EFFECTS OF DIFFERENT LEVELS OF CRUDE PROTEIN AND DRIED YEAST (*SACCHAROMYCES CEREVISIAE*) ON PERFORMANCE OF LOCAL LAYING HENS

By

A. Abd El-Maksoud, Salama A. A., El-Sheikh S. E.M., and Khidr R.E.

Animal and Poult, Nutrition Dep, Desert Research Center, El-Mataria, Cairo, Egypt

Correspondence:amaksoud2005@yahoo.com

.Received: **27/04/2011** Accepted: **16/05/2011**

Abstract: *This experiment was carried out at Siwa Oasis Experimental Station, to study the effect of different levels of crude protein (CP) and dried yeast (SDY) containing Saccharomyces cerevisiae on performance of local laying hens. A total number of 90 Matrouh laying hens of 32 weeks of age were randomly divided into six experimental groups, 15 hens each. Each group was sub-divided into five replicates, (three hens each). A (3 X 2) factorial experimental design with three levels of CP (16, 14 and 12 %) and two levels of SDY (0.00 and 250 mg /kg diet) was tested for 12 weeks.*

Hens fed on 16% CP showed the highest (P<0.01) values in egg production (67.68%), egg weight (46.25g) and egg mass (31.33g) during the whole experimental period. Hens fed diets supplemented with SDY (250 mg/kg diet) showed significantly (P<0.01) the highest values of egg production (64.69%) and egg mass (28.78g) during the whole experimental period. Moreover, hens fed diet containing 16% CP with SDY 250mg/kg diet showed the highest significant (P<0.01) values of egg production (72.00%) and egg mass (34.21g) during the whole experimental period.

Hens fed on 12% CP diet recorded significantly (P<0.01) the highest value of feed consumption (82.98 g/hen/day) while there was no significant difference between hens fed 16% and 14 % dietary CP. Moreover, hens fed on dietary 16% or 14% CP showed significantly (P<0.01) the best value of feed conversion ratio during the different intervals and the whole experimental period compared with the hens fed dietary 12% CP. However, there were no significant effect on feed consumption and feed conversion ratio by dietary yeast supplementation during the different interval periods and the whole experimental period. Hens fed diets containing 12% CP with SDY 250mg/kg showed higher value of feed consumption (88.60g/hen/day) compared with other groups. However, hens fed diet containing 16% CP with dietary yeast 250mg/kg diet showed the best value of feed conversion (2.10 g feed/g egg mass) compared with other groups.

Yolk wt (%), egg shape index (%), egg shell thickness and haugh unit were insignificantly (P>0.05) influenced by CP levels. However, hens fed diets containing 14% CP showed higher value of shell weight (12.62%) compared with other groups. Hens fed SDY (250 mg/kg diet) showed the highest value of egg shell thickness (0.5002 μm) compared with control group. However, interaction between dietary CP levels and SDY supplementation had no significant effect on egg quality parameters. The exception only, hens fed diet containing 16% CP with dietary yeast (250mg/kg diet) showed the highest value of shell thickness (0.5411 μm) compared with other groups.

The best value for (E.E) and (R.E.E) recorded hens feed diet 16% CP (0.89 and 100.00%) respectively, followed by 14% CP (0.86 and 96.63) respectively. Dietary SDY

supplementation showed the best value of (E.E) and (R.E.E) (0.75 and 84.27) respectively. Hens consuming 16% CP with supplementation SDY recorded the best value for (E.E) and (R.E.E) (1.09 and 122.47), respectively followed by 14% CP with supplementation SDY (0.88 and 98.88).

The results indicated that hens fed on 16% CP without or with dried yeast improved egg production, egg weight, egg mass, feed conversion ratio, eggshell quality, economical efficiency and relative economical efficiency. Dietary dried yeast supplementation (250 mg/kg diet) improved egg production, egg mass, shell thickness, economical efficiency and relative economical efficiency.

INTRODUCTION

Feed cost accounts constitute more than70% of the total production cost. However, protein cost account about 15% of feed cost (**Singh, 1990 and Banerjee, 1992**). Thereby, protein content of the diet strongly affects costs as well as revenues in egg production.

Methionine and lysine are generally the first and the second limiting amino acids in corn-soy a diets of laying hens. Therefore, the efficiency of protein utilization is increasing by methionine and lysine supplementation (**Schutte *et al.*, 1994 and Novak *et al.*, 2004**). **Keshavarz and Jackson, (1992)** reported similar egg production when using low-protein diets in phase-feeding program (14, 13 and 12 %CP) with supplemental Met, Lys, Trp, and Iso compared with positive control (18, 16.5 and 15%CP). A similar responses in egg production and egg mass were reported when low-protein diets (15 or 13%) supplemental with Lys, Met, Trp, Arg, Thr,Val, and Ile compared with high-protein (17.6 or 15.5%) diets(**Harms and Russell,1993**). **Keshavarz and Austic (2004)** indicated that supplementing the negative control (13%CP) with lysine, methionine, and tryptophan resulted in performance comparable to that obtained with the positive control (16%CP). However, performance of laying hens fed a 13 or 14% protein diet supplemented with adequate essential amino acids was not as satisfactory as the performance of a control group fed a 16% protein diet (**Jensen *et al.*, 1990**). Similarly, **Zou and Wu (2005)** indicated that increasing dietary protein intake from 15.3 to 16.3 g/hen per day increased egg production. **Gunawardana *et al.*, (2008)** reported that increasing protein intake from 13.8 to 17 g/hen per day increased egg production from 65.2 to 71.7%.

