genus Aloe and belongs to the Liliaceae family. *Aloe-vera* gel contains compounds with proven antibacterial, antiviral, antifungal, antioxidant, anti-inflammatory, anti-diabetic, immune modulatory, and wound healing properties (Boudreau and Beland, 2006, Chris-

taki and Florou-Paneri, 2010). *Aloe-vera* gel contains acemannan, which has been identified as the primary polysaccharide. Polysaccharides can affect the humoral immune response and cellular immunity [3]. Studies showed that acemannan is able to activate macrophages to release inflammatory cytokines such as interleukin-1 (IL-1), IL-6, and tumor necrosis factor-α (TNF-α) [4]. *Aloe-vera* gel has demonstrated antimicrobial properties against a wide range of pathogenic bacteria such as *Staphylococcus aureus* and *Escherichia coli*. Darabighane and Nahashon [5] observed the beneficial influence of Aloe-vera gel on intestinal microflora and immunity in broiler chickens. Furthermore [6] reported positive effects of *Aloe-vera* to relative weight of lymphoid organs of broilers.

Poultry meat offers considerable potential for bridging the gap between supply and demand for animal protein, especially in Africa. Mwale., *et al*. [7] highlighted that farmers in rural areas use *Aloe vera* to control poultry diseases.

Several research studies indicate use of ethno veterinary medicines but lack of rigorous experimentation has led to realisation of gaps in determining the effective concentration that improve overall wellbeing of indigenous chickens.

Moreover, the effects of ethno chemicals on Growth and palatability of indigenous chicken meat have not been done. Therefore, the aim of this trial was to further enhance our knowledge and examine the effects of drinking water containing *Aloe vera* extracts on growth and palatability of black Austrolop and Koekoek ecotype chickens.

Materials and Methods

Study site

The experiment was carried out at Bika Secondary School. The site is in agro-ecological zone four which receives an annual rainfall of 650mm annually with a mean annual temperature of 27^0C.

Experimental design

The experiment was a 2 x 5 factorial design with three replications laid out in a complete randomised design (CRD). Factor 1 was *Aloe-vera* extracts with four levels (distilled water 0%, 2%, 6% and 10% concentrations) and Factor 2 were two strains of chicken (Koekoek/spotted and the black austrolorp). Each treatment combination had six birds per replicate. All birds were two weeks old at the start of the experiment.

Method

Extraction of *Aloe vera* extracts

Aloe-vera leaves were harvested around Bika Secondary School localities in August 2018. The *Aloe-vera* leaves were air dried, ground into powder form and sieved to leave it in powder form. Two, six and ten grams of crushed powder were mixed with 100ml of water to produce 2%, 6% and 10% Aloe-vera solutions respectively.. This is in line with the protocol used by Sakadzo., *et al* [8].

Experimental birds

Two strains Koekoek/spotted and black autsrolop were acquired when they were two weeks old and their mean induction mass was 80 grams. The birds were fed adlib with road runner starter mash. The birds were bought from Standard farm opposite stop over (Masvingo -Great Zimbabwe road).

Management of birds

On arrival birds were weighed and randomly allocated to groups of six per strain and allocated to the four *Aloe-vera* extract treatments.

The birds were supplied with prepared *Aloe-vera* extracts in drinking water for 25 weeks that was from 26 November 2018 up to 10 May 2019. The birds were housed in a deep litter system and fed with rod runner starter mash for eight weeks.

Figure 1: Housing of birds.

During the 9th week the road runner starter mash was mixed gradually with road runner finisher mash for the birds to get used to the new feed. This feed was given up to slaughter stage and the birds were 25 weeks old. These feeds do not contain a coccidiostat, growth promoter, antibiotics or artificial additives.

Data collection

Initial mean weight of birds in each experimental unit was recorded. Growth rate was monitored through collection of weight every fortnight from day of arrival up to slaughter date.

The average live weight of each treatment replicate was recorded.

Preparation after slaughter

To determine the effects of *Aloe – vera* extracts on the palatability of the two strains of chickens 16 birds were slaughtered. Two birds of each strain from each *Aloe-vera* treatment were slaughtered. Two birds per treatment x 4 concentrations = 8 units (birds per strain). 8 units x factor 1 (Strain)= 8 x 2 = 16 birds slaughtered. Dressed mass was also recorded.

