Journal of Animal and Poultry Production

Journal homepage: www.japp.mans.edu.eg
Available online at: www.jappmu.journals.ekb.eg

Effect of Glycine Supplementation of Mandarah Laying Hens Diets on Production Performance and Egg Quality

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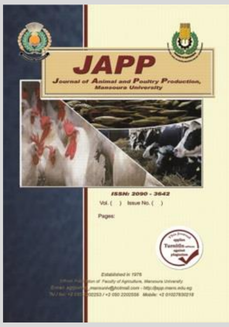

ABSTRACT

The current research was conducted to study the effect of dietary supplemental of glycine (gly) levels 0.1 and 0.2 % on modulating productive performance in Mandarah (M) during laying period from 28 to 40 weeks (wks.) of age. The 1st treatment (T1) was fed the basic diet and served as the control treatment with no additional gly. The 2nd and 3rd treatments were fed the basic diet supplemented with 0.1 and 0.2 % gly/kg diet, respectively. Results indicated that hens fed (T2} and (T3) supplementation significantly improved feed conversion ratio for all intervals except from (28 to 30 wks. of age) compared to control. Egg number, egg weight and egg mass values were significantly increase in M hens fed diets containing T2 or T3 compared to control T1 during the whole period studied. Egg quality {shell (thickness and %), albumen %, yolk (% and index)} were significantly affected due to T2 and T3 supplementation to hens. Significant increases have been recorded in abdominal fat % and triglyceride (TG) values of hens in T2 and T3 compared to T1 (control) values at 40 (wks.) of age. Significant decreases have been recorded in litter traits (pH, moisture, nitrogen and ammonia %) of hens of T2 compared to control (T1) values at 40 wks. of age. The results of the current research indicated that gly supplementation during the laying period promoted the productive performance and had beneficial effects on quality of poultry litter.

Keywords: Glycine, Productive Performance, Egg Quality, Laying Hens

INTRODUCTION

Local Egyptian chicken strains are known to own favorite properties such as disease resistance, good meat savor and taste, and preferable eggs for consumers. In addition, it has superior survival under local production conditions than the commercial hybrid strain, but it had lower egg production or feed efficiency. Thus, enhancing productive efficiency and health of local strains is count one of the preferences of the Egyptian poultry industry (Sayed *et al*., 2017). Furthermore, in the latest years, poultry productivity is coping with many challenges such as the bad effects of rising ambient temperature resulting from climate change perform less feed intake, a decrease in broilers body weight and meat quality, egg production, egg quality. Moreover, there was an increase in mortality rate and feed conversion in laying hens. Also, there was an excess generation of free radicals with a reduction in resistance of antioxidants (Nisar *et al*., 2013 and Ganaie *et al*., 2013). Thus it was requisite to investigate many solutions to save birds from diseases and enhance their production. So we need nutritional solutions to increase productivity and overcome these defy along with breeding and management. Poultry uses amino acids to achieve a variety of functions, structural constituents and preserves feathers, bone, skin, muscles, and organs (NRC, 1994). Furthermore, amino acids can benefit different functions of metabolic and act as a precursor for body constituents such as multi substantial non-protein (Han and Thacker, 2011).

Meister (1965) indicated that gly is the plainest amino acid in nature; in 1820 it was initially isolated from protein acid hydrolysates by a French chemist called H. Braconnot. In addition, Li and Wu (2017) demonstrated that gly is sweet such as glucose; so, its name was obtained from the Greek word "glykys", which means sweet. Moreover, gly is important components of bile acids excrete into the cavity of the small intestine which is vital for the dietary fat digestion and the sucking of long-chain fatty acids. gly is important for the regulation of metabolic, neurological function, and anti-oxidative reactions. So, this alimentary has been used to prohibit tissue injury, boost anti-oxidative capacity, foster protein synthesis, wound cure, improve immunity, remedy metabolic disorders, cardiovascular disease, cancers, and different inflammatory diseases (Wang *et al*., 2013). Traditionally, gly is sight as a limiting amino acid at a precocious stage for chickens, for thus the requirement of gly has been evaluated especially for a starter of broilers (Dean *et al*., 2006; Ospina-Rojas *et al*., 2013). In addition, gly is categorized for broilers as semi-essential during the period of the grower (Graber and Baker 1973; and Ospina-Rojas *et al*., 2013), also, gly can be limited through broilers full life as low level dietary crude protein (CP) (Awad *et al*., 2015; and Belloir *et al*., 2017). Gly supplementation can affect mucin production indirectly by prohibiting catabolism of threonine into gly or helping as a substrate directly for the protein backbone of mucin because it is rich with gly (Moghaddam *et al*., 2011). Moreover, intestinal mucosa function, digestibility enhancing of dietary fat and manifest metabolizable energy content rising can be affected by gly in broiler diets (Ospina-Rojas *et al*., 2013). Dietary supplementation with gly can correct glutathione (GSH)

