

EFFECT OF WHEAT DRY DISTILLER'S GRAIN IN COMPOUND FEEDS FOR BROILER CHICKENS ON PRODUCTIVE AND SLAUGHTER TRAITS

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Abstract

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The present experiment aimed to investigate the effect of feeding compound feed with various proportions of wheat dry distiller's grain on the productive and slaughter traits in broiler chickens. The study was conducted with 120 male Ross 308 broiler chickens divided into 4 groups with 30 birds each. Each group was further subdivided into 3 subgroups of 10 chickens. Chickens were reared in battery cages with water and feed *ad libitum*. The live body weight of 1-day-old chickens in all groups was equal. The duration of the experiment was 42 days and live body weight was checked at 10, 28 and 42 days of age, whereas feed utilization – during each period of the life based on feed intake and weight gain of subgroups. Except for the control, the starter, grower and finisher of experimental groups (II–IV) were supplemented with wheat dry distiller's grain (DDG) as followed: Group I – 0%, group II – 10%, group III – 15% and group IV – 20% DDG. By the end of the 42-day period, 5 chickens from each group with a body weight close to group mean were slaughtered and slaughter analysis was performed. The inclusion of 10% and 15% wheat DDG in compound feeds for broiler chickens fattened up to 42 days of age did not have a significant effect on their growth as compared to control group. The inclusion of 20% wheat DDG to compound feed reduced substantially ($p < 0.05$) live body weight of chickens by 6.1% vs controls. During the starter period, a trend to poor feed utilization was observed in groups which received 15 and 20 % DDG with compound feed – by 9.7 and 7.6% vs controls, but during the grower and finisher periods, as well as throughout the entire 42-day experimental period, this parameter did not show any significant differences between the control and experimental groups as well as among the three experimental groups. Compound feeds with 15% and 20% wheat DDG fed to broiler chickens resulted in statistically significant reduction of the bratfertig, grill, thigh weights and slaughter yield vs controls at the end of the trial. The inclusion of 20% DDG in the ration also resulted in statistically significantly lower breast weight than in controls. The inclusion of DDG in compound feed for broiler chickens did not influence significantly the chemical composition of meat. Based on conclusions made, the inclusion of no more than 15% DDG in compound feeds for broiler chickens throughout the 42-day fattening period was recommended.

Key words: Dry Distillers Grains (DDG), growth performance, feed utilization, body weight, chicken broilers

Abbreviations: DDG – dried distillers grains; DDGS – dried distiller's grains with solubles

Introduction

During the last years, the high feed costs stimulate the utilization of various non-traditional and relatively

cheap feed ingredients, for which the available information is still few.

One of these feeds is the dry distiller' grain with soluble (DDGS) – a by-product of alcohol production.

It is considered a valuable source of energy and protein for poultry industry (Waldroup et al., 1981; Parsons and Baker, 1983).

During many years, DDG was used in feeds at a level of 5%. Later studies have shown that its level of inclusion in broiler feeds could be up to 25%, provided that the energy supply is constant (Waldroup et al., 1981).

The study of Dale and Batal (2003) has established that the inclusion of 18% DDG in broiler chicken rations had a negative impact on live body weight and feed intake, whereas the utilization of 12% DDG resulted in a slight reduction of production traits.

In an experiment with broiler chickens, Shim et al. (2011) established that DDG from corn could be used up in proportions to 24%, if feeds are properly balanced.

Corzo et al. (2009) have used 8% DDG in rations of chickens fattened until 42 days of age and did not observe any differences in the quality of meat.

In a trial with broiler chickens, Wang Z. et al. (2007b) used rations with constant and variable DDG levels in the different experimental periods. It was found out that the addition of 15% DDG in the feed had no negative impact on live weight and slaughter traits during the entire period. The increasing of DDG level in starter and grower feeds to 30% however decreased the live weight, increased feed intake, and reduced breast muscle weight compared to both rations with 15% DDG and control rations.

Loar et al. (2010) found out that the inclusion of 15% DDG or more in broiler chicken feeds up to 28 days of age could have an adverse effect on live body weight and feed intake.

Abdel-Raheem et al. (2011) reported that rations with 12% DDG reduced the live body weight and slaughter yield by the end of the experiment as compared to the control group.

The addition of dry distiller's grain from wheat in compound feed for broiler chickens in Bulgaria was not studied in detail, so it was the incentive of the present study. It aimed to establish the effect of different levels of wheat dry distiller's grain in fattening broiler chickens feed on productive and slaughter traits.

