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Effect of Feeding Diets Supplemented with Varying Levels of Amino Acids on Productive and Physiological Performance of Local Chicken Breed Al-Salam

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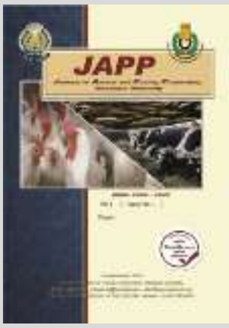
Abd allah, E. A.*; Hanaa K. Abd El-Atty; H. A. Madian; Abeir A. Eshera; Y. K. Badawi and M. F. Saad

Animal Production Research Institute- Agriculture Research Centre, Giza, Egypt.



ABSTRACT

The current study was carried out in the Animal Production Research Station, Sakha Kafr El-Sheikh Egypt belonging to Animal Production Research Institute (APRI Animal Production Research Institute (APRI), EGYPT. Two experiments were carried out to evaluate the effects of dietary amino acid supplementation (Methionine or lysine) in the diet of local chicken breed AL-SALAM on the performance and serum chemistry. The control group contained 0.2 g lysine / kg diet and 0.2 g methionine / kg diet. Lysine levels were 1.12, 1.37 and 1.6 g lysine / kg diet. Methionine levels were 0.60, 0.64 and 0.68 g methionine / kg diet. We found that when adding access amino acid lysine to the diet at level (1.6%) or adding access methionine at levels (0.64 % and 0.68 %) increased daily body weight gain significantly, compared with the control group. Lysozyme's activity was increased when adding access amino acid methionine (0.64 and 0.68%M) then levels (.12%L, 1.37%L, 1.60%L, and 0.60%M, respectively) than the control group. Relative economic efficiency was better when adding access levels (1.60%L or 0.64 and 0.68%M), than other groups. Finally, we suggest adding access lysine with levels 1.60 (%) or access methionine with levels 0.64 and 0.68 % to rations of local poultry breeds from 14 days to reach market weight to reveal the best economic profit gain and to promote the economic efficiency, with reasonable cost.

Keywords: methionine, lysine, chicken, diets, productions.

INTRODUCTION

Native chicken is a local Egyptian chicken with a high population and it is spread throughout Egypt for the production of meat and eggs. Indigenous varieties of chickens have critical roles in such communities, accounting for up to 90% of the poultry population while maintaining a balanced farming system (Pym, 2013).

There is a link between different amounts of essential amino acids in the food in broiler chickens, and any shortfall or surplus might have a detrimental influence on levels of this amino acid in the plasma and muscles and therefore on bird growth (Balnave and Brake 2002 and Jankowski *et al.*, 2020a).

As stated by Jankowski *et al.*, (2017a, b), increasing the amount of methionine (Met) in the diet can increase poultry output. There is additional evidence that Met and Lysine (Lys) levels influence the relative weight of lymphoid organs, which oversee the creation and maintenance of the B-cell compartment in birds (Jankowski *et al.*, 2014). While Sigolo *et al.*, (2019) observed that boosting Lys and Met levels as suggested by the NRC (1994) enhances the relative weight of the Fabritius bursa and consequently improves humoral immunity in birds. It was discovered that using a high level of (4.5% Lys) in the diet improved turkey production outcomes (Jankowski *et al.*, 2020b).

Wen *et al.*, (2017) show that Met supplementation in the broiler feed boosts body weight growth and breast muscle. Rehman *et al.*, (2019) reported a beneficial effect of Met in the diet as a rise in weight gain, carcass weight, chest weight, and thigh weight.

Indigenous breeds' tolerant immune systems aid in their tolerance to adverse weather circumstances and inadequate husbandry techniques (Padhi, 2016). Because it has greater health benefits and customer preferences such as taste, flavor, high levels of vitamins and minerals, comparatively low fat and cholesterol contents and the cuts are easier to handle and less expensive than red meat (Liu *et al.*, 2012).

Several studies have shown that Met has a beneficial effect on the immune system, enhancing both cellular and humoral immune response. It has been reported that Met requirements for optimal immunity are higher than those for optimal growth (Linh *et al*., 2021; Swain and Johri, 2000; Shini and Bryden, 2005).

The beneficial role of synthetic amino acids in the poultry industry has been proven. However, most of the previous investigations have focused on the role of amino acids in improving feed conversion and the immune response in general. This may have crucial economic advantage as the supplementation can reduce mortality and enhance weight.

* **Corresponding author.**
E-mail address: dremad2019@gmail.com
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The local chicken breed AL-SALAM is an indigenous Egyptian dual-purpose breed that was developed for long time ago to be suitable for the Egyptian environmental conditions. Also, the requirements of Lysine and Methionine for this local breed have been changed at last period, so we need to renew the requirements for our local breed AL-SALAM. As a result, the goal of this study was to evaluate how varying levels of methionine (Met) and lysine (Lys) in meals would affect the growth performance and immunological status of local breed chickens.

MATERIALS AND METHODS

The current study was carried out in the Animal Production Research Station, Sakha Kafr El-Sheikh Egypt belonging to Animal Production Research Institute (APRI). The biochemical analysis was done in the laboratories of APRI during the period from November 2020 to February, 2021.

