EFFECT OF IMPROVING THE UTILIZATION OF WHEAT BRAN ON PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE FOR LOCAL LAYING HENS

By

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Abstract: *A total number of 72 Matrouh laying hens (local strain) at 32 weeks of age were used to study the effect of using 50% wheat bran in the laying diets and the possibility to improve the feeding value of wheat bran (WB) when supplemented with some feed additives. Hens were housed in individual cages and were randomly divided into six equal treatments (12 birds each) and were approximately similar in their body weight. Treatment 1 birds were received the control diet contained 16% CP and 2703 kcal ME/Kg. Treatment 2 birds were received the basal wheat bran diet (WB-diet) contained 16.01% CP and 1841 Kcal ME/Kg. Birds of Treatments 3,4,5 and 6 were received the WB-diet supplemented with either 1.0% sodium sulphate (SS), 0.1% kemzyme (KE) , 1.0% (SS) plus 0.1% (KE) , or 0.1% (KE) plus 1.0% Radish extract (RE) , respectively. Birds were fed the experimental diets for three months. Results showed that WB-diet significantly reduced feed intake and numerically decreased egg number. Addition of SS or KE+RE increased egg number and egg mass compared to hens fed WB-diet alone. WB-diet increased level of calcium and phosphorus in serum while decreased cholesterol, low density lipoprotein (LDL) and high density lipoprotein (HDL) in yolk compared to hens fed control diet. It could be concluded that the detrimental effect of inclusion of 50% wheat bran in Matrouh laying hen diets can be overcome by addition of SS or KE+RE.*

INTRODUCTION

Large amounts of fiber rich by-product like wheat bran could be an economical and good source of protein in many tropical countries (Picard *et. al* (1993). Andersen *et.al* (1988) reported that Bonds in wheat bran are hydrolysed almost instantaneously on contrast with the acidic (pH 2.5) stomach contents of humans. Vilarino *et.al* (1996) found that dilution the

laying diets with 45% wheat bran significantly increased feed intake per hen with no significant differences among treatments in laying rates. Some studies have suggested that high endogenous-phytase cereals and their by products can effectively enhance phosphorus utilization by monogastrie species. Cavalcanti and Behnke (2004) found that inclusion of wheat bran in broiler diets resulting in improving phosphorus utilization by the birds when compared to the reference basal diet and indicated that wheat bran can be utilized as a viable source of phytases.

On the other hand non-starch polysaccharides, phytate, tannins in cereal grains and their by-products reduce their digestibility and nutrient availability and hence their feeding value (Annison *et. al.* 1995). Fahey *et. al* (1993) showed that the phenolic nature of lignin itself may act as an inhibitor of the enzymes since most phenolics are known to be enzyme inhibitors. Shyama and Muralikrishna (2004) showed that phenolic acids, such as coumaric and ferulic acids, mainly bound to arabinoxylans, in cereals. Results of many experiments indicated that enzyme supplementation of poultry diets improved the nutritional value of cereal grains and their by-products. Improvements in apparent metabolizable energy AME (Bedford *et. al.*, 1998), starch digestibility (Choct and Annison, 1992), and phytate utilization (Simons *et. al* 1990.) due to added enzyme have been reported. Many experiments showed that sulphate esters of phenol could be synthesized in liver and intestinal by sulphotranserase enzyme and consequently phenol is excreted as its sulphate conjugate (Debethizy and Hayes, 1994). Kroon *et. al* (2004) showed that polyphenols are presented in plasma and tissues as conjugated with glucuronate or sulphate. Bartelt and Kirinya (1976) found that liver slices from geese, ducks and chickens contained low uridine diphospho(UDP)glucuronyl transferase and high sulphate conjugation enzyme activities. They also found that activities of UDP- glucuronyl transferase and sulphate conjugation enzymes were higher in the duodenum than the remainder of alimentary tract. Tsujiyama *et. al* (1993) compared alkaline treatment and phenoloxidase (Laccase and Horseradish peroxidase) treatments to cellulase-treated lignin- carbohydrate complex. They found that similar amounts and composition of monosaccharides being released from each treatment. Matuschek *et. al* (2001) found that incubation sorghum with polyphenol oxidase (mushroom tyrosinase) had a reducing effect on the total phenol content.

Ali (2002) found with broiler diet contained 30% wheat bran that sodium sulphate, enzyme preparation, radish extract (as source of

peroxidase enzyme) and enzyme preparation plus radish extract succeeded in improving performance and digestibility of all nutrients. Abaza *et. al* (2004) with local hens found that diets contained 35% wheat bran that addition of sodium sulphate, enzyme preparation, enzyme preparation plus sodium sulphate and enzyme preparation plus radish extract improved feed conversion, egg weight and egg mass.

The objective of this study were to:

1- Evaluate the dilution of laying diets with 50% wheat bran on laying hens productive performance.
2- Determine the effect of sodium sulphate, commercial enzyme (kemzyme), sodium sulphate + commercial enzyme or commercial enzyme + radish extract on laying hens performance fed wheat bran (WB) containing diet.
3- Provide some detailed information on the effect of WB-diet and these additives on some productive and physiological parameter of laying hens.

MATERIALS AND METHODS

The present study was carried out at Bourg EL-Arab Poultry Station, Animal Production Research Institute, Agricultural Research Center, Giza, ARE. A total number of 72 laying hens (Matrouh strain), 32 weeks of age old were used for three month period. Birds were distributed randomly according to their weights into 72 separate layer cages in open system house and both feed and water were provided *ad libitum*. The control diet and experimental diets were formulated to be isonitrogenous but differ in metabolizable energy content. The experimental diets were supplied to meet the requirements of the Agriculture Ministry Decree (1996). Anhydrous sodium sulphate (SS) was supplied by the Egyptian Salt and Mineral Company. Radish extract (RE) was prepared by cutting the root of radish into chips and put the chips into carrotpress and the juice was collected into clean glass cups and then mixed with diet every 28 days. Kemzyme (KE) dry is a commercial enzyme preparation which contains alfa amylase (540u/g), protease (450u/g), beta–glucanase (3000u/g) and cellulase (5000 u/g). The feed additives were added to the diets on the expense of yellow corn. Laying hens were allotted on the following dietary treatments:

1. The control diet (Table 1).
2. WB-diet contained 50% WB.
3. WB-diet + 1.0 % SS.
4. WB-diet +0.1% KE.
5. WB-diet + 1.0 % SS + 0.1% KE.
6. WB-diet + 0.1% KE+ 1.0 %RE