Material and Methods

The study was conducted with 120 male Ross 308 broiler chickens divided into 4 groups with 30 birds each. Each group was further subdivided into 3 subgroups of 10 chickens. Chickens were reared in battery cages with water and feed *ad libitum*. The live body weight of 1-day-old chickens in all groups was equal. The duration of the experiment was 42 days and live body weight was checked at 10, 28 and 42 days of age whereas feed utilization – during each period of the life based on feed intake and weight gain of subgroups.

Chickens from the control and experimental groups received a balanced compound feed as per the requirements of the hybrid (Table 1). Except for the control, the starter, grower and finisher of experimental groups (II-IV) were supplemented with wheat dry distiller's grain (DDG) as followed: Group I – 0%, group II – 10%, group III – 15% and group IV – 20% DDG.

By the end of the 42-day period, 5 chickens from each group with a body weight close to group mean were slaughtered and slaughter analysis was performed. The chemical composition of the breast and thigh meat was performed by the Weende method (AOAC, 1996).

The experimental data were processed by ANOVA/MANOVA and the LSD post hoc test with statistical software STATISTICS.

Results and Discussion

The composition and nutritional value of compound feeds fed to all groups according to the age (Table 1) is in compliance with the requirements of the Ross 308 hybrid.

The rations of experimental groups differed with respect to the proportion of DDG: 10% DDG, 15% DDG and 20% DDG in groups II, III and IV, respectively.

The analysis of results about the growth (Table 2) showed that the addition of 10% and 15% DDG to the compound feed of chickens up to 28 days of age (Table 2) did not result in statistically significant differences in the live body weight of chickens from experimental groups II and III vs controls.

The inclusion of 20% DDG in the ration of chickens from experimental group IV at 10 days of age reduced

Table 1
Compound feed composition, g·kg⁻¹

Ingredients	Compound feeds / Groups											
	Starter				Grower				Finisher			
	I experi- mental Control	II experi- mental 10% DDG	III experi- mental 15% DDG	IV experi- mental 20% DDG	I experi- mental Control	II experi- mental 10% DDG	III experi- mental 15% DDG	IV experi- mental 20% DDG	I experi- mental Control	II experi- mental 10% DDG	III experi- mental 15% DDG	IV experi- mental 20% DDG
Corn	561.8	510.8	488.8	462.2	580.6	532.8	508.8	486.3	636.1	587.1	560.5	536.6
DDG	-	100	150	200	-	100	150	200	-	100	150	200
Soybean meal	287.7	226	193	163.8	278	217	185	153	228.9	168	139	106.4
Sunflower meal	50	50	50	50	50	50	50	50	50	50	50	50
Fish flour	50	50	50	50	40	40	40	40	30	30	30	30
Sunflower oil	15	28	33	39	18	27	33	37	22	32	38	44
DL-methionine	1.7	1.2	1	0.7	1.8	1.3	1.1	0.9	1.3	0.8	0.6	0.4
Threonine	-	-	-	-	-	0.1	0.3	0.4	-	-	-	0.1
Lysine	1	2.4	3.1	3.8	0.8	2.1	2.8	3.6	0.4	1.8	2.4	3.2
Salt	3	3	3	3	3	3	3	3	3	3	3	3
Limestone	5.8	8.8	10.3	11.5	5.3	8.2	9.5	10.8	5.3	8.3	9.5	10.8
Dicalcium phosphate	19	14.8	12.8	11	17.5	13.5	11.5	10	18	14	12	10.5
Vitamin/ trace ele- ment premix	5	5	5	5	5	5	5	5	5	5	5	5
The compound feed contains:												
Metabolizable energy, MJ/kg	12.6	12.6	12.6	12.6	12.5	12.5	12.5	12.5	12.8	12.8	12.8	12.8
Crude protein, g	225	225	225	225	220	220	220	220	200	200	200	200
Crude fibre, g	40	40	40	40	39	39	40	40	36	37	37	37
Lysine, g	13.8	13.8	13.8	13.8	13	13	13	13	11	11	11	11
Methionine+cysteine, g	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	8.2	8.2	8.2	8.2
Calcium, g	10	10	10	10	9	9	9	9	8.5	8.5	8.5	8.5
Utilisable phosphorus, g	5	5	5	5	4.5	4.5	4.5	4.5	4.2	4.2	4.2	4.2

Table 2
Live body weight, g

Parameters	Groups							
	I experimental Control		II experimental 10% DDG		III experimental 15% DDG		IV experimental 20% DDG	
	x ± Sx	%	x ± Sx	%	x ± Sx	%	x ± Sx	%
Live weight 1 day of age	47.7	100	47.3	-	47.3	-	47.5	-
Live weight 10 days of age	252ac ± 6.1	100	258a ± 5.2	102.4	252ac ± 7.1	100.00	241bc ± 4.7	95.6
Live weight 28 days of age	1459a±31.0	100	1434a ± 27.1	98.3	1406a ± 32.5	96.3	1399a± 27.8	95.9
Live weight 42 days of age	2880a ± 45.6	100	2781ac ± 54.0	96.6	2739ac ± 69.9	95.1	2704bc± 56.9	93.9