Two experiments were conducted to investigate the effects of supplementing dietary amino acids (Methionine or Lysine) in the diet of the local chicken breed AL-SALAM on the performance and serum chemistry.

Experimental Birds and Management: Three hundred and fifteen one day old unsexed local breed AL-Salam, at 14 days old chicks were randomly assigned to seven experimental diets. Each amino acid treatment was conducted on one hundred and thirty-five day-old chicks to investigate the effect of using dietary amino acids on meat production, physiological and immunological parameters of AL-SALAM local breed. Three experimental levels groups of each amino acid were tested compared to the control group. Each group included 45 birds, divided into 3 subgroups, each containing15 birds. Group 1 was served as a control for all experiments, group 2 was supplemented with 9.2 g lysine / kg diet, group 3 was supplemented with 11.7 g lysine / kg diet and group 4 was supplemented with 14 g lysine / kg diet, group 5 was supplemented with 4.0 g methionine / kg diet, group 6 was supplemented with 4.4 g methionine / kg diet and group 7 was supplemented with 4.8 g methionine / kg diet Table (1).

Table 1. Amino acids lysine and methionine composition (gm. /Kg) of control and experimental diets:

Treatment		Lysine %	Methionine gm/kg
Basic diet (Control)	G1	0.2	0.2
Lysine	G2	0.92+0.2=1.12	0.2
Lysine	G3	1.17+0.2=1.37	0.2
Lysine	G4	1.40+0.2=1.60	0.2
Methionine	G5	0.2	0.40+0.2=0.60
Methionine	G6	0.2	0.44+0.2=0.64
Methionine	G7	0.2	0.48+0.2=0.68

The chicks were reared in deep litter with feed and water offered ad-libitum. The experimental period started from week 3 up to the end of the experiment at 16 weeks old chicks.

Experimental Diet: Chicks were given standard meals for the whole experimental period and supplemented with levels of amino acids. The basal diet was supplemented with 0.92, 1.17 or1.40% L-Lys, or 0.40, 0.44, or 0.48% DL-Met.

Chemical composition of control and based diet (%) Table (2): Dry matter 88 %, Crude protein 16%, crude fiber 3.35%, ether extract 2.87%, digestible energy 2700 (kcal/ kg), Lysine (0.2 g / Kg) and Methionine (0.2 g /Kg) .

Table 2. Chemical composition of basic diet:

Chemical analysis (on DM basis, %):	Control diet
Dry matter (%)	88
Crude protein	16
Crude fiber	3.35
Ether extract	2.87
Digestible energy (kcal/ kg)	2700

Abd-El Rahman and Attia (2001) supplemented low protein rations of laying hens with (0.81% Lys. and 0.35% Met.), we exceeded these amino acids levels to (0.92, 1.17 and1.40% for L-Lys, and to 0.40, 0.44, and 0.48% DL-Met).

Management: A total of 315 chicks from AL-SALAM strain were obtained from research station hatchery and raised from 1 to112 days of age. The birds were divided into a factorial arrangement of treatments with three replicate cages of 45 birds per treatment. On day 4 and 14, chickens were vaccinated against Newcastle disease and infectious bronchitis. Vaccination against infectious bursal disease was administered on day 21. Vaccinations were performed via eye drops. Water and experimental feed were provided ad libitum. The feeding experiment was conducted for 16 wk. The experimental birds received humane care as outlined and approved by Institutional the Animal production and use Committee for use of Animals for Scientific Purposes (Research Policy, APRI, Egypt). The temperature of the room was maintained at 32 to 34 °C for the first 3 d and then reduced by 2 to 3 °C per week to a final temperature of 20 °C.

Data Collection and Analysis: One a weekly basis, individual body weight (BW) and feed intake (FI) were recorded. Mortality was checked daily, and weights of dead birds were used to adjust feed conversion ratio (FCR). Data collected for 16 wk were recorded, and calculations for body weight gain (BWG) and feed intake (FI) of the bird were performed. The feed conversion ratio (FCR) was calculated as follows: total feed consumed by birds/total weight gain, and the results were analyzed using Statistical Analysis Software (SAS, 2013).

Sample collection: At the end of the experiment, 3 birds per group were randomly selected and weighed before being slaughtered. Initial and final live body weight (IBW and FBW), feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR), recorded. At the end of the experimental period, carcass characteristics were evaluated for 9 chicks from each treatment. Finally, economic efficiency (E E) was determined

Economical Efficiency: was calculated, while lysine Kg price = 45 LE/Kg and methionine Kg price = 65 LE/Kg.

Body Weight Gain (BWG): Body weight gain was determined weekly and average weight gain was calculated every 4 weeks. Body weight gain means determined as daily body weight gain. Total body weight in 4 weeks period/ number of chicks = average body weight/bird/4 weeks, and then divided on 28 days to reach mean body weight/bird/day.

