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GROWTH PERFORMANCE AND PHYSIOLOGICAL RESPONSES OF INSHAS COCKERELS SUPPLEMENTED WITH ASHAWGANDHA (*WITHANIA SOMNIFERA*) ROOT POWDER

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ABSTRACT: The present study was aimed to determine the effects of different levels of Ashwagandha root powder (*Withania somnifera*) on growth performance, immunity status and serum biochemical parameters in cockerels of Inshas chicks. A total number of 225 cockerels of Inshas local strain aged 28-day were randomly divided into five treatment groups. Each treatment group was represented by three replicates, of 15 cockerels each and housed in 15 rearing cages until the end of the experiment (16 weeks of age). The treatments consisted of five groups of Ashwagandha (0, 0.5, 1.0, 1.5 and 2.0 %). Body weight and body weight gain increased in Ashwagandha treated groups. Feed consumption was significantly decreased and feed conversion was significantly improved by adding Ashwagandha to the diet. The highest carcass, gizzard, liver, heart and spleen percentages were achieved by supplementation of 0.5% Ashwagandha in feed of cockerels. On the other hand, a significant reduction in the relative weight of abdominal fat was observed in Ashwagandha treated groups as compared to untreated group. Supplementation of Ashwagandha root powder significantly ($P<0.05$) increased blood RBCs, WBCs, Hb, PCV, IBV titer, total protein, globulin, T_3, TAC and HDL, while, blood cholesterol was significantly ($P<0.05$) decreased as compared to control group. A non-significant difference was noted in albumin, the liver function enzymes and LDL in all treatment groups as compared to control.

It may be concluded that the inclusion of 0.5 % of Ashwagandha root powder in cockerels ration as a herbal feed additive was beneficial in improving the growth performance, blood hematological and biochemical profile.

Key words: Ashwagandha, Cockerels, Growth, Carcass, Haematology; Serum biochemistry

INTRODUCTION

Nutrition experts tend to use herbs as an additional nutritional supplement in poultry. It was found that the use of herbs has many advantages, as it improves the enzymes secreted from the digestive system and thus improves nutritional efficiency. It also works to stimulate the immune status and improve the physiological condition of poultry. It leads to lower costs, reduces environmental pollution, and improves human health (Devegowda, 1996).

Ashwagandha (*Withania somnifera*, fam. Solanaceae) is commonly known as "Indian Winter Cherry" or "Indian Ginseng". The Ashwagandha plant contains alkaloids and lactones, and the alkaloid withanine, is responsible for the biological activity of Ashwagandha. In addition to alkaloids, the plant also contained steroids, saponins, phenolics, flavonoids, phytophenols, and glycosides (Mishra et al. 2000). It also possesses properties like antioxidative, immunomodulatory, neuroprotective, growth promoter and antiaging properties (Singh et al., 2016; Thakur et al., 2017; Jyotsana and Berwal, 2019). Vasanthakumar et al. (2015) recorded significant ($P<0.05$) improvement in the body weight, feed intake, antioxidant level, and immune status of broilers fed 1% Ashwagandha root powder and 0.15 % Ashwagandha root extract when compared to the control group for a period of six weeks. Similarly, Abdallah et al. (2016) reported that the addition of 0.5 and 1% Withania somnifera powdered root significantly increased body weight and weight gain and improved hematological profile of broiler chicks.

The aim of this study was to clarify the effect of Ashwagandha on growth and immunological and physiological status in Inshas cockerel chicks.

MATERIALS AND METHODS

The present study was carried out at Inshas Poultry Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Giza, Egypt.

A total number of 225 cockerels of Inshas local strain aged 28-day were individually weighed and randomly divided into five treatment groups. Each treatment group was represented by three replicates, of 15 cockerels each and housed in 15 rearing cages (open system) until the end of the experiment (16 weeks of age). The dietary treatments supplemented with 0, 0.5, 1.0, 1.5 and 2.0 % of Ashwagandha root powder. The chicks were fed starter and grower diet ad libitum during 0 to 8 and 9 to 16 wks of age, respectively (Table 1). All birds were kept under similar management conditions in rearing cages. Feed and water were supplied ad libitum throughout the experimental period. No mortality was recorded during the experimental period.

Measurements

All birds were individually weighed (g) and recorded every 4 weeks. Feed consumption during these periods was also recorded. Body weight gain was calculated and used to determine feed conversion ratio (g feed/g gain).