* different superscripts within a row indicate statistically significant differences ($p < 0.05$)

Table 3
Feed efficiency, kg/kg weight gain

Parameters	Groups							
	I experimental Control		II experimental 10% DDG		III experimental 15% DDG		IV experimental 20% DDG	
	x ± Sx	%	x ± Sx	%	x ± Sx	%	x ± Sx	%
Feed expendi- ture, kg per 1 kg 1–10 days	1.243a ± 0.027	100	1.270a ± 0.030	102.17	1.364a ± 0.031	109.73	1.338a± 0.058	107.64
Feed expendi- ture, kg per 1 kg 11–28 days	1.487a ± 0.031	100	1.503a ± 0.040	101.07	1.520a ± 0.030	102.22	1.531a ± 0.026	102.96
Feed expendi- ture, kg per 1 kg 29–42 days	1.999a ± 0.020	100	1.993a ± 0.034	99.70	1.926a ± 0.028	96.35	1.999a ± 0.042	100.00
Feed expendi- ture, kg per 1 kg 1–42 days	1.711a ± 0.021	100	1.720a ± 0.033	100.53	1.714a± 0.025	100.17	1.746a± 0.033	102.04

different superscripts within a row indicate statistically significant differences ($p < 0.05$)

considerably ($p < 0.05$) the live weight by 4.4% vs control birds. This trend was preserved until 28 days of age, but with insignificant differences between group IV and the control group.

Over the entire fattening period, the live weight of chickens from groups II (10% DDG) and III (15%

DDG) attained 2781 g and 2739 g respectively, which was by 3.4% and 4.9% respectively lower than the mean weight of the control group (2880 g), but the differences were not significant. The lowest live weight – 2704 g was registered in birds from experimental group IV (with highest dietary proportion of DDG), with

substantial differences vs controls. Our data are comparable to those of Thacker and Widyaratne (2007), Oryschak et al. (2010) reporting that the inclusion of 10% and 15% DDG did not have a negative effect on the growth potential of broiler chickens. Choi et al. (2008) experimentally demonstrated that DDG could be used in the fattening of broiler chickens at dietary levels of 5%, 10% and 15% without compromising the growth.

With regard to the feed expenditure per 1 kg weight gain (Table 3), the inclusion of 10%, 15% and 20% DDG in compound poultry feed tended to result in higher feed intake vs controls during the starter (from 2.2% to 7.6%) and grower period (from 1% to 3%), but with insignificant differences.

Feed utilization in experimental and control groups during the finisher period and total for the experimental period was almost the same, with insignificant differences.

Fattening traits of broiler chickens at 42 days of age were established via slaughter analysis of 5 birds of average weight (Table 4).

Bratfertig weights in the different groups exhibited a reduction parallelly to increasing the dietary level of DDG in the experimental groups, with statistically significant differences between controls and groups III and IV.

The changes in bratfertig weights correlated positively to grill weights. Chickens fed rations without DDG and with 10% DDG had higher grill weight (2091

Table 4
Slaughter traits

Parameters	I experimental Control	II experimental 10% DDG	III experimental 15% DDG	IV experimental 20% DDG
	x ± Sx	x ± Sx	x ± Sx	x ± Sx
Bratfertig, g	2210.6a ± 31.27	2165.80ac ± 20.64	2126.0bc ± 15.50	2074.4b ± 15.19
Grill, g	2091a ± 35.46	2046ac ± 23.39	2007bc ± 10.97	1961b ± 10.87
Breast, g	785a ± 31.56	766ac ± 18.27	746ac ± 21.55	714bc ± 13.51
% of grill	37.5	37.4	37.1	36.4
Thighs, g	675a ± 6.62	652ac ± 6.62	636bc ± 13.11	644bc ± 14.25
% of grill	32.29	31.85	31.69	32.85
Edible offal, g	119.8a ± 5.93	120.0a ± 3.81	121.4a ± 3.93	113.8a ± 7.90
Internal fat, g	23.4b ± 3.43	27bc ± 2.02	24.6bc ± 1.33	32.4ac ± 4.09
% of grill	1.12	1.20	1.39	1.65

* different superscripts within a row indicate statistically significant differences ($p < 0.05$)

