

POTENTIATING ACTIVITY OF HERBS ALONG WITH CALCIUM AND PHOSPHOROUS TO IMPROVE THE MEAT QUALITY PARAMETERS IN BROILERS

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Abstract: An experiment was conducted to assess the potentiating activity of herbs (*Cissus quadrangularis*, *Uraria picta* and *Lepidium sativum*) with calcium and phosphorous on the various meat quality parameters in broilers. The supplementation was done both on per bird basis (group B) and per kg feed basis (group C). 153 birds were grouped into three groups; one control – group A and two test groups-group B and group C, each having 51 birds. The preparations of Ayucal[®] for group B and group C birds were AV/ALP/17 and AV/CSP/14. After 42 days trial, the body weight at disposal and FCR were significantly higher in group B birds (1901.93g & 1.52 respectively) and group C birds (1824.06g & 1.61 respectively) compared to control group A (1729.81g & 1.80 respectively). The pectoral muscle weight and hip muscle weight were also significantly high in group B birds (273.87 & 35.11 g respectively) & group C birds (256.11 & 34.76 g, respectively). Whereas the same in group A birds were 230.42 and 29.10g, respectively. The dressing percentage in group B birds was 69.72% and group C birds was 67.11% which is far higher than the 61.18% dressing percentage in control group A birds. The optimal pH in group B birds was 5.63 and group C birds were 5.62 which is very near to normal optimal pH of 5.6. The optimal pH of control group (group A) birds was 5.72 which is slightly more than the optimal pH and is not a desirable character. The water holding capacity of group B and group C birds was found to be 99.28% and 98.87%, respectively, which is significantly (P=0.05) higher than that of the 94.28% in control group A birds. The hedonic scores (out of 10) of the taste panel were 9.5 and 9.0 in group B & C birds which is significantly higher than the 7.5 in control group A birds. The results obtained in this experiment infer that feeding of herbal products with calcium and phosphorous has potentiating effect on calcium and phosphorous absorption and utilization and hence yield higher carcass traits particularly if fed per bird basis by mixing in drinking water.

Keywords: *Cissus quadrangularis*, *Uraria picta* and *Lepidium sativum*, Calcium, Phosphorous, Chicken meat Quality Parameter.

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INTRODUCTION

Calcium and phosphorous are the two main minerals required for the musculo-skeletal growth. However, mere feeding of calcium and phosphorous rich feeds may not produce good musculo-skeletal growth because of poor absorption and metabolism. Many herbal plants have been shown to have effect on increasing the absorption and bio availability of minerals.

Cissus quadrangularis, is a perennial climber and is widely used in traditional medicinal systems of India has been reported to possess bone fracture healing (Garima *et al.*, 2010) which shows its activity of on the calcium metabolism. Ethanol extract (95%) of *Cissus quadrangularis* enhances the development of cortical bone and trabeculae, which may be related to rich content of calcium & phosphorous and has shown to influence early regeneration and quick healing of bone fracture (Bhagath *et al.*, 2009, Jaiswal *et al.*, 2004, Sikarwar *et al.*, 2008 and Unnati, 2011).

There is a mention of use of *Lepidium sativum* (Halam) seeds in the treatment of rheumatoid fracture (Yogesh *et al.*, 2011). *Lepidium sativum* (LS) seeds have been used in traditional folk medicine to heal fractured bones (Abdullah and Abdullah, 2007 and Elshal *et al.*, 2013). Similarly there are reports of the effect of *Uraria picta* on calcium metabolism and hence its use in fracture healing (Prasad *et al.*, 1964 and Asgar, 1999).

In this study an attempt was made to study the potentiating effect of the three herbs *Cissus quadrangularis*, *Lepidium sativum* and *Uraria picta* when fed with calcium and phosphorous as these herbs increase absorption and utilization of dietary Ca and P in the body and eventually effect on meat quality parameters in broilers.

MATERIALS AND METHODS

Herbal preparations: Ayucal[®] (Dabur Ayurved Ltd.). It is a premix for poultry containing three herbs; *Cissus quadrangularis* (Harjor), *Uraria picta* (Prishnaparni) and *Lepidium sativum* (Halam). Two preparations are available; AV/ALP/17 and AV/CSP/14.

Experimental protocol: 153 chicks were procured and randomly grouped into three groups in triplicates as follows;

Group	No. of birds	Treatment	Dosage
A	17×3*	Basal diet consisting of Ca and P	No treatment
B	17×3*	Basal diet consisting of Ca and P + AV/ALP/17	15ml/100 birds/day – mixed in drinking water
C	17×3*	Basal diet consisting of Ca and P + AV/CSP/14	1 kg/ton of feed

* In triplicates

The chicks were reared under deep litter system. Throughout the experiment, standard management practices like brooding, feeding, watering and provision of light were followed uniformly in all the groups. The brooding temperature was gradually decreased from 34°C (first week) to 26°C (third week) of age. The vaccination of the chicks was carried out as per the standard schedule.