Yeast culture products containing *Saccharomyces cerevisiae*, which are rich in enzyme, vitamins, and other nutrients, have many beneficial effects on animals such as growth rate, feed efficiency, egg production, and reproduction (**Dawason, 1993**). Dried yeast from malted grain fermentation constitutes natural concentrate mixture of essential nutrients and is biologically able protein combined with high potency vitamin B-complex and important trance minerals (**Ayanwale *et al.*, 2006**). However, there are still conflict reports on the beneficial effect of culture supplementation in poultry diets. Several studies reported improved feed efficiency (**Liu *et. al.* 2002 and Tangendjaja and Yoon, 2002**), increased egg weight and decreased egg yolk cholesterol without affecting performance and egg traits (**Yalcın *et al.*, 2008**), increased egg production (**Thayer *et al.*, 1978**) **) or decreased egg production (Dizaji and Pirmohammadi, 2009**), improved internal egg quality (**Miles and Bootwalla, 1991**). In contrast, other studies described by **Day *et al.*, (1987) and Nursoy *et al.*, (2004)** reported no effect of dietary yeast culture on feed consumption, egg production, egg weight, and feed efficiency in laying hens.

The objective of the present experiment to study the effect of different levels of crude protein (CP) and dried yeast (SDY) on performance of local laying hens.

MATERIALS AND METHODS

This experiment was carried out at Siwa Oasis Research Station, to study the effect of different levels of crude protein (CP) either alone or supplemented with *Saccharomyces cerevisiae* containing dried yeast (SDY) on performance of laying hens. A total number of 90 Matrouh laying hens of 32 weeks of age were randomly divided into six experimental groups; 15 hens each. Each group was sub-divided into five replicates, (three hens each). A (3 X 2) factorial experimental design with three levels of CP (16, 14 % and 12 %) and two levels of (SDY) (0.00 and 250 mg /kg diet) was tested for 12 weeks experimental period. All the experimental diets had the same nutritive values of amino acids (methionine and lysine) and iso-caloric (2612ME Kcal/kg). Composition and calculated analysis of the experimental diets are presented in Table 1. All hens were kept under the same managerial and environmental conditions and artificial lighting (16 hours of light per day) through the experimental periods.

Body weights were recorded at the beginning and at the end of the experiment (32 and 44 week of age, respectively). Egg weight and egg number were recorded daily to calculate the egg production percentage and egg mass (g/hen/day). Feed consumption (g/hen/day) and feed conversion values (g feed /g eggs) were recorded biweekly.

At the end of the experiment, egg quality parameters were measured using 36 eggs (6 eggs / each treatment group). These measurements involved yolk, albumen and shell weight percentage. Egg shell thickness was measured in µm using a micrometer. Egg shape index was computed as the ratio of egg width to the length (**Awosanya *et al.*, 1998**). Yolk index was calculated according to **Funk *et al.*, (1958)**, as yolk height divided by yolk diameter. Haugh unit was calculated according to **Eisen *et al.* (1962)** using the calculation chart for rapid conversion of egg weight and albumen height.

The economic efficiency of the experimental diet was calculated based upon the differences in both selling revenue and feeding cost, which was calculated according to the price of the experimental diets and egg production during the year of (2009).

Statistical analysis:

Data obtained were statistically analyzed using the General Linear Model Procedure (**SAS, 2003**). Duncan's Multiple Range Test was used to test the significance ($P<0.05$) of mean differences (**Duncan, 1955**).

RESULTS AND DISCUSION

Effect of protein levels, SDY and their interaction on:

1-Body weight and egg production parameters:

Hens fed dietary 14 and 16 % CP recorded the highest significant (P<0.01) values of final body weight (1575.79 and 1556.68 g) respectively compared with hens fed dietary 12% CP (1449.95 g) (Table 2). Similar results were obtained by **Yakout (2010)** who reported that dietary CP levels were significantly (P ≤ 0.001) effect on final body weight. However, there was no significant effect on body weight changes by dietary CP levels (Table 2). This result was agreed with data reported by **Sohail *et al.*, (2003), Roberts *et al.*, (2007), and Hussein *et al.*, (2010),** who reported no significant effect of reducing dietary protein levels on body weight changes.

Increased dietary CP (16%) showed the highest (P<0.01) values of egg production during the 32 to 36 wk36 to 40 wk of age and the whole experimental period (70.98%), (74.04%) and (67.68%) respectively compared with the other groups (Table 2). Egg weight had the same trend, where hens fed dietary 16 % CP recorded the highest (P<0.01) egg weight during 32 to 36 wk36 to 40 wk, 40 to 44 of age and the whole experimental period (46.33g),(46.25g), (47.82g) and(46.25 g) respectively. Moreover, hens fed dietary 16 % CP recorded the highest (P<0.01) egg mass values during the different interval period and the whole experimental period compared with the other groups. The effect of dietary protein on egg production, egg weight, egg mass in this study was consistent with **Gunawardana *et al.*, (2008)** who reported that increasing protein intake from 13.8 to 17 g/hen per day increased egg production ,egg mass and egg weight. Similarly, **Liu *et al.*, (2005) and Wu *et al.*, (2005),** reported that increasing dietary protein improved egg] production and egg weight. Also **Zou *et al.*,(2005)** reported that increasing dietary protein intake from 15.3 to 16.3 g/ hen day increasing egg production by 3.2%. However, **Novak *et al.*, (2006)** indicated that the level of protein decreased in the diet egg mass linearly decreased even when supplementing certain amino acid. The same authors, explained reasons of egg production and egg weight reduces as the reduction of dietary protein reduced intake of non-essential amino acids such as Glu, Cys and Gly which are important nitrogen sources. These amino acids may become limiting or may be converted for nonessential purposes and hence resulted in a limitation of protein (egg) synthesis. Also, **Roberts *et al.*, (2007)** reported that the reduced-CP diets resulted in decreased egg production, which may be attributed to an amino acid deficiency. However, **Leeson and Caston (1996)** previously, reported that egg weight and egg mass was lower with diets containing 14.4% protein compared with 16.8% protein, although both diets had equal levels of Met and Ly. They attributed the lower egg weight to an inadequate level of total nitrogen.