The chicken strains were cooked separately and birds from different concentrations were cooked separately. Water and boiling time were the same. A two plate gas stove was switched on to 3 for 33 minutes for all the pots. One and a half heaped table spoons of red seal iodised salt and 500ml of water were the only additives put. Four treatment combinations were prepared and served on the first day (10 May 2019) and these were black Astrolops and koekoek from 0% and 2% *Aloe vera* concentrations other four treatment combinations 6% and 10% on the other day (12 May 2019).

The two pots for the two plate stove were labelled in order for the researcher to know from which strain of chicken and concentration is the meat from. The pots were of the same size (12,5litres) so that the chicken pieces in each pot experience the same temperature.

The meat was removed from source of heat when it was golden before it turned crisp brown. When the chicken was ready, the meat was put in bowls labelled accordingly. The chicken meat was wrapped in an aluminium foil to keep it warm so that it will be served at almost the same temperature with the other two treatment combinations cooked last.

Serving

Twenty people were served with four pieces of chicken each and each piece was from a different treatment combination. People were served with pieces of chickens they favour most. The four pieces for each were the same part (if it is drumsticks four of them were served to one person). Only the following parts were on the taste drum sticks, thighs, wings, backs ribcages, breasts and necks. The chicken pieces were each partly wrapped with an aluminium foil with codes for the researcher to know from which treatment combination they are from.

Figure 2: Four pieces of chicken from each treatment.

The twenty people were given questionnaires designed in line with the taste panel sensory evaluation to respond to. Questions in the questionnaires were addressing the tenderness, juiciness and chicken flavour intensity of the birds using a scale of 1-8 ranging from extremely tough to extremely tender, extremely dry to extremely juicy and extremely bland to extremely intense respec-

tively. The questionnaires were each written the part of chicken meat which was being referred to when answering the questionnaire. Treatment combinations were not written to avoid bias from respondents.

The researcher wrote treatment combination after the questionnaire had been answered on by the respondents. Four questionnaires were given to each and after eating a piece the researcher was given the aluminium foil paper to find out which treatment combination was eaten and responded to on the questionnaire. The researcher then had to write on the treatment combination space on the questionnaire for analysis.

The questionnaires were designed in line with the taste panel sensory evaluation.

The 5th quarter (gizzards, shanks, heads, livers, were not on taste but were weighed to find out if the *Aloe vera* had an effect.

Data analysis

Collected data was subjected to Analysis variance (two way ANOVA) using SAS Version 9.1. Duncan multiple range test for least significant differences LDS was used.

Results and Discussion

To find out the effects of *Aloe-vera* extracts on body weight of the Koekoek and black Austrolops chickens.

The effect of *Aloe vera* extracts concentration on chicken growth was significant (P=0.0414). There was a general increase in weight gain as concentration increased in the two tested strains. However, there was an interaction between the strain and the concentration also. The mean of Koekoek was 370g and 356g for the black austrolop. At this phase the least significant difference was 12,4g.

t Grouping	Mean	n	Strain	LSD
a	370g	12	Koekoek	12,4g
b	356g	12	B/Aust	

Table 1: t Test Least significant Difference (LSD) for the starter phase gain.

*Means followed by different letter (a b) are significantly different

On the *Aloe-vera* concentrations there was no significant different on the starter phase.

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t Grouping	Mean	n	Conce	LSD
a	369g	6	10	17,5g
a	368g	6	2	
a	358g	6	6	
a	357g	6	0	

Table 2: t Tests (LSD) for Starter Phase Gain concentration weight.

*Means followed by the same letter are not significantly different.

The LSD was 17,5g. On the finisher phase P value was 0,0846 there was no significant difference on the mean gain of the strains.

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t Grouping	Mean	N	Strain	LSD
a	1102g	12	Koekoek	
a	1029g	12	B/Aust	84,9g

Table 3: t Test for LSD finisher phase.

*Means followed by the same letter are not significantly different.

However there were significant differences on the finisher phase gain on concentration effect. P value was 0,029. There was a significant difference between 6% and 2% concentrations and between 6% and 0% concentrations.

t Grouping	Mean	n	Concentration
a	1158g	6	6
ab	1100	6	10
b	1024	6	2
b	981	6	0

Table 4: Multiple Rang Test for Finisher Phase, Gain of Concentration effect.