Feed Intake (FI): Feed intake was determined weekly and average FI was calculated every 4 weeks. Feed intake means determined as daily feed intake (DFI). Total feed intake in 4 weeks period / number of chicks = average feed intake/bird/4 weeks, and then divided on 28 day to reach mean feed intake/bird/day.

Feed Conversion Ratio (FCR): FCR was measured weekly and average FCR was calculated every 4 weeks. Feed conversion ratio means calculated as daily feed conversion ratio. Total feed conversion in 4 weeks period / number of chicks = average feed conversion/bird/4 weeks, and then divided on 28 days to reach average feed conversion ratio/bird/day.

Carcass Characteristics: Data collection at the end of the experimental periods three birds from each replicate of each dietary treatment were randomly selected and weighed individually, then slaughtered and allowed to bleed. Dressing percentage, Non carcass component (heart, gizzard, liver, giblets and spleen) were weighed and means were calculated.

Blood constituents and immunity parameters: Samples of blood were collected from three birds/replicate (9 birds/ treatment) into clean dry test tubes and allowed to clot and serum was separated, collected and analyzed.

Chemical Analysis and Immunity of Blood Serum Parameters: Blood serum parameters (IGG, IGM. IGA and LYZOZIME) were used as criteria of response. Total serum protein was determined by the Biuret method as described by King and Wooton (1965). Cholesterol concentration was determined according to the methods described by Naito (1984).

Economic Efficiency calculated as follow:

Cost of feed = (Total feed intake × Kg feed cost)

Cost of feed representing 75% of total cost, it calculated when total feed cost multiply (100 / 75)

Total cost = (Total feed intake × Kg feed cost) + cost of managements

Economic efficiency =Net revenue / Total cost

Statistical Analysis: All data were subjected to one way statistical analysis according to (SAS, 2013). The differences among groups means were determined according to Duncan's multiple rang test (Duncan, 1955).

RESULTS AND DISCUSSIONS

1- Growth performance

The effect of Lysine supplemented diets on growth performance:

As presented in Table 3, our data reported that Lys. treatments showed that 1.12 gm Lys/kg diet; (group 2) at 0-16 weeks of age) was substantially greater (P<0.05) than the control. Also, group 2 (1.12 gm Lys /kg diet); recorded a highly significant increase in values compared to the control group during (0-4) and (9-12) week periods. On the other hand, group 4 (1.6 gm Lys /kg diet); recorded a highly significant increase in values compared to the control one during (0-4) week period. These results are in agreement with Cruz *et al*., (2017) who showed that in all cases, body weight (BW) was significantly improved by increasing the amount (of Lys in the diet. Belloir *et al*., (2019) indicated that increasing dietary Lys level (7, 8.5, 10 and 11.5 g/kg) increased BW (P <0.001).

Hussain *et al.*, (2018) demonstrated that a 1.30% digestible Lys level regimen with an optimal amino acid ratio may be employed to boost early development in native Aseel chickens.

Jespersen *et al.*, (2021) stated that 0.30% lysine biomass (LB) meals produced comparable overall (0-35 days body weight growth, and birds were heavier (P<0.001) than the other LB treatments.

Pirzado *et al.*, (2021) found that 12g/kg lysine levels in diet resulted in greater body weight increase.

Effect of Methionine supplemented diets improve growth performance:

Effect of Meth supplemented diets on BWG is presented in Table 3. Results showed that 0.6 gm Met /kg diet; (group 5) overall the experimental periods till the end of experiment recorded significantly increased in daily increase in body weight. While there were statistically significant differences between 0.6 and 0.68 gm Meth /kg diet; (group 6 and 7) and control (basal diet; group 1).

These results are in agreement with Linh *et al.*, (2021) who believes that there has been a linear improvement in daily weight gain. With low diet of 0.25% Meth. (0.38 and 0.28 g/100 g), adequate Met (0.51 and 0.42 g/100g), and high Meth. (0.65 and 0.52 g/100 g) diets boosted BWG only in fast growing (FG) broilers, according to Wen *et al.*, (2017). The adequate Meth feeds rose (P <0.05) FI in the fast growing broilers but had no effect on the slow growing (SG) broilers during 1-21 and 22-42 days.

Table 3. Effect of dietary amino acids lysine and methionine on final body weight and daily body weight gain (DWG) during experimental period (0 - 16 weeks old chicks).