Table 5
Chemical composition of breast meat (without skin), %

Parameters	I experimental Control	II experimental 10% DDG	III experimental 15% DDG	IV experimental 20% DDG
	x ± Sx	x ± Sx	x ± Sx	x ± Sx
Water	73.39a ± 0.10	73.64a ± 0.09	72.84a ± 0.11	72.70a ± 0.14
Protein	22.84a ± 0.41	22.90a ± 0.16	23.08a ± 0.12	23.07a ± 0.24
Fat	2.94a ± 0.53	2.55a ± 0.07	2.45a ± 0.19	2.16a ± 0.16
Ash	1.16a ± 0.02	1.08a ± 0.03	1.04a ± 0.04	1.07a ± 0.04

* different superscripts within a row indicate statistically significant differences ($p < 0.05$)

Table 6
Chemical composition of thigh meat (without skin), %

Parameters	I experimental Control	II experimental 10% DDG	III experimental 15% DDG	IV experimental 20% DDG
	$\bar{x} \pm Sx$	$\bar{x} \pm Sx$	$\bar{x} \pm Sx$	$\bar{x} \pm Sx$
Water	74.43a $\pm$ 0.13	73.48a $\pm$ 0.14	73.94a $\pm$ 0.25	73.43a $\pm$ 0.11
Protein	18.73a $\pm$ 0.10	17.93a $\pm$ 0.54	19.05a $\pm$ 0.25	19.24a $\pm$ 0.24
Fat	5.39a $\pm$ 0.12	5.81a $\pm$ 0.09	5.65a $\pm$ 0.18	6.65b $\pm$ 0.15
Ash	1.07a $\pm$ 0.02	1.04a $\pm$ 0.02	1.16a $\pm$ 0.14	0.99a $\pm$ 0.01

* different superscripts within a row indicate statistically significant differences ($p < 0.05$)

g and 2046 g) respectively than groups fed compound feed containing 15% (2007 g) and 20% DDG (1961 g), with statistically significant differences between controls and experimental groups III and IV.

The addition of 20% DDG to compound feed of broilers from experimental groups IB resulted to substantial reduction of breast weight (714 g) vs control chickens (785 g). This finding is in agreement with data reported by Loar et al. (2012), Wang et al. (2007a,b), proving that breast meat yield decreased with increasing the proportion of DDG in compound feed.

The weight of thighs in the different groups, expressed as percentage of the grill, varied within a narrow range between 31.69% and 32.85%. The differences between thigh weights of experimental groups were insignificant, but the mean value in controls (675 g) was superior to that in either group III (636 g) or IV (644 g) ($p < 0.05$).

There were no statistically significant difference between control and experimental groups with respect to edible offal.

In chickens from experimental group IV fed 20% DDG, the amount of internal fat was higher (32.4 g) vs controls (23.4 g).

The slaughter traits in this study were similar to those reported by Lumpkins et al. (2004) – lack of statistically significant differences in the different parts of the carcass up to dietary DDG levels of 12%.

The chemical composition of breast meat is presented in Table 5. There were no considerable differences between experimental groups' vs controls with regard to water, protein and fat content.

The chemical composition of thighs (Table 6) revealed that water content in the different groups varied within a narrow range – from 73.43% (experimental group IV) to 74.43% (control group).

There were no significant differences in meat protein content among the groups.

With respect to fat content of thigh meat, it did not differ significantly between controls and groups II and III, receiving compound feeds with dietary DDG levels of 10% and 15%. The addition of 20% DDG in feed however resulted in substantial increase of fat content (6.65%) compared to control group (5.39%).

The ash contents of thigh meat of birds from the four groups were small and statistically negligible.

Conclusions

The inclusion of 10% and 15% wheat DDG in compound feeds for broiler chickens fattened up to 42 days of age did not have a significant effect on their growth as compared to control group. The inclusion of 20% wheat DDG to compound feed reduced substantially ($p < 0.05$) live body weight of chickens by 6.1% vs controls.

During the starter period, a trend to poor feed utilisation was observed in groups which received 15 and 20% DDG with compound feed – by 9.7 and 7.6% vs controls, but during the grower and finisher periods, as well as throughout the entire 42-day experimental period, this parameter did not show any significant differences between the control and experimental groups as well as among the three experimental groups.

Compound feeds with 15% and 20% wheat DDG fed to broiler chickens resulted in statistically significant reduction of the bratfertig, grill, thigh weights and slaughter yield vs controls at the end of the trial. The inclusion of 20% DDG in the ration also resulted in statistically significantly lower breast weight than in controls.

The inclusion of DDG in compound feed for broiler chickens did not influence significantly the chemical composition of meat.

Based on conclusions made, the inclusion of no more than 15% DDG in compound feeds for broiler chickens throughout the 42-day fattening period was recommended.

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