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IMPACT OF USING I-BOOST IN BROILER DRINKING WATER ON PERFORMANCE, CARCASS TRAITS, INTESTINE MORPHOLOGY, AND ECONOMIC EFFICIENCY

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Abstract

A total of 204-day-old chick Ross 308 was divided into three treatments, with four replicates containing 17 chicks each. The treatments were; T1 (control with no additive in drinking water), T2 (1 ml/L), T3 (2 ml/L) of I-boost compound in drinking water for three consecutive days per week from day-one to 35 days of age. All treatments were fed an ad-libitum commercial broiler diet. Measured parameters were broiler performance, Dressing percentage, Internal organs percentage, Jejunum histology (Villi height, Crypt depth, Villi width, Villi base width, Villi height/crypt depth, surface area), and Economic Efficiency. In the results, treatments including I-boost (1ml and 2 ml/L of drinking water) had significant effect ($P<0.0001$) on broiler performance (Body weight, Weight gain, Daily weight gain, and FCR) while had no effect on Feed and water intake, and live ability. Adding I-boost levels into drinking water had no effects on both dressing percentage and internal organs percentage compared to control group. Addition of I-boost into drinking water increased all the Jejunum histology parameters except crypt depth compared to control group. Among the treatments, addition of 2ml/L of I-boost had higher significant effect on most of the studied Jejunum parameters than 1ml/L and control group. However, T2 (1ml/L) had better economic efficiency compared to T3 and control groups. Overall, inclusions of herbal extract (I-Boost) have significant effect on broiler performance and gut morphology and improved the economic efficiency.

Keywords: I-Boost, Broiler, Medicinal plant, Histology, carcass traits, performance

INTRODUCTION

Due to antibiotic-resistant bacterial strains that may pose a serious hazard to public health, the use of antibiotics in broiler feeds has been restricted in many parts of the world (Mehrabi et al., 2012; Berrama et al., 2017). Because poultry tend to receive more antibiotics than other farm animals (van den Bogaard 2001; Graham et al. 2017), and because resistance is more likely to develop in overcrowded and unhygienic environments, poultry production is thought to pose a high risk for the emergence of antibiotic resistance (Rousham et al. 2018). It has been acknowledged that one of the most effective methods for enhancing growth performance and feed efficiency is to manipulate the gut function and microbial habitat of domestic animals through feed additives (Collington et al., 1990). Synthetic compounds have been used in feed for approximately 80% of domestic animals for either medical treatment or growth stimulation (Lee et al., 2001). The use of non-traditional feed additives in animal diets has increased as a result of the ban on the use of antibiotics as feed additives. As feed supplements, herbal extracts are utilized to boost animal performance, particularly in intensive management methods (William and Losa, 2001). Plant extracts can support both general performance and health status (Janssen 1989; Manzanilla et al., 2001).