*Means followed by different letters in the same column are significantly different.

On overall gain there was a significant difference (P 0, 0446) on the strains. The Koekoek had a mean of 1472g while Black Astrolops had 1385g. They (LSD) was 84,9g.

t Grouping	Mean	N	Strain	LSD
a	1472g	12	Koekoek	
b	1385g	12	B/Aust	84,9

Table 5: t Test LSD for overall gain on strains.

*Means with different letters are significantly different.

On the concentrations on overall gain there were significant differences (P=0.0288). There was a significant difference between 6 and 0% concentration and between 6 and 2% concentration.

t Grouping	Mean	n	Strain	LSD
a	1515g	6	6	
ab	1469g	6	10	120g
bc	1392g	6	2	
c	1338g	6	0	

Table 6: Duncan multiple range t Test LSD for overall gain on concentrations.

*Means followed by different letters in the same column are significantly different.

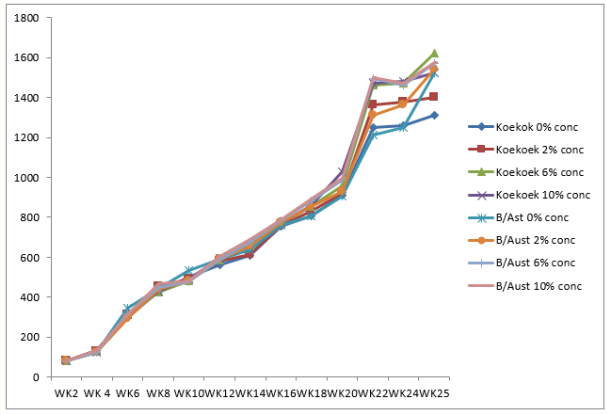

Figure 3: Weight gain at different growth phases.

The graph shows that concentration had an effect on the finisher phase or overall gain. There was a significant difference unlike in the starter phase where the growth was almost the same.

Live mass results

Results showed that Koekoek birds from T6 gained more than even those which had 10% concentration as shown on table 7.

Strain	T0	T2	T6	T10	Strain	
					Average	
Black	1325	1359	1485	1536	1476,25	
Austrolop						
Spotted	1519,5	1540	1565		1562,5	1546,75

Table 7: Average live mass from each treatment (g).

Aloe vera	T0	T2	T5	T10	Strain
Concentration					Average
Strain					
Black	66%	74%	70%	70%	70%
Austrolop					
Spotted	70%	1090	1115	1127,5	1100,5

Table 8: Dressing out percentage.

Overall dressing out percentage of the two strains were almost the same; 70 and 71% for black austrolop and Koekoek respectively. Black austrolop in T2 recorded the highest dressing out percentage of 74%. With the Koekoek it was T10 with 72%.

Results of fifth quarter

From the results obtained on the 5th quarter (gizzards, livers, shanks and heads) mass increased with concentration increase. T0 had the least mass while T10 weighed most on both strains *Aloe-vera* concentration had an effect on the internal organs as shown in table 9.

	T0	T2	T6	T10	Strain Average
B/Aus	451,5g	452,5g	462,5g	487,5g	463,5g
Spotted	452,5g	459g	465g	487,5g	466g

Table 9: Average weight of the 5th quarter (g).

Results on palatability

On tenderness slightly tender and moderately tender had highest response. Drumsticks were slightly tender especially for the Koekoek. Wings were moderately tender 50% black austrolop and 37,5% Koekoek. Backs were moderately tender with 62,5% on the two strains. For breasts, rib cages and Koekoek necks slightly tender, was the response.

NB: Number of responses per chicken piece = n x 4 questionnaires each x 2 days.

	n=4	n=4	n=4	n=2	n=2	n=2	n=2	
Strain	Drumsticks	Thighs	Wings	Backs	Ribcages	Breasts	Becks	
B/Aust	31	43,7	18	25	75	75	25	41,8
Koe	50	43,7	25	25	62	75	62	49

Table 10: Percentages of tenderness results.

Results on juiceness

Results on juiciness showed that slightly juice had the highest responds as high as 62% on black aus and 45% on Koekoek.

	n=4	n=4	n=4	n=2	n=2	n=2	n=2	
Strain	Drumsticks	Thighs	Wings	Backs	Ribcages	Breasts	Becks	Overall %
B/Aust	50	56	43	75	63	75	75	62
Koek	37	31	56	63	25	75	25	45

Table 11: Percentages of juiceness.