Treatment	Initial BW (g)	Final BW (g)	DWG 0-4 weeks (g)	DWG 5-8 weeks (g)	DWG 9-12 weeks (g)	DWG 13-16 weeks (g)	DWG 0-16 weeks (g)
G1 Control	31.1±0.23	1230.3±6.55^{d}	9.20±0.04^{b}	8.46±0.68^{d}	12.06±0.42^{b}	9.89±0.45^{d}	10.71±0.06^{d}
G2 L<1.12	30.4±0.26	1288.7±4.54^{c}	10.44±0.17^{a}	11.80±0.16^{ab}	14.05±0.46^{a}	11.89±0.30^{c}	11.23±0.04^{c}
G3 L<1.37	31.0±0.09	1298.4±2.62^{c}	8.54±0.05^{c}	12.49±0.11^{ab}	12.44±0.29^{b}	11.80±0.19^{c}	11.32±0.02^{c}
G4 L<1.60	31.6±0.13	1285.0±3.22^{c}	10.41±0.15^{a}	10.24±0.01^{c}	11.87±0.17^{b}	12.25±0.15^{c}	11.19±0.03^{c}
G5 M<0.60	31.1±0.09	1371.0±3.48^{a}	10.37±0.27^{a}	8.48±0.48^{d}	15.00±0.68^{a}	14.03±0.34^{b}	11.96±0.03^{a}
G6 M<0.64	30.6±0.25	1336.6±8.74^{b}	9.51±0.19^{b}	11.58±0.11^{b}	11.08±0.74^{bc}	14.46±0.34^{ab}	11.66±0.08^{b}
G7 M<0.68	31.4±0.15	1322.0±3.67^{b}	8.47±0.03^{c}	12.86±0.21^{a}	9.56±0.64^{c}	15.21±0.37^{a}	11.52±0.03^{b}

a, b, c and d: Means denoted within the same column with different superscripts are significantly different at (P ≤ 0.05).

According to Ahmed and Abbas (2011), dietary Meth greater than NRC (1994) boosted body weight gain and breast muscle weight in broilers as compared to the control. It was proposed that chicken development performance was improved because Meth in the meals helps hens' boosts their capacities to absorb and digest nutrients in the foods by expanding the height and length of the villus (Horn *et al.,* 2009; Lee *et al.,* 2020). Furthermore, Met is directly utilized by animals as a precursor for protein synthesis (Fang *et al.,* 2010. Furthermore, our results for lysine and methionine are consistent with Pesti *et al.,* (2005), who showed that supplementing native chickens with the amino acids Met and Lys can accelerate development and attain maximal growth.

2- Feed conversion ratio and daily feed intake:

Effect of lysine supplemented diets on feed conversion ratio and daily feed intake:

Our results showed that there were no significant differences of Lys diet supplementation levels on DFI at 0-4 and 13-16 week of experimental period. There were no significant differences at periods (5-8) and (9-12) weeks of age; between all groups in DFI. feed conversion ratios were better for group 2 which fed (1.12 gm lys/ kg diet.

Tables (4 and 5) show the effect of Lys. supplemented diets on daily feed intake and FCR. Nonetheless, the findings revealed that there were no significant differences of lysine diet supplementation between all groups in DFI at the end of experimental periods, there were significant differences between all groups during periods (5-8) and (9-12) weeks of age.

Table 4. Effect of dietary amino acids on daily feed intake (DFI) during the experimental period (0 - 16 weeks old chicks).

Treatment	DFI 0-4 weeks (g)	DFI 5-8 weeks (g)	DFI 9-12 weeks (g)	DFI 13-16 weeks (g)	DFI 0-16 weeks (g)
G1 Control	19.34±0.06^{b}	41.31±0.13^{c}	64.00±0.11^{bc}	82.17±0.40	51.70±0.08^{b}
G2 L<1.12	19.56±0.37^{b}	43.50±0.26^{ab}	65.06±0.19^{ab}	81.79±0.29	52.48±0.11^{ab}
G3 L<1.37	19.30±0.38^{b}	42.63±0.23^{b}	63.85±0.60^{c}	80.54±0.35	51.58±0.17^{b}
G4 L<1.60	19.20±0.57^{b}	42.58±0.46^{b}	64.22±0.28^{bc}	81.98±0.82	52.00±0.18^{b}
G5 M<0.60	20.69±0.25^{a}	43.82±0.18^{a}	65.59±0.18^{a}	83.02±1.73	53.28±0.49^{a}
G6 M<0.64	20.66±0.24^{a}	43.07±0.18^{ab}	64.22±0.45^{bc}	80.88±0.72	52.24±0.39^{b}
G7 M<0.68	20.25±0.11^{ab}	43.50±0.65^{ab}	63.99±0.10^{bc}	81.00±0.70	52.19±0.16^{b}

a, b, and c: Means denoted within the same column with different superscripts are significantly different at ($P \leq 0.05$).

Table 5. Effect of dietary amino acids on feed conversion ratio (FCR) during the experimental period (0 - 16 weeks old chicks).

Treatment	FCR 0-4 weeks	FCR 5-8 weeks	FCR 9-12 weeks	FCR 13-16 weeks	FCR 0-16 weeks
G1 Control	1.85±0.03^{e}	4.94±0.36^{a}	4.57±0.14^{cd}	5.33±0.14^{d}	4.53±0.01^{d}
G2 L<1.12	2.13±0.05^{c}	3.69±0.04^{bc}	5.41±0.21^{bc}	6.89±0.16^{b}	4.67±0.01^{b}
G3 L<1.37	2.26±0.04^{b}	3.41±0.03^{c}	5.14±0.16^{cd}	6.83±0.09^{b}	4.56±0.02^{cd}
G4 L<1.60	1.58±0.01^{e}	4.16±0.05^{b}	5.42±0.08^{bc}	6.69±0.05^{b}	4.65±0.03^{bc}
G5M<0.60	2.39±0.01^{a}	5.20±0.29^{a}	6.76± 0.49^{a}	8.35±0.40^{a}	4.83±0.03^{a}
G6M<0.64	2.00±0.03^{bc}	3.72±0.04^{bc}	5.87±0.46^{b}	5.59±0.08^{cd}	4.48±0.06^{d}
G7M<0.68	1.84±0.04^{d}	3.39± 0.08^{c}	4.40±0.20^{d}	5.92±0.05^{c}	4.45±0.03^{d}

a, b, and c: Means denoted within the same column with different superscripts are significantly different at ($P \leq 0.05$)