Hens fed diets without SDY recorded the highest significant (P<0.01) value of final body weight (1580.03g). However, body weight changes was not significantly influenced by supplementation dietary yeast (Table 2).This finding is in agreement with **Ayanwale *et al.*,(2006)** who reported that yeast supplementation had no effect on body weight gain of laying hens and laying quails. However, the supplementation of yeast culture to the laying diet resulted in significant increase in body weight changes independent from usage of soy bean meal and sunflower seed meal (**Yalcin *et al.*, 2008**).

Hens fed diets supplemented with SDY 250 mg/kg diet showed significantly (P<0.01) the highest values of egg production during 32 to 36 wk, 40 to 44 wk of age and the whole experimental period(68.54 %, 57.14%and 64.69%), respectively (Table 2). Egg weight was not significantly affected by supplementation yeast during the different interval periods and through the whole experimental period. However, hens fed diet supplemented with SDY 250 mg /kg diet recorded significantly (P<0.01) the highest values of egg mass during 32 to 36 wk and the whole experimental period (30.19g and 28.78g), respectively compared with the control group (Table 2). The significant improvement in egg mass with supplementation SDY 250 mg /kg diet may be due to the highest significantly value in egg production (64.69%) and the higher insignificant value of egg weight (44.31g) compared with control diet during total experimental period (Table 2). Similarly to our results yeast culture supplementation in this concern improved (P<0.05) in egg production (**Liu *et al.*, 2002 and Abou El-Ella *et al.*, 1996**) and in laying quails (**Yildiz *et al.*, 2004**). However, yeast culture supplementation had no effect on egg weight in laying quails (**Yildiz *et al.*, 2004**) and in laying hens (**Nursoy *et al.*, 2004 and Yalcin *et al.*, 2008**).

Hens fed on a diet containing 16% CP with SDY 250 mg/kg diet showed significantly (P<0.01) the highest values of egg production during the whole experimental period (72%) compared with the other experimental groups(Table 3). Egg weight was insignificantly influenced by the interaction between dietary CP levels and dried yeast supplementation during the whole experimental period. However, hens fed diet containing 16% CP with SDY 250 mg/kg diet showed significantly (P<0.01) the highest value of egg mass (34.21g) during the total experimental period (Table 3).This improved in egg production and egg mass by 16% CP with supplementation SDY diet may be due to enhancing the beneficial intestinal bacterial population that in turn improved nutrient retention (**Liu *et al.*, 2002**).

2- Feed consumption and feed conversion ratio:

Hens fed on 12% CP diet recorded the highest significant (P<0.01) value of feed consumption (82.98 g/hen/day) while there was no significant difference effect among the other groups (Table 4). However, **Wu *et al.*,(2007)** indicated that hens fed a 16% CP diet consumed less feed compared with those fed diets containing 15.5 or 14.9% CP, while, **Novak *et al.*, (2006)** reported increased feed consumption when feeding low-protein diet to hens.

Hens fed dietary 16% or 14 CP showed significantly (P<0.01) the best value of feed conversion ratio during the different intervals and the whole experimental period compared with the hens fed dietary 12% CP (Table 4) . In the present study, as dietary protein increased, feed conversion ratio improved significantly. Because egg weight and egg production increased significantly with increased dietary protein and feed intake decreased for hens fed 16% or 14% CP (Table 2, 4). This result was in agreement with that of **Liu *et al.*, (2005), Wu *et al.*, (2005) and Novak *et al.*, (2006)** who reported that increased dietary protein improved feed conversion

Feed consumption and feed conversion ratio were not significantly influenced by SDY supplementation (Table 4). Similar to results were found in laying hens (**Day et al. 1987; Nursoy et al., 2004 and Yalcin *et al.*, 2008**) and in laying quail (**Yildiz *et al.*, 2004**). In contrast, **Liu *et al.*, (2002)** reported that yeast culture supplementation to the diet at the level of 0.2% decreased feed intake (P < 0.05) in laying hens. While, **Ayanwale *et al.*, (2006)** reported that yeast supplementation improved feed conversion efficiency of laying hens.

There was a significant (P<0.01) interaction between dietary CP levels and SDY supplementation on feed consumption. Moreover, hens fed diets containing 12% CP with SDY 250 mg/kg showed a higher value of feed consumption (88.60 g/hen/day) compared with other groups (Table 4).

Hens fed diet containing 16% CP with SDY 250 mg/kg diet showed the best value of feed conversion ratio (2.10 g feed/g egg mass) compared with other groups (Table 4). It may be postulated that the beneficial effect of SDY may enhance the metabolic utilization of nutrient. **Liu *et al.*, (2002)** reported that improvement in feed efficiency in laying hens may partially be attributed to the establishment of an intestinal bacterial population that improved nutrient retention. At the same time, many researchers have reported that feed efficiency was improved (P < 0.05) by yeast culture supplementation to diets of laying hens (**Abou El-Ella *et al.*, 1996; Liu *et al.*, 2002 and Tangendjaja and Yoon, 2002**).

3- Egg quality measurements:

Yolk wt (%), egg shape index (%), egg shell thickness and haugh unit (%), were insignificantly affected by CP levels. However, albumen wt. (%), shell wt.(%) and yolk index were significantly (P<0.01) influenced by CP levels. Hens fed diets containing 14% CP showed higher value of shell wt. (12.62%) compared with other groups (Table 5). This is in agreement with the results of **Novak *et al.*, (2006)** who showed that feeding low-protein diet to laying hens increased shell (wt.%) while haugh unit was not affected by different protein levels. **Leeson and Caston (1997)** reported similar responses to our results for haugh unit when feeding low-protein diets. Moreover, there were no significant differences between the control and low-protein groups with respect to albumen height, shell thickness, and shell strength against breaking (**Khajali, *et al.*, 2008**). In contrast, **Gunawardana *et al.*, (2008)** reported that increasing protein intake significantly increased albumen and yolk weight but had no influence on yolk, albumen or whole egg solids. **Shafer *et al.*, (1998)** previously indicated that increasing amino acid (lysine and TSAA) intake had a significant effect on albumen weight.