Meat quality traits:

For this experiment the following chicken meat quality traits were studied.

1. **Body weight at 42 day age:** Weighed by using digital weighing machine - Roy electronic[®].

2. **FCR:** FCR was calculated by using the formula;

$$\text{FCR} = \frac{\text{Total body weight gained}}{\text{Total feed consumed}}$$

3. **Pectoral muscle weight:** Weighed by using digital weighing machine - Roy electronic[®].

4. **Hip muscle weight:** Weighed by using digital weighing machine- Roy electronic[®].

5. **Water Holding Capacity (WHC):** Miller centrifuge method (Tsai and Ockerman, 2006) was followed for estimating water holding capacity. In this method 20 g of chicken meat is weighed and placed in a polypropylene centrifuge tube and then centrifuged for 10 minutes at 1200 RPM. Any free liquid is then decanted and the sample is weighed. The liquid lost during centrifugation is subtracted from the grams of moisture present in 20 g sample. The water holding capacity is expressed as the percent of total moisture retained in 20 grams of meat sample after centrifugation.

6. **Optimal pH:** The optimal pH was measured by using electronic pH meter (digital pH meter[®]-Systronics) after resolution of rigor mortis i.e. 6 hrs after slaughter (Thielke *et. al.*, 2005). Chicken meat extract is prepared by triturating 10 gm of meat and 10 ml of distilled water. pH of the meat extract is measured by placing the electrodes into the extract.

7. **Tenderness and palatability:** Tenderness and palatability were measured by hedonic score card method. Three birds from each group in triplicates were slaughtered scientifically; chicken was prepared and offered to the taste panel. The taste panel consisted of several experienced persons from Veterinary College Bidar and were made to have sensory evaluation of the chicken prepared from the meat of the experimental birds from each group and their score was recorded on 10 point hedonic scale in a standard proforma.

8. Dressing percentage: The dressing percentage was measured by slaughtering 10 birds from each group at 42 day age. It was calculated by using the following formula.

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Body weight}} \times 100$$

Statistical analysis:

In the present study, mean as a measure of central tendency, standard deviation (SD) (Snedecor and Cochran, 1994) as a measure of dispersion and student's 't' test ((P=0.05) as a measure of significance were used for statistical analysis.

RESULT AND DISCUSSION

The results of this study are presented in Table 1. The body weight at 42nd day age was significantly (P=0.05) higher in treated groups (B & C) (1901.93±2.01g & 1824.06±1.67g respectively) than control group A (1729.81±2.01g). The FCR of group B & C (1.52 & 1.61) supplemented with Ayucal[®] was significantly (P= 0.05) higher than control group A (1.80). This higher body weight gain & better FCR can be correlated with the role of constituent herbal ingredients; *Cissus quadrangularis* (Harjor), *Uraria picta* (Prishnaparni) and *Lepidium sativum* (Halam) in Ayucal[®]. It is a premix for poultry containing three herbs, that might have enhanced the bioavailability of calcium (Ca) and phosphorus (P), important for bone and muscle building and thereby increasing the body weight. The enhanced weight gain ultimately must have led to superior FCR in treated broilers.

Sanjeev Kumar *et. al.* (2011) reported that supplementation of *Lepidium sativu* increased the dry matter intake, body weight and milk yield in lactating murrah buffaloes. Alshawabkeh *et. al.* (2013) reported that supplementation of plant extracts of *Lepidium sativum* seeds increased milk production and its composition of Awassi Ewes and the role of calcium metabolism in milk production is well known fact.

In the similar line the pectoral muscle weight and hip muscle weight were significantly higher in treated groups B (273.87 & 35.11 g respectively) & C (256.11 & 34.76 g, respectively) compared to the control group A (230.42 and 29.10, respectively). This finding again accentuates the pottentiating effect of the herbs constituting the Ayucal[®] preparation in increasing the assimilation of calcium and phosphorous which are required for muscle growth. The influence of these three herbs on calcium and phosphorous absorption and tibial mineralization has been shown by Jadhav *et. al.* (2010). Ashan *et. al.* (1989) also has shown the enhanced bioavailability of Ca & P by feeding the birds with Ayucal[®] containing *Cissus quadrangularis*, *Lepidium sativum* and *Uraria picta*.

When we analyzed the average dressing yield(including the skin), the group B birds yielded 69.72% of meat and group C birds yielded 67.11% of meat which is far higher than the dressing yield of the control group A birds which was found to be 61.18% which is significantly lower than the treated groups. This specifies the utilization of absorbed calcium and phosphorous for the growth of the muscle and bone which is enhanced by the herbal constituents of Ayucal[®] in group B and C.

