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EFFECT OF BARLEY REPLACEMENT AND ENZYME SUPPLEMENTATION ON PERFORMANCE AND EGG QUALITY OF LAYING HENS

By

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Abstract: *A total number of six hundred and thirty 26-weeks old, Commercial Hy-line W-36 hens were randomly assigned into 10 groups, each group contains nine replicate (seven birds per each) to study performance and egg quality of White Hy-line layers as affected by barley replacement at 0, 25 , 50 , 75 and 100 % of yellow corn with or without multi - enzymes (Caplix) supplementation into drinking water by 6 ml / 20 liter . The obtained results could be summarized as follows:*

Multi - enzymes supplementation significantly increased overall mean of hen-day egg production, accumulative egg number, average egg mass and feed consumption however, average egg weight was slightly increased and feed conversion was not improved . Moreover , egg quality measurements did not affected by multi - enzyme supplementation .Hens fed 50 % barley replacement diet had higher (P<0.01) overall mean hen day egg production, cumulative egg number, egg weight, average egg mass , and feed consumption . while the lowest feed consumption was recorded with control diet. Barley replacement had significant effect on egg quality in terms of shell thickness, shell weight and albumen percentage. But, the interaction between multi - enzyme and barley replacement had no significant effect on either hen performance or egg quality. In conclusion, with enzyme supplementation, barley can replace up to 50 % of yallow corn in W-36 laying hen diets without adverse effect on performance and egg quality.

INTRODUCTION

Yellow corn production in Egypt is not adequate to supply poultry feed, so it must depend on the use of imported yellow corn. Barley become a possible alternative grain to be used in poultry feeding, but the use of barley in commercial poultry diets has traditionally been limited. It is now well known that the nutritive value of barely is adversely affected by the presence of certain non-starch polysaccharides (NSP) in its endosperm cell walls. An important feature of the NSP is the mixed linked β-D glucan and arabinoxylans. The most adverse effects of soluble NSPs on nutrient digestion and absorption in monogastric animals, especially in poultry, are due to their ability to increase the viscosity of the digesta (Chcot, 2002), and excretions of sticky droppings (Iji, 1999). Also, NSP caused an increase in intestinal weight through rate of cell proliferation, leading to changes in mucosal structure and function. β-glucans and other NSPs may bind to dietary nutrients as well as reduce nutrients mobility, thereby impairing digestion and absorption (Read, 1987). NSPs can bind to digestive enzymes and so reducing activity and digestion (Ikarda and Kusano, 1983). So the net effects may include altered intestinal transit time, increased endogenous losses of nutrient and change of nutrient digestion and absorption patterns. In experiments to study the effects of commercial enzyme supplementation of barley-based diets, the results indicated that egg production, egg weight and live body weight were not affected by barley level or dietary enzyme supplementation (Benabdeljelil and Arbaoui, 1994; Benabdeljelil and Barkok, 1996) while improved feed efficiency (Benabdeljelil and Arbaoui, 1994; Vukic and Wenk, 1995) and laying rate (Poultry International, 1996). Francesch *et al.* (1995) reported that addition of blend enzyme (xylanase, β–glucananse, pectainase) to basal diet (60% barley and 20% sunflower meal) increased egg weight during the first four weeks. Ciftci *et al.* (2003) reported that there were no significant effect of diets type (wheat or tritical) or enzyme supplementation as well as their interaction on laying rate, egg weight, egg mass and feed efficiency. Mathlouthi *et al.* (2003) reported that multi-enzyme (Quatrazyme HP) had significant improvement in feed conversion ratio but did not affect either egg production, egg weight or egg mass. Also, Akif and Bolat(2003) concluded that there were no significant differences among the groups (60% corn, 30% corn + 30% barley) and enzymes such as betaglucanase (Allzyme BG), xylanase (Allzyme PT) and amylase (Allzyme AB) in terms of feed consumption, egg yield, feed conversion rate during the 135-day trial period. Dipeolu *et al.* (2005) reported that the inclusion of enzyme alone or enzyme alternated with antibiotic (enzyme/antibiotic) in a standered diet for laying birds had the best egg productive performance in terms of egg produced /hen day and feed /Kg egg . This work was carried out to study the effect of barley replacement and enzyme supplementation on laying performance and egg quality.

