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EFFECT OF DIETARY INCLUSION LEVEL OF DISTILLERS DRIED GRAINS WITH SOLUBLES ON LAYING PERFORMANCE IN DOMYATI DUCKS

By

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Abstract : *A total number of 300 Domyati laying ducks 25 weeks-old were weighed, and randomly divided into four treatment groups of 3 replicates each to investigate the effect of using corn distillers dried grains with solubles (DDGS) in the diet at levels of 0 , 10 , 20 and 30 % from 25 until 40 weeks of age on laying performance, egg quality traits, fertility and hatchability percentages, nutrients digestibility and some blood constituents as well as economic efficiency .*

The results indicated that DDGS resulted in insignificant effect on egg number, laying rate % , egg weight and egg mass per duck, which were improved for the group fed diet contained 30 % DDGS as compared to those of the control during the overall experimental period (25-40 wks). Records of feed consumption (g /duck/4 wks) were not significantly affected during all the experimental period due to treatments. It decreased by 4.67, 5.75 and 5.02 % for the groups fed diet contained 10, 20 and 30 % DDGS during the whole experimental period, respectively as compared to the control group. Feed conversion ratio (g feed / g egg mass) values were insignificantly improved of groups fed diets contained different DDGS levels during the whole experimental period as compared to that of the control. Egg quality traits were insignificantly affected due to feeding DDGS in the diet except of relative weights of yolk and albumin which were affected significantly. Relative yolk weight was significantly decreased, whereas relative albumin weight was significantly increased by feeding 30 % DDGS in the diet. Fertility percentage was insignificantly improved by feeding diet contained 20 % DDGS, whereas, decreased by feeding 30 % DDGS diet as compared to the control. Hatchability of fertile eggs was insignificantly decreased due to feeding different DDGS levels in the diet as compared to the control. Also, live body weight and mortality were not significantly affected due to treatments. All nutrients digestibility coefficient were improved by feeding 30 % DDGS in the diet. Plasma constituents were not significantly affected by feeding different levels of DDGS in the diet. The economical efficiency values were directly improved by increasing DDGS up to 30 % in the diet as compared to the control. These results indicated that corn DDGS could be used in laying duck diets up to 30 % to maximize the productivity and profitability in addition to the hatchability traits and economical efficiency of Domyati ducks.

INTRODUCTION

Distillers dried grains with solubles (DDGS) is a primary co-product of ethanol production from dry milling of cereal grains. Increasing amounts of corn are being used for producing ethanol for fuel, resulting in increased price and reduced availability of corn for poultry feed.. Concomitant with the production of fuel alcohol the production of corn distiller's dried grains with solubles (**DDGS**), has increased tremendously *(Wang et al., 2008)*.

Traditionally, DDGS has been fed mainly to ruminants because of its high

level of fiber and high variability in content and bioavailability of some nutrients, particularly lysine (***Cromwell et al., 1993; Shurson, 2003***). However, DDGS is a good source of P, containing 0.72 % total P ***(NRC, 1994)***, and the bioavailability of P is higher than the 25 to 35% that is typical of most plant ingredients.

Distillers dried grains with solubles (DDGS) is a source of protein/amino acids, energy and available phosphorus for poultry because the nutrient fractions (protein, oil and fiber) are 2 to 3 times more concentrated in DDGS compared to corn (***Creswell, 2006***). Because of the nutritional characteristics of DDGS and the high price of corn and soybean meal encourages the use of higher levels of DDGS than has typically been used in the past. To date, most research about DDGS has centered on nutrient content and variability (***Cromwell et al., 1993; Knott et al., 2004; Shurson, 2005; Robinson, 2005; Behnke, 2007***), with little emphasis on factors such as pellet quality and energy density, which can influence the utilization of DDGS in poultry diets. ***Lumpkins et al. (2005)*** suggested a maximal inclusion rate of 10-12% DDGS in diets for laying hens. In addition, ***Roberson et al. (2005)*** and ***Swiatkiwicz and Koreleski (2006)*** reported that 15% DDGS did not adversely affect performance of laying hens while, inclusion of 20% negatively affected laying rate and egg weight. Recently, ***Roberts et al. (2007)*** and ***Shalash et al (2010)*** found that using 10% DDGS in laying hens diets had no negative effects on egg production or egg quality parameters. Moreover, ***Scheideler et al. (2008)*** who found that increasing graded levels of DDGS from 0-25% for White Leghorn-type hens (24 wks) had no negative effect on egg production, feed intake and body weight gain

Thus, the objective of this experiment was to evaluate the effect and feasibility of using varying levels of corn DDGS in laying duck diets on laying performance and egg quality as well as economic efficiency.