These results are in agreement with Cruz *et al.*, (2017), who showed that in all cases, raising the dietary Lys level considerably increased growth performance levels and FCR. Changes in Lys level enhanced FCR by 20%, according to Belloir *et al.*, (2019).

According to Jespersen et al. (2021), the 0.30% lysine biomass (LB) and 0.90% LB groups showed a higher ($P \leq 0.001$) total FCR than the negative control (NC). Pirzado *et al.*, (2021) demonstrated that a lysine content of 12g/kg in diet enhanced feed efficiency (FE).

Effect of methionine supplemented diets on feed conversion ratio and daily feed intake:

Our results showed that there were no significant differences of Lys and Met diet supplementation levels on DFI at 13-16 week of experimental period. There were significant differences at periods (0-4), (5-8) and (9-12) weeks of age; between all groups in DFI.

Feed conversion ratios were better for group 5 and 6 which fed (0.6 and 0.64 gm meth/ kg diet), respectively. These results are in agreement with (Linh *et al.*, 2021) who demonstrated a linear improvement in FI and FCR. Methionine addition at 0.25% in the diets decreased feed consumption and enhanced feed conversation ratio. Rehman *et al.*, (2019) hypothesized that Meth-rich diets promote villus formation. As a result, chickens did not consume a large amount of feed in relation to their need.

3- Carcass characteristics:

The effect of lysine supplemented diets on carcass characteristics:

In Lys groups it could be observed that group 3 had LBW considerably ($P \leq 0.05$) greater in comparison to other groups despite the fact that there were no significant differences in lysine levels groups in carcass %, organs % decreased significantly ($P \leq 0.05$) in lysine levels groups. Jespersen *et al.*, (2021) when compared to the negative control (NC) group, birds given 0.30% lysine biomass (LB) meals had higher (P, 0.05) absolute weights of liver, spleen, gizzard, pancreas, and ileum, as well as higher ($P \leq 0.001$) splenic relative weights.

Pirzado *et al.*, (2016) showed that 12g/kg lysine level in feed improved high carcass yield of broilers.

The effect of Methionine supplemented diets on carcass characteristics:

From the presented data in Table 6, it could be observed that Meth groups (5 and 7) had higher carcass % in comparison to the control group. The differences in LBW between groups 5 and 6 and the control group were significant ($P \leq 0.05$). While, in group 7 it was not significant ($P \leq 0.05$) compared to the control group. However, organs% reduced considerably ($P \leq 0.05$) as compared to the control and Meth groups; there were no significant changes between Meth groups.

These findings are consistent with Linh *et al.*, (2021), who found that 0.25% Met supplementation increased carcass weight linearly ($P \leq 0.05$). Internal organs, on the other hand, showed no significant change ($P \leq 0.05$).

It was because of the substantial influence of the amino acid Meth on chicken muscle and edible organs where protein synthesis occurs (Jariyahatthakij *et al.*, 2018).

As stated by Pesti *et al.*, (2005), providing the amino acids Meth and Lys to native chickens can accelerate development and attain maximal growth. As a result, adding Lys and Meth to the native chicken feed influences the carcass weight of native chickens.

Table 6. Effect of dietary amino acids on carcass characteristics at the end of the experimental period.

Treatment	LBW (kg)	Carcass (%)	Heart (%)	Liver (%)	Gizzard (%)	Giblets (%)	Spleen (%)
G1 Control	1.20±0.10^{b}	63.9±2.96^{b}	0.99±0.11^{a}	4.03±0.28^{a}	3.59±0.36^{a}	8.61±0.64^{a}	0.71±0.11^{a}
G2 L<1.12	1.42±0.04^{ab}	67.6±0.97^{ab}	0.57±0.05^{bc}	2.61±0.24^{bc}	2.39±0.13^{b}	5.57±0.32^{b}	0.33±0.03^{b}
G3 L<1.37	1.48±0.04^{a}	68.0±3.19^{ab}	0.49±0.02^{bc}	2.62±0.26^{bc}	2.47±0.07^{b}	5.58±0.22^{b}	0.53±0.15^{ab}
G4 L<1.60	1.40±0.08^{ab}	67.4±1.51^{ab}	0.55±0.02^{bc}	2.30±0.11^{c}	2.50±0.19^{b}	5.34±0.11^{b}	0.33±0.03^{b}
G5M<0.60	1.61±0.09^{a}	71.4±2.83^{a}	0.70±0.12^{b}	2.90±0.26^{bc}	2.46±0.14^{b}	6.06±0.25^{b}	0.47±0.08^{ab}
G6M<0.60	1.57±0.06^{a}	63.6±1.84^{b}	0.44±0.03^{c}	2.88±0.03^{bc}	2.61±0.10^{b}	5.93±0.17^{b}	0.40±0.04^{b}
G7M<0.68	1.40±0.03^{ab}	67.1±0.82^{ab}	0.48±0.06^{bc}	3.28±0.30^{b}	2.28±0.25^{b}	6.03±0.50^{b}	0.43±0.01^{b}

a, b, and c: Means denoted within the same column with different superscripts are significantly different at (P ≤ 0.05).