MATERIALS AND METHODS.

This study was carried out at the Poultry Research Farm, Faculty of Agriculture, South Valley University, Qena. Six hundred and thirty 26-weeks old, Commercial Hy-line W-36 hens were randomly assigned in a 2 x 5 factorial design into ten groups, each group contains nine replicates of seven birds each. Barley replaced yellow corn at 0 , 25, 50 75 and 100 % (Table 1) either without or with multi-enzyme (Caplix) supplementation into drinking water at 6 ml L 20 liters . Caplix enzymes produced by WockHardt Limited, WocHardt Towers, Bandra-Kurla Complex, Bandra (E), Mumbai- 40051, is a blend of xylanase, β-glucanase, cellulase, arbinase, alpha-glucosidase, lipase, amylase, pectinase, and protease and recommended to be used at 6 ml / 20 liter of drinking water.

Birds were kept in wire cage of 61 x 55 x 45 cm in controlled closed system house. Standered commercial management of layers was used throughout the experiment and they were kept at approximately 65% relative humidity and averaged 22 °C temperature, the photo period was 16 hours per day and light intensity ranged from 20 to 25 Lux.

Egg production was recorded during the whole experimental period also, accumulative egg number, egg weight, egg mass , feed consumption and feed conversion ratio were calculated during the whole period .

Egg quality measurements were determined monthly after three months from starting the experiment using 9 eggs per group till the end of the experiment which lasted for 90 days.

The data obtained were analyzed using General Linear Models Procedure of SAS software (SAS institute, version 6.12, 1996). Duncan (1955) was used to detect the differences between groups.

RESULTS AND DISCUSSION

1. Egg production.

1.1. Hen - day egg production.

Results in Table (2) reveal that multi - enzyme supplementation into drinking water significantly increased overall mean of hen-day egg production by 1.71%. These results are in agreement with those of Dipeolu *et al.* (2005) who reported that the inclusion of enzyme in diet for laying hens caused the best hen - day egg production due to the improve in nutrient availability . Barley replacement at 25, 50 and 75 % had insignificant effect on hen - day egg production, while 100 % barley replacement level significantly decreased egg production, compared to the control.

The interaction between enzyme supplementation and barley replacement had not significant effect on overall mean of hen – day egg production.

1.2. Accumulative egg number:

Enzymes supplementation significantly improved overall mean egg number and caused an improve by 4.93 eggs (Table 2) .These results are in agreement with those reported by Nasi (1988), Aimonen and Nasi (1991) and Dipeolu *et al.* (2005) who reported that, a multi-enzyme or commercial multi-enzyme preparation supplementation improved laying performance. This increase may be due to utilization of fibrous material as reported by Brufau *et al.* (1994) and improved digestion as well as absorption of fat, starch and protein (Makled , 1993) by decreasing viscosity of NSP (Bedford and Classen ,1993). Hens fed diets containing 50% and 75% barley replacement instead of yellow corn recorded the highest values of egg number (256.70 and 252.28), respectively , while the lowest value (233.47) of egg number was obtained with 100% barley replacement . These results are in agreement with those of Dunstan (1973) who reported that egg production rate had been affected with barley level. On the other hand, the interaction between barley level and enzyme supplementation had insignificant effect on accumulative egg number.

1.3. Egg weight:

The results in Table (2) reveal that, enzyme supplementation and the interaction between enzyme and barley level had insignificant effect on average egg weight .These results are in agreement with those of Mathlouthi *et al.* (2003) who reported that addition of (Quatrazyme HP) containing xylanase and beta-glucanase to either wheat/barley or maize-based diets and fed to JSA Brown laying hens had no effect on egg weight .On the other hand , barley level had significant effect ($p<0.05$) on average egg weight. The highest value (60.06 g) of egg weight was obtained with diet containing barley and yellow corn (1: 1), while the lowest value (58.66 g) was recorded with 100% barley. The results are in agreement with those of Arscott *et al.* (1962) who reported that no adverse effect have been observed on egg weight when barley replaced an appreciable quantities of yellow corn in laying hen diets .