MATERIALS AND METHODS

This study was carried out at El – Serw Water Fowl Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. The experiment was conducted from April to August 2010. Three hundred (240 females and 60 males) Domyati ducks of 25 weeks-old were weighed and randomly distributed into four experimental groups , each group contained 75 ducks. Ducks in all treatments were reared under similar hygienic and managerial conditions. Ducks of each treatment (60 females and 15 males) were taken at random, weighed then divided into three equal replicates (20 females and 5 males each). Ducks of each replicate were housed as 2.3 ducks /m^2 in a house with windows and received additional artificial light to provide 16 h light and 8 h dark daily. Throughout the experimental period (25-40 wks), feed and fresh water were available all the time. Corn dried distillers grains with solubles (DDGS) was provided by Cairo Poultry Company. Four diets were formulated which contained corn DDGS (27%CP, 0.17%Ca., 0.72% Phos., 0.6% Meth., 0.75%Lys., 0.48 %Sod., and 2820 kcal/kg ME) at levels of 0 , 10 , 20 and 30 % , then were fed for 16 weeks of age. The composition and calculated analysis of the experimental diets are shown in Table (1).

Data collection:

Egg number was daily recorded and weighed from 25 to 40 wks of age. Egg number (EN) was calculated per duck for 4 wks period as follows: EN per duck = Total egg number per replicate / Number of duck at housing. Laying rate (LR) was calculated for the same period as follows:

LR % = EN per duck / Number of days x 100

Egg weight was recorded to the nearest gram for each replicate. Egg mass (EM) was calculated per duck for the same periods as follows: EM per duck = Total egg mass per replicate / Number of duck at housing. Feed consumption (FC) of each replicate for all treatments was weekly recorded, it was then averaged and expressed in grams per duck / 4 wks. Feed conversion ratio (FCR) for egg production was also calculated during the same periods. At 33 weeks of age, a total number of 60 eggs (15 from each treatment) were randomly taken to determine egg components and quality. At the end of experiment period ducks of each treatment were weighed. also mortality was recorded during the whole experimental period.

Egg fertility and hatchability percentages:

A total of 300 eggs were collected from each treatment during 36-37 weeks of age to determine fertility and hatchability percentages. They were randomly divided into three equal replicates. Fertility percentage was determined in the 10^{th} day of incubation. Hatchability percentage of fertile was determined at the end of incubation period

Nutrients digestibility:

At 38 wks of age, 12 Domyati duck drakes (one from each replicate), with an average body weight of about 2.25 kg were randomly chosen to evaluate the digestibility of nutrients for all experimental diets. Each experimental diet was fed to drakes for four days as a preliminary period, followed by three days collection period, where excreta was quantitatively collected. Simultaneously, records of daily feed consumption for each drake were maintained . The daily excreta was voided from drake in each replicate, pooled and thoroughly mixed. Then, representative excreta samples were taken and dried immediately for chemical analysis *(AOAC 1995)*. The procedure described by *Jakobsen et al. (1960)* was used for separating fecal protein from excreta samples. Urinaly organic matter (UOM) was determined according to *Abou-Raya and Galal (1971).* Digestion coefficients of dry matter (DM) , organic matter (OM), crude protein (CP), crude fiber (CF) , ether extract (EE) and nitrogen free extract (NFE) as well as total digestible nutrient (TDN) and metabolizable energy (ME) were calculated according to *(Fraps ,1946).*

Slaughter test:

At the end of the experimental period (40 wks), three ducks from each treatment group were randomly taken for slaughter test. Ducks were fasted for 12 hours before slaughtering and individually weighed pre and after slaughtering until complete bleeding. Presently after scalding, feather picking and evisceration were performed and different body parts, organs and abdominal fat were dissected and weighed.

During slaughtering, blood samples were collected in heparinized test tubes and centrifuged at 3500 rpm for 15 minutes to obtain blood plasma .Then, total protein *(Peters, 1968)*, total cholesterol *(Ellefson and Caraway, 1976)*, triglycerides *(Bucolo and David, 1973)* and transaminase enzymes activity being GOT and GPT *(Reitman and Frankel, 1957)* and creatinine were determined by suitable commercial kits..

Statistical analysis:

Data was statistically analyzed according to SAS program *(SAS, 2004)* using general linear model (GLM) based on the following model; $Y_{ij} = \mu + T_i + e_{ij}$ where, Y_{ij} = An observation, μ = Overall mean,

T_i = Effect of treatment (1, 2, ... , 4) , and e_{ij} = Random error . The significant differences among treatments were determined by Duncan's multiple range test *(Duncan, 1955).*

RESULTS AND DISCUSSION

Laying performance of Domyati ducks:-

Results of Table (2) showed that no significant differences were found among all the experimental groups in egg number (EN) per duck and laying rate (LR) during all the interval periods. EN per duck an LR % were improved by feeding 20 and 30% DDGS as compared to that of the control group during 25-28 and 29-32 wks of age, whereas, it was decreased at 37-40 wks of age. EN per duck was decreased by 2.60 and 0.32 % % for the groups fed diet contained 10 and 20 % DDGS, whereas, it was increased by 1.39 % for the group fed diet contained 30 % DDGS, respectively as compared with that of the control at the overall experimental period (25 – 40 wks of age).