The other two very important meat quality characters are; water holding capacity (WHC) and optimal pH i.e. pH after resolution of rigor mortis. The average water holding capacity of group B and group C birds was found to be 99.28% and 98.87%, respectively, which is a good indicator of the healthy and excellent quality meat. The average water holding capacity of the control group A birds was 94.28% which is significantly lower than the treated groups. Physiologically higher the concentration of intracellular calcium higher is the water holding capacity. The role of calcium and phosphorous on water holding capacity of the meat is reported by Zhao and Xiong (2012). And low water holding capacity indicates low quality of meat, less juiciness and less palatability of the meat (Cheng and Sun, 2008).

The average optimal pH of group B birds was 5.63 and group C birds was 5.62 which is nearer to the standard optimal pH 5.6. Whereas the average optimal pH of control group A birds was 5.72. Though the optimal pH of the control group is within the normal range of 5.6-5.8 but it is away from the standard optimal pH 5.6. The tenderness of meat is governed by the attainment of optimal pH after the resolution of rigor mortis.

The hedonic scores (out of 10) indicating the tenderness and palatability of the chicken meat were 9.5 and 9.0 in group B & C birds which is significantly higher when compared to 7.5 in control group A birds. The reason for higher palatability and tenderness could be the attainment of optimal pH, high calcium concentration in the muscles and high water holding capacity.

There are fewer reports on the effect of different herbs and calcium on meat quality. However there are reports of influence of *Cissus quadrangularis* and *Lepidium sativum* on calcium metabolism which may substantiate our findings. There are many reports on the effect of *Cissus quadrangularis* on calcium metabolism and bone mineralization (Bhagath *et. al.*, 2009, Jaiswal *et. al.*, 2004, Sikarwar *et. al.*, 2008 and Unnati, 2011). And many researchers have reported the effect of *Lepidium sativum* on calcium metabolism and hence use in fracture healing (Abdullah and Abdullah, 2007, Yogesh *et. al.*, 2011, Divanji *et. al.*, 2012 and Elhal *et. al.*, 2013). Elhal *et. al.* (2013) has reported the Potentiating effect of *Lepidium*

sativum and phosphorous in rats and found that treatment with either *Lepidium sativum* and/or Alendronate, which contains phosphates, enhanced serum calcium levels in rats.

There are few reports of effect of *Uraria picta* on calcium metabolism and bone mineralization (Singh *et. al.*, 2011). However, it has antioxidant properties (Bharatkumar *et. al.*, 2011 and Veronica *et. al.*, 2013) which may have potentiating effect with *Cissus quadrangularis* on calcium metabolism. In addition, *Uraria picta* and *Lepidium sativum* are rich source of calcium (Snehal *et. al.*, 2012 and Saxena *et. al.*, 2014). These reports support our findings and hence the potentiating effect of the three herbs *viz;* *Cissus quadrangularis*, *Lepidium sativum* and *Uraria picta* with calcium and phosphorous on chicken meat quality parameters like optimal pH, water holding capacity of the meat, tenderness and palatability, muscular growth and body weight gain.

When we analyzed the effect feeding the Ayucal[®] by mixing in drinking water per bird basis (group B) and feeding by mixing it in the concentrate feed per kg feed (group C), we have found that the chicken meat quality parameters, body weight gain and FCR are higher in group B birds than group C birds. Therefore, it is suggested that the feeding of Ayucal[®] preparation containing the three herbs *viz;* *Cissus quadrangularis*, *Lepidium sativum* and *Uraria picta* per bird basis by mixing in drinking water @ 15ml/100 birds/day is beneficial than feeding it by mixing in concentrate feed.

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Table 1: Effect of AV/ALP/17 and AV/CSP/14 supplementation on Chicken meat quality parameters in broilers (5 weeks)

Parameter	Group A	Group B	Group C
Body weight at 42 day age (g) (Mean±S.E.)	1729.81±2.01	1901.93±2.01	1824.06±1.67
FCR (Mean±S.E.)	1.80±0.28	1.52±0.19	1.61±0.40
Pectoral muscle weight (g) (Mean±S.E.)	230.42±0.51	273.87±0.12	256.11±0.19
Hip muscle weight (g) (Mean±S.E.)	29.10±0.66	35.11±0.11	34.76±0.47
Water holding capacity (WHC) (Mean±S.E.)	94.28±0.28	99.28±0.43	98.87±0.37
Optimal pH (Mean±S.E.)	5.72±0.013	5.63±0.006	5.62±0.009
Tenderness (score card method=x/10) (Mean±S.E.)	7.5±0.004	9.5±0.029	9.0±0.016
Dressing % (Mean±S.E.) *	61.18±0.090	69.72±0.057	67.11±0.028

* including skin