Dietary yeast level had no significantly (P<0.01) effect on egg quality parameters. The exception only, for hens fed a dietary SDY 250 mg/kg diet as showed the highest value of shell thickness (0.5002µm) compared with control group (0.4459 µm) (Table 5). The improvement in shell thickness may due to the increased bio-availability of certain minerals such as Ca, Cu, Zn, Fe, and Mn with supplementation yeast phytase (**Thayer *et al.*, 1978**). These results are similar obtained by **Yalcin *et al.*, (2008)** who reported that feeding supplemental yeast culture had no effect on egg shape index, shell weight percentage, albumen index, albumen weight percentage, yolk index, yolk weight percentage, and haugh units. The interaction between dietary CP levels and SDY supplementation had no significant effect on egg quality parameters. The exception was only with hens fed diet containing 16% CP with SDY 250 mg/kg diet which showed the highest value of shell thickness (0.5411 µm) compared with other groups, the improved of shell thickness due to supplementation dried yeast which improved significant shell thickness (Table 5).

Results in Table (6) showed that, the best value for economical efficiency (E.E) and relative economical efficiency (R.E.E) was recorded by hens fed diet containing 16% CP (0.89 and 100.00%) respectively, followed by 14% CP (0.86 and 96.63) respectively. Dietary SDY supplementation recorded the best value of (E.E) and (R.E.E) (0.75 and 84.27) respectively. Hens fed 16% CP with supplementation SDY recorded the best value for (E.E) and (R.E.E) (1.09 and 122.47), respectively followed by 14% CP with supplementation SDY (0.88 and 98.88).

It could be concluded that dietary 16% CP without or with SDY improved egg production, egg weight, egg mass, feed conversion ratio, eggshell quality, economical efficiency and relative economical efficiency. Dietary SDY supplementation (250 mg/kg diet) improved egg production, egg mass, shell thickness, economical efficiency and relative economical efficiency.

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

Ingredients:%	Protein levels		
	16	14	12
Yellow Corn	59.87	63.60	66.50
Soybean meal 44%	19.00	16.43	10.30
Corn Gluten meal 60%	2.16	0.00	0.00
Wheat bran	7.74	8.73	11.75
Limestone	8.91	8.80	8.84
Dicalcium phosphate	1.75	1.75	1.75
Salt(Nacl)	0.25	0.25	0.25
Vit&min premix*	0.30	0.30	0.30
L-Lysine HCL	0.00	0.08	0.22
DL-Methionin	0.02	0.06	0.09
Total	100	100	100
Calculated analysis			
ME kcal/kg	2610	2610	2610
CP%	16.00	14.00	12.00
CF%	3.53	3.51	3.48
EE%	2.71	2.81	2.96
Ca%	3.56	3.55	3.56
Total P%	0.72	0.72	0.72
Available P%	0.45	0.45	0.44
Methionine&Cystein%	0.56	0.49	0.44
Methionine	0.30	0.30	0.30
Lysine%	0.74	0.74	0.74
Price/kg feed (L.E.)	1.695	1.588	1.507

* Vit. and Min. Premix per Kg of diet: 12000 IU. Vit. A, 2000 IU. Vit. D3, 10 mg Vit. E, 4 mg riboflavin, 10mg Pantothenic acid, 0.01 mg Vit. B12, 500 mg Choline chloride, 2 mg Vit. K, 1 mg. Vit. B1, 1.5 mg Vit. B6 ،1mg Folic acid, 30 mg Niacin, 0.05 mg Biotin, 10 mg Cu, 1 mg I, 30 mg Fe, 55 mg Mn, 55 mg Zn and 0.1 mg Se.

Table 2: Body weight changes, egg production, egg weight, and egg mass of laying hens as affected by CP and SDY levels.

Parameters / Treatments		Initial body wt.(g)	Final body wt.(g)	Body changes wt.(g)	Egg Production (%)				Egg Weight(g)				Egg Mass(g)			
					Period in weeks											
CP%	(SDY) mg/kg diet				32- 36	36-40	40 -44	Overall mean	32- 36	36-40	40 -44	Overall mean	32- 36	36-40	40 -44	Overall mean
16		1355.71	1556.68a	200.98	70.98a	74.04a	58.03	67.68a	46.33a	46.25a	47.82a	46.25a	32.90a	34.27a	26.78a	31.33a
14		1358.54	1575.79a	217.25	64.70b	68.82a	54.01	61.62b	42.83b	42.77b	46.16a	44.47b	27.75b	29.44b	24.55ab	27.41b
12		1342.38	1459.95b	117.57	62.29b	58.86b	51.33	58.39c	39.96c	40.98b	41.07b	40.67c	24.89 c	24.10c	22.24b	23.74c
SEM		18.57	32.59	35.43	1.9843	2.0771	1.9397	0.8956	0.7362	0.7045	0.7537	0.5154	0.9473	0.9508	1.0057	0.4528
P-value		0.8063	0.0319	0.1106	0.0175	0.0002	0.0740	<.0001	<.0001	0.0002	<.0001	<.0001	<.0001	<.0001	0.0177	<.0001
	0.00	1365.39	1580.03 a	214.64	63.43b	66.09	51.78b	60.44b	42.23	42.55	45.06	43.28	26.84b	28.12	23.42	26.21b
	250	1339.03	1481.59b	142.56	68.54a	68.38	57.14a	64.69a	43.86	44.12	44.97	44.31	30.19a	30.41	25.63	28.78a
SEM		15.16	26.60	28.93	1.6202	1.6959	1.5837	0.7313	0.6011	0.5752	0.6154	0.4208	0.7730	0.7763	0.8212	0.3692
P-value		0.2234	0.0110	0.0828	0.0386	0.3520	0.0279	0.0007	0.0711	0.0694	0.9165	0.0986	0.0067	0.0514	0.0734	0.0001

[a,b,c] Means with different superscripts in same columns for each criterion are significantly different ($P \leq 0.05$). SEM: Standard error

Table 3: Body weight changes, egg production, egg weight, and egg mass of laying hens as affected by interaction between CP and SDY levels.

