Rauwolfia serpentina: A Stress Alleviator of Coloured Broilers Using Incentive to Feed In Extreme Summer

R.C. Kulkarni[1], A.B. Mandal[2], S.S. Sole[3] S. Dey[4] and V.M. Salunke[5]

1& 3. Assistant Professor, College of Veterinary & Animal Science, Udgir-413 517 (MS)
2. Principal Scientist and Head, ANFT, Central Avian Research Institute, Izatnagar-243 122 (UP)
4.Principal Scientist, Division of Veterinary Medicine, IVRI, Izatnagar-243 122 (UP)
5. Deputy Director Research, College of Veterinary & Animal Science, Udgir-413 517 (MS)
Corresponding author e-mail: kramvet23@gmail.com

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ABSTRACT

The present study was conducted to evaluate the effects of Rauwolfia serpentina *(sarpagandha) on productive performance of coloured broilers (n= 112, day-old) during the summer. Four dietary treatments were prepared by adding different levels of dried sarpagandha root powder (0, 0.1, 0.2 and 0.3% of diet) in broiler starter (0-3 wk) and finisher (3-6 wk) diets. The parameters like body weight gain, feed conversion ratio, immunity and oxidative stress were studied. No significant difference was observed in body weight gain at any growth phase. The feed intake was reduced (P<0.001) and FCR was improved (P<0.001) on addition of 0.1 per cent Sarpagandha. Dietary addition of Sarpagandha (0.1, 0.2 and 0.3%) raises hemoglobin level compared to control. The Lipid peroxidase activitiy remained comparable but lower levels of reduced glutathione (P<0.05) and oxidative stress factor (P<0.05) were estimated in broilers fed diets with sarpagandha, being lowest at 0.3 per cent level. The H:L ratio did not differ significantly on addition of Sarpagandha root powder. Therefore, the results indicated that addition of Sarpagandha root powder in diet improved productive performance and humoral immune response of broilers during extreme summer.*

Key words: *Coloured broiler;* Rauwolfia serpentine; *Immunity; Oxidative stress factor;*

High ambient temperature can be distressing to commercial broilers; when they are coupled with high humidity the combination can become critical and may compromise performance and productivity through reducing feed intake and decreasing nutrient utilization, growth rate and feed efficiency, which lead to economic losses in poultry (*Butcher and Miles, 2015*). Heat stress is generated in birds when the body heat load (internal body heat production plus external absorption of heat) exceeds its dissipation. This negative imbalance between the net amount of energy flowing from the animal to its surrounding environment and the amount of heat energy produced by the animal is induced by several factors such as environmental factors. To ameliorate this, animals must lose heat by evaporative heat loss mechanisms such as sweating and panting. When animals fail to use these mechanisms to cool the body, then death is likely to occur (*Ensminger et al., 1990*). -Due to absence of sweat glands birds has to make major thermo-regulatory adaptations in order to prevent death from heat exhaustion as a result the full genetic potential of the broiler is often not achieved.

The uses of herbal plants as health promoters are gaining increasing attention in poultry industry and scientific arena. There are very few studies which have revealed the mechanism of action for immunostimulatory action of Sarpagandha. *Rauwolfia serpentina* (family: Apocynaceae) is a medicinally important herb (*Salma et al., 2008*). Roots and leaves are major plant parts containing medicinal properties due to presence of more than 50 different alkaloids mainly reserpine (*Klyushnichenko et al., 1995*), which is used

to treat hypertension (*Von Poser et al. 1990*), and insomnia, anxiety, excitement, schizophrenia, insanity, epilepsy, hypochondria, diarrhea, dysentery etc. in Ayurveda medicines (*Bhardwaj and Yadav, 2016; Mouli et al. 2009; Qureshi and Udani, 2009*). Reserpine is an alkaloid first isolated from *R. serpentina* which was widely used as an antihypertensive drug. (*Sing et al. 2015*). In view of the sedative activity of Sarpagandha, the present study was undertaken to evaluate the stress alleviating potential of root powder of Sarpagandha in coloured broilers during extreme summer

METHODOLOGY

The present study was conducted on coloured broilers (n=112, Day old) at the Division of Avian Nutrition and Feed Technology (ANFT), Central Avian Research Institute (CARI), Izatnagar. The chicks were fed the diets with or without addition of Sarpagandha during extreme summer (May-June, 38^0C to 43^0C). Fresh plant roots were collected from the natural habitat away from the areal pollution, identified and authenticated from Botanical Survey of India, Central National Herbarium, Howrah, India. The roots were washed with distilled water, air dried under shed, then powdered in an electrical grinder and stored in air tight container at room temperature for use.

