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USING YEASTS IN LAYING HEN DIETS

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ABSTRACT

The current study was conducted to evaluate the effect of adding inactive or active dried yeast (*Saccharomyces Cerevisiae*) into laying hen diets on their performance and egg quality. For this purpose a total number of 900 white Hy line hens 24 weeks old were divided into nine treated groups of 100 laying hens each. For 16 weeks experimental period the groups were fed on basal diet supplemented with 5 graded levels of active or inactive dried yeast as 0.0% (control), 2%, 4%, 6% and 8%. These experimental diets were formulated to be iso-caloric. The obtained results showed that:

1- Adding yeast either inactive or active to layer diets at most tested levels increased both egg production and egg weight compared to the control group.
2- Adding yeast culture to layer diets at most tested levels significantly reduced the average feed intake and significantly ($P \leq 0.05$) improved feed conversion ratio compared to the control group.
3- Values of most egg quality traits especially shell thickness, yolk index and shape index were not affected significantly by suppling layer diets with either inactive or active yeast at most tested levels in comparison to the control group.
4- Suppling layer diets with inactive or active yeast at each tested level improved both crude protein and ether extract digestibilities and nitrogen balance % compared to the control group.

Conclusively, it could be recommended to incorporate 2% inactive yeast or 6% active yeast to laying hen diets for improving their performance, egg quality and economic efficiency.

Keywords: (yeasts, laying hens, performance, egg quality.)

INTRODUCTION

Probiotics have been defined as live microbial feed supplements that beneficially affect host animals by improving their intestinal microbial balance (*Fuller*, 1977; *Bardly et al.*, 1994 and *Abd El-Azeem*, 2002). They found that addition of yeast to diets improve growth performance and feed conversion ratio in layers (*Scott et al.*, 1982 and *Santin et al.*, 2003) and egg production (*Abdulrahim et al.*, 1996; *Maia et al.*, 2001and *Osman*, 2003) feed consumption (*Kornegay et al.*, 1995 and *Park et al.*, 2001) egg weight (*Tortuero and Fernandez*, 1995 and *Jin et al.*, 1997) as well as egg mass and egg size in layers (*Park et al.*, 2002 and *Santin et al.*, 2003) and egg specific gravity (*Mohan et al.*, 1995 and *Yildirm* and *Parlat*, 2003).

Recently, active live yeast and non active live dry yeast have been successfully examined as satisfactory alternative to antibiotics feed additives due to its antagonistic effect against harmful pathogenic bacteria (*Wakwak et al.*, 2003). Furthermore, live yeast and dry yeast are effective in counteracting aflatoxin or redestine (*Stanley et al.*, 1993).

The objective of the present study to determine the effect of both live yeast and inactive live dry yeast on laying hen performance and egg quality.

MATERIALS AND METHODS

The experimental work of the present study was carried out at the poultry farm of the El-Shark El-Aousat Company (MELARKGYPT). The chemical analytical part was performed at the Laboratories of Animal Production Department (Animal Nutrition), Faculty of Agriculture, Cairo University.

The objective of the study was to investegate the effect of using different sources and levels of yeast as a partial replacing for soy bean meal on laying hen performance, egg quality, nutrients digestibility and economic efficiency.

Experimental design:

Two sources of yeast and four levels of replacement were studied in this work. Yeast sources were inactive and active yeast. The different levels of replacement were 2, 4, 6 and 8% of soybean mean. Accordingly, 8 (2×4) experimental diets were formulated, in addition, the control diet containing corn-soy without either inactive or active yeast was used. Therefore, a total of 9 experimental treatments were performed.

Experimental diets:

Composition of the 9 basic experimental diets used in this study and their calculated analysis are presented in table (1).

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

Ingredients	Basal Diets (%)								
	Control	Yeast$_1$ (Inactive)				Yeast$_2$ (Active)			
		2%	4%	6%	8%	2%	4%	6%	8%
Yellow Corn	57.7	57.6	57.5	57.5	57.4	57.6	57.5	57.5	57.4
Soy bean meal (44% CP)	24.5	22.5	20.5	18.5	16.5	22.5	20.5	18.5	16.5
Gluten (48 % CP)	3	3	3	3	3	3	3	3	3
Yeast	0	2	4	6	8	2	4	6	8
Oil	2.5	2.6	2.7	2.7	2.8	2.6	2.7	2.7	2.8
Bone meal	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Lime stone	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Salt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Premix *	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Methionine	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Lysine	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Calculated Values **									
Crude protein%	18	18	18	18	18	18	18	18	18
ME K cal/kg	2850	2850	2850	2850	2850	2850	2850	2850	2850
Crude fiber %	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58
Ether extract %	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04	3.04
Methionin %	0.52	0.52	0.51	0.51	0.51	0.52	0.51	0.51	0.51
Lysine %	0.98	0.96	0.95	0.94	0.92	0.96	0.95	0.94	0.92
Ca %	4	4	4	4	4	4	4	4	4
Av. Phosphorus% ***	0.47	0.48	0.52	0.54	0.56	0.48	0.52	0.54	0.56
Linoleic acid%	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37