1.4. Egg mass:

Data in Table (2) reveal that enzyme supplementation into drinking water of Hy-line commercial strain improved the average of egg mass during the whole egg laying period. By 2.53 %. Diets containing 50% barley instead of yellow corn recorded the highest value (15414.58 g) of egg mass while, the lowest value (13711.35 g) of egg mass was recorded with 100% barley. These results are in agreement with those of Vukic and Wenk (1995) who found that enzymes added to barley fed to laying hen had little effect on egg mass. Moreover , Mathlouthi *et al.* (2003) and Cifitci *et al* (2003) came to the same conclusion that added enzyme to barley fed to laying hens had little effect on egg mass. The interaction between enzyme supplementation and barley level had no significant effect on egg mass, compared to the control.

1.5. Feed consumption and conversion ratio

Data in Table (2) show that, enzyme supplementation significantly increased feed consumption while, feed conversion did not significantly affected. The results are similar to those of Lazaro *et al.* (2003) who reported that, there was an increase in feed consumption when added enzymes to layer feed and this improve may be due to reducing viscosity of digesta which improves contact between nutrients and digestive enzymes, as well as reducing retention time within the gut and increasing benefits of enzyme supplementation in laying hen diets.

Data in Table (2) show that feed consumption of laying hens was significantly increased with the increase in barley replacement however, feed conversion was significantly altered by increasing barley level. This findings are similar to those obtained by Choct *et al.* (1999) who reported that daily feed intake was markedly ($P<0.01$) influenced by diet. Also, Choct and Annison (1992) reported with broilers that increasing barley replacement level tend to increase digesta viscosity and lowered feed conversion efficiency.

The interaction between enzyme supplementation and levels of barley replacement had insignificant effect on feed consumption and overall mean of feed conversion efficiency.

2-Egg quality.

2-1-Egg component.

Data presented in Table (3) show that, there was insignificant differences in egg component percentages (egg shell %, yolk % and albumen %) due to enzyme supplementation into drinking water.

Level of barley replacement had significant ($p<0.01$) effect on average egg shell percentage and the highest value (12.69%) was obtained with feeding 100 % barley instead of yellow corn with no significant differences between this group and control. Also, barley level had significant ($p<0.05$) effect on the average of albumen percentage but, did not affect yolk percentage.

In concern to the effect of enzyme supplementation , the results are in agreement with those of Dipeolu *et al.* (2005) who reported that, the inclusion of enzyme either alone or alternated with antibiotic (enzyme/antibiotic) in diet for laying hen had no effect on egg shell and yolk percentage .

The interaction between enzyme and dietary barley level had insignificant effect on the average values of egg shell, yolk and albumen percentages. These results are partially in accordance to those of Igbasan and Guenter, (1997).

2-2-Egg shell thickness:

Results presented in Table (4) show that, shell thickness was significantly decreased with enzymes supplementation.

Data presented in Table (4) show that the lowest value of shell thickness (320.14) was significantly obtained by feeding 75% barley replacement level .However, results of Akif and Bolat (2003) and Ciftci *et al.* (2003) showed that there were no significant effect of either diets type or their interaction with enzyme supplementation on thickness of eggshell.

2-3-Egg shape index.

As shown in Table (4) enzyme supplementation into drinking water significantly decreased egg shape index .However, Dipeolu *et al.* (2005) reported that enzymes had no effect on the formation of egg shape.

Dietary barley levels and their interaction with enzyme supplementation had insignificant effect on overall mean egg shape index .In this connection, results of Ciftci *et al.* (2003) showed that the diet type significantly affected egg shape index while the interaction between diets type and enzyme supplementation did not affect on egg shape index when tritical was used with either maize or wheat.

2-4-Yolk index:

Data of yolk index presented in Table (4) explain that, enzyme addition, dietary barley levels or their interaction had insignificant effect on overall mean of yolk index.

2-5 Haugh-units:

Enzyme supplementation significantly decreased Haugh unit value while, dietary barley levels and the interaction with enzyme supplementation had insignificant effect on such criteria.