Four dietary treatments were prepared by adding different levels of dried root powder (0, 0.1, 0.2 and 0.3% of diet) in practical broiler starter (0-3 wk) and finisher (3-6 wk) diets (Table 1). Each diet was offered to 4 replicated groups of 7 birds each. The l chicks were reared group wise in randomly allotted cabins of the electrically heated battery brooders with the provision of wire-mesh floor, feeder and waterer, located in the well ventilated room; with 24 hours light and uniform management following approved welfare practices. Weighed amount of each test diet used during starter (0 3 wk) and finisher (3-6 wk) period was offered daily in quadruplicate lot of 7 chicks each to ensure *ad libitum* feeding, but with care to avoid spillage and wastage. The fresh and wholesome water was always made available to all the birds during the study period.

The feed consumption was recorded on weekly basis while the body weight gain (BWG) was recorded on 21st and 42nd day to calculate feed conversion ratio. The immunological response viz., cell mediated, humoral and weight of lymphoid organs (bursa and spleen) were studied. The cell mediated response (foot web index to Phytohaemagglutinin, lectin from *Phaseolus Vulgaris*-PHAP) was studied by the method of *Corrier and Deloach (1990)*. The humoral immune response (haemagglutination titre to sheep red blood corpuscles) was studied by the method of *Siegal and Gross 1980; Vander Zijpp 1983*. For immunological study, a total of 32 chicks (8 chicks/treatment) were selected. The weight of bursa and spleen was taken by scientific slaughtering of birds at the end of experiment and expressed as per cent of live weight.

Table 1. Ingredients (%) and chemical composition of basal diet used during starting and finishing phases of the experiment

Ingredients	Starting (0-3 wks)	Finishing (3-6 wks)
Yellow maize	62.25	70.375
Soybean meal, solv.ext	34.2	26.4
Vegetable oil	0.3	0.00
Dicalcium phosphate	1.40	1.40
Limestone	1.20	1.20
Salt	0.3	0.3
DL-methionine	0.15	0.125
B-complex	0.02	0.02
Choline chloride	0.06	0.05
Trace mineral premix*	0.1	0.1
Vitamin premix**	0.1	0.1
Total	100.00	100.00
ME, kcal/kg	2951.175	3006.32
Crude protein	23.011	20.043

*Trace mineral mixture contained (mg/kg diet): KIO_3 2; $MnSO_4.H_2O$ 124; $CuSO_4.5H_2O$; $FeSO_4.7H_2O$ and $ZnSO4.7H_2O$ 174.

**Vitamin premix supplied/kg diet Vit. A 8250 IU. Vit. D3 1200 ICU, Vit. K 1 mg, Vit. E 40 IU, Vit. B1 2 mg, Vit. B2 5 mg, Vit. B12 10 mcg, Choline 500 mg, Niacin 60 mg and Pantothenic acid 10 mg.

The haemoglobin concentration was estimated by cyanomethemoglobin method. The packed cell volume was determined by capillary microhaematocrit method. Blood smears were prepared from fresh blood stained by Geimsa stain (1:9 Dilution for 45 min) for differential leucocyte count (DLC) to calculate heterophil to lymphocyte (H:L) ratio. Reduced glutathione (GSH) level in serum was estimated by *Lin et al. (1988)* method. Lipid peroxide level in serum was measured by determining the malondialdehyde (MDA) production using thiobarbituric acid (TBA) as per *Buege and Aust (1978)* modified by *Suleiman et al. (1996)*.

The data pertaining to various parameters were analyzed statistically by the methods of *Snedecor and*

Cochran (1989). The significant mean differences were attributed according to Duncan's multiple range test (DMRT) as described by *Duncan (1955)*.

RESULTS AND DISCUSSION

Sarpagandha roots has been used as ayurvedic medicine in treating mental anxiety, hypertension, epilepsy, sleeping disorder, gastro-intestinal problem (*Bhardwaj and Yadav, 2016*). In India and in South-East Asian countries Sarpagandha has traditionally been used as ethno-medicine for treating stings from insects, rodents and snakes. In view of multidimensional activity of plant drugs and putting above explained observations together, the present investigation reports suggests that Sarpagandha roots possess significant stress relieving efficacy.

The overall body weight gain (Table 2) during 0-3, 3-6 and 0-6 wk of age was remained statistically unchanged. Feed intake was lower (P<0.001) in the broilers fed diet containing Sarpagandha powder at any level in comparison to control. Feed intake was lower (P<0.001) in Sarpagandha added diet at any level than the control but significantly lowered intake was found in 0.1 per cent Sarpagandha added diet than dietary levels of 0.2 and 0.3 per cent. The feed conversion ratio during starting (0-3 wk) and overall (0-6 wk) phase was significantly better (P<0.001) in 0.1 per cent Sarpagandha added diet compared to control and other dietary treatments but FCR remained comparable during finishing (3-6 wk) phase.