No significant effects were found on egg weight (EW) and egg mass per duck (EM) due to feeding diets contained different levels of DDGS (Table 2). EW was improved by about 1.09 % of the group fed diet contained 30 % DDGS as compared to those of the control group at overall period (25-40 wks). EM per duck was improved by 2.49 % for the group fed 30 % DDGS at the overall experimental period as compared to the control. These results may be due to the DDGS obtained from modern ethanol plants as an attractive alternative ingredient for layer diets because of it's higher nonphytate phosphorus content and higher relative bioavailability of phosphorus than the original corn source ***(NRC, 1994; Martinez Amezcua et al., 2004)***. Also, DDGS is a good source of riboflavin and thiamin ***(D'Ercole et al., 1939)*** and that most of the riboflavin is found in the soluble fraction ***(Sloan, 1941)***. These results are in agreement with those reported by ***Lumpkins et al.(2005)*** who suggested that feeding laying hens on diet contained 10 - 12 % DDGS had no significant effects on laying performance. In addition, ***Roberson et al. (2005)*** reported that 15% DDGS did not adversely affect performance of laying hens but suggested that lower levels of DDGS is preferred when introducing it into the diet. Also, ***Swiatkiwicz and Koreleski (2006)*** reported that up to 15% DDGS could be used in layer feeds. Recently, ***Roberts et al. (2007)*** found that feeding diet contained 10% DDGS for laying hens had no negative effects on egg production parameters. ***Scheideler et al. (2008)*** found that increasing graded levels of DDGS from 0-25% for White Leghorn-type hens during 24 wks period had no negative effect on egg production. ***Loar et al.(2010)*** reported that feeding different levels of DDGS (0 -32 %) for Bovans White laying hens did not have adverse effects on any of the laying performance parameters. On contrast , ***Shalash et al. (2010)*** reported that increasing DDGS to 15 or 20% in laying hen diets significantly ($P<0.01$) decreased egg production %, egg number, egg weight and egg mass compared to the other levels (0, 5 and 10%). Also, inclusion of 20 % DDGS in laying diets had negatively affected laying rate and egg weight ***(Swiatkiwicz and Koreleski, 2006)***.

Results of Table (3) showed that no significant differences were found among the experimental groups in feed consumption (FC) and feed conversion ratio (FCR) at different experimental periods. FC (g / duck / 4 wks) was decreased by feeding diets contained different DDGS levels during all the experimental period. Decreasing of FC per duck was 4.67, 5.75 and 5.02 % for the groups fed diet contained 10, 20 and 30 % DDGS at the whole experimental period, respectively as compared to the control group. These results may be due to that the ducks are supplied by their requirements of different dietary nutrients rather than increasing feed consumption. These results are in agreement with that reported by ***Scheideler et al. (2008)*** who found that increasing graded levels of DDGS from 0-25 % for White Leghorn-type hens (24

wks) had no negative effect on feed intake .Also, ***Shalash et al. (2010)*** who reported that increasing DDGS level from 0.0-20 % had no significant effect on feed intake.

FCR (g. feed / g. egg mass) was improved by feeding different DDGS levels during all the experimental periods except of 37-40 wks of age which decreased as compared to the control . FCR values were improved by 2.04, 5.62 and 7.41 % for the groups fed diet contained 10, 20 and 30 % DDGS at the whole experimental period (25-40 wks) of age as compared to the control, respectively. These results may be attributed to the decrease of feed consumption.

Egg quality traits:-

Data of components and quality measurements of eggs produced by laying Domyati ducks fed diets contained different DDGS levels at 33 wks-old are presented in Table (4). No significant differences were observed among the experimental groups in all egg components and quality measurements except of relative weights of both yolk and albumin component, which were significantly affected. Relative weight of yolk was significantly increased by feeding diet contained 10 % DDGS, whereas, relative albumin weight was significantly decreased as compared to those fed diet contained 30 % DDGS diet. Shell thickness was improved directly by increasing DDGS level in the diet as compared to the control.

Relative egg shell weight was reduced for the groups fed diet contained 20 and 30 % DDGS as compared to those of the groups fed control diet and 10 % DDGS. This may be due to that DDGS contain sulfur, which may interfere with absorption of dietary calcium from the small intestines ***(Pineda et al., 2008)***. These results are in agreement with those reported by ***Lumpkins et al. (2005)*** and ***Roberts et al. (2007)*** who mentioned that egg quality parameters were not affected by feeding White Leghorn-type laying hens (23 to 58 wks of age) diets containing 10% DDGS. Moreover, ***Pineda et al. (2008)*** reported that egg quality was not affected by feeding DDGS inclusion in the laying diet.