The enhancement of endogenous digestive enzyme release, activation of the immunological response, and antiviral, antioxidant, and anthelminthic effects could all have a good impact on the health and performance of animals. A medicinal herb called Silybum marianum (SM) has historically been used to treat gastrointestinal tract and biliary diseases. Among the substances that make up the active components of this plant include resinous, flavonoid, and oily compounds. The three flavonoids silybin, silychristin, and silydianin are collectively known as silymarin which is the most significant flavonoids in SM fruit. According to Tedesco et al. (2004), silymarin supplementation lessened aflatoxin B1's detrimental effects on broiler performance, particularly feed intake, body weight, carcass characteristics, and liver morphology. Afshin et al. (2017) examined the impact of SM seed, extract, and powder on broilers-fed diets containing aflatoxin B1 and found that the existence of aflatoxins decreased body weight and increased FCR. In comparison to control chicks, they demonstrated that adding SM powder boosted feed intake and enhanced FCR in broilers given the contaminated feed during the growing period. Thyme (Thymus vulgaris) and its constituents (thymol, 40%, and carvacrol, 15%) are also used medicinally (Mikaili et al., 2010). Thyme has been shown by Toghyani et al. (2010) to have antibacterial, antifungal, and anticoccidial properties in addition to enhancing broiler health in general. According to Sigolo et al. (2021), thyme extracts at 300 mg/L increased feed efficiency and weight gain ($p<0.05$). By balancing the gut microbial ecosystem and promoting the release of endogenous digestive enzymes, the active components of essential oils work as a digestibility enhancer, enhancing growth performance in chicken (Cross et al., 2007; Ayoub et al., 2011; Barakat et al., 2016; El-Far et al., 2016a). As a result, thyme can be employed as a readily accessible source of organic antioxidants and antibiotics in foods and medicines. According to Al-Kassie et al. (2009) and Qureshi et al. (2015), adding dandelion (Taraxacum officinale) as a feed additive improved feed conversion ratio (FCR) and body weight growth (BWG) significantly ($p<0.05$). Yan et al. (2012) stated that the addition of dandelion significantly ($p<0.05$) improved the BWG, FCR, and nutrient consumption. Qureshi et al. (2016a) demonstrated that adding extra dandelion greens during the growing season increased the growth performance measures of broiler chickens. Therefore, the current study was conducted to investigate the use of I-Boost on performance, carcass traits, intestine morphology, and economic efficiency

MATERIAL AND METHODS

Experimental design

This experiment was performed in commercial farm conditions. A total of two hundred and four (204) day-old chicks (Ross 308) were used in this trial. On the first day, Initial weight was recorded for each replicate, and chicks were randomly and equally distributed into different treatments as follows;

T1 control (no additive in drinking water).
T2 adding I-Boost in drinking water (1m/1 litter) for 3 consecutive days per week.
T3 adding I-Boost in drinking water (2m/1 litter) for 3 consecutive days per week.

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Four replicates were used in each treatment to include 17 chicks each. Floor pens were used for rearing during the entire experimental period. The essential pieces of equipment were equipped in the rearing halls including heating facilities and adjustable thermostats. The chicks were fed a treatments diet from 1-35 days with an ad-libitum diet. The live body weight was measured weekly. The weight gain was calculated according to the equation below:-

WG= final weight - initial weight.

Feed intake and feed conversion ratio were calculated with the equations below;

FI/birds= (feed introduced - residual feed)/ number of birds.

Table 1: Temperature of the rearing hall

Age	Temperature degree °C
1st week	34-35
2nd week	32-33
3rd week	29-30
4th week	27-28
5th week	26-27

FCR= feed intake (g) /weight gain (g).

From day 21 to 35, the dead birds were recorded to determine the mortality percentage according to the following equation;

Mortality (%) = number of (mortal chicks / total chicks) x 100.

Table 2: Ingredient of the ration used in the experiment

Ingredient	Kg/ton	
	Starter	Grower
Yellow Corn	426.5	460
Wheat	100	100
Wheat bran	40	40
Soya bean meal (46%)	370	340
Vegetable Oil	20	22
Limestone	2	2
Di calcium phosphate	13	10
DL- methionine	0.5	0.5
Lysin	0.5	0.5
Anti-toxin (toxbond)	1	1
Anti-coccidia (salinomycin)	0.250	0.250
Salt	1.5	1.5
Premix [1]	25	25
Analysed chemical composition		
Crude protein (%)	22.64	21.48
Energy ME/kg diet	2923	3050
Fat %	4.12	4.43
Linoleic acid %	2.04	2.19
Crude fibre %	2.93	2.92
Methionine %	0.50	0.49
Lysine%	1.52	1.43
Tryptophan %	0.40	0.38
Meth. + cystine %	0.84	0.81
Arginine %	1.60	1.51
Threonine %	1.02	1.04
Calcium %	1.04	0.95
Available phosphorus %	0.47	0.42
Sodium %	0.18	0.19
Chloride %	0.21	0.18
Aflatoxin (ppb)	1	5.4
Ochratoxin (ppb)	0.2	1.4
T2 toxin(ppb)	43.6	38.3