The result of immunological parameters is present in Table 3. The cell mediated immune response, relative weight of bursa and spleen did not differ significantly

Table 2. Overall body weight gain, feed intake and feed conversion ratio

Sarpagandha (% of diet)		Control T1 (Mean)	0.1% T2 (Mean)	0.2% T3 (Mean)	0.3% T4 (Mean)	SEM	P value
BWG (g/b)	0-3 wk	438.4	427.5	424.8	431.2	4.51	NS
	3-6 wk	850.9	841.8	834.8	862.2	11.28	NS
	0-6 wk	1289.3	1269.2	1259.6	1293.3	14.32	NS
FI (g/b)	0-3 wk	846.6^{a}	713.4^{c}	727.0^{bc}	739.5^{b}	6.44	P<0.001
	3-6 wk	1779.8^{a}	1628.4^{c}	1713.3^{b}	1795.5^{a}	9.89	P<0.001
	0-6 wk	2626.5^{a}	2341.8^{d}	2440.3^{c}	2535.0^{b}	14.33	P<0.001
FCR (kg	0-3 wk	1.95^{b}	1.68^{a}	1.73^{a}	1.73^{a}	0.02	P<0.001
feed/kg	3-6 wk	2.15	1.97	2.08	2.11	0.03	NS
gain)	0-6 wk	2.07^{b}	1.86^{a}	1.96^{ab}	1.98^{ab}	0.02	P<0.005

Values bearing different superscripts differ significantly (P<0.05) NS= Non significant

Table 3. Immune response and immune organ weight

Sarpagandha (% of diet)		Control T1 (Mean)	0.1% T2 (Mean)	0.2% T3 (Mean)	0.3% T4 (Mean)	SEM	P value
Immune	CMI (cm)	0.22	0.23	0.13	0.23	0.02	NS
response	HA (log 2)	3.17^{b}	7.10^{a}	7.28^{a}	7.79^{a}	0.40	P<0.001
Immune organ	Bursa	0.07	0.10	0.09	0.09	0.01	NS
weight (%BW)	Spleen	0.19	0.21	0.20	0.18	0.01	NS

Values bearing different superscripts differ significantly (P<0.05) NS= Non significant

Table 4. Haemoglobin level, lipid peroxidase activities and oxidative stress factor

Sarpagandha (% of diet)		Control T1 (Mean)	0.1% T2 (Mean)	0.2% T3 (Mean)	0.3% T4 (Mean)	SEM	P value
Hb (g%)		13.82^{b}	16.33^{ab}	15.35^{ab}	18.03^{a}	0.55	P<0.03
LPO (n mole/ml)	59.99	69.83	69.71	45.57	4.65	NS	
GSH (mg% of blood)		22.66^{a}	16.11^{b}	16.81^{b}	15.35^{b}	0.96	P<0.01
OSF (LPOXGSH/PCV)		33.29^{a}	22.77^{ab}	25.44^{a}	12.45^{b}	2.58	P<0.02
H:L ratio	0.43	0.40	0.41	0.41	0.01	NS	

Values bearing different superscripts differ significantly (P<0.05) NS= Non significant

due to dietary addition of Sarpagandha. However humoral immune response was improved (P<0.001) in Sarpagandha fed birds.

The result on haemoglobin level, lipid peroxidase activities, reduced glutathione and oxidative stress factor (LPOXGSH/PCV) is shown in Table 4. The haemoglobin level of birds remains higher (P<0.05) in Sarpagandha fed groups being highest at 0.3 per cent of addition. Lipid peroxidase activities remained comparable but lower levels of reduced glutathione (P<0.05) and oxidative stress factor (P<0.05) were observed in Sarpagandha fed birds being lowest at 0.3 per cent level. The addition of sarpagandha did not bring any significant effect on H:L ratio.

CONCLUSION

Results of this study indicates that dietary inclusion of 0.3 per cent Sarpagandha seems to be recommendable to improve growth and immunity and have the potential as an additive to reduce the mortality in extreme summer and consequently this will have a positive effect on the survival rate. The improved survival rate may be due to the enhanced immune response resulting from improved defense mechanism. The Sarpagandha addition in the poultry feed has shown better performance of birds, ultimately enhancing the production potential. However, still there is a need to establish standards of Sarpagandha use in broiler feed.

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