Fertility and hatchability traits:-

Fertility and hatchability percentages, live body weight change and mortality of laying Domyati ducks fed diet contained different DDGS levels are presented in Table (5). The statistical analysis of data of incubated eggs showed no significant differences among treatments for fertility and hatchability percentages. Fertility percentages numerically improved by about 2.41 % for the group fed diet contained 20 % DDGS, whereas, it decreased by 2.61 and 2.92 % for the groups fed diet contained 10 and 30 % DDGS, respectively as compared to those of the control. Depressing fertility percentage of all ducks may be due to the environment conditions, fertility was measured for hatched eggs which were collected during July 2010. Hatchability percentages of fertile eggs were insignificantly decreased by about 4.88, 3.98 and 2.48 % for groups fed diet contained 10, 20 and 30 % DDGS as compared to those of the control, respectively.

Results of Table (5) revealed no significant differences in live body weight change at the end of experiment and total mortality of laying Domyati ducks. These results may be due to laying Domyati ducks ability which can tolerate the studied levels of DDGS in the diets. These results are in agreement with those reported by ***Shalash et al. (2010)*** who reported that increasing DDGS level from 0-20 % in laying hen diets had no significant effect on body weight gain.

Carcass traits:-

Results of Table (6) revealed no significant differences in all carcass traits except of relative weights of spleen and pancreas which were significantly affected due to feeding diets containing different

DDGS levels at 40 wks of age. Both of eviscerated carcass and edible parts percent were slightly increased by feeding diets containing DDGS. Total giblets percent of Domyati ducks was insignificantly decreased by about 4.21 , 9.82 and 9.28 % for the groups fed diet contained 10 , 20 and 30 % DDGS ,respectively as compared to the control group. Abdominal fat percent was insignificantly increased by 36.36, 34.09 and 30.68 % for the groups fed diet contained 10 , 20 and 30 % DDGS, respectively as compared to the control group. Relative spleen weight was significantly decreased by feeding different levels of DDGS in the diet compared to the control, whereas, relative pancreas weight was significantly increased by feeding diet contained 20 and 30 % DDGS as compared to the control. These results are in agreement with those reported by ***Shalash et al. (2009)*** who reported that feeding diet contained 12 % DDGS had no significant effects on different carcass characteristics. ***Lumpkins et al. (2004)*** found that feeding 6 to 18% DDGS to broiler chicks had no effect on carcass yield. Also, ***Wang et al. (2007)*** reported that broilers can be fed 15% DDGS without affecting carcass composition.

Nutrients digestibility:-

Percentages of ash and nitrogen retention as well as digestion coefficients of DM, OM, CP, EE, CF, NFE and nutritive values (TDN and ME) are illustrated in Table (7). Results showed that no significant effect was found on ash and nitrogen retention and all digestion coefficients due to feeding diets contained different levels of DDGS. Ash and N-retention values were slightly increased by feeding diet contained 30 % DDGS as compared to the control. Also, all digestibility coefficient of nutrients were insignificantly improved by feeding diet contained 30 % DDGS as compared to control. These results may be due to that DDGS has high bioavailability of some nutrients, particularly lysine (***Cromwell et al., 1993; Shurson, 2003***). Also, DDGS is a good source of P, containing 0.72% total P (***NRC, 1994)***, and the bioavailability of P is higher than the 25 to 35% that is typical of most plant ingredients. These results are in agreement with those reported by ***Shalash et al. (2010)*** who reported that digestibility coefficient values of crude protein (CP), crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) were not significantly affected by dietary DDGS levels(0-20%).

Blood plasma constituents:-

Plasma parameters of laying Domyati ducks, measured in the present study, were estimated to show the metabolic status of ducks and their health as affected by feeding different levels of DDGS. Data of some blood plasma constituents of Domyati laying ducks fed the diets contained different levels of DDGS are illustrated in Table (8) Results showed that no significant differences were found among treatments in all plasma constituents. Plasma total protein value was increased by 6.19 % for the group fed diet contained 30 % DDGS as compared to the control. Plasma triglycerides were decreased by 1.96, 11.92 and 16.20 % for the groups fed diet contained 10, 20 and 30 % DDGS as compared to the control, respectively. Also, plasma total cholesterol was decreased by 9.19, 18.10 and 20.76 % for the groups fed diet contained 10, 20 and 30 % DDGS as compared to the control, respectively. Means of plasma transaminases (GOT and GPT) and creatinine values were insignificantly higher than the control group due to treatments. These results demonstrate that DDGS diet did not affect the liver and kidney function under the conditions of this study. These results are in agreement with those reported by ***Shalash et al. (2009)*** who reported that plasma cholesterol, total lipids and creatinine content were not significantly affected by feeding diet contained 12 % DDGS . Also , ***Gabr et al.***

(2008) found that total protein , cholesterol, GOT and GPT were not significantly affected by feeding diets contained 10 , 15 and 20 % DDGS , whereas, total lipids were significantly decreased by feeding diet contained 20 % DDGS as compared to the control.