Carcass traits

At 16 weeks of age, 6 cockerels from each treatment were selected randomly and slaughtered for carcass evaluation. Carcass was eviscerated and head and shank were removed. Then, gizzard, liver, heart, spleen, and abdominal fat were dissected from the viscera and weighed. Each portion was expressed as a percentage of life body weight.

Blood analyses

At 16 wks of age, blood samples were randomly taken from 6 cockerels from each treatment (2 cockerels / replicate) in non-heparinized tube from the brachial wing vein. The fresh blood samples were used for determination of hemoglobin (Hb), red blood cell count (RBCs), packed cells volume (PCV), white blood cell counts (WBCs). Blood serum was separated by centrifugation of blood at 3000 rpm for 15 min and was then stored at -20°C for analysis. Serum total protein, albumin, cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), total antioxidants capacity (TAC) ,alanine aminotransamenase (ALT) and asparatate aminotransamenase (AST) were determined spectrophotometrically using available commercial Kits. Globulins were estimated by subtraction of albumin value from the total protein value of each sample. Serum was so isolated to quantify triodothyronine (T_3) hormone level by Radioimmunoassay (RIA) kits (diagnostic product's corporation, Los Angeles, USA. Also, antibody titers against infectious bronchitis virus (IBV) were detected by ELISA technique using commercial kits.

Statistical analysis

Data statistically analyzed using the GLM procedure of Statistical Analyses Software® (SAS 2004) using one-way ANOVA according to the following model:

$Yij = \mu + tj + eij,$

Where, Yij = any observation, μ = the general mean, tj = the effect of treatment, eij = the experimental error.

Differences among treatment means were estimated by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Body weight and body weight gain:

Supplementation of Ashwagandha in the basal diet of Inshas cockerel chicks was found to significantly increase body weight during the experimental periods (Table 2). The best body weight was recorded for the group supplied with 0.5% Ashwagandha throughout the duration of the experiment. Likewise, the body weight gain achieved a significant increase ($P<0.001$) by addition different levels of Ashwagandha during 4-8, 8-12 and 4- 16 wks of age compared with the control group. While, during 12-16 wks of age body weight gain for cockerels fed basal diet supplemented with 1.5% Ashwagandha, was significantly increased compared with the other treatment groups. Anbalagan and Sadique, (1981) investigated that Ashwagandha has an anabolic effect, and enhancing the synthesis of proteins in liver which leads to an increase in body weight in humans and animals. In addition, medicinal herbs, especially Ashwagandha, act as a growth stimulant when added to poultry feed, which leads to an improvement in productivity (kumar et al. 2000; Singh et al. 2017; Sandeep et al. 2020; Azimi et al. 2020). This agrees with earlier researchers of Khobragade (2003), Akotkar et al. (2007) and Bhardwaj and Gangwar (2011). Kumari (2006) also observed increase average body weight in broilers fed Ashwagandha supplemented diets. Moreover, Singh et al. (2010) noted increase in body weight in the chickens treated with ashwagandha. A significant increase in body weight and weight gained was found by adding 1.5g of Ashwagandha /kg basal diet to the broiler chicken (Ahmed et al., 2015).

Feed consumption and feed conversion ratio:

As shown in Table 3, the addition of Ashwagandha to the cockerels feed led to a significant decrease in feed consumption during the periods 8-12 and 4- 16 wks of age, but in the period between 12 to 16 weeks, the addition of 0.5 and 1% of Ashwagandha did not differ from the control group. While, the other two groups significantly decreased feed consumption compared to the others. Moreover, a significant improvement in the feed conversion rate was observed when adding different levels of Ashwagandha compared to the control, during 8-12 and 4- 16 wks of age. The results of feed consumption agree partially with Abdallah et al. (2016) who reported that addition of Ashwagandha powdered root at 0.5 and 1% significantly decreased the feed consumption and the feed efficiency in comparison with the control diet at the 28 and 42 days of age. Also, a reduction in feed intake was observed in broilers fed with 0.5% Ashwagandha (Shisodiya et al., 2008). Pandey et al. (2013) observed a significantly reduction in feed consumption and improvement in feed conversion for broiler chicks fed with mixture of medicinal plants containing Ashwagandha. On the other hand, Ansari et al. (2008) showed adding 1% *W. somnifera* root powder leads to significant increase in feed consumption in broilers chickens. Rindhe et al. (2012) who reported that supplementation of herbal antistressor product containing *Withania somnifera* is efficacious in improving feed conversion ratio in broiler at six week of age.