*** Vitamin and mineral premix at 0.3% of the diet supplies the following per kg of the diet: Vit. A 10000 IU, Vit. D_3 3000 IU, Vit. E 20 mg, Vit. K_3 3 mg, Vit. B_1 2 mg, Vit. B_2 6 mg, Pantothenic acid 10 mg, Folic acid 1mg, Biotin 5mcg, Choline Chloride 500 mg, Niacin 66mg, Vit. B_6 5 mg, Vit. B_{12} 20 mcg, Mn 100 mg, Fe 100 mg, Zn 75mg, Cu 8 mg, I_2 45 mcg and Se 10mcg.**

**** According to NRC (1994).**

***** Av = Available.**

The control diet (No. 1) was formulated to meet the requirement of crude protein without using the tested yeast sources. The different sources of yeast used in this study were *Saccharomyces Cervisiae* in inactive or active form. Two yeast protein products were used in this study. The first one was inactive dried yeast, grown on molasses, product of the Egyptian Sugar and Distillation Company, Hawamdia. While, the second source was active dried yeast, product of the Egyptian Strach Products and Yeast Company, Alexandria. Each one of the tested yeast sources was replaced for soybean meal at levels of 2, 4, 6 and 8%. In all experimental diets, amino acids, vitamins and minerals were adjusted according to the strain recommended catalog. The experimental diets were formulated to meet the nutrient requirments according to the recommended allowances of the Hy-lin breed, which 18% CP and 2850 kcal ME/kg.

Experimental birds and management:

A total number of 900 white Hy-lin laying hens, 24 weeks of age were used. Hens were rendomly divided into 9 groups of 100 hens in four replicates of 25 hens each. Birds were kept in cleaned and fumigated cages of wire floored batteries in closed system house. Feed and water were offered ad-libitum all over the experimental period (16 weeks) from 24 to 40 week of age, under a total of 16 hours light per day regimen.

Measurements and methods of interperetating results Laying hen performance:

The daily eggs laid were recorded on a hen day (HD) basis. The average daily egg production was calculated per hen every four weeks intervals. The average weight was recorded per hen every four weeks intervals to the nearest 0.10g. Also, the daily feed consumed per hen was calculated every four weeks intervals during the experimental periods. Records of egg production, egg weight and feed consumption were used to calculate the amount of feed (kg) required to produce one kg of eggs/hen. Therefore, feed conversion was calculated as follow:

Feed conversion = (kg. feed) / (kg. Eggs).

Egg quality:

A total of 20 eggs were taken from each treatment (5eggs from each replicate) every four weeks for testing their quality. Shape index was determined according to *Romanoff* and *Romanoff* (1949). Shape index % = egg width (cm)/egg length (cm) × 100. Dry shell was weighed to the nearest 0.10g. Shell thickness was measured by using Ames shell thickness Gauge. Yolk index was calculated according to *Funk* (1948).

Yolk index = Yolk height / diameter × 100.

The height was measured using tripod micrometer reading to the nearest 0.01cc, while the yolk diameter was measured by vernier caliber to the nearest mm. Albumen index was calculated as:

height / diameter mean × 100.

Digestion trials:

Digestion trials were conducted at the end of the experimental period to estimate the digestion coefficients and nitrogen retention of the experimental diets. A total number of 72 laying hens were used in digestion trials (8 hens from each treatments, 2 hens from each replicate). The analysis of both diets and excreta were performed according to the Association of official Agricultural Chemists. (*A.O.A.C.*, 1990). Faecal nitrogen was determined according to *Jakobsen et al.* (1960) and urinary organic matter was calculated according to *Abo-Raya* and *Galal* (1971).

Economic efficiency:

To determine the economic efficiency of egg production, the amount of feed consumed during the experimental period and the total eggs produced per treatment were obtained. The price of experimental diets was calculated according to the price of local market as well as the price of the yeast and prices of the ingredients at the time of the experiment.