Economical efficiency:-

Calculations were carried out according to the prices of feed ingredients, additives and eggs prevailing during year 2010 (the experimental time) as listed in Table (9). The economical efficiency values of laying Domyati ducks were improved by 12.32 , 25.97 and 35.62 % for the groups fed diets contained 10 , 20 and 30 % DDGS as compared to the control , respectively during the studied laying period from 25 to 40 weeks of age. So, increasing inclusion levels of DDGS up to 20 and 30 % in the diet of laying ducks improves net return per duck and economical efficiency compared to those of the control. It may be due to the decreasing of feed consumption and the feed cost.

CONCLUSION

Generally the best results in most studied traits were recorded for diets contained 20 and 30 % corn DDGS during the studied laying periods. So, corn DDGS could be used in laying duck diet by levels up to 30 % to maximize the productivity and profitability in addition to the hatchability traits and economical efficiency of Domyati ducks .

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

Ingredients %	DDGS %			
	0	10	20	30
Yellow corn	67.65	62.58	57.55	52.50
Soy bean meal (44 %)	23.10	17.60	12.17	6.50
DDGS[1]	0.00	10.00	20.00	30.00
Wheat bran	0.00	0.68	1.20	2.10
Di-calcium phosphate	1.70	1.55	1.45	1.25
Limestone	6.70	6.80	6.90	6.95
Vit & Min. premix [2]	0.30	0.30	0.30	0.30
NaCl	0.45	0.35	0.23	0.10
DL- Methionine (99%)	0.10	0.07	0.05	0.04
L –lysine Hcl (98%)	0.00	0.07	0.15	0.26
Total	100	100	100	100
Calculated Analysis [3]				
Crude protein %	16.00	16.00	16.01	16.02
ME (Kcal / kg)	2783	2784	2786	2789
Crude fiber %	3.11	3.60	4.07	4.57
Ca. %	3.00	3.01	3.02	3.00
Av. Phosph.%	0.43	0.44	0.46	0.45
Lysine (%)	0.79	0.78	0.77	0.78
Methionine (%)	0.36	0.35	0.35	0.36
Meth. + Cyst. (%)	0.55	0.56	0.57	0.58
Na %	0.20	0.20	0.20	0.20
Price (LE/kg) [4]	1.905	1.826	1.769	1.708

1- DDGS = corn distillers dried grains with solubles

2- Each 3kg of Vit .and Min. premix contains 100 million IUVit A;2 million IU Vit.D3;10 g Vit.E; 1 g Vit.K_3 ; 1 g Vit B1; 5 g Vit B2 ;10 mg Vit.B12 ; 1.5 g Vit B6; 30 g Niacin ;10 g Pantothenic acid ;1g Folic acid;50 mg Biotin ; 300 g Choline chloride; 50 g Zinc; 4 g Copper; 0.3 g Iodine ; 30 g Iron; 0.1 g Selenium; 60g Manganese ;0.1 g Cobalt; and carrier $CaCO_3$ to 3000 g .

3- According to NRC (1994)

4- Price of one kg (LE) at time of experiment for different ingredients : yellow corn ,1.70 ; Soy been meal, 2.80 ; DDGS ,1.60 ; Wheat bran, 1.10 ; Di-calcium,3.0 ; limestone,0.10 ; Vit&Min.,8.0 ; Nacl,0.25; Meth.,25.0 and Lys.,20.0.

Table (2): Effect of DDGS on egg number, laying rate, egg mass and egg weight of laying Domyati ducks.