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DOI: 10.21608/jappmu.2020.161205

shortage and decrease oxidative stress supply important metabolic benefits to the rats which fed sucrose by enhancing insulin sensitivity (El-Hafidi *et al*., 2018). Diets supplementing with gly for broiler chicks raised its bone-breaking strength and tibia diameter (Yuan *et al*., 2012). Moreover, 0.5, 1 and 2 % gly dietary supplementation increased ($P<0.05$) plasma concentricity of gly and serine, daily weight gain, and bodyweight without affecting body structure, while decreasing plasma concentricity of ammonia, urea, and glutamine, in a dependent manner dose. In addition, gly increased ($P<0.05$) the highest of small-intestinal villus and anti-oxidative capacity thus gly is an essential amino acid for greater protein accretion in milk-fed piglets (Wang *et al*., 2014). Sugiyama *et al*., (1993) indicated that lowering of plasma cholesterol which affects dietary gly might be related to the change of microsomal phospholipid composition. Furthermore, the co-administration of oxidized oils with gly or glutamic acid displays significant recuperation of the liver structure and function thus; gly or glutamic acid is useful, prevents food toxicity, and can be considered as a beneficent food supplement (Zeb and Rahman, 2017). Feed intake and egg weight in laying hens increased ($p<0.01$) linearly by the moderate energy diet supplemented with gly but egg production and feed conversion were not affected significantly. Also, egg content such as albumen (weight and percentage) and yolk weight increased significantly while there was a linear decrease in yolk percentage, yolk to albumen ratio, and eggshell percentage. Thus the addition of gly to laying hen feed can increase egg (production and weight), and that may be mediated throughout feed intake, ileal digestibility of fat, and energy increase (Han and Thacker, 2011). Therefore, gly is very important for economical animal feeding, animal health support, eco-sustainable, zootechnical performance promote when supplemented to standard CP diets. So, gly considered a growth promoter, promote performance by feed intake stimulation (Akinde, 2014).

Former researchers studied glycine supplementation to low protein diets affect on broiler, but not in wide on laying hens' egg production. So, the objective of this experiment was to estimate gly supplementation effects on productive performance, egg quality, relative organ weights, and blood constituents of Mandarah local Egyptian strain laying hens.

MATERIALS AND METHODS

This experiment was performed at Sakha's Poultry Farm, Animal Research Station, Institute of Animal Production Research, and Agricultural Research Center, Egypt.

Hens, housing and management:

A number of 135 hens, 28 weeks of age, are taken from the Mandarah Egyptian local strain (M).. They are weighed and divided into 3 treatments, each treatment has 3 replicates, and each replicate has 15 hens. Access to water and feed (mash form) was granted to hens ad libitum.

Treatments and diet formulation:

All hens were randomly divided into 3 equivalent replicates in each treatment (15 hens, each) with 3 replicates each. The basic diet was supplied to the 1st treatment (T1) and served as the control treatment. While the 2nd (T2) and the 3rd (T3) treatments were given the basic diet with 0.1 and 0.2 % gly, respectively (Gly 98% feed grade). Each replicate was individually weighed, housed in separated floor pens (185 x 320 cm) and submitted to the same managerial conditions in a windowed house with light cycle regimen of 16 hours light: 8 hours darkness. Hens were fed ad libitum and continuously provided with fresh water. During the experimental period, the basic experimental diet was formulated to meet the nutritional requirements of chickens (from 28 to 40 wks. of age) according to Agriculture Ministry Decree (1996). According to Feed Composition Tables for Animal and Poultry Feed Stuffs Used in Egypt (2001), the composition and calculated analysis of the experimental basic diet is present in Table (1).