Body weight was recorded monthly for each hen. Also, feed intake (FI) per hen per day, egg number (EN) and egg weight (EW) for each hen were recorded daily to calculate egg mass (EM). Six eggs from six hens from each of the six groups were collected at the end of experimental period to determine egg quality. At the end of the experimental period, three hens from each treatment were randomly taken, fasted for 12 hrs ,weighted, slaughtered and the carcasses eviscerated and then hearts, livers, spleens ,kidneys, abdominal fat, thymus gland, gizzard, stomach, pancreas, small intestine, ovary and oviduct were excised and weighted. Blood samples were taken, centrifuged at 4000 rpm for 15 minutes and the clear serum was separated and stored in deep freezer at – 20° c. Serum cholesterol. LDL,HDL, triglycrids, total lipids calcium and phosphorus were determined using a suitable commercial kits. Samples of liver from each treatment were prepared to determine the cholesterol, LDL, HDL, total lipids and triglycrids according to Zollner and Kirsch, (1962). Liver cholesterol, LDL, HDL, total lipids and triglycrids were determined using a suitable commercial kits. After measuring the egg quality, yolk samples from each treatment were separated from the broken eggs, and extracted to determine cholesterol and total lipids were used to determine HDL according to wavnick et. al., (1983), LDL according to Assmann et al., (1984), total lipids according to Zollner and Kirsch., (1962) according to Folch *et. al* (1957). Yolk cholesterol, LDL, HDL, total lipids and triglycrids were determined using a suitable commercial kits. At the end of feeding trial, three hens from each treated groups were taken randomly and housed individually in metabolic cages to determine the nutrients digestibility coefficients of the experimental diets. Proximate analysis for WB (Table 2), diets and feces were determined according to official methods (A.O.A.C., 1980). Fecal nitrogen was determined by separating method of trichloro acetic acid according to Jakobsen *et. al* (1960). Moreover a sample of radish extract was taken to measure peroxidase activity according to method of Amako *et. al* (1994). The peroxidase activity of radish extract is expressed in a unit / milligram protein (Peroxidase activity = 0.01794 u/mg protein). A measure of ration density was determined for control and basal diets by measuring weight to volume in graduated cylinder. The caloric value of feed and excreta was determined in a standard adiabatic bomb. The statistical analysis was computed using analysis of variance procedure and the significant mean differences among treatment

means were separated by Duncan's Multiple Range test, the procedure described in the SAS, (SAS, 1990).

RESULTS AND DISCUSSION

Laying Hen Productive Performance:

As shown in Table (3) there were no significant differences between treatments in egg number (EN), egg weight (EW) or egg mass (EM). The hens fed WB-diet recorded value (41.75 egg) was lower by 5.45% compared to hens fed the control diet. Vilarino *et. al* (1996) found that dilution the laying diet with 45% WB did not affect laying rates but significantly decrease the average egg weight. In this respect Sutton *et. al* (1981) found that when they used 56.82% WB in the quail diet, the birds consumed lower levels of energy and produced lower egg production than control diet. On the other hand, Abaza *et. al* (2004) found the dilution the local hens diets with 35% WB did not affect either egg number or egg weight. The addition of SS to WB diet numerically increased egg number and egg mass by 10.17 and 10.56 %, respectively compared to hen fed WB-diet alone. Konishi-Inamura *et. al* (1991) found that with human, sulfation of phenolic compound generally led to inactivation. Ali (2002) found that the addition of 1% SS to broiler diets contained 30% WB significantly increased body weight. Abaza *et. al* (2004) found that addition of 1% SS to hens diet contained 35% wheat bran numerically increased EN, EW, and EM compared to WB-diet alone. It was surprise that the addition of KE enzyme alone decreased egg number and egg mass. These results agree with the results obtained by Patterson *et. al* (1988) who found that when they used 89% wheat middling (bran and wheat flour middlings), the addition of cellulase enzyme decreased egg production compared to hens fed diets without enzyme. Shyama and Muralikrishna (2004) showed that phenolic acid such as coumaric and ferulic acids mainly bound to arabinoxylans in cereals. The phenolic compound may be inhibit exogenous enzyme (KE) and the enzyme can not recognize the substrate like cellulose, hemicellulose, starch...etc. Fahey *et. al* (1993) showed that the degrading enzymes may not recognize lignin - hemicellulose complexes as substrates and thus are unable to degrade them or the phenolic nature of lignin itself may act as an inhibitor of the enzymes since most phenolics are known to be enzyme inhibitors. On the other hand Gleaves and Dewan (1970) found that the fungal enzyme fed with both corn and milo increased livability, egg production and body weight gain of hens. The addition of KE plus SS numerically decreased EW and EM compared to hens fed WB diet alone while Abaza *et. al* (2004) found with diet contained 35% WB, that addition of

SS or KE increase EW and EM. These differences may be due to differences between levels of wheat bran in two experiments. The addition of KE plus RE numerically increase EN, EW and EM compared to hens fed WB diet alone. These results agree with those obtained by Ali (2002) and Abaza *et. al* (2004) who found that addition of RE to commercial enzyme improved productive performance compared to enzyme alone. The RE may be detoxification of phenolic compound or other enzyme inhibitors and consequently increase the exogenous enzyme activity. However, peroxidases can promote a large number of separate reactions and are able to catalyse peroxidatice and oxidative reactions through the involvement of free radicals (Robinson, 1991).WB-diet significantly decreased feed itake compared to the control diet. Decreasing feed intake in WB-diet may be due to decreasing its density compared to the control diet (0.76 VS 0.45 g/cm^3) and consequently feed intake decreased due to the physical limitation. These results disagree with those obtained by Vilarino *et. al* (1996) who found that dilution the laying diet with 45% WB significantly increased feed intake per hen, they also found that by volume the average daily feed intake of a hen was (279 ml/hen/day) while in this experiment was (246.3 ml/hen/day). Also, Weiss and Scott (1979) found that hens fed diet contained 50% WB increased their feed intake compared to hens fed control diet. Addition of SS, KE, or KE plus SS significantly increased feed intake. The addition of RE to KE numerically improved feed conversion compared to hens fed WB-diet alone. These findings agree with Ali (2002) and Abaza *et. al* (2004) who found that the addition of RE to enzyme preparation improved feed conversion and indicated that addition of RE may increase the activity of exogenous enzyme through affecting the phenolic compound presence in WB. In this respect, Kroon *et. al* (1997) found that total phenol in WB was 5 mg/g. The hens fed WB-diet recorded the lowest body weight gain and these results agree with those obtained by Vilarino *et. al* (1996) who found that diluted hen diet by 45% WB was on average 40 to 52% lower than those in the other treatment. The results of this study were similar to those reported in previous work in our laboratory with broiler (Ali 2002), local laying hens (Abaza *et. al* 2004) and we hypothesized that the detrimental effect of inclusion high level of WB can be overcome by suitable combination of commercial enzyme with either SS or RE (as a source of peroxidases enzyme).