Age (wks)	DDGS, %			
	0	10	20	30
Egg number /duck / 4 wks.				
25 – 28	19.07±0.52	18.15±0.89	19.48±1.14	20.15±0.59
29 – 32	21.33±1.38	20.08±1.08	23.12±1.22	22.60±0.18
33 – 36	19.17±0.68	19.60±0.46	19.12±0.55	19.17±0.32
37 – 40	19.55± 0.28	17.23±0.28	17.15±0.45	18.30±0.74
Overall period	79.12±1.96	77.06±2.14	78.87±2.67	80.22±0.52
Laying rate %				
25 – 28	68.10±1.82	64.82±3.20	69.58±4.08	71.96±1.40
29 – 32	76.19±5.35	78.87±3.87	82.5±4.37	80.71±0.63
33 – 36	68.45±2.44	70.00±1.66	68.29±1.96	68.45±1.13
37 – 40	69.82± 0.98	61.54 ±1.16	61.25±1.62	65.36± 2.65
Overall period	70.64±1.75	68.80±1.91	70.42±2.38	71.63±3.35
Egg weight (g)				
25 – 28	59.30±0.15	59.10±0.75	59.52±0.71	59.91±0.43
29 – 32	62.44±0.63	62.20±0.95	62.47±0.43	63.44±0.92
33 – 36	65.23±0.24	63.94±0.53	64.31±0.41	65.17±0.87
37 – 40	63.29±0.49	64.30±1.58	64.00±0.98	64.84±1.06
Overall period	62.58±0.37	62.43±1.00	62.52±0.14	63.26±0.67
Egg mass (g / duck /4 wks)				
25 – 28	1130.6±29.3	1074.1±65.8	1159.1±64.8	1207.0±19.3
29 – 32	1332.9±92.6	1375.5±86.8	1444.9±84.2	1433.8±27.3
33 – 36	1250.6±48.7	1253.8±40.3	1229.6±29.6	1249.1±24.4
37 – 40	1237.6 ±25.9	1107.9±21.2	1097.6±44.0	1185.2±31.1
Overall period	4951.6±150.0	4811.2±200.8	4931.2±170.2	5075.0±23.1

Treatment had no significant effect at ($p \leq 0.05$) all parameters.

Table (3): Effect of DDGS on feed consumption and conversion of laying Domyati ducks.

Age (wks)	DDGS, %			
	0	10	20	30
Feed consumption (g /duck / 4 wks)				
25 – 28	4294.9±132.5	3999.5±104.0	3944.8±84.1	4041.6±137.7
29 – 32	4906.0±185.3	4634.1±96.7	4528.0±212.7	4688.4134.6
33 – 36	4806.0±181.5	4629.1±215.6	4574.4±105.3	4427.2±134.2
37 – 40	5313.1±65.7	5153.8±268.1	5160.7±91.0	5193.2±240.3
Overall mean	19320.0±446.5	18416.5±548.3	18207.9±266.3	18350.3±204.1
Feed conversion (g feed/ g egg)				
25 – 28	3.80±0.16	3.75±0.26	3.43±0.25	3.35±0.06
29 – 32	3.73±0.34	3.41±0.30	3.14±0.10	3.28±0.14
33 – 36	3.87±0.31	3.71±0.28	3.72±0.06	3.54±0.08
37 – 40	4.30±0.14	4.65±0.34	4.70±0.13	4.39±0.26
Overall mean	3.91±0.21	3.83±0.28	3.69±0.10	3.62±0.03

Treatment had no significant effect at ($p \leq 0.05$) all parameters.

Table (4): Effect of DDGS on egg quality traits at 33 wks of age of laying Domyati ducks

Parameters	DDGS, %				Sig.
	0	10	20	30	
Egg weight ,g	63.2±1.0	64.7±1.13	63.0±1.3	64.9±1.7	NS
Yolk weight ,%	31.2±0.8^{ab}	32.7±0.6^{a}	31.7±0.6^{ab}	30.3±0.8^{b}	0.05
Albumin weight ,%	56.0±1.1^{ab}	54.5±0.7^{b}	56.1±0.5^{ab}	57.6±0.8^{a}	0.01
Shell weight ,%	12.8±0.4	12.8±0.6	12.2±0.3	12.1±0.2	NS
Shell thickness, mm	0.34±0.01	0.34±0.01	0.35±0.01	0.35±0.01	NS
Yolk index	0.45±0.02	0.45±0.01	0.44±0.01	0.44±0.01	NS
Shape index	0.76±0.01	0.78±0.01	0.76±0.01	0.79±0.01	NS
HU	93.8±1.5	94.2±1.3	92.8±1.3	93.5±1.7	NS

a,b,c :means in the same row bearing different superscript are significantly different ($p \leq 0.05$).
NS = not significant

Table (5): Effect of DDGS on hatchability traits and live body weight of laying Domyati ducks.

Traits	DDGS, %			
	0	10	20	30
Fertility %	78.38±2.18	76.33±1.64	80.27±3.72	76.09±0.44
Hatchability of fertile eggs %	75.15±2.90	71.48±1.53	72.16±1.83	73.28±0.33
Initial BW	1970.0±7.5	1942.3±26.2	1965.7±7.8	1923.7±10.1
Final BW	1774.7±12.5	1773.3±35.3	1790.7±16.7	1762.0±26.2
Change BW	-195.3±10.1	-169.0±9.1	-175.0±14.5	-161.7±19.5
Mortality No. per treatment	2/75	1/75	3/75	2/75

Treatment had no significant effect at ($p \leq 0.05$) all parameters.
*BW= body weight

Table (6): Effect of DDGS on carcass traits of laying Domyati ducks at 40 weeks of age.