Economic efficiency = the net revenue / total cost.

Statistical analysis:

Data collected in this study were statistically analyzed using the general linear models (**GLM**) of (***SAS*, 1996**). One-way model was used to study the main effect of treatments on different parameters, the used model was:

$$\mathbf{Y_{ij}} = \mu + \mathbf{T_i} + \mathbf{E_{ij}}$$

Where:

$\mathbf{Y_{ij}}$ = the observation of the parameter measured.

μ = overall mean.

$\mathbf{T_i}$ = effect of treatments, i (1 to 9).

$\mathbf{E_{ij}}$ = experimental error.

Significant differences among means were achieved using the Duncan's Multiple Range test (*Duncan*, 1955). Significant level was set at 5%.

RESULTS AND DISCUSSION

Laying hen performance:

Egg Production and egg weight:

Effect of the experimental diets on egg production and egg weight at the defferent period is presented in Table (2).

During the first period (24- 28 weeks of age). It could be noticed that layer groups fed 2% $yeast_1$ or 6% $yeast_2$ diets produced higher ($P \leq 0.05$) eggs and had higher ($P \leq 0.05$) egg weight than the control group. Neverthless, the opposite trend was noticed when birds group fed $yeast_2$ 8% in comparison to the control group. While, at the second period (28-32 weeks of age), results revealed that layer groups fed $yeast_1$ (2, 4, 6 and 8 %) or $yeast_2$ (2, 4 and 6%) diets had higher ($P \leq 0.05$) egg production and egg weight compared to the control group. However, layers group fed $yeast_2$ 8% diet recorded less ($P \leq 0.05$) egg production and a lower insignificant egg weight compared to the control group. At the third period (32-36 weeks of age), layer groups fed $yeast_1$ 2% or 6% and $yeast_2$ 2% or 6% had higher ($P \leq 0.05$) egg production compared to the control group. Besides, egg weight values were higher ($P \leq 0.05$) with layer groups fed 2% $yeast_1$ or 6% $yeast_2$ than the control group. At the forth period (36- 40 weeks of age). layer group fed 2% $yeast_1$ diet produced egg higher ($P \leq 0.05$) than the control group, while the production was significantly (P ≤0.05) lower with that fed 8% $yeast_2$ in comparison to the control group. Also, there were insignificant differences in egg weight values among the different experimental groups except 8% $yeast_2$ for egg weight whereas the values were significantly (P ≤0.05) lower than the control group.

Table (2): Effect of the experimental diets on egg production and egg weight.

Treatments	The first period (24-28 wk)		The second period (28-32 wk)		The third period (32-36 wk)		The forth period (36- 40 wk)		Overall period (24-40 wk)	
	EP%	EW(g)	EP%	EW(g)	EP%	EW(g)	EP%	EW(g)	EP%	EW(g)
Control	70.08^{b}	51.33^{b}	72.67^{c}	52.91^{c}	74.88^{b}	60.50^{b}	82.33^{b}	63.34^{a}	74.99^{c}	58.02^{ab}
2% - Y_1	81.43^{a}	60.00^{a}	85.02^{a}	61.55^{a}	84.91^{a}	64.36^{a}	88.88^{a}	64.89^{a}	87.56^{a}	62.70^{a}
4% -Y_1	74.81^{ab}	50.66^{ab}	80.90^{ab}	57.26^{ab}	81.16^{ab}	62.19^{ab}	83.81^{b}	62.45^{ab}	80.17^{ab}	58.14^{ab}
6% - Y_1	77.90^{ab}	50.00^{b}	81.95^{ab}	57.88^{ab}	82.79^{a}	62.69^{ab}	85.00^{ab}	63.03^{a}	81.91^{ab}	58.14^{ab}
8% -Y_1	74.81^{ab}	52.33^{ab}	79.16^{b}	57.91^{ab}	79.70^{ab}	62.76^{ab}	83.77^{b}	63.40^{a}	79.36^{b}	59.10^{ab}
2% -Y_2	78.36^{a}	47.33^{c}	80.04^{ab}	56.33^{ab}	82.86^{a}	60.73^{b}	85.14^{ab}	61.41^{ab}	81.60^{ab}	56.45^{b}
4% - Y_2	74.52^{ab}	50.00^{b}	74.85^{b}	57.26^{ab}	79.31^{ab}	62.40^{ab}	83.12^{b}	62.52^{ab}	77.95^{b}	58.04^{ab}
6%- Y_2	81.00^{a}	56.66^{a}	84.55^{a}	59.64^{a}	85.21^{a}	64.08^{a}	87.72^{ab}	64.34^{a}	84.62^{a}	61.18^{a}
8% -Y_2	67.16^{c}	57.33^{a}	67.16^{d}	59.65^{a}	72.16^{b}	60.48^{b}	75.76^{c}	60.62^{b}	70.56^{c}	56.02^{b}

a, b, c, d . . . Mean each column bearing the same superscripts don't differ significantly (P ≤0.05)
Y_1: Inactive yeast ..... 2 %, 4%, 6% & 8%. Y_2: Active yeast ..... 2 %, 4%, 6% & 8%.