Table 1. Composition and calculated analysis of the experimental diets

Ingredients (%)	Control diet	Gly. 0.1%	Gly. 0.2%
Yellow corn	63.37	63.44	63.50
Soybean meal (44%CP)	24.60	24.35	24.20
Wheat bran	2.07	2.15	2.14
Limestone	7. 80	7. 80	7. 80
Di calcium phosphate	1.50	1.50	1.50
Premix[1]	0.30	0.30	0.30
Salt	0.30	0.30	0.30
DL– Methionine	0.06	0.06	0.06
Glycine	0.00	0.10	0.20
Total	100	100	100
Calculated analysis[2]:			
CP %	16.00	16.00	16.00
ME (kcal/kg)	2700	2700	2700
Calcium %	3.30	3.30	3.30
Available phos. %	0.42	0.42	0.42
Dl-Methionine %	0.35	0.35	0.35
Meth.+cyc.	0.62	0.62	0.62
L- lysine-Hcl	0.89	0.88	0.88
Glycine	0.67	0.77	0.86
Glycine+Serine	1.47	1.55	1.64

[1]Vitamin and mineral premix provides per 3kg: Vitamin A 12000 IU; Vitamin D3 2000 IU; Vitamin E. 10mg; Vitamin k3 2mg; VitaminB1 1mg; Vitamin B24mg; Vitamin B6 1.5 mg; Pantothenic acid 10mg; VitaminB12 0.01mg; Folic acid 1mg; Niacin 20mg; Biotin 0.05mg; Choline chloride (50% choline) 500 mg; Zn 55mg; Fe 30mg; I 1mg; Se 0.1mg; Mn 55mg; ethoxyquin 3000 mg. [2]According to Feed Composition Tables for Animal and Poultry Feedstuffs Used in Egypt (2001).

Measurements

Egg number (EN), egg weight (EW) and egg mass (EM) = {EN × average EW/period} In addition, feed conversion (FC) = (g diet/hen/day) and feed conversion ratio (FCR) = (g feed/g eggs) were recorded then were averaged and expressed per hen/ 2 (wks.) through the period from 28 to 40 (wks.) of age. A number of 105 eggs (35eggs per each treatment) were taken after 40 (wks.) of age to determine the interior and exterior egg quality parameters. Eggs were individually weighed, broken, and the inner contents were placed on a leveled glass surface to determine the inner quality of the egg. Albumen and yolk (weight %) were measured, shell {weight %, thickness (mm), and membranes}, egg {length (mm), and width (mm)}, yolk {height, and diameter (mm)} were measured by a micrometer.

(Yolk and shape) index (%) were calculated according to Tilki and Saatci (2004) as revealed in the following equation:

Yolk index (%) = Yolk height (mm) / Yolk diameter × 100

Shape index (%) = (width/length) × 100

Haugh unit score (HU) was applied from a special chart using EW and albumin height which was measured by using a micrometer according to Haugh (1937), Kotaiah and Mohapatra (1974) and Eisen *et al*. (1962).

Haugh unit = 100* log (H+7.57) - (1.7*W$^{0.37}$)

where

H= Albumen height in mm, W= EW in gm.

Blood collection and serum metabolites analysis:

At 40 wks of age, 3 hens/ replicate were selected randomly and slaughtered and 3 mL of blood samples were collected in tubes kept in ice. After that, the blood samples were centrifuged at 4 C at 4000 g for 20 min. Hemolysis-free serum samples were transferred to 1.5 mL micro centrifuge tubes and stored at -20 oC until further analysis. Serum concentrations of cholesterol and TG were determined according to Richmond (1973) and Fassati and Prencipe (1982), respectively, HDL according to Burstein, (1970), Albumin according to Doumas *et al*., (1949), Total protein according to Gornal *et al*., (1949). ALT and AST according to Reitman and Frankel (1957). Creatinine according to Schirmeister *et al*., (1964).

Carcass yields:

Live body weights (LBW) of selected hens (9/ treatment) were individually recorded prior to the halal slaughter. After that the hens were slaughtered, eviscerated, and the liver, heart, and abdominal fat pad samples were weighed and expressed as % of LBW. The weights of the carcass without (feathers, head, shanks, intestines, and all internal organs except the kidneys and lungs) were recorded and expressed as % of LBW. Abdominal fat weight, intestine and oviduct lengths (from Infundibulum to the end of Vagina), and liver weight were recorded.

Litter sampling

Litter samples were collected at 40 wks of age as described by Atapattu *et al*., (2008). Three samples from each replicate were randomly taken by avoiding the area of feeder and drinker. The litter ammonia (LA, ppm) at hens head height, litter pH (LpH, degree) using comparative pH paper and house humidity (HH, %) were taken at 2 wks periods. The 3 samples from a replicate were pooled and kept in the refrigerator for 24 h. Samples were then analyzed for their Nitrogen and moisture contents.