Carcass characteristics:

The mean values of different carcass parameters are presented in Table 4. Carcass, gizzard, liver, heart and spleen percentages differed significantly in groups supplemented with Ashwagandha as compared to control group. Highest carcass, gizzard, liver, heart and spleen percentages were 80.59, 3.19, 2.77, 0.63 and 0.54%, respectively, Recorded for the group supplied with 0.5% Ashwagandha supplemented group. Higher giblet percent in supplemented birds may be due to higher final body weight and subsequently higher giblet weight. On the other hand, a significant reduction in the relative weight of abdominal fat was observed in Ashwagandha treated groups as compared to untreated group. The highest reduction was observed in 0.5% and 1.5% Ashwagandha supplemented group. Rindhe et al. (2012) recorded an increasing in the carcass and giblet yields with mixture of medicinal plants containing Ashwagandha. Also, Jyotsana and Berwal (2019) observed a significant increase in the relative weight of liver, heart and gizzard when Ashwagandha was added in levels 0.5, 0.75 and 1% compared to the control, while the relative weight of abdominal fat decreased when using the same levels of Ashwagandha.

Hematological and antibody titre against IB

Dietary supplementation with Ashwagandha leads to significant increasing in RBCs, WBCs, Hb, PCV and IBV titer values comparing with control (Table 5). The highest values of RBCs, WBCs, Hb, PCV and IBV titer were obtained with 0.5% Ashwagandha powder. Sujatha et al.(2010)found that Ashwagandha is a blood protector, and this may be due to the antioxidant activity, which protects red blood cells from oxidation, and also improves the activity of red blood cells enzymes. These

findings are similar to the findings reported by Bhardwaj et al. (2012) who revealed significant increase in the Hb, PCV, RBCs and WBCs for Ashwagandha-treated groups. Beside of that Mushtaq et al. (2012) found that the supplementation of the extract of Ashwagandha at 10, 20, and 30 g L−1 increased Hb, PCV, WBCs and the antibody titer against infectious bursal disease (IBD) and infectious bronchitis (IB) . In another study, treated broilers with 1% Ashwagandha powder and 0.15% Ashwagandha extract improved the immune status as compared to the control birds(Vasanthakumar et al., 2015). In addition, Okonkwo et al. (2015) obtained higher antibody titer in broiler groups feed with herbal preparations including Ashwagandha. Jadhav et al. (2008) showed that the presence of glycowithanolides may be responsible for the immunomodulatory activity of Ashwagandha.

Biochemical parameters:

The biochemical parameters of Inshas cockerels as influenced by graded levels of Ashwagandha are presented in Table 6. Adding Ashwagandha increased levels of total protein and globulin in treated cockerels, while serum albumin concentration did not affect compared to control group. Chicks fed diet with 0.5% Ashwagandha showed the highest value of total protein and globulin. The elevation in serum protein after addition of Ashwagandha is may be due to the anabolic effect of Ashwagandha, which is reflected in an increase in blood protein levels and thyroid hormone levels. These results agree with Sujatha et al. (2010) and Ansari et al. (2013) who observed increased protein levels by feeding herbal mixture and Ashwgandha respectively. Dhenge et al., (2009) observed higher significant levels of total protein and globulin concentrations in serum for broilers fed on *W. somnifera* root powder. Availability of dietary protein affects serum protein levels, which indicates that protein in Ashwagandha is more available to the birds (Obikaonu et al., 2012).

Significant rises in TAC and T_3 hormone concentrations with the addition of Ashwagandha root powder compared with untreated cockerels (Table 6). The findings of the present investigation are in strong agreement with results demonstrated by Sujatha et al. (2010) who observed numerically higher triiodothyronine hormone and statistically higher thyroxin hormone concentration in broilers supplemented with herbal formulation containing *W. somnifera* root powder. Panda and Kar (1997) showed that treated with Ashwagandha significantly increased serum T_4 concentration compared with control. But, there was no significant effect on the T_3 concentration and T_3:T_4 ratio between the different treatments. Mirjalili et al. (2009) explained that the immunomodulatory effect of Ashwagandha is due to the presence of steroidal lactones (withanolides and withaferins), alkaloids,saponins, polyphenols, and flavonoids. It was found that the components of the Ashwagandha plant have an effect in activating defense mechanisms against pathogens, which affect cellular receptors and stimulate gene expression responsible for the immune response (Bricknell and Dalmo, 2005).Furthermore, Iuvone et al. (2003)reported that the withanolides present in the roots and leaves of Ashwagandha has an immunomodulatory effect through its effect on stimulation of the nitric oxide synthase gene.