4- Blood constituents:

Effect of lysine supplemented diets on blood constituents:

Results in table (7) showed that: in Lys groups all blood constituents (Albumin, Globulin, and AST were not statistically differe from the control group When compared to the control group, ALT were considerably (P≤0.05). Also, group 2 protein value recorded higher concentration than other groups.

El-Damrawy *et al.*, (2021) indicated that optimal blood serum parameters (Albumin, Globulin) were achieved when fortified lysine and methionine in low crud protein with 500 mg/kg diet phytase in broiler chickens' diets.

5- The effect of lysine supplemented diets on immunity parameters:

From the presented data in Table 8, it could be observed that in Lys groups; the lysozyme when compared to the control group. All groups' activity rose considerably (P≤0.05). While IGG, IGA and IGM were higher in lysine groups but not significant compared to control groups. Also, methionine groups lysozyme activity had when compared to the control group, all groups significantly (P≤0.05) increased. When compared to the control group, IGG and IGA rose considerably (P≤0.05)

Table 7. Effect of dietary amino acids on blood constituents at the end of experimental period:

Treatment	T. Protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	GOT (U/L)	GPT (U/L)
G1 Control	5.44±0.22^{ab}	3.58±0.16	2.02±0.83	42.33±3.70^{b}	2.33±0.38
G2 L<1.12	6.85±0.24^{a}	4.38±0.21	2.47±0.36	58.33±6.60^{a}	2.57±0.03
G3 L<1.37	5.81±0.17^{ab}	4.31±0.34	1.61±0.36	40.67±2.60^{b}	2.47±0.30
G4 L<1.60	4.74±0.50^{b}	7.44±0.78	0.80±0.56	32.00±1.70^{b}	2.20±0.15
G5 M<0.60	5.60±0.28^{ab}	4.29±0.39	1.31±0.51	40.33±2.33^{b}	2.70±0.12
G6 M<0.64	5.37±0.89^{ab}	3.60±0.25	1.76±0.72	45.00±5.57^{b}	2.70±0.32
G7 M<0.68	5.44±0.40^{ab}	4.65±0.28	0.80±0.61	35.67±4.81^{b}	2.27±0.20

a, b, and c: Means denoted within the same column with different superscripts are significantly different at (P ≤ 0.05).

Table 8. Effect of dietary Lysine on immunity parameters at the end of experimental period:

Treatment	LYSOZIME ACTIVITY mg/ml	IGG mg/ml	IGA mg/ml	IGM mg/ml
G1 Control (0.2%Lys)(0.2%Meth)	0.09±0.04^{c}	0.28±0.04^{b}	1.84±0.29^{b}	0.31±0.06^{b}
G2 (1.12% Lys)	0.27±0.09^{b}	0.32±0.01^{ab}	2.02±0.07^{ab}	0.43±0.08^{ab}
G3 (1.37% Lys)	0.30±0.13^{b}	0.48±0.08^{ab}	2.89±0.46^{ab}	0.35±0.14^{ab}
G4 (L1.60% Lys)	0.27±0.05^{b}	0.31±0.03^{ab}	1.98±0.25^{ab}	0.46±0.09^{ab}
G5 (0.6 % Meth)	0.29±0.08^{b}	0.38±0.07^{ab}	2.47±0.486^{ab}	0.50±0.03^{ab}
G6 (0.64% Meth)	0.49±0.21^{a}	0.53±0.09^{a}	3.45±0.604^{a}	0.59±0.11^{ab}
G7 (0.68%Meth)	0.48±0.20^{a}	0.46±0.09^{ab}	2.99±0.60^{ab}	0.67±0.10^{a}

a, b, and c: Means denoted within the same column with different superscripts are significantly different at (P ≤ 0.05).

Our findings correspond with those of Jankowski *et al.*, (2020a), who found that Met levels (30 and 45%) relative to dietary Lys's content (1.83, 1.67, 1.49, and 1.20%) had no effect on IGA. Furthermore, Meth levels (30 and 45%) in relation to dietary Lys content (1.60, 1.50, 1.30, and 1.00% Lys %) had no effect on IGA Jankowski *et al.*, (2020b).

Sigolo *et al.,* (2019) suggested that the antibody reaction was the strongest for Lys levels the antibody response to NDV after the first immunization tended to rise when Lys levels increased. In addition, supplementary Meth and/or Lys can raise the amount of anti-NDV antibodies in broilers (Mirzaaghatabar *et al.,* 2011; Bouyeh 2012 and Faluyi *et al.,* 2015).