Egg Quality :

The effect of treatments on egg quality are shown in Table (4). There were insignificant differences among treatments in egg quality parameters except yolk color. The hens fed the control diet recorded the highest value.

The decrease yolk color in WB treatments may be due to lower pigments as a result of lower yellow corn in such diets. Hen fed WB diet + KE recorded the lowest value in yolk color score and these results disagree with those obtained by Benabdeljeli and Barkok (1996) who found that Kemzyme supplementation to high barely diets for laying hens did not have any significant effect on yolk color scores. In this respect, Patterson *et. al* (1988) found that addition of 89% wheat middling decreased yolk color score compared to control diet.

Digestibility Coefficient :

The effect of treatments on the nutrients digestibility coefficient and apparent metabolizable energy (AME) are summarized in Table (5). There were significant differences among treatments in digestion coefficient of crude protein. The hens fed the control diet recorded the highest value while those fed WB-diet +KE recorded the lowest value. On the other hand, Pourreza and Classen (2001) found that addition of xylanase enzyme to broiler diet containing 25% WB improved protein digestibility. Also, Ali (2002) found with broiler fed 30% WB that addition of SS or commercial enzyme plus RE significantly increased CP digestion coefficient compared to WB-diet alone. There were significant differences between treatments in crude fiber digestion coefficient. The addition of KE numerically increased the value of digestion coefficient of crude fiber compared to hens fed WB-diet. Abou EL-Wafa (1993) found that enzyme preparation increased digestion coefficient of crude fiber. There were significant differences in digestion coefficient of nitrogen free extract. The hens fed the control diet recorded the highest value. The addition of KE numerically increased digestion coefficient of NFE compared to hens fed WB-diet alone. It was surprisingly that the determined AME value of WB-diet was higher than calculated value. These results agree with those obtained by Abaza *et. al* (2004) who suggested that AME value of wheat bran is higher than that presented in NRC (1994). The classical method of determined the AME value for WB alone is different from when it fed with other nutrients like salt, vitamin, source of protein...etc. In this respect, Andersen *et., al* (1988) reported that bonds in wheat bran are hydrolysed almost instantaneously on contrast with the acidic (pH-2.5) stomach contents of humans. The feed additives used in this experiment did not improve AME value while Abaza *et. al* (2004) showed that the addition of either SS or RE to KE improved AME value and the differences between the two experiments may be due to the level of wheat bran (35%) they used. However, Annison (1992) reported that various commercial enzyme preparations significantly raised the AME

of Australian wheat by 7.2-10.2%.

Carcass Traits :

Effects of dietary treatments on carcass traits are summarized in Table (6). There were insignificant differences among treatments in most of the parameters under study. There were significant differences between treatments in relative pancreas weight percentage. The hens fed WB-diet recorded the highest value while those fed the control diet recorded the lowest value. Ikegami *et. al* (1990) reported a depressive action of non-starch polysaccharides on endogenous enzyme activity causing hypertrophy of the pancreas in rats. There were insignificant differences between treatments in intestine length and hens fed the WB-diet alone recorded the highest value. Many experiments showed that high fiber diet affect the length and weight of gastrointestinal tract (Savory and Gentle 1976; Moss, 1989; Savory; 1992).

Blood Parameters :

The effect of dietary treatments on some blood serum parameters of Matrouh strain at 44 weeks of age is shown in Table (7). The hens fed WB-diet + SS recorded the highest value of total cholesterol while hens fed WB-diet + KE recorded the lowest value. There were insignificant differences between hens fed WB-diet alone and the control diet. These results agree with those obtained by Weiss and Scott (1979) who found that inclusion of 50% WB in the laying hens diets did not affect plasma cholesterol. Also Sutton *et. al* (1981) used 56.82% WB in the quail diet and found no significant differences in serum cholesterol and suggested that serum and tissue cholesterol levels were inversely related to the number of eggs laid per hen per day. The addition of KE to WB-diet significantly decreased cholesterol level compared to hens fed control diet or WB-diet. These results disagree with Pettersson and Aman (1992) who found with oat bran based diet that the enzyme supplementation increased serum cholesterol concentrations. Analysis of variance for LDL indicated that differences among the experimental treatments were significant. The addition of KE + RE to WB-diet significantly decrease the level LDL in serum compared to hens fed the control diet and the same trend in values of HDL. Analysis of variance for serum total lipid indicated that the differences among the experimental treatments were significant. Also, in this parameter the hens fed WB-diet + KE + RE recorded the lowest value and significantly different compared to any other treatment. The radish contains large quantities of glucosinolates (Reddy and Hayes 1994). The common names

of some important glucosinolates include sinigrin, progoitrin and epiprogaitrin and later resulted in enlargement of thyroid (hyperthyroidism), liver and kidneys (Van Eten and Tookey 1983). The RE may play role in metabolism of lipid and caused the reduction in its level in serum. On the other hand, Rudolf (1992) showed that the increased number of hepatic LDL receptors and decreased plasma LDL can be as a result from hyperthyroidism. Analysis of variance for serum calcium indicated that the differences among the experimental treatments were significant. The hens fed WB-diet recorded value that found to be higher by 79% compared to hens fed the control diet. This finding agree with those reported in previous work in our laboratory (Abaza *et. al* 2004) who found that hens fed 35% wheat bran recorded value of serum calcium was found to higher by 22.62% compared to hens fed control diet. These findings can be explained by the effect of endogenous phytase in WB-diet. However, Ballam *et. al* (1984) showed that phytate hydrolysis by chicks fed a diet containing wheat bran was greater than that of those fed the corn-soybean meal basal diet. The addition of KE significantly decreases the serum calcium level. The KE contains protease which may be degrading endogenous phytase in WB. Ralf and Ines (2003) suggested that proteases (invitro) breakdown the phytate-degrading enzyme. The addition of RE + KE to WB-diet increase serum calcium by 114.8% compared to control diet. Since the peroxidase is a ligninolytic enzyme (Monties 1994), The peroxidase may increases the activity of both WB phytase and exogenous KE and then increase liberation of calcium from fiber matrix. Ismail-Beigi *et. al* (1977) showed that the fiber sources themselves may reduce trace mineral availability by binding the mineral to the fiber matrix. Analysis of variance for serum phosphorus indicated that the differences among the experimental treatments were significant. The hens fed WB-diet increased phosphorus serum by 60.38% compared to hens fed control diet. However, Cavalcanti and Behnke (2004) showed that the WB can be utilized as a viable source of phytases and lowering the need for sources of inorganic P. Also, Juanpere *et. al* (2005) found with wheat –based diet that high values of total phosphorus retention and indicating that this effect may be due to its endogenous phytase activity. The addition of KE+RE to WB-diet significantly increased phosphorus level by 64.32% compared to hens fed WB-diet alone and this may be due to effect of endogenous phytase, KE and RE on liberation of phosphorus. Zyla *et.al* (1995) found that a cocktail of phytate-hydrolysing and cell wall-degrading enzymes was able to completely dephosphorylate corn-soybean meal diets under simulated *invitro* intestinal conditions of the turkey. Further research is needed to elucidate the interactions between peroxidase enzyme and phytase enzyme.