Statistical analysis

Data from all the response variables were subjected to one way analysis of variance (SAS, 2000)

$$X_{ij} = \mu + T_i + e_{ij}$$

Where:

Xij = any observation

µ = Overall mean

Ti = Treatments (i = 1, 2…and 10)

eij = Experimental error

Variables having a significant F-test ($P < 0.05$) were compared using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Egg Production:

The effect of gly supplementation of Mandarah local strain laying hens diets on egg production is presented in Table (2). The results indicated that egg number (EN) as well as egg mass (EM) values were significantly increased ($P \leq 0.05$) due to gly supplementation in 0.1% gly (T2) or 0.2% gly (T3) during all production periods except periods from (28 to 30 wks. of age) in EN and (28 to 30 and 30 to 32 wks. of age) in EM, the differences were no significant. Hence, EN in overall period (28-40 wks.) were 40.00, 45.46 and 47.93 egg/hen for control, 0.1 and 0.2 gly respectively, There were significant increases ($P \leq 0.05$) have been recorded in egg number and egg mass values of0.2% gly group compared to 0.1% gly group values during the period from 38-40 (wks.) of ageand the whole period (28 to 40 wks. of age). While, there was no significant differences among treatments in EW due to gly supplementation. These observed findings were in accordance with Cave (1983) whoobserved that egg production was higher ($P \leq 0.05$) for chicks that had received the glycine in starter diet compared with control. Also, this results are in agreement with Han and Thacker (2011) who found that the overall results of gly (0.05 to 0.1%) supplementation in layinghen diets has the potential to increase egg production, these improvement seemed to be mediated through increases in feed consumption, energy and the fatileal digestibility..

Table 2. Effect of glycine supplementation of Mandarah laying hens diets on productive performance

Items	Control	0.1% glycine	0.2% glycine	SEM	P-Value
		Egg number (egg/hen/period)			
28-30wks	6.53	6.93	7.46	0.232	0.288
30-32wks	6.48^{b}	7.00^{ab}	7.40^{a}	0.158	0.029
32-34wks	6.73^{b}	7.60^{a}	8.08^{a}	0.220	0.007
34-36wks	7.08^{b}	8.95^{a}	8.68^{a}	0.301	0.001
36-38wks	6.53^{b}	7.57^{a}	7.64^{a}	0.206	0.014
38-40wks	6.62^{c}	7.40^{b}	8.64^{a}	0.299	0.0001
28-40wks	40.00^{c}	45.46^{b}	47.93^{a}	1.202	0.0001
		Egg weight (g)			
28-30wks	47.91	47.63	48.08	0.199	0.706
30-32wks	50.78	50.99	50.01	0.302	0.438
32-34wks	49.86	52.41	50.32	0.640	0.244
34-36wks	49.97	48.68	49.32	0.351	0.372
36-38wks	49.85	49.59	49.94	0.297	0.911
38-40wks	49.58	48.97	48.10	0.312	0.144
28-40wks	49.67	49.70	49.27	0.202	0.697
		Egg mass (g/hen/day)			
28-30wks	22.35	23.60	25.63	0.798	0.266
30-32wks	23.55	25.48	26.43	0.538	0.054
32-34wks	23.98^{b}	28.40^{a}	29.08^{a}	0.849	0.002
34-36wks	25.28^{b}	31.14^{a}	30.60^{a}	0.969	0.0001
36-38wks	23.27^{b}	26.82^{a}	27.26^{a}	0.729	0.016
38-40wks	23.45^{c}	25.89^{b}	29.69^{a}	0.923	0.0001
28-40wks	23.65^{c}	26.89^{b}	28.11^{a}	0.673	0.0001

[a, b] Means bearing different superscripts within the same row are significantly different (P<0.05).

Nevertheless, this effect may indeed have palatability basis as glycine is sweet, although sense of taste of poultry is assumed to be weak However, gly supplementation in poultry diets should be conducted with care, since extra ingestion of gly can be negative to feed intake. Further, glycineimprovechicks performance fed corn-soya standard crude proteinrations, within appropriate range of amino acids balance and typical nutritive composition. Ospina-Rojas *et al* (2013) indicated that gly supplementation resulted in significant increases in body weight gain: feed ratio, intestinal mucin secretion, fat apparent digestibility, and apparent metabolizable energy values of the gly supplementation diets. Also, they showed that glycine can influence with direct or indirect way the accurate intestinal mucosa function and enhance dietary energy utilization. Moreover, Takahashi *et al*., (2008) indicated that glycine supplementation decrease mRNA expression of pro-inflammatory cytokines like interleukin-1, interleukin-6 and tumor necrosis factor-α as a result of injection of lipopolysaccharide in broiler chickens. This effect may decrease nutrient which directed to immune response and provide more nutrient to production and another mechanism to explain increasing egg production effect of glycine.