Treatments / Parameters		Initial body wt.(g)	Final body wt.(g)	Body changes wt.(g)	Egg Production (%)				Egg Weight(g)				Egg Mass(g)			
					Period in weeks											
CP%	(SDY) mg/kg diet				32- 36	36-40	40 -44	Overall mean	32- 36	36-40	40 -44	Overall mean	32- 36	36-40	40 -44	Overall mean
16	0.00	1374.33	1616.37	242.03	67.03	71.28	51.78b	63.37b	44.79	43.95b	46.10	44.95	29.98	31.32b	23.91	28.46b
	250	1337.08	1497.00	159.92	74.92	76.79	64.28a	72.00a	47.88	48.55a	46.22	47.55	35.82	37.21a	29.65	34.21a
14	0.00	1353.75	1614.50	260.75	63.92	68.45	52.67b	61.68b	42.37	41.20bc	48.25	43.94	27.12	28.18bc	25.43	27.13b
	250	1363.33	1537.08	173.75	65.47	69.18	50.00b	61.55b	43.30	44.35b	47.40	45.01	28.38	30.69b	23.67	27.70b
12	0.00	1368.08	1509.22	141.13	59.34	58.55	50.89b	56.26c	39.52	42.50bc	40.85	40.95	23.42	24.86cd	23.56	23.06c
	250	1316.67	1410.68	94.01	65.24	59.17	57.14ab	60.51b	40.40	39.46c	41.30	40.39	26.36	23.33d	20.92	24.42c
SEM		26.26	46.08	50.11	2.8062	2.9375	2.7431	1.2666	1.0412	0.9963	1.0659	0.7289	1.3398	1.3446	1.4223	0.6404
P-value		0.4817	0.9018	0.9103	0.5256	0.6431	0.0401	0.0101	0.4914	0.0028	0.8196	0.1225	0.2508	0.0415	0.0516	0.0015

[a,b,c] Means with different superscripts in same columns for each criterion are significantly different ($P \leq 0.05$). SEM : Standard error

Table 4: Feed utilization of laying hens as affected by CP, SDY levels and their interaction.

Treatments	Parameters	Feed consumption(g/ hen/day)				Feed conversion (g feed/ g egg mass)			
		Period in weeks							
CP%	(SDY) mg/kg diet	32- 36	36-40	40 -44	Overall mean	32- 36	36-40	40 -44	Overall mean
16		67.61^{b}	73.70^{ab}	78.16^{a}	73.15^{b}	2.10^{c}	2.20^{b}	2.97^{b}	2.35^{b}
14		70.90^{b}	70.75^{b}	67.65^{b}	69.77^{b}	2.57^{b}	2.41^{b}	2.80^{b}	2.55^{b}
12		84.52^{a}	80.22^{a}	84.25^{a}	82.98^{a}	3.40^{a}	3.34^{a}	3.84^{a}	3.49^{a}
SEM		2.3800	2.3263	2.2503	1.6232	0.1245	0.10830	0.1799	0.08234
P-value		0.0002	0.0289	0.0002	<.0001	<.0001	<.0001	0.0015	<.0001
	0.00	73.55	73.60	75.30	74.14	2.79	2.66	3.32	2.86
	250	75.14	76.18	78.07	76.46	2.59	2.64	3.08	2.73
SEM		1.9432	1.8994	1.8373	1.3253	0.1016	0.0884	0.1469	0.0672
P-value		0.5697	0.3489	0.2997	0.2308	0.1679	0.8955	0.2616	0.1911
Interaction									
CP%	(SDY) mg/kg diet								
16	0.00	71.60^{bc}	73.45^{b}	78.17^{a}	74.40^{bc}	2.42^{b}	2.40^{dc}	3.30^{ab}	2.61^{b}
	250	63.62^{c}	73.95^{b}	78.15^{a}	71.90^{bc}	1.78^{c}	2.00^{d}	2.63^{b}	2.10^{c}
14	0.00	71.95^{bc}	72.90^{b}	67.05^{b}	$70.65b^{c}$	2.66^{b}	2.58^{bc}	2.71^{b}	2.62^{b}
	250	69.85^{bc}	68.60^{b}	68.25^{b}	68.90^{c}	2.48^{b}	2.24^{dc}	2.90^{b}	2.48^{b}
12	0.00	77.10^{b}	74.45^{b}	80.67^{a}	77.37^{b}	3.30^{a}	2.99^{b}	3.96^{a}	3.36^{a}
	250	91.95^{a}	86.00^{a}	87.82^{a}	88.60^{a}	3.50^{a}	3.69^{a}	3.72^{a}	3.63^{a}
SEM		3.3658	3.2899	3.1824	2.2956	0.1761	0.1531	0.2544	0.1166
P-value		0.0003	0.0326	0.0018	0.0001	<.0001	<.0001	0.0065	<.0001

$^{a,b,c...}$ Means with different superscripts in same columns for each criterion are significantly different ($P \leq 0.05$). SEM : Standard error mean

Table 5: Egg quality measurements of laying hens as affected by CP, SDY levels and their interaction.