Parameters	DDGS, %				Sig.
	0	10	20	30	
LBW (g)	1833±79	1847±47	1867±64	1857±83	NS
Eviscerated carcass %	64.46±1.14	65.18±0.39	66.52±2.00	65.29±1.91	NS
Liver %	3.86±0.29	3.47±0.45	3.02±0.16	3.2±0.37	NS
Gizzard %	2.54±0.19	2.61±0.19	2.62±0.04	2.48±0.21	NS
Heart %	0.72 ±0.10	0.74±0.04	0.74± 0.03	0.75 ±0.02	NS
Total giblets %	7.12±0.15	6.82±0.40	6.39±0.07	6.44±0.20	NS
Edible part %	71.58±1.57	72.00±0.30	72.90±1.72	71.73±1.97	NS
Abd. fat %	0.88±0.05	1.20±0.29	1.18±0.15	1.15±0.05	NS
Spleen %	0.11±0.01^{a}	0.09±0.01^{b}	0.06±0.01^{c}	0.06±0.01^{c}	0.05
Pancreas %	0.27±0.05^{b}	0.4±0.06^{ab}	0.46±0.03^{a}	0.43±0.04^{a}	0.05

a,b,c :means in the same row bearing different superscript are significantly different ($P \leq 0.05$).
NS = not significant

Table (7): Effect of DDGS on nutrients digestibility of laying Domyati ducks at 38 weeks of age.

Parameters	DDGS, %			
	0	10	20	30
Ash retained	35.75±0.36	35.69±1.43	35.74±0.29	36.06±0.36
N- retained	60.18±0.61	60.05±0.60	60.07±0.59	60.20±0.62
Digestion coefficient,%				
Dry matter	65.18±0.58	65.07±0.61	65.13±0.55	65.22±0.57
Organic matter	74.49±0.79	73.95±0.72	74.42±0.73	74.70±0.77
Crude protein	89.20±0.62	88.46±0.98	89.12±0.61	90.03±0.55
Ether extract	88.26±0.62	87.83±1.28	88.12±0.64	89.04±0.58
Crud fiber	27.20±0.64	27.09±0.57	27.11±0.60	27.24±0.63
Nitrogen free extract	78.71±0.88	77.96±0.69	78.53±0.80	78.74±0.86
TDN	67.95±0.68	67.39±0.68	67.93±0.63	68.04±0.65
ME(Kcal/kg)	2854±29	2830±29	2853±27	2858±27

Treatment had no significant effect at ($p \leq 0.05$) all parameters.

Table (8): Effect of DDGS on plasma constituents of laying Domyati ducks at 40 weeks of age.

Parameters	DDGS, %			
	0	10	20	30
Total protein (g/dl)	5.97±0.26	6.07±0.22	5.94±0.31	6.34±0.29
Triglycerides (mg/dl)	966.7±150.4	946.8±168.6	850.6±95.2	809.3±141.1
Total cholesterol (mg/dl)	121.5±15.1	110.3±24.3	99.5±9.4	96.3±16.4
GOT(U/l)	42.63±10.6	46.90±19.36	48.30±10.91	56.30±6.76
GPT(U/l)	24.13±1.90	24.87±2.73	25.16±0.84	27.60±1.91
Creatinine (mg/dl)	0.33±0.04	0.32±0.03	0.37±0.08	0.43±0.03

Treatment had no significant effect at ($p \leq 0.05$) all parameters.

Table (9): Effect of DDGS on economical efficiency of laying Domyati ducks during 25-40 weeks of age.

Parameters	DDGS, %			
	0	10	20	30
Average feed consumption kg per duck during overall period	19.320	18.417	18.208	18.350
Cost / kg feed, L.E [1]	1.905	1.826	1.769	1.708
Total feed cost, L.E [2]	36.80	33.63	32.21	31.34
Number of egg produced /duck	79.12	77.07	78.87	80.22
Price of one egg, L.E [3]	1.00	1.00	1.00	1.00
Total return /duck, LE	79.12	77.07	78.87	80.22
Net return / duck. LE	42.32	43.44	46.66	48.88
EEF [4]	1.150	1.292	1.449	1.560
Relative EEF [5]	100	112.32	125.97	135.62

1-L.E = Egyptian pound
2-According to price of different ingredients available in Egypt at the experimental time.
3-According to local price at the experimental time.
4- EEF = economic efficiency = (Net return LE / Total feed cost LE).
5-Relative EEF = assuming EEF of the control equals 100%