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[1]Analytical constituents: 93.2 %, Crude ash 0.55 %, Crude fibre 0.63 %, Crude protein 0.02 %, Crude fat Composition: Calcium carbonate. 29.6 %.,Calcium 0.34 %, Magnesium 0.03 %,Sodium 0.006 %, Phosphorus 0.05 g/kg , Lysine 0.03 g/kg, Methionine 0.05 g/kg, Threonine 0.01 g/tryptophan

Additive per kg: Trace elements: 6,000 mg Fe (3b103 Iron(II)sulphate monohydrate); 150 mg I (3b201 Potassium Iodide); 1,500 mg Cu (E4 Cupric(II)sulphate-pentahydrate); 7,000 mg Mn (3b502 Manganese(II) oxide); 6,000 mg Zn (3b603 Zinc oxide); 25 mg Se (E8 Sodium Selenite) Vitamins: 1,000,000 IU Vitamin A (3a672a Retinyl acetate); 300,000 IU Vitamin D3 (3a671); 3,000 mg Vitamin E (3a700 dl-tocopherol); 200 mg Vitamin K3 (3a710 Menadione sodium bisulphite); 150 mg Vitamin B1 (3a821 Thiamine mononitrate); 400 mg Vitamin B2 (Riboflavin); 1,250 mg Vitamin B5 (3a841 Calcium-d-pantothenate); 3,500 mg Vitamin B3 (3a315 Niacinamide); 300 mg Vitamin B6 (3a831 Pyridoxine hydrochloride); 3,000 mcg Vitamin B12 (Cynacobalamin); 100 mg Vitamin B9 (3a316 Folic acid); 30,000 mg Vitamin B4 (3a890 Choline chloride); 10,000 mcg Vitamin H (3a880 Biotin).

Body weight uniformity percent.

Estimation of body weight uniformity was done by weighing individual birds in each replicate every week during the entire period of the experiment as follows;

Body weight uniformity %= number of chicks within mean ±5%/ total number of chicks

Carcass traits and internal organs as a percent of live body weight

At the end of the trial (35 days), two birds were randomly selected from each replicate and killed with a sharp tool. After feather removal, dressing percentage and dressing percentage with edible organs as well as internal organ percentage were calculated as follows;

Dressing percentage = (carcass weight/ live body weight) x 100

Dressing percentage with edible parts= (carcass weight + edible parts weight)/ live body weight) x 100

Internal organ percent = (organ weight / live body weight) x 100.

Histology of intestine (jejunum)

At 35 days of age, two birds from each replicate were chosen for the jejunum tissue sample. After proper wash with normal saline, the tissues were saved in 10% of formalin. Tissue staining was performed with haematoxylin and eosin. Later, paraffin wax was used to fix the tissue samples onto the slides. Finally, a 10X magnification light microscope (Dino-Eye-Microscope Eyepiece 38 digital Camera) was used, and measuring the targeted parameters was done according to Iji et al., (2001).

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Vaccination program

Day old Chicks were vaccinated against infectious bronchitis and Newcastle diseases by spray. At 17 and 27 days of age chicks were vaccinated against Newcastle diseases by drinking water. All vaccines were from Czech Republic

Economic efficiency

Economic efficiency (cost-benefit ratio) was calculated according to Mustafa, (2021)

Statistical analysis

Microsoft Excel spreadsheet was used to prepare a data for analysis. Then, the data were analysed by SAS statistical software program. Later the SAS package (PROC GLM) statistically was used for the significance of the main effects determination (SAS, 2013). For the detection of the differences between individual treatment means Duncan's multiple range test was used.