Treatments CP%	(SDY) mg/kg diet	Egg wt.(g)	Albumen wt. (%)	Yolk wt. (%)	Shell wt. (%)	Shape index, (%)	Yolk index	Shell thickness (µm)	Haugh unit
16		43.87	53.25[a]	37.82	11.540[b]	78.15	41.33[b]	0.4896	87.03
14		41.80	50.45[b]	39.43	12.62[a]	77.55	44.23[a]	0.4669	89.43
12		43.17	55.09[a]	36.86	11.18[b]	79.15	43.84[a]	0.4628	89.58
SEM		0.7790	0.8547	1.0009	0.3401	0.7866	0.9214	0.0100	0.9868
P-value		0.1492	0.0024	0.2025	0.0142	0.3595	0.0440	0.1016	0.0972
	0.00	42.58	53.83	37.06	11.50	78.29	42.68	0.4459[b]	88.39
	250	43.31	52.02	39.01	12.05	78.28	43.58	0.5002[a]	88.97
SEM		0.6361	0.6978	0.8173	0.2777	0.6423	0.7523	0.0081	0.8057
P-value		0.4005	0.0649	0.0887	0.1563	0.9873	0.3832	<.0001	0.6030
Interaction									
CP%	**(SDY) mg/kg diet**	**Egg wt.(g)**	**Albumen wt. (%)**	**Yolk wt. (%)**	**Shell wt. (%)**	**Shape index, (%)**	**Yolk index**	**Shell thickness (µm)**	**Haugh unit**
16	0.00	43.95	54.93	35.79	10.83	78.28	39.92	0.4380[c]	85.10
	250	43.79	51.57	39.86	12.24	78.02	42.74	0.5411[a]	88.96
14	0.00	39.71	51.05	39.21	12.48	76.36	44.14	0.4568[bc]	89.93
	250	43.89	49.86	39.64	12.76	78.75	44.32	0.4770[bc]	88.93
12	0.00	44.08	55.53	36.19	11.21	80.23	43.98	0.4429[bc]	90.15
	250	42.27	54.64	37.53	11.15	78.07	43.70	0.4827[b]	89.02
SEM		1.1017	1.2087	1.4156	0.4810	1.1125	1.3031	0.0141	1.3956
P-value		0.0292	0.4847	0.3574	0.2343	0.1394	0.3844	0.0091	0.1003

[a,b,c...] Means with different superscripts in same columns for each criterion are significantly different ($P \leq 0.05$). SEM: Standard error mean

Table 6: Economical evaluation of laying hens as affected by CP, SDY levels and their interaction.

Parameters		Feed intake Kg/hen	Price of 1.0kg diet LE.	Total feed cost,LE.	Egg mass, Kg/hen	Total revenue	Net revenue	Economical efficiency	Relative economical efficiency
CP%	(SDY) mg/kg diet								
16		6.14	1.695	10.41	2.631	19.733	9.32	0.89	100.00
14		5.86	1.588	9.31	2.302	17.265	7.96	0.86	96.63
12		6.97	1.507	10.50	1.994	14.955	4.45	0.42	47.62
	0.00	6.222	1.596	9.93	2.201	16.508	6.58	0.66	74.16
	250	6.422	1.611	10.35	2.417	18.128	7.78	0.75	84.27
Interaction									
CP%	(SDY) mg/kg diet	Feed intake Kg/hen	Price of 1.0kg diet LE.	Total feed cost,LE.	Egg mass, Kg/hen	Total revenue	Net revenue	Economical efficiency	Relative economical efficiency
16	0.00	6.249	1.695	10.59	2.390	17.925	7.33	0.69	77.52
	250	6.039	1.71	10.33	2.873	21.548	11.22	1.09	122.47
14	0.00	5.934	1.588	9.42	2.278	17.085	7.66	0.81	91.01
	250	5.787	1.603	9.28	2.326	17.445	8.17	0.88	98.88
12	0.00	6.499	1.507	9.79	1.937	14.528	4.73	0.48	53.93
	250	7.442	1.522	11.33	2.051	15.383	4.06	0.36	40.45

Price of 1.oKg Egg was 7.50 LE. At the time of the experimental period
Price of 1.0Kg dried yeast was 60LE.

REFERENCES

Abou El-Ella, M. A., Attia, M. Y., El-Nagmy, K. Y. and Radwan., M. A. H. (1996). *The productive performance of layers fed diets supplemented with some commercial feed additives. Egypt J. Anim. Prod. Suppl,. 33: 423–430.*

Awosanya, B., Joseph, J.K. and Olaosebikan, O.D. (1998). *Effect of age of birds on shell quality and component yield of egg. Nig. J. Anim. Prod., 25: 68-70.*

Ayanwale, B.A., Kpe, M.and Ayanwale, V.A. (2006). *The effect of supplementing Saccharomyces cerevisiae in the diets or egg laying and egg quality characteristics of pullets. Int. J. Poult. Sci., 5: 759-763.*

Banerjee, G. C., (1992). *Poultry (3rd edition). Oxford and IBH publishing Co. Pvt. Ltd. New Delli, pp: 168-172.*

Dawson, K. A. (1993). *Current and future role of yeas culture in animal production: A review of research over the last seven years. Pages 169–171 in Biotechnology in the Feed Industry. Proc. 9th Annual Symposium. Alltech Technical Publications, Nicholasville, KY.*

Day, E. J., Dilworth, B. C. and Omar, S. (1987). *Effect of varying levels of phosphorus and live yeast culture in caged layer diets. Poult. Sci., 66:1402–1410.*

Dizaji and Pirmohammadi, R (2009). *Effect of saccharomyces cerevisiae and Bioplus 2B on performance of laying hens. International Journal of Agriculture and Biology ISSN Print:*

1560–8530; ISSN Online: 1814–9596 08–347/AAK/2009/11–4–495–497.