Feed consumption (FC) and feed conversion ratio (FCR):

The data shown in (Table 3) show the effects of supplementing Mandarah laying hens diets with gly. Data indicated that there was no significant effect of levels of gly on FC throughout all the experimental periods except the periods from 32-34 wks., gly 0.1% recorded significantly high FC (91.86 g/hen/day) compared to (85.68 g/hen/day) control. In addition, the results showed that significant improvement (P≤ 0.05) in (FCR) due to gly addition groups in all production periods except the first period (28-30 wks.) compared to control. From our experimental results we can investigate that gly addition to laying hens diets led to improve egg production through improve feed efficiency which may due to better nutrient digestibility and small intestine health. Similar results were reported by Ospina-Rojas *et al.*, (2013) indicated that the increase in intestinal mucin secretion appeared to result from increases in threonine. However, inoculation of with Gly inhibits the degradation of Threonine into Glycine (Bernardino *et al.*, 2011). This concept is supported by several studies (Faure *et al.*, 2005; Hamard*et al.*, 2007; Horn *et al.*, 2009, Moghaddam *et al.*, 2011) who indicated that increasing in crude mucinsecretion after glycine incorporation, whereas mucinplay a vital role in intestine protecting from digestive enzymes, acidity and harmful bacteria (Horn *et al.*, 2009). Furthermore, mucin plays a role in purifying nutrients in the gastrointestinal tract, thus affecting the digestion and absorption process of nutrients (Smirnov *et al.*, 2006). In addition, Powel *et al* (2009) observed thatglycine addition to broiler chicks diets improve feed efficiency and decreased serum uric acid in diets with 1.35% lysine (Lys) and excess total sulphur amino acids. Moreover, Yuan *et al.* (2012) found thatthe addition of glycine significantly increased the body weight and improved FCR of broilers fed the diets in which Arginine, Tryptophan, Histidin and Valine became. In the same manner, Hofmann *et al.* (2020) indicated that the gain: feed ratio in broiler chicks increased with digestible Glycine_{equ} (glycine + serine) intake increased (0.9–2.1%). In the case of pigs (Wang *et al.*, 2014) found that dietary glycine improved intestinal health in young pigs under conditions of oxidative stress and glycine deficiency. Also, Xu *et al.* (2018) indicate that gly supplementation 1and 2% could improve energy status and protein synthesis by regulating signaling pathways, and relieve inflammation to alleviate intestinal injury in *Escherichia coli* lipopolysaccharide (LPS)-challenged piglets.

The current research, there was a trend towards increasing levels of gly supplementation with a linear increase in egg production. Peak production usually occurs in local poultry production, when hens reach 34 to 36 wks of age and production gradually decreasesto the laying hensreach around 52 wks. (Theage of taken out of production).The recent study was conducted near the peak production period and it will be interesting to repeat the study to determine the effect of glycine incorporation on the productivity of laying hens during the later periods of the production.

Table 3. Effect of glycine supplementation of Mandarah laying hens diets on feed consumption and feed conversion ratio

Items	Control	0.1% glycine	0.2% glycine	SEM	P-Value
Feed consumption (g/hen/day)					
28-30wks	94.08	92.51	92.47	0.364	0.105
30-32wks	92.23	89.98	91.10	0.595	0.348
32-34wks	85.68^c	91.86^a	90.11^b	0.936	0.0001
34-36wks	89.18	92.00	91.90	0.747	0.237
36-38wks	94.08	92.51	92.47	0.364	0.105
38-40wks	92.23	89.98	91.10	0.595	0.348
28-40wks	91.25	91.47	91.53	0.272	0.927
Feed conversion ratio (feed/egg mass)					
28-30wks	4.21	3.93	3.65	0.129	0.232
30-32wks	3.92^a	3.53^b	3.44^b	0.089	0.037
32-34wks	3.57^a	3.23^b	3.10^b	0.079	0.011
34-36wks	3.52^a	2.95^b	3.00^b	0.094	0.0001
36-38wks	4.05^a	3.45^b	3.39^b	0.116	0.006
38-40wks	3.93^a	3.47^b	3.06^c	0.127	0.0001
28-40wks	3.85^a	3.40^b	3.25^c	0.092	0.0001

$^{a,\ b}$ Means bearing different superscripts within the same row are significantly different (P<0.05).