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الملخـــص العربـــي

تأثيـر مستوى احتواء العليقة من النواتج المجففة لتقطير الحبوب بالسوائل علـى أداء إنتـاج البيـض وصفـات الفقس فى البط الدمياطى

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أجرى هذا البحث لدراسة تأثير إستخدام النواتج المجففة لتقطير الحبوب بالسوائل (DDGS) للأذرة بمستويات متدرجة في علائق البط الدمياطي خلال فترة إنتاج البيض على الأداء الانتاجى وصفات التفريخ ومعاملات هضم المركبات الغذائية ومقاييس جودة البيض ومقاييس الذبيحة وبعض صفات الدم والكفاءة الاقتصادية . تم استخدام عدد ٣٠٠ طائر بط دمياطي عمر ٢٥ أسبوع (٢٤٠ بطة و ٦٠ ذكر) تم تقسيمهم إلى أربعة مجاميع تجريبية (٦٠ أنثى و ١٥ ذكر لكل مجموعة تجريبية) ثم وزنت طيور كل مجموعة ووزعت عشوائيا على ثلاث مكررات متساوية. تم تكوين العلائق التجريبية الأربعة المحتوية على DDGS بمستويات (صفر ، ١٠ ، ٢٠ ، ٣٠ %) وتم تقديمها للمجموعات التجريبية الأربعة خلال فترة التجربة (٢٥ ــ ٤٠ أسبوع) ، وتم وزن البط عند نهاية التجربة . سجل استهلاك العليقة وعدد ووزن البيض الناتج خلال مدة التجربة (٢٥ ــ ٤٠ أسبوع) ، كما قدرت بعض مقاييس جودة البيض عند عمر ٣٣ أسبوع ، وتم جمع البيض عند ٣٦-٣٧ أسبوع من التجربة لمدة عشرة أيام لإجراء عملية تفريخ له وحساب نسبتى الخصوبة والفقس للبيض ، أيضا أجريت تجربة هضم على بعض الذكور لتقدير معاملات الهضم للمركبات الغذائية بالعليقة ، وتم أخذ عينات دم من البط عند عمر ٤٠ أسبوع أثناء إجراء اختبار الذبح لتقدير محتوى بلازما الدم من البروتين الكلى والجلسريدات الثلاثية والكولسترول الكلى وإنزيمات الترانس أمينيز (GOT,GPT) وفى النهاية تم تقدير الكفاءة الاقتصادية للمعاملات الغذائية خلال فترة إنتاج البيض.

وبتحليل النتائج اتضح الآتي :-

- وجود تحسن غيرمعنوي في عدد البيض وكتلة البيض الناتج لكل بطة وكذلك معدل إنتاج البيض للمجموعة التي تغذت على العليقة المحتوية على DDGS بمستوى ٣٠ % مقارنة بالكنترول خلال مدة التجربة من ٢٥ ــ ٤٠ أسبوع .
- لم تتأثر معنويا كمية العليقة المستهلكة لكل بطة بينما تحسن معنويا معامل التحويل الغذائي لإنتاج البيض للمعاملات المختلفة مقارنة بالكنترول خلال مدة التجربة من ٢٥ ــ ٤٠ أسبوع .
- لم تتأثر معنويا مقاييس جودة البيض المختلفة بالتغذية على علائق تحتوى على DDGS بينما انخفضت نسبة الصفار معنويا وارتفعت نسبة البياض معنويا بالتغذية على عليقة تحتوى ٣٠ % DDGS مقارنة بالكنترول .
- لم تتأثر معنويا صفات التفريخ للبيض الناتج بالمعاملات التجريبية وان تحسنت نسبة الخصوبة للمجموعة التي تغذت على عليقه تحتوى على DDGS بمستوى ٢٠ % مقارنة بالكنترول.
- وجود تحسن غير معنوي في نسبة كل من الرماد والنيتروجين المحتجزين ومعاملات هضم المركبات الغذائية المختلفة للمجموعة التي تغذت على عليقه تحتوى على DDGS بمستوى ٣٠ % مقارنة بالكنترول .
- لم تتأثر كل من صفات الدم و قياسات الذبيحة المدروسة بالمعاملات التجريبية مقارنة بالكنترول .
- لم يتأثر وزن الجسم ومعدل التغير في الوزن والنفوق بالمعاملات التجريبية مقارنة بالكنترول
- تحسنت الكفاءة الاقتصادية وصافى العائد لكل بطة بالمعاملات التجريبية مقارنة بالكنترول .

من النتائج السابقة يمكن الاستنتاج بأن إستخدام DDGS للأذرة في علائق البط الدمياطي البياض بمستوى يصل إلى ٣٠ % يمكن أن يؤدى إلى تحسن في مقاييس الأداء الانتاجى للبيض والخصوبة والكفاءة الأقتصادية.