Konieczka *et al.,* (2022) revealed that increasing dietary Lys and Meth levels had a positive influence on turkey performance and immunological parameters, as well as improving selected markers important for preserving gut integrity in diverse challenge settings. In response to Escherichia coli lipopolysaccharide (LPS), low Arg-Lys-Meth diets raised IgA concentration, but high Arg-Lys-Met diets had the reverse effect (P ≤ 0.001).

6 - The impact of lysine or methionine supplemented diets on economic efficiency:

Prices and costs assumed are shown in Table 9. The total costs were determined. The only return considered was the income from selling fattening birds. Price of one kg diet was 7.00 LE. But one kg of marketing live weight was 50 LE. While one kg of marketing dressed weight was 70 LE. Feed cost was calculated as shown in table 9. The costs included diet with and without levels of amino acids cost.

In the present study, we evaluate the coast of rations supplemented or not with levels of access amino acids and price of live and dressed birds. Amino acid price was 45 LE/Kg. for lysine and 65 LE/Kg at October 2021 before we start the study. For methionine. The relative economic efficiency (EE) values of lysine or methionine levels supplemented rations were calculated. The only return considered was the income from selling fattening birds. Control base diet consumption was 263 kg for 45 birds. Price of one kg diet was 7.00 LE/ kg of marketing live weight was 50 LE/kg of marketing dressed weight was 70 LE/kg. Feed costs were calculated as shown in table 9. The costs included diet with and without cost of amino acids levels.

Table 9. Effect of amino acids supplemented diets on relative economical efficiency %:

Treatment	LBW Mean	FCR 0-16 Mean	Total feed intake	Cost			Revinue/live birds			Revinue/dressed birds			
				Ration price/kg	Feed cost / bird (LE)	Total cost / bird (LE) *	Selling price/bird (50LE/kg) *	Net revenue / bird (LE)	Relative economical efficiency % ***	Dressed body weight means	Selling price / dressed bird (70LE)	Net revenue / dressed bird (LE)	Relative economical efficiency%
G1 Control (0.2%Lys) (0.2%Meth)	1.20	4.53	5.436	7.00	38.05	49.41	60	10.59	21.4	0.766	53.6	4.21	8.52
G2 (1.12% Lys)	1.42	4.67	6.631	7.35	48.73	66.24	71	4.76	7.2	0.960	67.2	0.96	1.45
G3 (1.37% Lys)	1.48	4.56	6.748	7.45	50.27	68.03	74	5.97	8.8	1.006	70.4	2.39	3.51
G4 (1.60% Lys)	1.40	4.65	6.510	7.53	49.02	58.77	70	11.23	19.1	0.944	66.1	7.31	12.44
G5 (0.6%Meth)	1.61	4.83	7.776	7.23	56.22	78.59	81	1.91	2.4	1.023	71.6	-6.98	-8.88
G6 (0.64%Met)	1.57	4.48	7.033	7.26	51.05	59.76	79	18.74	31.4	1.120	78.4	18.64	31.19
G7 (0.68%Meth	1.40	4.45	6.230	7.28	45.35	57.98	70	12.02	20.7	0.939	65.7	7.75	13.37

Economic Efficiency calculated as follow:
The present study was conducted during the period from November 2020 to February, 2021.
*** Price of one kg marketing live weight = 50 LE/kg**
****Price of one kg marketing dressed weight = 70 LE/kg.**
Cost of feed = (Total feed intake × Kg feed cost)
Cost of feed representing 75% of total cost
Management cost calculated when control feed cost multiply (100 / 75)
Management cost = 38.05/0.33=11.36 LE
Amino acid Lysine price = 45 LE/Kg. Amino acid methionine price = 65 LE/Kg.
Supplemented Ration with amino acid price/kg= base diet price + amino acid price
G1 Ration price =7000.00 LE/ton G2 Ration price =7349.60 LE/ton
G3 Ration price =7444.60 LE/ton G4 Ration price =7532.00 LE/ton
G5 Ration price =7232.00 LE/ton G6 Ration price =7255.20 LE/ton
G7 Ration price =7278.40 LE/ton
Total cost = (Total feed intake (kg) × feed cost (LE) + cost of managements (11.36 LE)
Economic efficiency =Net revenue / Total cost

In the present study, we evaluate the coast of rations supplemented or not with levels of access amino acids and price of live and dressed birds. Birds fed rations supplemented with lysine or methionine levels were highly in relative to economic efficiency than birds fed control diet with base amino acid levels either sold as live birds or sold as dressed birds.

The relative EE values of lysine or methionine supplemented rations were calculated. As shown in Table 9, we found that group 4 fed rations supplemented with access 1.60 % lysine and groups 6 and 7 fed rations supplemented with access 0.44 and 0.48 % methionine revealed best profit and relative EE/ live or dressed birds. Relative economical efficiency for dressed birds revealed best profit for group 4 supplemented with access lysine 1.60 % and groups 6 and 7 supplemented with access methionine 0.44 and 0.48 % than control group. Finally, we suggest adding access lysine with level of 1.60 (%) or methionine with levels of 0.44 and 0.48 % to rations of local poultry breed AL-SALAM from 14 days to reach market weight to reveal best economic profit gain and to promote the economic efficiency, with reasonable cost.