Egg quality:

Results of Table (4) shows the effect of gly levels 0.1 (T2) and 0.2 % (T3) at 40 wks.of age on external egg quality (shape index, shell weight % and shell thickness) and internal egg quality (albumen weight %, yolk weight %, yolk index and Haugh unit). External and internal egg quality were significantly affected due to levels of gly 00.1 (T2) and 0.2 % (T3) supplementation to laying hens except those of egg shape index and Hough unit which were not significantly different according to levels of gly.

Table 4. Effect of glycine supplementation of Mandarah laying hens diets on egg quality

Items	Control	0.1% glycine	0.2% glycine	SEM	P-Value
Egg weight (g)	50.7^b	53.4^a	52.3^a	0.2616	0.001
Shape index %	75.8	75.3	75.4	0.4006	0.061
Albumen %	55.67^b	56.79^a	56.80^a	0.3251	0.049
Yolk %	31.87^b	32.90^a	33.00^a	0.2773	0.010
Shell %	12.46^a	10.31^{ab}	10.20^b	0.1417	0.011
Yolk index %	43.6^b	46.7^a	47.5^a	0.2529	0.001
Haugh units score	79.4	79.9	79.5	0.1242	0.179
Shell thickness (mm)	0.341^b	0.380^a	0.387^a	0.0027	0.001

$^{a,\ b,\ c}$ Means bearing different superscripts within the same row are significantly different (P<0.05).

These results are in agreement with findings of Han and Thacker (2011) who found that gly supplementation significantly increased egg content, albumen weight and percentage as well as yolk weight, yolk percentage, yolk to albumen ratio and egg shell percentage, while Haugh units were unaffected by level of gly supplementation. Ospina-Rojas *et al.* (2013) indicated that improving egg shell% and thickness may be attributed to better absorption of minerals, in this regard Yuan *et al.* (2012) showed that glycine supplementation of broiler chicks diets improved bone-breaking strength and tibia diameter. In addition, glycine plays significant role in human growth hormone regulation (Eklund *et al.*, 2005), this effect of gly help to improve protein synthesis efficiency (Dean *et al.*, 2006). The role of glycine of asan important components of bile acids which is vital for the dietary fat digestion(Wang *et al.*, 2013) which may help to explain the increase in albumen and egg yolk % due to gly addition to laying hens diets.

Carcass traits:

The results of the effect of gly supplementation of M laying hens diets on carcass parameters during the laying period at 40 (wks.) of age are presented in (Table 5). There was no significant impact of glycine 0.1% (T2) and 0.2 % of the diet (T3) at 40 weeks of age on organ weights (liver, gizzard, heart, spleen, kidney, ovary %, ovary length, Intestine length) except abdominal fat %, were significant. These results are in agreement with those of (Awad *et al.*, 2017, Xie, *et al.*, 2017 and Yuan *et al.*, 2012) who found that liver, heart, and gizzard relative weights were not significantly affected by dietary gly added at levels of 0.02, 0.12, 0.13, 0.29, 0.35, and 0.49%.Ngo *et al.* (1977) found that a Gly-depleted diet could cause significantly reduce DNA, RNA, a lack of heavy ribosomal aggregates in the liver of chicks and reduce liver weight and BW due to protein synthesis. However, Namroud *et al.*, (2008) and Aletor *et al.*, (2000) reported that glycineand glutamic (Glu) supplementation to low protein diet significantly reduced liver percentage weight. Fortifying low crude proteinrations with glycine and glutamic led to a reduction in whole-body and abdominal cavity fat content.

Table 5. Effect of glycine supplementation of Mandarah laying hens diets on carcass traits

Items	Control	0.1% glycine	0.2% glycine	SEM	P-Value
Body weight (g)	1885.00	1784.44	1848.88	42.983	0.644
Abdominal fat %	4.77	4.55	3.70	0 .251	0.189
Liver %	1.82	1.94	2.00	0 .066	0.056
Gizzard %	1.44	1.53	1.74	0 .050	0.065
Heart %	0.538	0.53	0.49	0 .028	0.850
Spleen %	0.140	0.127	0.123	0 .005	0.478
Kidney %	0.405	0.364	0.358	0 .017	0.492
Ovary %	2.58	2.00	2.66	0 .149	0.149
Ovaryduct length(cm)	54.00	54.00	52.44	1.283	0.859
Intestine length (cm)	166.44	158.66	145.11	3.543	0.060

a, b, c Means bearing different superscripts within the same row are significantly different (P<0.05).