Generally, feeding layer hens on diets supplemented with 2% $yeast_1$ or 6% $yeast_2$ significantly (P ≤0.05) improved egg production in comparison to the control group. Nevertheless, the values were (P ≤0.05) lower than the control group when layer hens were fed diets supplemented with 8% $yeast_2$. The differences among the other experimental groups in comparison to the control group were insignificant as shown in Table (2).

It is worthy to note that addition yeast culture to layer diets at most tested levels resulted in an increase in both egg production and egg weight in comparison to the control group. These results are in agreement with those reported by *Tortuero* and *Fernandez* (1995); *Osman et al.* (2003); *Siam et al.* (2004); *Mohdavi et al.* (2005); *Abu-Taleb et al.* (2005) and *Chin et al.* (2006) who found that average egg production significantly increased due to adding active dried yeast by 1% or 1.5% into diets of laying quail for eight weeks experimental periods. The improvement in the productive performance may be attributed to the large amount of metabolites which with some viable yeast cell can be used as a probiotic as reported by *Miles* and *Bootwella* (1991).

Feed intake and feed conversion ratio:

Effect of the experimental diets on feed intake (FI) and feed conversion ratio (FCR) at the defferent periods is lested in Table (3). The differences in (FI) values among the experimental groups during the different experimental periods were nearly in significant. Nevertheless the values of (FCR) were significantly ($P \leq 0.05$) improved with adding $yeast_1$ or $yeast_2$ to layer diets during most experimental periods in comparison to the control group.

Table (3): Effect of the experimental diets on Feed Intake (FI) and Feed Conversion Ratio (FCR).

Treatments	The first period (24-28 wk)		The second period (28-32 wk)		The third period (32-36 wk)		The forth period (36- 40 wk)		Overall period (24 – 40wk)	
	FI	FCR	FI	FCR	FI	FCR	FI	FCR	FI	FCR
Control	87.00^{a}	2.42^{a}	94.25^{a}	2.45^{a}	101.50^{a}	2.24^{a}	101.60^{a}	1.95^{b}	96.09^{a}	2.21^{a}
2% - Y_1	85.00^{ab}	1.74^{d}	86.74^{b}	1.66^{f}	95.50^{b}	1.75^{c}	95.60^{b}	1.66^{d}	90.71^{b}	1.65^{e}
4% -Y_1	87.09^{a}	2.29^{b}	92.40^{ab}	1.99^{d}	98.80^{ab}	1.96^{b}	98.91^{ab}	1.89^{bc}	94.3^{a}	2.02^{b}
6% - Y_1	85.79^{ab}	2.20^{b}	93.90^{a}	1.98^{d}	98.60^{ab}	1.89^{b}	99.67^{a}	1.86^{bc}	94.49^{a}	1.98^{c}
8% -Y_1	85.70^{ab}	2.19^{b}	92.40^{ab}	2.02^{cd}	98.80^{ab}	1.97^{b}	99.93^{a}	1.88^{bc}	94.21^{a}	2.01^{bc}
2% -Y_2	85.00^{ab}	2.29^{b}	92.40^{ab}	2.05^{cd}	96.50^{ab}	1.92^{b}	95.50^{ab}	1.83^{c}	92.44^{ab}	2.01^{bc}
4% - Y_2	85.00^{ab}	2.28^{b}	92.25^{ab}	2.15^{c}	95.56^{b}	1.93^{b}	96.64^{ab}	1.86^{bc}	92.36^{ab}	2.041^{bc}
6%- Y_2	86.80^{a}	1.89^{c}	92.25^{ab}	1.83^{e}	95.50^{b}	1.75^{c}	95.63^{b}	1.69^{d}	92.55^{ab}	1.79^{d}
8% -Y_2	86.80^{a}	2.25^{b}	92.51^{ab}	2.13^{b}	98.80^{ab}	2.26^{a}	99.94^{a}	2.18^{a}	94.51^{a}	2.25^{a}

a, b, c, d . . . . Mean in each colum bearing the same superscripts don't differ significantly ($P \leq 0.05$).