Duncan, D.B. (1955). *Multiple F range and multiple test. Biometrics, 11:1-42.*

Eisen, E.J., Bohren, B.B. and Mckean, H.E. (1962). *The haugh unit as a measure of egg albumen quality. Poult. Sci., 41:1461-1468.*

Funk, E.M., Froning, G., Grottes, G., Forward, R. and Kinder, J. (1958). *Quality of eggs laid by caged layers. World Poult. Sci. J., 15:207.*

Gunawardana, P., Roland Sr., D. A. and Bryant, M. M. (2008). *Effect of energy and protein on performance, egg components, egg solids, egg quality, and profits in molted Hy-Line W-36 hens. J. Appl. Poult. Res., 17:432-439*

Harms, R. H., and Russell., G. B. (1993). *Optimizing egg mass with amino acid supplementation of a low-protein diet. Poult. Sci,.72:1892–1896.*

Hussein, M.A.A., Kiut El-Kloub, M.E., Gad El-Hak,M.K. and Abbas, A. M. (2010). *Optimal metabolizable energy and crud protein levels for Sinai laying hens. Egypt. Poult. Sci., 30: 1073-1096.*

Jensen, L. S., Calderon, V. M. and Mendonca, Jr, C. X. (1990). *Response to tryptophan of laying hens fed practical diets varying in protein concentration. Poult. Sci., 69:1956–1965.*

Keshavarz, K., and Austic, R. E. (2004). *The use of low-protein, low-phosphorous, amino acid-, and phytase supplemented diets on laying hen performance and nitrogen and phosphorous excretion . Poult. Sci., 83:75–83.*

Keshavarz, K., and Jackson, M. E. (1992). *Performance of growing pullets and laying hens fed low-protein, amino acid-supplemented diets. Poult. Sci., 71:905–918.*

Khajali, F.,Khoshouie, E. A., Dehkordi ., S, K. and Hematian, M. (2008). *Production performance and egg quality of Hy-Line W36 laying hens fed reduced-protein Diets at a constant total sulfur amino acid:lysine ratio. J. Appl. Poult. Res., 17:390–397.*

Leeson, S., and Caston, L. J. (1996). *Response of laying hens to diets varying in crude protein or available phosphorous. Appl. Poult. Res., 5:289–296.*

Leeson,S. and Caston, L.J.(1997). *A problem with characteristics of the thin albumen in laying hens. Poult. Sci., 76: 1332-1336.*

Liu, Z., Qi, G.and Yoon, I. (2002). *Effect of yeast culture on production parameters and intestinal micro flora in laying hens. Page 89 in Poultry Science Association 91st Annual Meeting Abstracts. August 11–14, 2002. Newark, DE. Abstract No: 381.*

Liu,Z., Wu, G.; Bryant, M. M. and Roland Sr, D. A. (2005). *Influence of add synthetic lysine in low-protein diets with the methionine plus cystine to lysine ratio maintained at 0.75. J. Appl. Poult. Res., 14:174–182.*

Miles, R. D., and Bootwalla, S. M. (1991). *Direct-Fed-Microbials in animal production. Natl. Feed Ingredients Assoc., West Des Moines, IA.*

Novak, C. ;Yakout, H.and Scheideler, S. (2004). *The combined effects of dietary lysine and total sulfur amino acid level on egg production parameters and egg components in Dekalb Delta laying hens. Poult. Sci., 83:977–984.*

Novak, C., Yakout, H. M. and Schedeler, E. (2006). *The effect of dietary protein level and total amino acid:lysine ratio on egg production parameters and egg* *yield in Hy-Line W-98 hens. Poult. Sci., 85:2195–2206.*

Nursoy, H., Kaplan, O.; Og˘uz, M. N. and Yılmaz ,O. (2004). *Effects of varying levels of live yeast culture on yield and some parameters in laying hen diets. Indian Vet. J.,81:59–62.*

Roberts, S. A., Xin, H.; Kerr, B. J., Russell, J. R. and Bregendahl, K. (2007). *Effects of dietary fiber and reduced crude protein on nitrogen balance and egg production in laying hens. Poult. Sci., 86:1716–1725.*

SAS (2003). *Statistical Analysis System, User's Guide, Statistics, SAS Institute Carry, North Carolina.*

Schutte, J. B., Jong, J. de and Bertram, H. L. (1994). *Requirement of the laying hen for sulfur amino acids. Poult. Sci., 73:274–280.*

Shafer, D.J., Carey, J.B., Prochaska, J.F. and A. R.,Sams.(1998). *Dietary methionine intake effects on egg component yield composition functionality and texture profile analysis. Poult. Sci., 77: 1056-1062.*

Singh, R. A., (1990). *Poultry production, 3rd edition. Kalyany publishers, New Delhi, Ludhiana.*

Sohail, S. S., Bryant, M. M. and Roland Sr, D. A. (2003). *Influence of dietary fat on economic returns of commercial Leghorns. J. Appl. Poult. Res., 12:356-361.*

Tangendjaja, B., and Yoon, I. (2002). *Effect of yeast culture on egg production and mortality in layer chickens. Page 89 in Poultry Science Association 91st Annual Meeting Abstracts. August 11–14, 2002. Newark, DE. Abstract No: 380.*

Thayer, R. H.; Burket, R. F; Morrison, R. D. and Murray, E.F. (1978). *Efficiency of utilization of dietary phosphorus by caged turkey breeder hens when fed rations supplemented with live yeast culture. Animal Science Research Report MP-103. Oklahoma State Univ., Stillwater, OK.*

Wu, G., P. Gunawardana, Bryant, M. M.; Voitle, R. A. and Roland Sr, D. A. (2007). *Effects of dietary energy and protein on performance, egg composition, egg solids, egg quality and profits of Hy-line W-36 hens during phase 3. Jap. Poult. Sci., 44:52–57.*

Wu, G.; Bryant, M. M.; Voitle, R. A. and Roland Sr, D. A. (2005). *Performance comparison and nutritional requirement of five commercial layer strain in phase four. Int. J. Poult. Sci., 4:182-186.*

Yakout, M. H. (2010). *Effects of reducing dietary crude protein with amino acids supplementation on performance of commercial white leghorn layers during the second production period. Egypt. Poult. Sci., 30: 961-974.*