Liver Parameters :

The effect of dietary treatments on liver parameters are shown in Table (8).Analysis of variance for liver cholesterol indicated that the differences among the experimental treatments were significant. However Sutton *et. al* (1981) found when they used 56.82% WB in the quail diet, the wheat bran increased liver cholesterol as a result of decreasing egg production. The hens fed WB-diet + SS recorded the highest value. These results disagree with Nockels (1973) who found that adding 1% sulphate to hens diet resulted in reducing muscle and liver cholesterol. The hens fed WB-diet + RE recorded the lowest value and this may be due to glucosinolates in radish extract. The same trend was found in LDL and HDL values.

Yolk Parameters :

The effect of dietary treatments on yolk parameters are shown in Table (9). Analysis of variance for yolk cholesterol indicated that the differences among the experimental treatments were significant. The hens fed WB-diet recorded the value of yolk cholesterol was found to be lower by 19.49% compared to hens fed the control diet. However, Weiss and Scott (1979) found that inclusion of 50% WB numerically decreased yolk cholesterol. On the other hand, Sutton *et al* (1981) found that inclusion of 56.82% WB in the quail diets did not alter the yolk cholesterol. It was surprised that hens fed WB-diet + RE recorded values higher than that was expected. The addition of RE decreased the level of cholesterol in both serum and liver but not alter yolk cholesterol. However, Hargis (1988) suggested that egg yolk cholesterol shows little or no variation in response to genetic, pharmacological, or dietary manipulation. It has been hypothesized that the relative resistance of egg composition to alteration by diet or through genetic selection may reflect nutritional and structural requirements for embryonic development (Kuksis, 1992). There were insignificant differences between LDL values of dietary treatment. The addition of SS or SS + KE to WB-diet numerically increased value of LDL compared to hens fed WB-diet alone.

Nockels (1973) showed that addition of sulphate to hen ration in the presence of adequate endogenous ascorbate may be enhance cholesterol mobilization from tissue such as muscle and promoted its excretion into egg. Analysis of variance for HDL indicated that the differences among the experimental treatments were significant . The hens fed WB-diet recorded value was found to be significantly lower than hens fed control diet.

In general, WB-diet succeeded in decreasing yolk cholesterol by 19.49% and numerically decreased LDL and this decreasing will be beneficial to the consumer.

CONCLUSION

Results indicated that using high level of wheat bran (50%) in Matrouh laying hens decreased numerically egg production and addition of Kemzyme alone failed to improve the productive performance. Addition of sodium sulphate or radish extract + kemzyme increased egg production and egg mass. WB- diets increased level of calcium and phosphorus in serum and reduced yolk cholesterol compared to control diet . Further studies are needed to determine the optimum level of sodium sulphate and radish extract at different levels of another high fiber ingredients such as rice bran, sunflower meal, canola meal...etc.

Table (1): Composition and calculated analysis of the control and basal diets WB-diet.

Ingredients %	Control diet	WB diet
Yellow corn	63.50	25.66
Soybean meal (44%)	24.57	14.80
Wheat bran	2.00	50.00
Lime stone	7.77	8.04
Premix*	0.30	0.30
Salt	0.30	0.30
Di calcium phosphate	1.50	0.85
DL methionine	0.06	0.05
Total	100	100
Calculated analysis**		
CP%	16.00	16.015
Kcal ME /kg	2703.34	1841.47
Crude fiber%	3.47	7.16
Crude fat %	2.86	3.196
Calcium %	3.32	3.301
Available phophorus %	0.406	0.402
Lysine %	0.889	0.822
Methionine %	0.350	0.320
Methionine + Cystine	0.620	0.646
Sodium	0.135	0.150

* Premix contain per 3kg vit A 10 000 000, vit D3 2000 000 IU, vit E 10000mg, Vit K3 1000mg , vit B1 1000mg, vit B2 5000mg, vit B6 1500mg, vit B12 10mg, pantothenic acid 10000mg, Niacin 30000mg, Biotin 50mg, Folic acid 1000mg, Choline 250gm, Selenium 100mg, Copper 4000mg, Iron 30000mg, Manganess 60000mg, Zinc 50000mg, Iodine 1000mg, Cobalt 100mg and $CaCO_3$ to 3000g

** According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (2): Approximate analysis of wheat bran (WB) %.

Moisture	CP	CF	EE	Ash	NFE
9.27	15.89	8.90	4.87	5.44	55.63

Table (3): Effect of experimental treatments on productive performance Parameters.

Dietary treatment	EN (hen/3month)	EW (g)	EM* (g)	FI (g/day/hen)	FC**	weight gain
Control	44.16 ±4.74	42.68 ±0.70	1887 ±199.80	126.72[a] ±0.39	7.30 ±1.10	150.8 ±20.6
WB-Diet	41.75 ±3.96	44.03 ±0.62	1846 ±176.90	110.86b ±4.00	6.07 ±6.14	75.41 ±18.19
WB+SS	46.00 ±5.17	43.67 ±0.72	2041 ±239.64	120.89[ab] ±4.92	7.08 ±1.44	100.00 ±44.94
WB+KE	37.33 ±4.48	43.30 ±0.49	1612 ±190.21	120.70[ab] ±4.64	7.45 ±0.76	81.11 ±30.11
WB+KE+SS	41.00 ±3.34	42.95 ±0.59	1776 ±165.95	115.85[ab] ±4.96	6.42 ±0.63	132.27 ±30.38
WB+KE+RE	42.66 ±3.86	44.40 ±0.54	1905 ±178.75	110.45[b] ±4.73	5.97 ±0.69	82.08 ±15.23

[a-b] Means in the same column with different letters, differ significantly ($P \leq 0.05$). Means ± standard error

EN: egg number

EW: egg weight

EM: egg mass

FI : feed intake

*EM = average egg weight X egg number

**Feed conversion (FC) = feed intake (g)/egg mass (g)

Table (4): Effect of dietary treatments on egg quality of Matrouh strain at 44 weeks of age.