Y_1: Inactive yeast ..... 2 %, 4%, 6% & 8%. Y_2: Active yeast ..... 2 %, 4%, 6% & 8%.

Generally, addition yeast culture inactive or active to layer diets at the most tested levels insignificantly reduced FI and Significantly ($P \leq 0.05$) improved FCR in comparison to the control group.

Its worthy to note that, the decline of feed intake resulted from addition yeast culture to layer diets at most tested levels was supported by several researches reported by *Koudela* and *Nyirenda* . (1995); *Balev* et al. (2001) and *Soliman* (2002) who reported that feed intake was reduced as active dried yeast added at 4g/kg into Bovans white laying hens diets at 25 weeks old for 90 days.

Egg quality:

Results of egg quality as indicated by shell weight (SW), shell thickness (ST), yolk index (YI), albumin index (AI) and shape index (SI) are presented in Table (4). Results showed that supplementation layer diets with $yeast_1$ at levels of 2, 4, 6 and 8% did not affect significantly on ST and YI compared to the control group. Also, the same trend was noticed with ST and SI when layer diets were supplemented with $yeast_2$ at levels of 2, 4, 6 and 8%. However, both AI and SI values were significantly ($P \leq 0.05$) improved with feeding layers on 4 or 6% $yeast_1$ diets in comparison to the control group. The AI value was only improved ($P \leq 0.05$) when layers fed on 8% $yeast_2$ diets compared to the control group (74.81 vs 78.53).

Table (4): Effect of experimental diets on egg quality.

Parameteres / Treatment	SW	ST	YI	AI	SI
Control	9.68^{ab}	36.69^{abc}	44.03^{a}	74.81^{b}	69.02^{bc}
2% - Y_1	10.67^{ab}	39.59^{b}	42.85^{ab}	78.16^{ab}	71.38^{ab}
4% - Y_1	10.03^{ab}	37.60^{b}	48.13^{a}	79.26^{a}	75.90^{a}
6% - Y_1	8.53^{b}	35.41^{abc}	42.4^{ab}	79.56^{a}	76.23^{a}
8% - Y_1	12.47^{a}	34.06^{bc}	42.1^{ab}	76.10^{ab}	72.48^{ab}
2% - Y_2	6.95^{bc}	37.39^{abc}	40.3^{ab}	76.30^{ab}	69.58^{b}
4% - Y_2	11.24^{a}	32.70^{c}	39.9^{b}	76.47^{ab}	72.90^{ab}
6% - Y_2	8.15^{bc}	40.34^{a}	40.5^{ab}	76.88^{ab}	73.95^{ab}
8% - Y_2	7.55^{bc}	33.38^{bc}	40.6^{ab}	78.53^{a}	67.15^{c}

a, b, c, d . . . Mean each column bearing the same superscripts don't differ significantly ($P \leq 0.05$) .
SW: shell weight. ST: shell thickness. YI: yolk index. AI: albumin index. SI : Shape index.

Generally, values of most egg quality traits especially ST, YI and SI were not affected significantly by suppling layer diets with dried $yeast_1$ or $yeast_2$ at most tested levels in comparison to the control group. These observations were supported with those reported by *Piva* et al. (2003) and *Nursoy* et al. (2004) who found that egg breaking strength, egg shell thickness, egg yolk index, egg albumin index and yolk colour scores were similar among leghorn hens groups fed diets supplemented with different levels of yeast culture (0, 0.2 and 0.3% of the diet).

Digestion coefficient and nitrogen balance.

Data in Table (5) showed that suppling layer diets with 6 or 8% $yeast_1$ improved significantly ($P \leq 0.05$) CP and EE digestibility and nitrogen balance (%) compared to the control group. The obtained values were 94.22, 96.63 and 96.94% for CP.; 74.06, 79.13 and 79.72% for EE and 78.60, 80.43 and 80.39% for nitrogen balance %, respectively. Besides, there was a significant ($P \leq 0.05$) improvement in CP digestibility due to fed laying hens diet containing 8% $yeast_2$ compared to the control group (96.74 vs 94.22%). However, the differences in NFE and OM digestibility among most experimental groups were insignificant.