Table 3: Effect of adding different levels of I-Boost in drinking water on broiler performance 1- 21 days

Variables	Treatments			SEM	P value
	T1	T2	T3		
Day old chick weight (g)	40.95 a	41.05 a	41.02 a	0.082	0.901
Body weight (g)	743.51 b	907.46 a	909.20 a	25.21	0.0001
Weight gain (g)	693.56 b	866.40 a	868.18 a	25.20	0.0001
Daily weight gain (g)	33.02b	41.25 a	41.34 a	1.20	0.0001
Feed intake(g)	1049.0 a	1044.75 a	1042.50 a	4.84	0.879
Feed conversion ratio (g/g)	1.514 a	1.205 b	1.201b	0.045	0.0001
Water intake (ml/bird)	2124.31 a	2113.10 a	2113.63 a	11.39	0.918
Liveability (%)	95.58 a	97.05 a	98.52 a	0.88	0.440

Different letter in the same row are significantly different

The effect of adding different doses of I-boost in drinking water on broiler performance from 1 to 21 days of age is shown in table (3). A significant ($P<0.01$) higher body weight and weight gain were recorded for chicks added 1 ml and 2 ml of I-boost per litter of drinking water compared to those had normal water. Concerning the feed conversion ratio, the chicks in T1 and T2 had a significantly ($P<0.01$) better feed conversion ratio compared to those in the control group. All treatments had no significant effect on the feed intake, water intake, and livability percentage. The results were in line with the finding of Noor et al., (2021) who found that using different levels of (Taraxacum officinale) in poultry diet significantly ($P<0.05$) improved live body weight and weight gain compared to control. Moreover, Afshin et al. (2017) found similar results when they used SM seed powder in broiler feed.

The effect of adding different doses of I-boost in drinking water on broiler performance from 22 to 35 days of age is shown in table (4). Significant ($P<0.0001$ and $P<0.0005$) higher body weight and weight gain respectively, were recorded for chicks added 1 ml and 2 ml I-boost per litter of drinking water compared to those had normal water. Concerning feed conversion ratio chicks that had water containing 1m and 2ml I-boost

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have significantly (P<0.01) better feed conversion ratio compared to those had normal water. All treatments had no significant effect on the feed intake, water intake, and livability percentage. These results are in agreement with those found by Al-Kassie et al. (2008), and Qureshi et al. (2015) who stated that including dandelion (Taraxacum officinale) in broiler feed significantly (p<0.05) increased the FCR, and BWG. However, no significant differences were recorded in feed intake which is disagreeing with the results found by Yan et al., (2012).

Table 4: Effect of adding different levels of I-boost in drinking water on broiler performance 22- 35 days

Variables	Treatments			SEM	P value
	T1	T2	T3		
Body weight (g)	1767.68 b	2024.45 a	2010.16 a	36.00	0.0001
Weight gain (g)	1033.16 b	1116.98 a	1100.96 a	12.13	0.0005
Daily weight gain (g)	73.79 b	79.78 a	78.63 a	0.86	0.0005
Feed intake(g)	2083.63 a	2048.29 a	2045.24 a	11.01	0.313
Feed conversion ratio (g/g)	2.017 a	1.834 b	1.857 b	0.027	0.0004
Water intake (ml/bird)	4203.65 a	4137.35 a	4187.36 a	18.94	0.362
Liveability (%)	95.31 a	98.52 a	96.87 a	0.93	0.410

Different letter in the same row are significantly different

Table 5: Effect of adding different levels of I-boost in drinking water on broiler performance 1- 35 days

Variables	Treatments			SEM	P value
	T1	T2	T3		
Day old chick weight (g)	40.95 a	41.05 a	41.02 a	0.082	0.901
Body weight (g)	1767.68 b	2024.45 a	2010.16 a	36.01	0.0001
Weight gain (g)	1726.72 b	1983.39 a	1969.14 a	35.99	0.0001
Daily weight gain (g)	49.33 b	56.66 a	56.26 a	1.028	0.0001
Feed intake(g)	3132.63 a	3093.04 a	3087.74 a	13.64	0.374
Feed conversion ratio (g/g)	1.772 a	1.527 b	1.536 b	0.034	0.0001
Water intake (ml/bird)	6327.96 a	6250.44 a	6300.99 a	24.67	0.470
Liveability (%)	91.17 a	95.58 a	95.58 a	1.254	0.274
European economic factor	254.09 b	354.44 a	350.14 a	14.57	0.0001