CONCLUSION

We found that adding access amino acids lysine or methionine to local chicken breed AL-SALAM diet increasing body weight rise every day, ultimate body weight, carcass % lysozyme activity, and decreased daily feed intake and feed conversion rate compared to control group. Relative economic efficiency was better when adding access amino acid levels than control group. Finally, we are suggesting that adding access lysine with levels of 1.60 (%) or methionine with levels 0.44 and 0.48 % to rations of local poultry breed AL-SALAM from 14 day to reach market weight reveal best economic profit gain and promote the economic efficiency with reasonable cost.

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تأثير التغذية على مستويات مختلفة من الأحماض الأمينية على الأداء الإنتاجي و الفسيولوجي لسلالة الدجاج المحلي "السلام"

عماد عبد العزيز عبد الله ، هناء كمال عبد العاطي ، هشام احمد مدين ، عبير عشرة ، ياسر كامل بدوي و محمد فهمي سعد

وزارة الزراعة , مركز البحوث الزراعية , معهد بحوث الإنتاج الحيواني , الدقي , الجيزة , مصر

الملخص

سلالة الدجاج السلام هي سلالة مصرية محلية ثنائية الغرض تم تطويرها منذ فترة طويلة لتكون مناسبة للظروف البيئية المصرية. و لأننا بحاجة إلى تجديد متطلبات سلالة السلام المحلية. من الأحماض الأمينية اللايسين و الميثايونين ، لذا كان الهدف من هذه الدراسة هو تقييم مدى تأثير المستويات المختلفة من الميثيونين (Met) والليسين (Lys) في العليقة على أداء النمو والحالة المناعية لدجاج سلالة السلام المحلية.أجريت هذه التجربة لدراسة أثرإضافة الحمض الأميني الليسين أو الحمض الأميني المثيونين الي عليقة كتاكيت اللحم من سلالة السلام المحلية و تأثيره على الأداء العام، وعلى صفات الذبيحة و مصل الدم في سبعة معاملات (1 و 2 و 3 و 4 و5 و 6 و 7) و هي : المجموعة القياسية وتتغذى على عليقة المزرعة و التي تحتوي على 2 كجم / طن من الحمض الأميني الليسين (0.2%) و 2 كجم / طن من الحمض الأميني المثيونين (0.2%)المجموعات الثانية و الثالثة و الرابعة و تتغذى على عليقة المزرعة مضاف لها الحمض الأميني الليسين بثلاثة مستويات هي (1.12 و 1.37 و 1.60 %) بالترتيب. المجموعات الخامسة و السادسة و السابعة و تتغذى على عليقة المزرعة مضاف لها الحمض الأميني المثيونين بثلاثة مستويات هي (0.60 , 0.64 و 0.68%) بالترتيب. أستخدم في هذه التجربة315كتكوت لاحم عمر 14 يوم من سلالة السلام حيث وزعت عشوائيا على سبعة معاملات كل معاملة بها ثلاث مكررات، كل مكررة بها 15 كتكوت وذلك لتقدير العليقة المستهلكة، معامل التحو يل الغذائي والوزن المكتسب، وصفات الذبيحة (نسبة التصافي و أوزان الأجزاء الداخلية الكبد، القلب، القانصة) ، و تم عمل تحليل صورة الدم الكاملة و الدهون الثلاثية و الكوليسترول . و في نهاية التجربة تم حساب الكفاءة الإقتصادية النسبية .
أوضحت النتائج ما يأتي : إضافة مستويات إضافية من الحمض الأميني الليسين أو الحمض الأميني المثيونين أدى إلى رفع الزيادة اليومية للوزن المكتسب مع خفض الإستهلاك اليومي للعليقة مما أدى إلى تحسن معنوي في متوسط معامل التحويل الغذائي و أدى إلى زيادة متوسط الوزن الحي النهائي و زيادة نسبة التصافي ، كما أدت إضافة مستويات من الحمض الأميني الليسين أو المثيونينإلى زيادة أجسام المناعية (IGG, IGA, IGM) وزيادة نشاط اللايسوزايم و بالتالي زيادة مناعة الطيور. كذلك أدى إضافة مستوى إضافي من الحمض الأميني الليسين أو الحمض الأميني المثيونين إلى رفع الكفاءة الإقتصادية للطيور عند بيعها حية أو مذبوحة . توصية : نوصي بإضافة الليسين بمستوى من 1.6 % أو المثيونين بمستوى من 0.64 -. 0.68% إلى علائق سلالة دجاج السلام المحلية لتحسين معدل التحويل وزيادة الوزن و زيادة المناعة و زيادة العائد الإقتصادي. نوصي بعمل دراسات أخرى على إستخدام الأحماض الأمينية في علائق سلالات الدواجن المحلية الأخرى للوصول بها إلى معدلات تحويل و متوسط وزن مكتسب قياسي و زيادة الكفاءة الإقتصادية .