In general, supplementation yeast 1 or 2 in layer diets at levels of 2, 4, 6 and 8% resulted in an improvement in both CP and EE digestabilities and nitrogen balance % in comparison to the control group. This improvement may be due to the benefit effect of yeast in altering metabolism by increasing digestive enzyme activity and decreasing bacterial enzyme activity and ammonia production and improving digestion neutralizing enterotoxins (*Guillot*, 2000 and *Nir* and *Senkoylu*, 2000).

Table (5): Effect of the experimental diets on digestion coefficient and nitrogen balance:

Parameteres / Treatment	CP(%)	EE(%)	CF(%)	NFE(%)	OM(%)	NB(%)
Control	94.22^{b}	74.06^{b}	26.04^{b}	81.10^{abc}	79.38^{ab}	78.60^{b}
2% - Y_1	97.85^{a}	75.58^{ab}	26.85^{a}	79.61^{c}	75.38^{C}	78.68^{b}
4% - Y_1	95.91^{ab}	76.19^{ab}	24.72^{d}	80.47^{bc}	77.02^{abc}	79.19^{ab}
6% - Y_1	96.63^{a}	79.13^{a}	25.38^{c}	81.02^{abc}	76.66^{bc}	80.43^{a}
8% - Y_1	96.94^{a}	79.72^{a}	26.00^{b}	81.57^{abc}	76.45^{bc}	80.39^{a}
2% - Y_2	96.18^{ab}	78.55^{ab}	26.22^{ab}	81.52^{abc}	77.99^{abc}	80.13^{ab}
4% - Y_2	96.20^{ab}	77.61^{ab}	26.82^{a}	80.93^{abc}	77.54^{abc}	79.77^{ab}
6% - Y_2	96.25^{a}	77.19^{ab}	25.38^{ab}	83.85^{a}	76.22^{bc}	79.45^{ab}
8% - Y_2	96.74^{a}	78.15^{ab}	26.05^{b}	83.00^{ab}	80.26^{a}	79.34^{ab}

a, b, c, d . . . Mean each column bearing the same superscripts don't differ significantly ($P \leq 0.05$) .
CP: Crude Protein. EE: Ether Extract. CF: Crude Fiber.
NFE: Nitrogen Free Extract
OM: Organic Matter. NB: Nitrogen Balance.

Economic efficiency:

Effect of the experimental diets on economic efficiency is shown in Table (6).

Table (6) : Effect of experimental diets on economic efficiency .

(1) L.E = 1 pound Egyptian Currency = 100 piasters.

Items	Control	Experimental treatments				Percentage of MF substitution			
		Yeast (1)				Yeast (2)			
	0 %	2 %	4 %	6%	8 %	2 %	4 %	6 %	8 %
Price / kg feed (L.E.) [1]	1.45	1.52	1.49	1.47	1.45	1.53	1.52	1.52	1.51
Total Feed Intake Kg/hen	11.36	11.99	11.42	11.47	11.44	11.22	11.15	11.20	11.41
Total Feed cost/hen (L.E)	16.47	18.25	17.02	16.86	16.59	17.17	16.95	17.02	17.23
Total number of eggs / hen	92	106	98	100	98	100	95	103	86
Price of total egg production /hen (L.E).									
Net Revenue / hen (L.E) [2]..........	26.84	30.92	28.59	29.17	28.59	29.17	27.16	30.05	25.09
Economic Efficiency (E :E) [3]	10.37	12.67	11.57	12.31	12.2	12.00	10.21	13.03	7.86
Relative Economic Efficiency [4]	0.63	0.85	0.68	0.73	0.74	0.70	0.60	0.77	0.46
...	100	135	108	116	148	118	95	122	73

(2) Net Revenue / hen (L.E) = Price of total egg production /hen (L.E) – total feed cost /hen (L.E).
(3) Economic Efficiency (E.E) = Net revenue / price of total feed intake.
(4) Relative Economic Efficiency = assuming that the relative economic efficiency (E.E) of the control = 100.

Data showed that addition of $yeast_1$ or $yeast_2$ except 4% and 8% $yeast_2$ improved the relative economic efficiency as compared to the control group. This improvement could be due to reducing the amount of the feed required to produce egg or improving the feed conversion values. These results coincided with those reported by *Abd–Elwahed* et al. (2003) who reported that the economic efficiency values of the layers groups fed 0, 2, 4 and 6% dry yeast substituted for soya been meal were 0.03, 0.38, 0.351 and 0.265, respectively.

Conclusively, addition of 2% inactive yeast or 6% active yeast to laying hen diets can be recommended for the performance, egg quality and economic efficiency.

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