Parameters	Treatments					
	Control	WB-Diet	WB+SS	WB+KE	WB+KE+SS	WB+KE+RE
Egg length (cm)	4.98 ±0.11	4.80 ±0.07	4.91 ±0.07	5.03 ±0.12	5.10 ±0.10	5.24 ±0.11
Egg breadth (cm)	3.24 ±0.11	3.42 ±0.02	3.48 ±0.07	3.43 ±0.03	3.48 ±0.03	3.52 ±0.02
Yolk height (mm)	16.84 ±0.52	17.22 ±0.27	17.10 ±0.36	16.50 ±0.30	16.78 ±0.17	17.36 ±0.40
Albumin height (mm)	5.04 ±0.36	5.42 ±0.29	5.20 ±0.26	5.65 ±0.35	6.04 ±0.16	6.26 ±0.21
Shell weight (g)	6.56 ±0.27	6.67 ±0.38	6.65 ±0.22	6.73 ±0.17	6.08 ±0.12	6.72 ±0.34
Shell thickness (mm)	0.352 ±0.004	0.345 ±0.002	0.318 ±0.009	0.320 ±0.005	0.324 ±0.002	0.320 ±0.007
Yolk width (cm)	3.28 ±0.08	3.45 ±0.06	3.65 ±0.05	3.60 ±0.10	3.62 ±0.03	3.66 ±0.03
Yolk color	7.80^{a} ±0.37	6.50^{abc} ±0.28	6.16^{bc} ±0.30	5.33^{c} ±0.33	7.00^{ab} ±0.44	6.80^{abc} ±0.73
Yolk weight (g)	16.54 ±0.81	16.07 ±0.43	16.56 ±1.32	16.00 ±0.90	15.26 ±0.77	16.08 ±0.67
Yolk weight (%)	36.84 ±2.01	34.65 ±0.82	35.21 ±1.95	33.58 ±0.31	32.64 ±0.52	32.48 ±1.32
Albumin weight (%)	48.59 ±1.94	50.97 ±1.44	50.33 ±1.11	52.56 ±0.86	54.27 ±0.44	53.93 ±1.87
Shell weight (%)	14.57 ±0.20	14.37 ±0.68	14.10 ±0.59	14.07 ±0.38	13.07 ±0.40	13.58 ±0.71
Shape Index (%)	65.24 ±2.98	71.35 ±2.52	70.86 ±1.07	68.26 ±1.29	68.33 ±1.39	67.30 ±1.56
Haugh unit (%)	78.20 ±1.65	76.25 ±2.09	74.80 ±2.00	79.33 ±1.66	79.60 ±2.22	80.66 ±1.45

[a-c] Means in the same raw with different letters, differ significantly ($P \leq 0.05$). Means ± standard error.

Table (5): Effect of dietary treatments on digestibility coefficients and apparent metabolizable energy.

Dietary Treatment	Digestion coefficients %				
	CP	EE	CF	NFE	AME* (Kcal/Kg)
Control	91.71[a] ±0.45	77.99 ±0.60	14.86[c] ±0.33	77.92[a] ±1.26	2875[a] ±139.30
Diet WB	87.92[ab] ±2.30	78.35 ±1.36	35.81[a] ±1.31	66.63[bc] ±2.14	2888[a] ±86.11
WB + SS	81.36[b] ±3.25	74.89 ±1.73	26.69[ab] ±1.58	58.81[c] ±2.84	2533[b] ±120.01
WB + KE	82.00[b] ±1.43	78.02 ±1.42	39.52[a] ±1.68	73.25[ab] ±1.19	2864[a] ±89.87
WB + KE + SS	87.17[ab] ±1.58	75.19 ±1.18	36.07[a] ±0.50	70.57[ab] ±1.30	2830[a] ±33.20
WB + KE + RE	85.95[ab] ±0.17	71.98 ±1.80	31.85[a] ±4.97	67.69[b] ±2.78	2846[a] ±52.56

[a-c] Means in the same column with different letters. differ significantly ($P \leq 0.05$).
Means ± standard error
*On DM basis

Table (6): Effect of dietary treatments on carcass characteristics of Matrouh strain hens of 44 week of age.

Parameters	Treatments					
	Control	WB-Diet	WB+SS	WB+KE	WB+KE+SS	WB+KE+RE
Dressed (%)	92.00 ±0.62	93.88 ±3.04	90.88 ±1.94	91.58 ±2.72	91.00 ±2.08	87.58 ±2.66
Heart (%)	0.42 ±0.02	0.34 ±0.01	0.40 ±0.05	0.46 ±0.05	0.45 ±0.04	0.40 ±0.05
Liver (%)	1.91 ±0.13	2.50 ±0.35	1.93 ±0.22	1.90 ±0.10	2.60 ±0.13	2.31 ±0.35
Spleen (%)	0.13 ±0.02	0.17 ±0.005	0.13 ±0.02	0.18 ±0.002	0.12 ±0.02	0.19 ±0.06
Kidney (%)	0.26 ±0.03	0.29 ±0.03	0.21 ±0.07	0.21 ±0.03	0.30 ±0.02	0.12 ±0.04
Abdominal fat (%)	3.28 ±1.15	4.18 ±1.44	3.48 ±1.24	3.68 ±1.84	2.30 ±0.78	2.89 ±1.15
Ovary (%)	2.24 ±0.20	2.48 ±0.14	2.04 ±0.18	2.64 ±0.08	2.67 ±0.30	2.01 ±0.09
Oviduct (%)	5.07 ±0.26	6.44 ±0.41	5.39 ±0.10	5.29 ±0.26	5.09 ±1.01	5.02 ±0.24
Thymus (%)	0.10 ±0.02	0.11 ±0.02	0.10 ±0.02	0.09 ±0.00	0.12 ±0.02	0.14 ±0.03
Gizzard (%)	1.90 ±0.20	1.91 ±0.20	1.79 ±0.25	1.78 ±0.09	1.75 ±0.12	1.66 ±0.07
Proventriculus (%)	0.53 ±0.03	0.57 ±0.08	0.46 ±0.07	0.46 ±0.05	0.63 ±0.04	0.49 ±0.09
Pancreas (%)	0.16^{b} ±0.002	0.28^{a} ±0.02	0.21^{ab} ±0.02	0.21^{ab} ±0.03	0.27^{a} ±0.04	0.20^{ab} ±0.02
Intestine length (m)	1.39 ±0.09	1.45 ±0.07	1.34 ±0.02	1.31 ±0.04	1.38 ±0.01	1.34 ±0.06

^{a,b} Means in the same raw with different letters, differ significantly ($P \leq 0.05$).
Means ± standard error.

Table (7): Effect of dietary treatments on some blood serum parameters of Matrouh strain at 44 weeks of age.