Discussion

The addition of enzyme preparations which included β-glucanase activity undoubtedly enhances the nutritive value of barley-based diets for laying hens. However, there are two issues having a bearing on practical value of supplementing diets with enzymes. One is the effect of treatments applied to diets during feed compounding, which could both disrupt the physical structure and affect the stability of supplementary enzymes . The other is the effect of the pH changes and the endogenous enzymes of the digestive tract might have on supplementary enzymes as the feed passes through the avian gut. However, it is still not known, what proportions of the added enzymes remains active after compounding, nor are the proportions of supplementary enzymes remaining active in the different sections of avian gut known. It would appear that the major obstacle to progress in this area lies in the difficulty of reliably measuring the enzyme activities with matrix of diets and digesta.

An abundance of experiments has shown that barley containing β-glucan in diets of chickens can lead to management problems arising from the production of sticky droppings. Many of them have shown that the deleterious effects of barley are ameliorated by supplementation of barley-based diets with multi-enzymes preparation containing β-glucanase activity. Adverse effects on digestion of nutrients and on passage of digesta through the gut have been implicated in the etiology of the problem associated with barley.

Enzymes supplementation might improve bird performance by different mechanism : increasing food intake and improving nutrient digestibility. Both mechanisms might be induced, at least partially, by a reduction of the viscosity within the intestinal tract. Enzymes supplementation reduce intestinal viscosity and decrease retention time of digesta in the gut allowing for greater consumption and therefore improving feed conversion. Also, a reduce viscosity will improve contact between nutrients and digestive enzymes leading to improving digestibility.

In conclusion, the present results have shown, from practical viewpoint, that barley, with enzymes supplementation can replace up to 50% of yellow corn in Hy-line laying diets with significant effect on hen performance.

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

Ingredients(kg/ton)	T1	T2	T3	T4	T5
Yellow corn	613.00	459.75	306.5	153.25	0.00
Barley	0.00	153.25	306.5	459.75	613.00
Soy bean meal (44%CP)	255.00	255.00	255.00	255.00	255.00
Wheat bran	40.00	40.00	40.00	40.00	40.00
Dicalcium phosphate	17.60	17.60	17.60	17.60	17.60
Premix*	3.00	3.00	3.00	3.00	3.00
Lime stone	67.00	67.00	67.00	67.00	67.00
NaCl	4.00	4.00	4.00	4.00	4.00
DL-methionine	0.40	0.40	0.40	0.40	0.40
Total	1000	1000	1000	1000	1000
Calculated analysis ** : ME, kcal/ Kg	2684.80	2570.47	2456.15	2341.82	2227.50
Crude protein , %	17.27	17.66	18.06	18.46	18.86
Crude fiber , %	3.96	4.28	4.61	4.93	5.25
Calcium , %	3.11	3.79	3.69	3.12	3.13
Available phosphours, %	0.54	0.56	0.57	0.59	0.60

Each kilogram contains: Vit. A, 100 IU; Vit. D3 2000 ICU; Vit. E, 10 mg ; Vit. K, 1 mg;Vit. B1, 10 mg; Vit. B2, 5 mg; Vit. B6, 1500 mg; Vit. B12, 10 mg; Pantothenic acid, 10 mg; Nicotinic acid, 30 mg; Folic acid, 1 mg ; Biotin , 50 mg; Choline chloride, 500 mg; Copper, 10 mg; Iron, 50 mg; Manganese, 60 mg; Zinc, 50 mg and Selenium, 0.1 mg .

** According to the NRC (1994) .

Table (2): Effect of barley replacement, enzyme supplementation in drinking water and their interaction on performance of white Hy-Line laying hens.