Yalcın, S., O¨zsoy, B., Erol, H. and Yalcın, S. (2008). *Yeast culture supplementation to laying hen diets containing soybean meal or sunflower seed meal and its effect on performance, egg quality traits, and blood chemistry. J. Appl. Poult. Res., 17:229-236.*

Yıldız, A. O¨., Parlat, S. S. and Yıldırım, I. (2004). *Effect of dietary addition of live yeast (Saccharomyces cerevisiae) on some performance parameters of adult Japanese quail (Coturnix coturnix Japonica) induced by aflatoxicosis. Revue. Med. Vet., 155:38–41.*

Zou, S. G., and Wu,Y. Z. (2005). *Effect of supplemental fat on performance of laying hens. Int. J. Poult. Sci., 4:998-1000.*

الملخص العربي

تأثير المستويات المختلفة من البروتين والخميرة الجافة على الأداء الإنتاجي لدجاج البيض المحلي

أحمد عبد المقصود، عاطف عبد الراضي، سعيد الشيخ و رأفت خضر

قسم تغذية الحيوان والدواجن-مركز بحوث الصحراء –المطرية القاهرة

أجريت هذه الدراسة لبحث تأثير المستويات المختلفة من البروتين والخميرة الجافة على الأداء الإنتاجي لدجاج البيض المحلي. أستخدم في هذه التجربة عدد ٩٠ دجاجة مطروح عمر ٣٢ أسبوع وزعت على ستة مجاميع تجريبية بمعدل ١٥ دجاجة لكل معاملة مقسمة على خمس مكررات بكل مكررة ثلاث دجاجات. أجريت التجربة فى تصميم إحصائى فكتوريال ٣X ٢ بإستخدام ثلاث مستويات بروتين (١٦، ١٤، ١٢ %) متساوية فى مستوى (المثيونين والليسين) ومستويان خميرة جافة (٠٠,٠أو ٢٥٠) ملجم/كجم عليقه. أشارت النتائج إلى :

سجل الدجاج المغذى على علائق تحتوى على ١٦% بروتين أعلى قيم معنوية فى إنتاج البيض (٦٧,٦٨%)، وزن البيض (٤٧,٨٢)جم وكتلة وزن البيض (٣١,٣٣) جم خلال الفترة الكلية للدراسة. الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم عليقة أظهر أعلى قيم معنوية فى إنتاج البيض (٦٤,٦٩%) وكتلة وزن البيض (٢٨,٧٨) جم خلال الفترة الكلية للدراسة. أظهر الدجاج المغذة على علائق محتوية على ١٦% بروتين مع الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم علف أعلى قيم معنوية لإنتاج البيض (٧٢%) وكتلة وزن البيض(٣٤,٢١) جم خلال الفترة الكلية للدراسة.

سجل الدجاج المغذة على ١٢% بروتين أعلى قيم معنوية لأستهلاك العلف (٨٢,٩٨)جم بينما لايوجد تأثير معنوى بين العلائق المحتوية على ١٦% أو ١٤% بروتين.سجل الدجاج المغذة على ١٦% أو ١٤% بروتين أحسن قيم معنوية لمعامل التحويل الغذائى خلال الفترات المختلفة للدراسة والفترة الكلية للدراسة.

الدجاج المغذى على عليقة محتوية على ١٢% بروتين مع الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم علف سجل أعلى قيم معنويةلأستهلاك العلف (٨٨,٦٠) جم مقارنة بالمجاميع الأخرى.على العكس من ذلك الدجاج المغذة على ١٦% بروتين مع الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم أظهر أحسن قيمة معنوية لمعامل التحويل الغذائى (٢,١٠) جم غذاء/جم كتلة بيض مقارنة بالمجاميع الأخرى.

وزن صفار البيض، ودليل البيضة، وسمك القشرة و وحدة هاو لم تتأثر معنويا بمستوى البروتين.بينما العلائق المحتوية على ١٤% بروتين أظهرت أعلى قيمة لوزن قشرة البيض (١٢,٦٢%) مقارنة مع المجاميع الأخرى.الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم أظهر أحسن قيمة معنوية لسمك القشرة (٠,٥٠٠٢)ملم مقارنة بالكنترول.لم يوجد أى تأثير معنوى للتداخل بين مستوى البروتين والأمداد بالخميرة الجافة على جودة البيض فيما عدا الدجاج المغذة على عليقة تحتوى على ١٦% بروتين مع ٢٥٠ ملجم خميرة جافة/كجم عليقة لسمك القشرة (٠,٥٤١١)ملم مقارنة بالمجاميع الأخرى.

الدجاج المغذى على عليقة ١٦%بروتين أظهر أحسن قيم للكفاءة الأقتصادية والكفاءة الأقتصادية النسبية (٠,٨٩و١٠٠) يلية العلائق المحتوية على ١٤% بروتين (٠,٨٦و٩٦,٦٣). الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم عليقة سجل أحسن قيم للكفاءة الأقتصادية والكفاءة الأقتصادية النسبية(٠,٧٥ و٨٤,٢٧) . الدجاج المغذى على عليقة ١٦%بروتين مع الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم سجل أفضل قيم للكفاءة الأقتصادية والكفاءة الأقتصادية النسبية (١,٠٩و١٢٢,٤٧).

تشير النتائج الى أن العلائق المحتوية على ١٦% بروتين بدون أو مع ٢٥٠ ملجم خميرة جافة/كجم حسن أنتاج البيض، وزن البيض،كتلة وزن البيض،معامل التحويل الغذائى،جودة قشرة البيضة والكفاءة الأقتصادية والكفاءة الأقتصادية النسبية. الأمداد بالخميرة الجافة ٢٥٠ ملجم/كجم عليقة حسن إنتاج البيض، كتلة وزن البيض،سمك قشرة البيضة ،الكفاءة الأقتصادية والكفاءة الأقتصادية النسبية .