Parameters	Treatments					
	Control	Diet WB	WB+SS	WB+KE	WB+KE+SS	WB+KE+RE
Cholesterol (mg / dl)	125.17^{a} ±7.86	119.33^{a} ±5.76	126.20^{a} ±13.04	90.26^{b} ±4.89	117.27^{a} ±10.96	91.22^{b} ±4.77
LDL (mg/dl)	84.02^{a} ±7.07	79.16^{ab} ±8.16	84.45^{a} ±8.52	60.13^{b} ±5.03	88.24^{a} ±2.06	61.67^{b} ±4.08
HDL (mg/dl)	41.15^{a} ±3.31	40.17^{a} ±2.41	41.75^{a} ±3.51	30.13^{b} ±2.69	29.03^{b} ±4.89	29.55^{b} ±0.72
Total lipids (g /l)	16.31^{ab} ±1.06	13.70^{b} ±2.00	17.00^{ab} ±0.64	14.75^{ab} ±0.99	18.60^{a} ±1.36	9.17^{c} ±1.37
Triglycrids (mg /dl)	515.50^{a} ±16.20	456.83^{b} ±8.05	516.19^{a} ±8.32	372.60^{c} ±3.79	493.33^{ab} ±22.26	329.18^{d} ±15.84
Calcium (mg /dl)	7.16^{d} ±0.87	12.82^{ab} ±0.64	12.14^{b} ±0.89	8.19^{cd} ±0.42	10.38^{bc} ±0.82	15.38^{a} ±0.29
Phosphorus (mg /dl)	4.62^{c} ±0.69	7.41^{b} ±0.70	7.53^{b} ±0.68	4.74^{c} ±0.27	7.99^{b} ±0.54	12.17^{a} ±0.13

$^{a-d}$ Means in the same column with different letters, differ significantly ($P \leq 0.05$).
Means ± standard error.

Table (8): Effect of dietary treatments on some liver parameters of Matrouh strain at 44 weeks of age.

Parameters	Treatments					
	Control	Diet WB	WB+SS	WB+KE	WB+KE+SS	WB+KE+RE
Cholesterol (mg / dl)	156.72^{ab} ±8.68	148.20^{ab} ±10.11	180.18^{a} ±5.09	123.05^{c} ±1.61	138.17^{bc} ±1.99	116.75^{c} ±12.17
LDL (mg/dl)	103.64^{ab} ±5.15	100.09^{ab} ±7.29	117.48^{a} ±6.41	82.44^{b} ±13.20	91.27^{ab} ±1.84	78.50^{b} ±6.04
HDL (mg/dl)	53.08^{ab} ±4.17	48.11^{abc} ±7.96	62.70^{a} ±6.47	40.61^{bc} ±7.38	46.90^{abc} ±0.15	38.25^{bc} ±2.41
Total lipids (g /l)	267.18^{ab} ±6.48	251.25^{bc} ±5.96	278.27^{a} ±1.27	219.18^{d} ±10.13	238.18^{cd} ±3.93	195.91^{e} ±8.08
Triglycrids (mg /dl)	502.07^{a} ±22.52	436.11^{b} ±8.41	503.08^{a} ±13.59	473.55^{ab} ±7.23	486.16^{a} ±11.01	439.58^{b} ±7.22

$^{a-e}$ Means in the same column with different letters. differ significantly ($P \leq 0.05$).
Means ± standard error.

Table (9): Effect of dietary treatments on some yolk parameters of Matrouh strain at 44 weeks of age.

Parameters	Treatments					
	Control	Diet WB	WB+SS	WB+KE	WB+KE+SS	WB+KE+RE
Cholesterol (mg / dl)	17.39^{a} ±0.71	14.00^{b} ±0.29	17.35^{a} ±1.56	15.76^{ab} ±0.40	18.07^{a} ±1.21	17.37^{a} ±0.02
LDL (mg/dl)	10.46 ±0.51	9.68 ±0.24	11.39 ±0.90	10.51 ±1.05	13.78 ±1.97	12.40 ±0.20
HDL (mg/dl)	6.93^{a} ±0.38	4.32^{b} ±0.17	5.96^{a} ±0.39	5.25^{ab} ±0.71	4.29^{b} ±0.11	4.97^{ab} ±0.13
Total lipids (g /l)	320.07^{abc} ±15.26	351.06^{a} ±27.99	339.19^{ab} ±10.48	266.11^{c} ±19.71	311.90^{abc} ±16.92	281.70^{bc} ±15.44
Triglycrids (mg /dl)	277.05 ±6.24	253.27 ±31.28	283.92 ±7.22	250.00 ±7.23	281.80 ±14.22	239.11 ±5.75

$^{a-c}$ Means in the same column with different letters, differ significantly ($P \leq 0.05$). Means ± standard error

REFERENCE

Abaza, M. I.; Ali, N. M.; and Hassan, S. M. (2004). *Nutritional and physiological studies on improving the utilization of wheat bran in laying hen diets .Egypt. Poult. Sci. vol 24(4):1015-1031*

Abou El-Wafa, S. (1993). *Influence of enzyme preparation and growth promoters on broiler performance. Ph.D. Thesis, University of Cairo.*

Agriculture Ministry Decree (1996). *The standard properties for ingredients, feed additives and feed manufactured for animal and poultry. EL Wakaee EL-Masria, No. 192 (1997) P 95 Amirria Press Cairo, Egypt.*

Ali, M.N (2002). *Improvement the utilization of some feed ingredients with high contenets of fiber in poultry diets. Ph.D. Thesis, Fac. Of Agric., Ain Shams Univ, Egypt.*

Amako, A.; Ghen, G.X.; and Asada, K. (1994). *Separate assays specific for the ascorpate peroxidase and guaiacol peroxidase and for the chloroplastic cytosolic isozyme of ascorbate peroxidase in plants. Plant cell Phsiol., 53:497-507.*

Andersen, J. R.; Bukhave K.; Rasmussen,H. S.; Hermansen, N.; Worning H., and Krag, E. (1988). *Decomposition of wheat bran and isphagula husk in the stomach and small intestine of healthy men. J. Nutr 118 326-331.*

Annison, G. (1992). *Commercial enzyme supplementation of wheat-based diets raises ileal glycanase activities and improves apparent metabolisable energy, starch and pentosan digestibilities in broiler chickens. Animal feed science and technology 38, 105-121.*

Annison, G. (1995). *Feed enzymes– the science, future developments and practical aspects in feed formulation. Proceedings of 10th European Symposium on Poultry Nutrition, Antalya, turkey, pp. 193-201.*

Annison,G.; Moughan, P.J.; and Thomas, D.V. (1995). *Nutritive Activity of soluble rice bran arabinoxylanase in broiler diets. Br. Poult. Sci., 36:479-488.*