Items	Hen- day egg production	Egg number	Egg weight g	Egg mass g	Feed consumption g	Feed conversion
Treatments	*	*	NS	*	**	NS
Enzyme	77.14± 0.64^{a}	249.46 ±2.12^{a}	59.34±0.17	14800.96±126.81^{a}	41786.63±262.46^{a}	2.84 ± 0.04
Without	75.43±0.63^{b}	244.53 ±2.03^{b}	59.02±0.15	14435.73 ±136.88^{b}	40667.92±244.07^{b}	2.83 ± 0.03
Diets •	**	**	**	**	**	**
Control(C)	76.98±0.80^{ab}	249.89±2.62^{ab}	59.11±0.28^{b}	14762.90 ±128.87^{b}	39079.56±351.66^{e}	2.65 ± 0.03^{c}
1	74.85±0.86^{b}	242.62±2.73^{b}	59.35±0.28^{b}	14405.16±198.67^{b}	40571.65±204.82^{d}	2.82 ± 0.03^{b}
2	79.31±0.79^{a}	256.70 ±2.56^{a}	60.06± 0.21^{a}	15414.58±137.01^{a}	41334.87±232.00^{c}	2.68 ± 0.03^{c}
3	77.87±0.85^{a}	252.28±2.61^{a}	58.66±0.17^{b}	14797.73 ±147.46^{b}	42081.40±151.10^{b}	2.85 ± 0.02^{b}
4	72.42± 1.01^{c}	233.47±3.35^{c}	58.72±0.21^{b}	13711.35 ±214.75^{c}	43068.91±375.79^{a}	3.16 ± 0.06^{a}
Interactions	NS	NS	NS	NS	NS	NS
Enzyme x C	76.20±1.12	247.40 ±3.77	59.40±0.43	14682.85 ±133.23	39863.06±409.22	2.72 ± 0.05
Enzyme x 1	75.86±1.03	245.60±3.25	60.04± 0.33	14745.92 ±213.63	41111.96±221.06	2.79 ± 0.04
Enzyme x 2	80.19±1.07	259.27±3.29	60.08±0.33	15567.88±121.91	41642.05±326.85	2.68 ± 0.03
Enzyme x 3	80.45± 0.74	260.24 ±2.50	58.71± 0.19	15276.86 ±126.49	42638.10±88.75	2.79 ± 0.02
Enzyme x 4	73.00±1.55	234.77±5.12	58.48±0.30	13731.28 ±311.70	43678.00±709.57	3.20 ± 0.11
Without x C	77.77± 1.15	252.38 ±3.67	58.82±0.35	14842.94 ±226.35	38296.06±452.38	2.60 ± 0.03
Without x 1	73.84±1.36	239.64±3.91	58.66±0.33	14064.40 ±305.10	40031.34±237.59	2.69 ± 0.06
Without x 2	78.43±1.15	254.14 ±3.91	60.05±0.28	15261.27 ±242.98	41027.69±313.58	2.90 ± 0.04
Without x 3	75.29±0.94	244.32±2.63	58.62±0.28	14318.59 ±137.92	41524.70±108.09	3.20 ± 0.04
Without x 4	71.83±1.37	232.16±4.58	58.95±0.31	13691.43 ±314.23	42459.81±62.86	3.11 ± 0.07

C (Control) = 100% yellow corn , 1= 25% barley + 75% corn , 2 = 50% barley +50%corn , 3 = 75% barley + 25% corn , 4 = 100% barley .

Means within each column bearing different letters(s) are significantly different ($p \leq 0.05$) .

Table (3): Effect of barley replacement, enzyme supplementation in drinking water and their interaction on egg quality of White Hy-Line laying hens.

Items	Egg shell %	Yolk %	Albumen %
Treatments	NS	NS	NS
Enzyme	12.02±0.08	26.74±0.12	61.23 ± 0.15
Without	12.27± 0.08	26.87± 0.11	60.86±0.12
Diets •	**	NS	*
Control(C)	12.51±0.11 [a]	26.77±0.17	60.70 ± 0.18 [bc]
1	11.61±0.08 [d]	26.97±0.23	61.42± 0.25 [a]
2	11.84±0.11 [c]	26.88±0.20	61.28± 0.26 [ab]
3	12.08±0.05 [b]	26.73±0.14	61.19±0.15 [abc]
4	12.69± 0.07 [a]	26.69±0.17	60.62± 0.16 [c]
Interactions	NS	NS	NS
Enzyme x C	12.27±0.08	٢٦.٩٠±٠.٦٣	60.83± 0.23
Enzyme x 1	11.43±0.10	26.81±0.57	61.75± 0.36
Enzyme x 2	11.74±0.15	٢٦.٦٩±٠.٦٨	61.56± 0.45
Enzyme x 3	12.00±0.07	٢٦.٥٥±٠.٨٠	61.45± 0.20
Enzyme x 4	12.67±0.09	٢٦.٧٣±٠.٢١	60.59±0.27
Without x C	12..17±0.70	26.62±0.52	60.62±0.28
Without x 1	11.78 ±0.10	27.13±0.14	61.09± 0.34
Without x 2	11.94 ±0.16	27.05±0.54	61.0± 0.27
Without x 3	12.16 ±0.10	26.95±0.60	60.94± 0.21
Without x 4	12.71±0.12	26.65±0.62	60.64 ±0.20