In contrast, Awad *et al.*, (2017) and Xie *et al.*, (2017) demonstrated that feeding negative control or gly adding negative control diets resulted in significant higher abdominal fat and relative liver weights ($P \leq 0.001$) also,Glycine level had no linear or quadratic relationship with carcass yields or relative weights of heart, liver, and abdominal fat.

Biochemical blood parameters:

Table (6) represented the effect of gly supplementation in M laying hen diets on biochemical blood parameters. In our study gly supplementation had no significant negative effects on serum total protein, albumin, globulin, AST, ALT, creatinine, total cholesterol, HDL. Glycine 0.2% group (T3) recorded the lowest value of total cholesterol (127.8 mg/dl) compared to control (187.6 mg/dl). While TG increased and low-density lipoproteins (LDL) decreased ($P \leq 0.05$) at 0.1% gly (T2) and 0.2 % (T3) at 40 (wks.) of age. Our results were in agreement with the results observed in finishing broilers of Corzo*et al.*, (2005) indicated that no change in total protein in broilers fed a low-crude protein, EAA + Gly, and control diet. Ospina-Rojas *et al.*, (2013) also noted that low-CP, EAA + Gly diet had no effect on serum total protein and albumin, while serum triglycerides were higher. Similarly, Awad *et al.*, (2017) found that no significant linear or quadratic impact was noted between gly level and serum Triglycerides, cholesterol or uric acid.

Table 6. Some blood constituents of Mandarah laying hens fed glycine supplemented diets .

Items	Control	0.1% glycine	0.2% glycine	SEM	P-Value
Total Protein (g/dl)	5.95	5.41	5.49	0.14	0.3
Albumin (g/dl)	2.55	2.75	2.82	0.08	0.4
Globulin (g/dl)	3.40	2.66	2.67	0.17	0.08
AST (U/L)	42.47	41.13	39.67	1.80	0.21
ALT (U/L)	54.45	50.67	53.61	2.27	0.13
Creatinine(mg/dl)	1.13	1.18	1.10	0.02	0.3
Total cholesterol (mg/dl)	187.60	141.60	127.83	9.66	0.08
Triglycerides (mg/dl)	128.77^{b}	130.53^{b}	154.07^{a}	4.59	0.009
HDL (mg/dl)	44.00	38.05	44.00	4.05	0.8
LDL (mg/dl)	112.78^{a}	107.45a^{b}	109.08^{b}	9.75	0.06

a, b, c Means bearing different superscripts within the same row are significantly different (P<0.05).

Litter traits:

The subsequent effect for previous experimental treatments (T1, T2 and T3) at 32, 36 and 40 weeks of age on litter traits (moisture %, pH, nitrogen % and ammonia %) are presented in Table (7).

Table 7. Effect of glycine supplementation of Mandarah laying hens diets on litter quality

Items	Control	0.1% glycine	0.2% glycine	SEM	P-Value
		Litter moisture%			
32wk	20.33	20.13	20.13	0.05	0.296
36wk	21.96^{a}	20.86^{b}	20.90^{b}	0.21	0.025
40wk	23.10^{a}	21.86^{b}	21.76^{b}	0.24	0.016
		Litter nitrogen%			
32wk	2.46	2.50	2.60	0.04	0.422
36wk	2.63	2.70	2.63	0.04	0.797
40wk	2.83^{a}	2.70^{ab}	2.60^{b}	0.04	0.047
		Litter ammonia%			
32wk	0.31^{a}	0.24^{b}	0.20^{b}	0.01	0.006
36wk	0.40^{a}	0.36^{ab}	0.33^{b}	0.01	0.062
40wk	0.44^{a}	0.36^{b}	0.35^{b}	0.01	0.000

a, b, c Means bearing different superscripts within the same row are significantly different (P<0.05).

The obtained results indicated that the litter traits improved with gly 0.1 (T2) and 0.2 % (T3) compared to control group. Control group (T1) recorded worst litter traits compared with the other groups. There were significant effects of T2 and T3 on litter pH and ammonia % at (32, 36 and 40), litter moisture % at (36 and 40) and litter nitrogen % at 40 (wks.) of age as compared to control group. The results similar to earlier findings Awad *et al.*, (2017) reported that feeding birds on gly supplemented low-CP diets obviously decreased moisture and N contents in the litter compared positive control group. While, there was no significant linear or quadratic relationship was noted between gly level and moisture or N contents of the litter.