Assmann, G; jabs. H.V.; Kohnert, V.; Nolte, W.; and Schriewer, H. (1984). *LDL- cholesterol polyvimyl sulphate method. (Kit of LDL). Clin. Chem. acta., Ao: 77- 83.*

Association of official analytical chemists A.O.A.C. (1980). *Official Methods of Analysis 13th ED., Puplished by the A.O.A.C. Washington, D.C.*

Ballam, G.C.; Nelson, N.S. and Kirby ,L.K. (1984). *Effect of fiber and phytate source and calcium and phosphorus level on phytate hydrolysis in the chick. Poult. Sci., 63: 333-338.*

Bartelt, A. L.; and Kirinya L. M. (1976). *Activities of mixed function oxidases, UDP-glucuronyl transferase and sulphate conjugation enzymes in galliformes and anserformes. Q. J. Exp. Physiol Congn. Med. Sci. Apr., 61 (2): 105-119.*

Bedford, M.R.; Scott, T.A.; Silverside, F.G.; Classen, H.L.; Swift, M.L.; and Pack, M. (1998). *The effect of wheat cultivar, growing environment and enzyme supplementation on digestibility of amino Acids by broilers. Can. J. Anim.Sci., 78 : 335-342.*

Benabdeljeli, k.; and Barkok, A. (1996). *Influence of enzyme Supplementation of barley diets on laying hens performance and egg quality. Egypt. J. Anim .Prod. 33 (2): 163 –174.*

Cavalcanti, B. W. and Behnke, C. K. (2004). *Effect of wheat bran phytase subjected to different conditioning temperatures on phosphorus utilization by broiler chicks based on body weight and toe ash measurements. International Journal* of Poultry Science 3:215-219

Choct, M.; and Annison, G. (1992). *The inhibition of nutrient digestion by wheat pentosans . Br. J.Nutr., 67: 123-132.*

Debethizy, J.D.; and Hayes J.R. (1994). *Metabolism: A determinant of toxicity principles and methods of toxicology. Third Edition, edited by A. Wallace Hayes. Roven press, LTD. New York p. 59-100.*

Fahey, G.S.; Bourquin, L.D.; Titgemeyer ,E.C.; and Atweel, D.G. (1993). *Post-harvest treatments of fibrous feedstuffs to improve their nutritive value. Forage cell wall structure and digestibility p 715-766. ASA-CSSA-SSSA, 677, S. Segoe Rd., Madison, WI. 53711, USA science press, Utrecht.*

Feed Composition Tables For Animal and Poultry Feedstuffs Used In Egypt (2001). *Technical bulletin No.1, central lab for Feed and food; ministry of Agriculture, Egypt.*

Folch, J.M.; Lees, M.; and Solve Stanley G.H. (1957). *A Simple method for the Isolation and purification of total lipids from animal tissues. Clinical chemistry (3).*

Gleaves, E.W.; and Dewan S. (1970). *Influence of a fungal-enzyme in corn and milo layer rations. Poult. Sci., 49: 596-599.*

Hargis, P.S. (1988). *Modifying egg yolk cholesterol in the domestic fowl-A review. Worlds Poult.Sci.J. 44:15-29*

Ikegami, S.; Tsuchikaski, F.; Harada, H.; Tsuchikaski, N.; Nishide, E.; and Innami, S. (1990). *Effect of viscous indigestible polysacchaides on pancreatic-biliary secretion and digestive organs in rats. J. Nutr.120:353-360*

Ismail-Beigi, F.; Faradji, B.; and Reinhold, J.G. (1977). *Binding of zinc and iron to wheat breed, Wheat bran and their components. Amer. J. Clin. Nutr. 30 : 1721-1725.*

Jakobsen, B.E.; Grertov, K.; and Nielsen S. H. (1960). *Fordojeligheds forag med fjerkrae "Digestibility trials with poultry" 322 bereting fraforsogs laboratories.*

Juanpere, J.; Perez-Vendrell, M. A.; Angulo, E. and Brufau; J. (2005). *Assessment of potential interactions between phytase and glycosidase enzyme supplementation on nutrient digestibility in broilers. Poult. Sci. 84:571-580.*

Konishi-Imamura, L; Kim, H. D.; and Kobashi, K. (1991). *Effect of enzymatic sulphation on biochemical and pharmacological properties of catecholamines and tyrosine-containing peptides. Chem. Pharm. Bull. (tokoy). No; 39 (11): 2994-2998.*

Kroon P. A.; Faulds,C.B.; Ryden ,P.; Robertson ,J.A.; and Williamson, G. (1997). Release of covalently bound ferulic acid from fiber in the human colon. J. Agric. Food Chem. 1997; 45:661-667.

Kroon, P. A; Clifford, M. N;Crozier, A., Day A. J, Donovan, L.J., Manach, C.; and Williamson, G. (2004). *How should we assess the effects of exposure to dietary polyphenols invitro. American Journal of Clinical Nutrition, vol. 80, No. 1, 15-21*

Kuksis, A. (1992). Yolk lipids. Biochim. Biophys.Acta 1124:205-222

Matuschek, E.; Towo, E.; and Svanberg, U. (2001). *Oxidation of polyphenols in phytate-reduced high-tannin cereals: Effect on different phenolic groups and on in vitro accessible iron. J. Agric. Food Chem. 49:5630-5638*

Monties, B. (1994). *Chemical assessment of lignin biodegraddation some qualitative and quantitative aspects. Federation of European Microbiological Societies, 1994 V. 13 (2/3) p. 277-283.*

Moss, R. (1989). Gut size and the digestion of fibrous diets by tetraonid birds. J. Experimental Zoology 3 Suppl., 61-65

National Research Council (1994). *Composition of poultry feeding Stuffs Nat. Acad. Sci. Washington D.C.*

Nockels, F. C. (1973). *The influence of feeding ascorbic acid and sulphate on egg production and on cholesterol content of certain tissues of the hen. Poult. Sci. ,52:373-378.*

Patterson, H. P.; Sunde, M. L.; Schieber, E. M.; and White, W. B. (1988) *Wheat middlings as an alternate feedstuff for laying hens Poult. sci.67:1329-1337.*

Pattersson, P.; and Aman, P. (1992). *Production responses and serum lipid concentration of broiler chickens fed diets based on oat bran and extracted oat bran with and without enzyme supplementation. Journal of the Science of Food and Agriculture 58: 569-576.*

Picard, M.; Sauveur, B.; Fenardji, F.; Angulo, I; and Mongin, P.(1993). *Adjustements techico-economiques possibles de l"alimentation des volailles dans les payes chauds. INRA Productions Animales, 6(2): 87-103.*