C (Control) = 100% yellow corn , 1= 25% barley + 75% corn , 2 = 50% barley +50%corn , 3 =
75% barley + 25% corn , 4 = 100% barley .
Means within each column bearing different letters(s) are significantly different ($p \leq 0.05$) .

Table (4): Effect of barley replacement , enzyme supplementation in drinking water and their interaction on shell thickness , egg shape index, yolk index and Haugh unit score of White Hy-Line laying hens .

Items	Shell thickness,mm	Egg shape index	Yolk index	Haugh unit
Treatments	**	*	NS	*
Enzyme	324.66±1.44 [b]	77.00±0.19 [b]	40.60±0.21	77.65±0.76 [b]
Without	341.25±2.12 [a]	77.66±0.16 [a]	40.66±0.20	80.06±0.76 [a]
Diets *	**	NS	NS	NS
Control(C)	338.96± 3.77[a]	77.21±0.33	40.14±0.38	78.94±1.83
1	336.36±2.72 [a]	76.82±0.28	40.86±0.33	77.81±1.28
2	332.85±2.60 [a]	77.11±0.29	40.80±0.26	77.58±0.82
3	320.45±3.21 [b]	77.70±0.28	40.79±0.29	80.27±0.85
4	336.14±3.38 [a]	77.82±0.23	40.57±0.33	79.65±1.09
Interactions	NS	NS	NS	NS
Enzyme x C	325.70±2.86	76.62±0.38	39.85±0.50	72.60±1.47
Enzyme x 1	329.53±4.08	76.28±0.40	40.89±0.60	78.00±1.82
Enzyme x 2	327.22±2.62	77.19±0.54	40.66±0.27	77.89±0.35
Enzyme x 3	317.14 ±2.96	77.12± 0.32	40.95±0.52	80.26±1.52
Enzyme x 4	323.69 ± 2.42	77.80± 0.39	40.68±0.41	79.48±1.83
Without x C	352.21±2.91	77.79±0.49	40.43±0.58	85.28±1.40
Without x 1	343.20±1.77	77.37±0.32	40.84±0.32	77.61± 1.90
Without x 2	338.47±3.75	77.02±0.23	40.94 ±0.45	77.27±1.65
Without x 3	323.77±5.67	78.28±0.37	40.64±0.29	80.28±0.88
Without x 4	348.59±2.00	77.83±0.28	40.46±0.54	79.83±1.29

C (Control) = 100% yellow corn , 1= 25% barley + 75% corn , 2 = 50% barley +50%corn , 3 = 75% barley + 25% corn , 4 = 100% barley .

Means within each column bearing different letters(s) are significantly different ($p \leq 0.05$) .

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الملخص العربي

تاثير إحلال الشعير واضافة الإنزيمات على الأداء الإنتاجى و جودة البيض للدجاج الهاى لاين الأبيض .

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**قسم النتاج الحيوانى و الدواجن – كلية الزراعة – جامعة جنوب الوادى - قنا