Liver function enzymes (ALT and AST) didn't differ significantly between treated and control groups (Table 6), this result agreed with Ahmed et al. (2015) who found that there were no significant differences in ALT and AST between the experimental groups. Srivastava et al. (2012) showed that there were insignificant differences in serum ALT and AST in broiler chickens fed at 2% of indigenous herbal drug per kg feed.

On the contrary, a significant decrease was found in the level of blood cholesterol for the cockerels fed on Ashwagandha compared to the control, with a rise in the level of HDL, while the level of LDL was not affected (Table 6). The level of 0.5 Ashwagandha achieved a decrease in the level of cholesterol about 36.55% and an increase in the level of HDL about 32.90%.Similarly, Kale et al. (2016) observed that addition of *Withania somnifera* root powder decreased serum concentration of cholesterol and increase in concentration of HDL . Kumar et al. (2020) showed that the addition of 1% Ashwagandha root powder to the diet of laying hens led to a significant decrease in serum cholesterol and LDL, while increased significantly HDL. This could be due to the effect of Ashwagandha to elevate excretion of cholesterol and bile acids through fecal sterol excretion. It has been shown in a previous study that the reduction of cholesterol by using the Ashwagandha plant is due to the presence of a high content of phytosterols, which delays the transport of cholesterol in the intestine and the absorption of carbohydrates from the gut (Ebihara and Schneeman, 1989). In addition, Ansari et al., (2013) found that Ashwagandha has an enzyme inhibitory effect on 3 hydroxy-3-methyl-glutaryl-co-A reductase, which is the main key in the synthesis of cholesterol.

It may be concluded from present investigation that the inclusion of Ashwagandha in the cockerel's diet at level of 0.5 % was more beneficial to improve growth performance, carcass traits and blood parameters in cockerels of Inshas chicks.

Table (1): Composition and calculated analysis of the basal experimental diets.

Ingredients	Starter diet % (0-8 wks)	Grower diet % (9-16wks)
Yellow corn	64.00	63.00
Soybean meal (44% CP)	32.10	17.60
Wheat bran	------	15.68
Dicalcium phosphate	1.80	1.25
Limestone	1.40	1.80
DL-Methionine	0.10	0.07
NaCl	0.30	0.30
Vit. and mineral (premix)*	0.30	0.30
Total	100	100
Calculated analysis		
Crude protein (%)	19.56	15.56
ME (Kcal/kg diet)	2860	2707
C/P ratio	146.2	174
Ether extract (%)	2.69	3.01
Crude fiber (%)	3.65	4.34
Calcium (%)	1.03	0.97
Phosphorus available (%)	0.47	0.39
Methionine (%)	0.41	0.33
Methionine + Cysteine (%)	0.74	0.54
Lysine (%)	1.03	0.73
Arginine (%)	1.25	0.95

* Vitamin- mineral premix provided per kg of diet: Vit. A 12000 IU; Vit. D3 2000 IU; Vit. E. 10mg; Vit. K3 2mg; Vit.B1 1mg; Vit. B2 4mg; Vit. B6 1.5 mg; Pantothenic acid 10mg; Vit.B12 0.01mg; Folic acid 1mg; Niacin 20mg; Biotin 0.05mg; Choline chloride (50% choline) 500 mg; Zn 55mg; Fe 30mg; I 1mg; Se 0.1mg; Mn 55mg; ethoxyquin 3000 mg.

Table (2): Mean values of body weight and body weight gain for Inshas cockerels fed with different levels of Ashwagandha.

Ashwagandha supplementation %	Body weight (g)				Body weight gain (g)			
	4wk	8wk	12wk	16wk	4-8 wk	8-12wk	12-16 wk	4-16 wk
0.0	296.02	531.47 ^{c}	1034.89^{b}	1494.22^{c}	235.44^{b}	503.42 ^{b}	459.33 ^{b}	1198.22 ^{c}
0.5	309.71	605.82 ^{a}	1189.56^{a}	1650.44^{a}	296.11 ^{a}	583.74 ^{a}	460.89 ^{b}	1340.73 ^{a}
1.0	303.60	579.27 ^{ab}	1140.89^{a}	1594.33^{ab}	275.67^{ab}	561.62 ^{a}	453.44 ^{b}	1290.73 $^{a\ b}$
1.5	293.33	576.89 ^{ab}	1131.33^{a}	1632.00^{ab}	283.56 ^{a}	554.87 ^{a}	500.67 ^{a}	1338.67 ^{a}
2.0	294.42	539.87 ^{b}	1128.89^{a}	1566.89^{b}	279.60 ^{a}	589.02 ^{a}	438.00 ^{b}	1272.47 ^{b}
SEM	4.23	8.56	11.15	11.99	5.38	4.99	5.91	9.16
P value	0.981	0.035	0.000	0.000	0.003	0.000	0.003	0.000