Chicken flavour intensity

Chicken flavour intensity was moderately intense on most parts despite strain or concentration as shown in table 12.

	n=4	n=4	n=4	n=2	n=2	n=2	n=2	
Strain	Drumsticks	Thighs	Wings	Backs	Ribcages	Breasts	Becks	Overall %
B/Aust	44	25	44	38	63	25	38	40
Koek	50	50	38	25	63	13	50	41

Table 12: Percentages of chicken flavour intensity.

Koekoek was rated slightly more on moderately intense 41% and black austrolop 40%.

Discussion

Effects of *Aloe vera* extracts on growth

Results showed that an increase in the concentration has an increase in growth of chickens. This was observed during the finisher phase.

Result showed that *Aloe-vera* concentrations had no effect on interaction with the two strains of indigenous breeds. This was observed on the finisher phase and on overall gain. During the starter phase however results showed that concentrations interacted with the strains. Mean weight of the spotted/koekoek was 370g and 356g for the black Austrolop. This might have been contributed by *Aloe-vera* which imfluenced the Koekoek to have an increase in feed intake or had better feed conversion efficiency (FCE). These findings are in line to those by Olupona., *et al*. (2010) who reported an increase in final body weight, weekly body weight gain and average food intake in the birds that received *Aloe vera* (at 15, 20, 25 and 30cm^3/dm^3). Average feed consumed by Koekoek in Treatment 10% at the end of the 8^{th} week was 15340 while the black austrolop having the same concentration by that same period was 15056g. Alemi, *et al*. 2012 concluded that there is better growth performance in broilers treated with 0,75% and 1% *Aloe-vera* gel powder as compared to the 0,5% *Aloe-vera* gel powder group and the control group. Chemicals substances in the Aloe-vera might have much interfered with the growth hormones of the Koekoek than those of the black Austrolop.

Aloe-vera gel extracts besides antimicrobial factors have nutrients which could also have added to the nutritional composition

of the road runner starter and finisher diets contributing to final body weight, weekly weight gain and high FCE. These results can be supported by Surjushe., *et al*. (2008) who stated that *Aloe-vera* have many biological active components including proteins, carbohydrates, vitamins, enzymes minerals, sugar lignins, saponins and salicyclic acids. The Koekoek strain had an overall live mass of 1547g while the black austrolop had 1476g. The highest live mass of 1565G was from T6 of the Koekoek but in T10 it was low (1563g). This could mean that as concentration of Aloe vera increased, weight gain increased up to a certain point as witnessed by Olupona., et al. [9]. There were no significant differences on addressed out percentage between the strains of indigenous chickens.

Results on the weight of the 5th quarter (livers, heads, shanks, gizzards) mass increased as the concentration of *Aloe vera* increased. An increase in *Aloe-vera* concentration had an effect especially on internal organs. These results concur to those by Tilly's nest. (2013) who condemn that over treating with one treatment can cause fat liver disease. Internal organs like the liver can be enlarged due to increased fat or trying to fight against the concentration which could be too much.

Aloe-vera concentration showed no differences in palatability of the two strains. Both Koekoek and black austrolop chicken pieces were categorized as tender products with Koekoek being more tender according the panel taste analysis. Koekoek had an overall tenderness of 49% and black austrolop 41,8%. This means that there was an interaction between the concentration and strain. Black austrolop was categorized as more juice than the Koekoek. Chicken favour intensity was almost the same (40 and 41%) and this could mean *Aloe-vera* concentration had no interaction on the strain and on the flavour [10-16].

Conclusion

It can be concluded from the results that *Aloe-vera* extracts increased overall gain of the Koekoek chickens than the black austrolop. There was no significant difference on growth between the two strains of indigenous chickens during the starter phase feeding. The meat was slight tender, slightly juice and moderately intense. *Aloe vera* increased growth without causing change in meat palatability.

Recommendations

Farmers should not use high levels of *Aloe-vera* concentration as this can lead to fatty liver diseases and high concentrations (10%) proved less gain. Further studies are suggested to find out the effects of *Aloe-vera* fed chickens in humans and effective concentration. The author further recommends farmers to use ethno botanicals since they are cheap and locally available.

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