أجريت هذه الدراسة فى مزرعة الدواجن التابعة لقسم الإنتاج الحيواني بكلية الزراعة – جامعة جنوب الوادى – قنا . صممت الدراسة لبحث تأثير إحلال ٥ مستويات من الشعير (صفر ، ٢٥% ، ٥٠% ، ٧٥% ، ١٠٠%) من الذرة الصفراء مع اضافة أو عدم اضافة مخلوط الانزيمات (كابلكس) الذى يتكون من (السيليوليز، الزيلينيز، بيتا جلوكانيز ،الفا جلوكانيز، الليبيز، الأميليز، الأرابينيز، بكتينيز، البروتييز) على كلا من الأداء الإ نتاجى و جودة البيض لسلالة الهاى لاين الأبيض وذلك بإستخدام عدد ٦٣٠ دجاجة من سلالة الهاى لاين الأبيض عمر ٢٦ أسبوع حيث قسمت عشوائيا الى ٥ معاملات من استبدال الذرة الصفراء بالشعير (كنترول ، ٢٥% شعير ، ٥٠% شعير ، ٧٥% شعير ، ١٠٠% شعير) مع إضافة أو عدم إضافة مخلوط الإنزيمات (كابلكس) بمعدل ٦ ملى لكل ٢٠ لتر ماء للحصول على ١٠ معاملات تجريبية . وتتلخص النتائج المتحصل عليها فيما يلى :

أولا : التاثير على الأداء الإنتاجى

١ - أدت إضافة مخلوط الإنزيمات الى تحسن المتوسط العام لمعدل إنتاج البيض اليومى وعدد البيض معنويا وتحسن كتلة البيض والغذاء المستهلك بنسبة ١.٧١% ، ٢.٠١% ، ٢.٥٣% ، ٢.٧٥% على التوالى ، بينما لم يكن له تأثير على متوسط وزن البضة و المتوسط العام لمعامل التحويل الغذائى

٢ - أدت زيادة مستوى الشعير الى زيادة المتوسط العام لمعدل إنتاج البيض اليومى و عدد البيض دون فروق معنوية بين مستوى ٥٠% ومستوى ٧٥% من الإحلال و كان لمستوى الشعير فى العليقة تأثير معنوى على إجمالى كتلة البيض و كانت أعلى قيمة مع ٥٠% شعير و أقل قيمة مع ١٠٠% شعير بينما أدت مستويات الشعير الى زيادة معنوية للغذاء المستهلك و كانت

أعلى قيمة مع ١٠٠% شعير، كما أدى إلى التحسن المعنوى فى متوسط وزن البيضه وكان أعلى وزن للبيضة مع ٥٠% شعير و أقل قيمة مع ١٠٠% شعير ووجد أن لمستويات الشعيرتأثيرعلى المتوسط العام لمعامل التحويل الغذائى حيث كانت أفضل القيم لمعامل التحويل الغذائى في الكنترول و ٥٠% شعير (٢.٦٨ و ٢.٦٥) بينما كانت أسوأ القيم مع ١٠٠% شعير(٣.١٧) .

٣ - لم يكن للتداخل بين مخلوط الإنزيمات و مستوى الشعير تأثير معنوى على انتاج البيض اليومى و المتوسط العام لعدد البيض و كتلة البيض و اجمالى استهلاك العلف ومعامل التحوبل الغذائى و متوسط وزن البيضة .

ثانيا : التأثير على جودة البيض

٤ – لم يكن لإضافة مخلوط الانزيم أى تأثير على مكونات البيضة (النسبة المئوية للقشرة و البياض و الصفار) و سمك القشرة و المتوسط العام لدليل الشكل و دليل الصفار ووحدات قياس إرتفاع البياض مقارنة بالكنترول .

٥ – كان لمستوى الشعير تأثير معنوى علىنسبة القشرة و سمك القشرة و نسبة البياض و لم يكن له تأثير على نسبة الصفار و المتوسط العام لدليل الشكل و دليل الصفار ووحدات قياس إرتفاع البياض مقارنة بالكنترول .

٦ - أدى التداخل بين اضافة مخلوط الإنزيمات و مستويات الشعير الى عدم تحسين قيمة المتوسط العام لمكونات البيضة و سمك القشرة والمتوسط العام لدليل الشكل و دليل الصفاروودحدات قياس إرتفاع البياض مقارنة بالكنترول .

توضح نتائج هذه الدراسة إمكانية إحلال الشعير مع إستخدام مخلوط إنزيمات فى علائق الدجاج البياض الهاى لاين الأبيض حتى ٥٠ % من الذرة الصفراء دون أى تأثير سلبى على إنتاج وجودة البيض .