Different letter in the same row are significantly different

The effect of adding different doses of I-boost in drinking water on broiler performance from 1 to 35 days of age is shown in table (5). Significant (P<0.01) higher body weight and weight gain were recorded for chicks that had 1 ml and 2 ml I-boost per litter in the drinking water compared to those that had normal water. Concerning the feed conversion ratio, chicks had water containing 1m, and 2ml I-boost had a significantly (P<0.01) better feed conversion ratio compared to those that had normal water. Significantly (P<0.01) Higher European economic factor was recorded for chicks had 1 ml and 2ml of I-boost in their drinking water compared to the control group being, 345.44, 350.14, and 254.09 respectively. All treatments had no significant effect on the feed intake, water intake, and livability percentage. These results are partially disagreeing with those claimed by Yan et al., (2012). However, regarding the BW and

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BWG, similar results were found by Al-Kassie et al. (2008), and Qureshi et al. (2015). These results are disagreeing with Omar et al., (2016) who found a decrease in mortality.

Table 6: Effect of adding different levels of I-boost in drinking water on broiler dressing percent and parts% from carcass weight.

Variables	Treatments			SEM	P value
	T1	T2	T3		
Dressing %	76.82	77.24	77.00	0.347	0.894
Dressing % with edible parts	81.09	81.64	81.41	0.349	0.823
Breast %	38.49	39.52	38.56	0.431	0.572
Neck %	6.21	6.36	6.46	0.205	0.889
Back %	17.20	17.52	18.25	0.256	0.239
Wing %	10.13	9.81	9.89	0.152	0.693
Legs %	27.01	26.24	22.61	1.118	0.237

Different letter in the same row are significantly different

The effect of adding I-boost in drinking water on broiler dressing and edible parts percentages from carcass weight is shown in Table (6). Adding 1 ml and 2 ml, as well as the control group, had no significant effects on the studied traits. Omar et al., (2016) partially disagree with our results which they stated that a mixture of medicinal plants had significantly increased the dressing percentage. However, they found no significant difference in carcass cuts which is agree with our results. Additionally, Sigolo et al., (2021) showed that thyme (300 mg/L) significantly improved the carcass and drumstick.

Table 7: Effect of adding different levels of I-boost in drinking water on broiler internal organ as a percent of live body weight (1g/100g)

Variables	Treatments			SEM	P value
	T1	T2	T3		
Liver %	2.44	2.42	2.49	0.05	0.888
Gizzard%	1.29	1.43	1.40	0.04	0.466
Bursa %	0.141	0.140	0.143	0.009	0.990
Heart %	0.52	0.54	0.51	0.01	0.486
Small intestine %	2.89	3.22	3.24	0.101	0.310

Impact of using different doses of I-boost in drinking water on broiler internal organ as a percent of live body weight shown in table (7). Results show no significant difference among all traits. Similar results were found by Omar et al., (2016) who stated that a mixture of medicinal plants had no significant effect on some visceral organs.

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Table 8: Effect of adding different levels of I-boost in drinking water on broiler jejunum histology at 35 days of age

Variables	Treatments			SEM	P value
	T1	T2	T3		
Villi height(μm)	875.60 c	1155.86 a	1101.63 b	12.07	0.0001
Crypt depth (μm)	224.38 a	211.67 a	226.80 a	2.73	0.0513
Villi apical width (μm)	81.91 c	109.08 b	113.31 a	1.47	0.0001
Villi base width (μm)	106.03 c	127.91 b	142.69 a	1.46	0.0001
Villi height / crypt depth	3.96 c	5.49 a	4.97 b	0.08	0.0001
Surface area ($μm^2$)	2029.05 b	2515.48 a	2490.60 a	25.24	0.0001