^{a,b,c} Means with the different letters in the same column are significantly different (P≤0.05). SEM= Standard error of means. P value = Probability level.

Table (3): Mean values of feed consumption and feed conversion ratio for Inshas cockerels fed with different levels of Ashwagandha.

Ashwagandha supplementation %	Feed consumption (g/cooks/day)				Feed conversion ratio (g feed/g gain)			
	4-8 wk	8-12 wk	12-16 wk	4-16 wk	4-8 wk	8-12 wk	12-16 wk	4-16 wk
0.0	51.98	61.48^{a}	73.58^{a}	62.35^{a}	6.27	3.41^{a}	4.53	4.39^{a}
0.5	50.67	57.84^{b}	73.52^{a}	60.68^{bc}	4.89	2.78^{b}	4.48	3.80^{bc}
1.0	51.66	58.67^{b}	72.35^{ab}	60.89^{b}	5.26	2.93^{b}	4.47	3.96^{b}
1.5	51.47	57.54^{b}	70.98^{bc}	60.00^{bc}	4.98	2.91^{b}	3.97	3.75^{c}
2.0	50.87	57.18^{b}	69.62^{c}	59.22^{c}	5.88	2.72^{b}	4.46	3.90^{bc}
SEM	0.24	0.51	0.45	0.33	3.99	0.07	0.08	0.06
P value	0.404	0.018	0.001	0.007	0.063	0.001	0.196	0.000

^{a,b,c} Means with the different letters in the same column are significantly different (P≤0.05). SEM= Standard error of means. P value = Probability level.

Table (4): Mean values of carcass traits for Inshas cockerels at 16 weeks of age fed with different levels of Ashwagandha.

Ashwagandha supplementation %	Carcass %	Gizzard %	Liver %	Heart %	Spleen %	Abdominal fat %
0.0	70.86^{c}	2.23^{c}	1.89^{b}	0.41^{d}	0.27^{c}	0.63^{a}
0.5	80.59^{a}	3.19^{a}	2.77^{a}	0.63^{a}	0.54^{a}	0.42^{c}
1.0	77.88^{b}	2.73^{b}	2.46^{a}	0.45^{cd}	0.43^{b}	0.50^{b}
1.5	78.54^{b}	3.18^{a}	2.75^{a}	0.54^{b}	0.48^{b}	0.44^{c}
2.0	77.54^{b}	2.77^{b}	2.47^{a}	0.50^{bc}	0.46^{b}	0.51^{b}
SEM	0.95	0.45	0.39	0.10	0.07	0.08
P value	0.000	0.002	0.02	0.003	0.000	0.01

^{a,b,c,d} Means with the different letters in the same column are significantly different (P≤0.05). SEM= Standard error of means. P value = Probability level.

Table (5): Mean values of hematological parameters and antibody titer against IB for Inshas cockerels at 16 weeks of age fed with different levels of Ashwagandha.

Ashwagandha supplementation %	RBCs (10^6/mm^3)	WBCs (10^3/mm^3)	Hb (g/dl)	PCV (%)	IBV titer
0.0	1.60 [b]	7.83 [b]	9.75[c]	29.65 [b]	1218.00 [b]
0.5	2.99 [a]	9.67 [a]	12.99[a]	37.98 [a]	1566.00 [a]
1.0	2.94 [a]	9.50 [a]	12.31[b]	36.79 [a]	1547.67 [a]
1.5	2.97 [a]	9.50 [a]	12.88[a]	37.77 [a]	1550.33 [a]
2.0	2.91 [a]	9.50 [a]	12.60[ab]	36.63 [a]	1540.33 [a]
SEM	0.11	0.15	0.23	0.62	27.20
P value	0.000	0.000	0.000	0.000	0.000

[a,b,c] Means with the different letters in the same column are significantly different (P≤0.05). SEM= Standard error of means. P value = Probability level. RBCs= red blood cells. WBCs= white blood cells. Hb= hemoglobin. PCV= packed cell volume. IBV titer = Antibody titers against infectious bronchitis disease virus.