Pourreza, J. ; and Classen, L.H.(2001). *Effects of supplemental phytase and xylanase on phytate phosphorus Degradation ,ileal protein and energy digestability of a corn-soybean-wheat bran diets in broiler chicks. J.Agric.Sci. Technol. (2001) vol.3:19-25*

Ralf,G. and Ines, E. (2003). *Determination of the activity of acidic phytate-degrading enzymes in cereal seeds. J.Agric. Chem. 51:847-850*

Reddy C.S. and Hayes, A.W. (1994). *Food-Borne toxicants P 317-360 principles and methods of toxicology third edition. Edited by A. Wallace Hayes. Raven press. Ltd. New York.*

Robinson, D.S. (1991). *Peroxidases and catalases in food p.1-47. Oxidative Enzymes In Foods. Elsevier Science Publishers LTD printed in Northern Ireland by the universities press (Belfast) Ltd.*

Rudolf Clarnburg, (1992). *Lipid metabolism p 292-333. Physiological chemistry of domestic animals. Edited by Robert W. Reinhardt .Printed in the United States of America. Mosby-Year Book, Inc.*

SAS (1990). *SAS Users Guide, Statistics, SAS Institute, Inc, Cary, NC.*

Savory, C.J.; and Gentle, M.J. (1976). *Changes in food intake and gut size in Japanese Quail in Response to manipulation of dietary fiber content. Br. Poultry Sci., 17: 571-580.*

Savory, C. J. (1992). *Gastrointestinal morphology and absorption monosaccharides in fowls conditioned to different types and levels of dietary fibre. Br. J. of Nutrition 67,77-89.*

Shyama, P. R.; and Muralikrishna, G. (2004). *Non-starsh polysaccharide-phenolic acid complexes from native and germinated cereals and millet. Food Chemistry 84: 527-531*

Simons, P.C.M.; Versteegh, H.A.G.; Jongbloed. A.W.; Kemme. P.A.; Slump. P.; Bos., K.D.; Wolters, M.G.E.; Beudeker, R.F.; and

Verschoor, G.J. (1990). *Improvement of phosphorus availability by microbial phytase in broilers and Pigs. Br. J. Nutr., 64: 525-540.*

Sutton, D.C., Muir, M. W.; and Begin, J. J. (1981). *Effect of fiber on cholesterol metabolism in the coturnix quail Poult. Sci. 60:812-817*

Tsujiyama, S. I.; Azuma, J.I.; and Okamura, k. (1993). *Degradation of lignin-carbohydrate complex (LCC) by wood – rotting fungi IV. Enzymic splitting of bondings between hemicellulose and lignin via quinone methide by coriolus versicolor. Mokuzai.Gakkaishi. j. Jaban Wood Research Society.39:1404-1408*

Van Etten, C.H.; and Tookey, H. L. (1983). *Glucosinolates in: Handbook of naturally occurring Food toxicants, edited by M.Rechcigl, jr., P. 15 – 30 CRC press, Boca Raton, FL.*

Vilarino, M.; Picard, M. L.; Melcion, J.P.; and Faure, J. M. (1996). *Behavioral adaptation of laying hens to dilution of diets under mash and Pellet form British poult. Sci. 37:895-907*

Warnck,G.R.; benderson, V.; and Alders, N. (1983). *HDL- cholesterol procedure No. 0599 (K.t of HDL- cholesterol). Selected Method clin. Chen., 10:91- 99.*

Weiss, F. G.; and Scott, M. L. (1979). *Effects of dietary fiber, fat and total energy upon plasma cholesterol and other parameters in chickens. J. Nutr. 1 09:693-701.*

Zollner, N.; and Kirsch, K.; (1962). *Total lipid reagent colorimetric method. (Kit of total lipid). Z. fur die Geesampte EXP. Med., 135: 535- 545.*

Zyla, K.; Ledoux, R. D.; and Veum, L. T. (1995). *Complete enzymic dephosphorylation of maize-soybean meal feed under simulated intestinal conditions of the turkey. J. Agric. Food Chem. 43:288-294.*

الملخص العربي

تأثير تحسين الاستفادة من نخالة القمح على الأداء الانتاجي والفسيولوجي للدجاج البياض المحلي

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استخدم عدد ٧٢ دجاجة بياضة من سلالة مطروح عمر ٣٢ اسبوع لدراسة تأثير استخدام نخالة القمح في علائق الدجاج البياض وكذلك امكانية تحسين القيمة الغذائية لها عن

طريق بعض الاضافات الغذائية. الدجاجات تم اسكانها في اقفاص فردية وتم توزيعها عشوائيا في ٦ معاملات (١٢ طائر في المعاملة). وكانت اوزان الطيور متقاربة.

المعاملة الاولى تم تغذيتها على عليقة قياسية تحتوي على ١٦% بروتين خام و ٢٧٠٣ كيلو كالوري طاقة ممثلة لكل كجم، المعاملة الثانية تم تغذيتها على عليقة قاعدية تحتوي على ٥٠% نخالة قمح وكانت تحتوي على ١٦,٠١% بروتين خام و كذلك ١٨٤١ كيلو كالوري طاقة ممثلة لكل كجم. المعاملات ٣ ، ٤ ، ٥ ، ٦ تم تغذيتها على العليقة القاعدية السابقة مضافا اليها اما ١% كبريتات الصوديوم أو ٠,١% كيمزيم أو٠,١% كيمزيم + ١% كبريتات صوديوم أو ٠,١% كيمزيم+١% مستخلص الفجل على الترتيب واستمرت التجربة لمدة ثلاث شهور.

اوضحت النتائج ما يلي:

- ادت عليقة نخالة القمح الى خفض معنوي في الغذاء المأكول ونقص غير معنوي في انتاج البيض .
- اضافة كبريتات الصوديوم او كيمزيم + خلاصة الفجل ادت الى زيادة عدد البيض وكتلة البيض بالمقارنة بالدجاجات التي تغذت على عليقة نخالة القمح منفردة.
- عليقة نخالة القمح ادت الى زيادة في نسبة الكالسيوم و الفوسفور في سيرم الدم بينما ادت الى نقص مستوى الكوليسترول والليبوبروتين عالي الكثافة (HDL) والليبوبروتين منخفض الكثافة (LDL) فى صفار البيض بالمقارنة بالدجاجات التي تغذت على عليقة قياسية.
- النتائج تدل على أن التأثير السيئ لاضافة ٥٠% نخالة قمح في علائق الدجاج البياض من سلالة مطروح المحلية يمكن التغلب عليها باضافة كبريتات الصوديوم أو كيمزيم + خلاصة الفجل.