Different letter in the same row are significantly different

The influence of using different doses of I-boost in drinking water on broiler jejunum histology traits is presented in table (8). Results show that villi height, villi apical width, villi base width, villi height/crypt depth, and surface area were significantly (P<0.01) higher for chicks that had water containing 1 ml and 2ml of I-boost per 1 litter in their drinking water compared to those chicken had normal water. Gules and Yildiz (2021) obtained similar results when they used different levels of phytogenic compounds in the broiler diet. They stated that the used levels had a significant increase in intestinal surface area, villus high, and width in chicks feed phytogenic compounds compared to the control group. According to these researchers, increasing these parameters, especially intestinal surface area, might enhance digestion and absorption which lead to body weight improvement.

Table 9: Effect of adding different levels of I-boost in drinking water on the economic efficiency of broiler at 35 days of age.

Variables	T1	T2	T3
Chick cost ($)	34.5	34.5	34.5
Medicine and labor cost ($)	60	71.67	84.57
Feed cost ($)	125.58	130.61	130.42
Total cost ($)	220.08	236.78	249.49
Live body weight produced(kg)	109.37	131.54	130.63
Price ($/kg)	2.4	2.4	2.4
Total revenue	262.488	315.696	313.512
Cost-benefit ratio	1.192694	1.333288	1.256611
Improvement %		14.05947	6.391792

Table (9) shows the effect of adding different doses of I-boost in drinking water of broiler on economic efficiency at 35 days of age. Both treatments improved economic income compared to the control. Higher improvement was recorded for chicks that had water-containing I-boost (1ml/1 litter) (14.05%) compared to those chickens in the control group. These results agree with those found by Omar et al., (2016) who obtained a 13% increase in the relative economic efficiency of groups fed medicinal plants compared to the control group.

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Figure(1) Impact of using I-boost in drinking water of broiler on body weight uniformity percentage at differrent age.

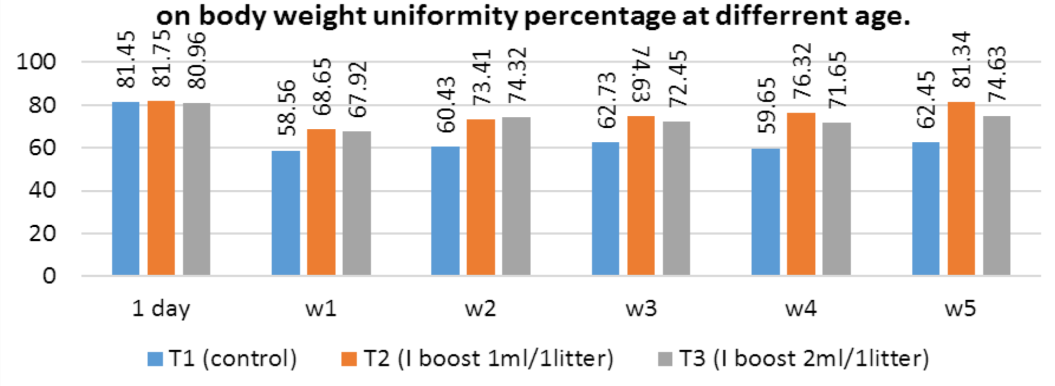

Figure (1) shows the effect of adding different doses of I-boost in drinking water of broiler on body weight uniformity percentage at different ages. Both treatments improved the percentage of body weight uniformity during the whole experimental period. Better body weight uniformity percentages for all weeks were recorded for chicken that had water containing I-boost (1ml/1litter) compared to control. this result is in agreement with finding of Mustafa, (2022) who found that adding phytogenic in broiler drinking water led to improve the body weight uniformity percentage of broiler chicks compared to control.

CONCLUSION

Overall, in the current study, it is concluded that addition of medicinal plant extract generally improved the broiler performance, increased villi height, villi width, and surface area. Therefore, this herbal extract might lead to improve digestion as well as absorption of nutrients. Consequently, the economic efficiency was increased.

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