Table (6): Mean values of biochemical parameters for Inshas cockerels at 16 weeks of age fed with different levels of Ashwagandha.

Ashwagandha supplementation %	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	TAC (mg/dl)	T_3 (ng/ml)	ALT (U/L)	AST (U/L)	Cholest (mg/dl)	LDL (mg/dl)	HDL (mg/dl)
0.0	4.33 [b]	3.00	1.33 [b]	1.17 [b]	2.00 [b]	54.67	123.33	221.17[a]	71.83	52.67[b]
0.5	5.73 [a]	3.40	2.33 [a]	2.01 [a]	3.00 [a]	52.83	117.17	140.33[b]	66.33	70.00[a]
1.0	5.33 [a]	3.33	2.00 [a]	1.67 [a]	2.83 [a]	49.50	120.67	153.67[b]	74.00	68.83[a]
1.5	5.39 [a]	3.39	2.00 [a]	2.00 [a]	3.00 [a]	50.83	118.67	148.17[b]	72.83	66.83[a]
2.0	5.50 [a]	3.33	2.17 [a]	1.83 [a]	2.83 [a]	51.83	118.83	153.33[b]	75.50	67.50[a]
SEM	0.13	0.28	0.89	0.08	0.08	1.75	2.38	6.24	1.39	1.64
P value	0.000	0.151	0.001	0.002	0.000	0.922	0.949	0.000	0.286	0.001

[a,b] Means with the different letters in the same column are significantly different (P≤0.05). SEM= Standard error of means. P value = Probability level. TAC= total antioxidants capacity. T_3= triiodothyronine. AST= asparatate aminotransamenase. Cholest = cholesterol. ALT = alanine aminotransamenase. LDL= Low density lipoprotein. HDL= High density lipoprotein.

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الملخص العربى

أداء النمو والأستجابات الفسيولوجية لديوك أنشاص المضاف لها جذورالأشواجندا المطحونة

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تهدف الدراسة الحالية إلى تحديد تأثير المستويات المختلفة لمسحوق جذور الأشواغاندا على أداء النمو والمناعة والمقاييس البيوكيميائية في سيرم الدم لديوك أنشاص. تم تقسيم 225 ديك من سلالة أنشاص المحلية بشكل عشوائي عند عمر 28 يومًا إلى خمس مجموعات معاملة كل مجموعة قسمت الى ثلاث مكررات ، بكل منها 15 ديك في 15 قفص حتى نهاية التجربة (16 أسبوعًا من العمر). تتكون المعاملات من خمس مجموعات من اشواغاندا (0 ، 0.5 ، 1.0 ، 1.5 و 2.0٪). وقد وجد زيادة فى وزن الجسم وزيادة فى وزن الجسم المكتسب في المجموعات المعاملة بأشواغاندا. انخفض استهلاك العلف معنويا وتحسن التحويل الغذائي معنويا بإضافة اشواغاندا إلى العلف. تم تحقيق أعلى نسب مئوية للذبيحة والقونصة والكبد والقلب والطحال عن طريق إضافة 0.5٪ من الاشواغاندا لعلف الديوك. من ناحية أخرى ، لوحظ انخفاض معنوي في الوزن النسبي لدهون البطن في المجموعات المعاملة بأشواغاندا مقارنة بالمجموعة غير معاملة. أظهرت نتائج الدراسة أن أضافة مسحوق جذور أشواغاندا أدت إلى زيادة معنوية في عدد كريات الدم الحمراء ، كريات الدم البيضاء ، الهيموجلوبين ، PCV ، عترة IBV ، البروتين الكلي ، الجلوبيولين ، T_3 ، TAC و HDL بينما انخفض بشكل ملحوظ كوليسترول الدم في للديوك المعاملة مقارنة بمجموعة الكنترول. لوحظ عدم وجود اختلاف معنوي في الألبومين وإنزيمات وظائف الكبد و LDL في جميع المجموعات مقارنة بمجموعة الكنترول.
يمكن الاستنتاج أن اضافة 0.5٪ من مسحوق جذور اشواغاندا في علف الديوك كاضافة عشبية كان مفيدا في تحسين أداء النمو والصفات الهيموتولوجية و الكيميائية للدم.