CONCLUSION

This study demonstrated clearly that glycine supplementation 0.1 or 0.2% can improve the egg production, feed conversion, egg shellthickness, decrease abdominal fat bad and improve litter quality of local laying hens' strains.

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تأثير إضافة الجليسين الي علائق دجاج المندرة أثناء فترة إنتاج البيض علي الأداء الإنتاجي و جودة البيض

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تهدف هذه الدراسة الي معرفة تأثير استخدام الحامض الأميني الجليسين كإضافة غذائية في علائق سلالة المندرة أثناء فترة وضع البيض (28 – 40 أسبوع) علي الأداء الانتاجي و جودة البيضة , خواص الذبيحة و معاملات الدم. تم استخدام عدد 135 دجاجة من سلالة المندرة عمر 28 أسبوع و تم تقسيمهم الي 3 مجموعات (45 دجاجة لكل معاملة) و 3 مكررات متساوية لكل معاملة, المعاملة الأولي (الكنترول) بدون أي إضافات , المعاملة الثانية (الكنترول+ 0,1 جليسين) المعاملة الثالثة (الكنترول + 0,2% جليسين) بحيث كانت جميع المعاملات متساوية في البروتين و الطاقة الممثلة . خلال فترة التجربة تم تسجيل استهلاك العلف و عدد البيض اليومي و وزن البيض و صفات جودة البيضة و كذلك حساب كتلة البيض و معامل التحويل الغذائي وكذلك تقدير رطوبة و درجة pH الفرشة و نسبة النيتروجين في الفرشة و نسبة الأمونيا. وقد أشارت النتائج الي : تحسن معنوي في عدد البيض المنتج و كتلة البيض نتيجة إضافة الجليسين (0,1 , 0,2 %) في جميع مراحل التجربة ما عدا الفترة (الأسبوع 28 – 30) حيث كان التحسن غير معنوي. كذلك لم يكن هناك تأثير للجليسين علي وزن البيضة. لم يكن هناك أي فروق معنوية في العلف المأكول لجميع المعاملات في كل الفترات المدروسة , ما عدا الفترة (من الاسبوع 32 الي 34) حيث ارتفعت كمية العلف معنويا نتيجة إضافة الجليسين بالنسبة الي الكنترولتحسن معنوي في معامل التحويل الغذائي في جميع مراحل التجربة ما عدا أول أسبوعين و ذلك نتيجة إضافة الجليسين بالمقارنة بالكنترول. أدي إضافة الجليسين الي تحسن معنوي في النسبة المئوية لألبيومين البيضة و كذلك الصفار ومؤشر الصفار و سمك القشرة نتيجة إضافة الجليسين. لم يكن هناك أي فروق معنوية في خصائص الذبيحة نتيجة إضافة الجليسين (النسبة المئوية لكل من (وزن الزبيحة , وزن الكبد , وزن القونصة , وزن الطحال, وزن الكلي, وزن المبيض)) كذلك طول المبيض و طول الأمعاء , ما عدا النسبة المئوية لدهن البطن حيث قلت معنويا نتيجة إضافة الجليسين حيث سجل 69,00 , 82,55 % في المعاملات 0,1 , 0,2 % بالمقارنة بالكنترول (92,33%).لم يكن هناك أي تأثيرات معنوية نتيجة إضافة الجليسين علي معاملات الدم ما عدا الدهون الثلاثة حيث كانت مرتفعة معنويا في المجموعة 0,2% جليسين بينما انخفض الكوليسترول منخفض الكثافة (LDL) نتيجة إضافة الجليسين. تحسن معنوي في جودة الفرشة نسبة الرطوبة , نسبة النيتروجين, نسبة الأمونيا في الفرشة يستنتج من هذه الدراسة أن إضافة الجليسين الي علائق دجاج البياض المحلي بنسبة 0.2% ادي الي أفضل كفاءة غذائية وتحسن سمك القشرة بالإضافة الي تحسن خواص الفرشة, نحتاج الي مزيد من الدراسات لمدي تأثير الجليسين في الفترات المتأخرة من عمر الدجاج علي إنتاج البيض و أيضا في فترة التربية بالإضافة الي تأثيره في تقليل مستوي البروتين المضاف