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The Effect of Supplementing Dl-methionine and L-lysine to Low Energy and Protein Diet on Growing Chicks

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A NUMBER of 95 White Plymouth Rock (WPR) and 108 WPR x Fayoumi (F) were involved. They were divided into two treatments for each breed, studying the effect of adding Dl-methionine and L-lysine to a relatively low protein-energy ration [17.54% crude protein (CP) and 2172 Kcal metabolizable energy (ME) per kg diet] for the control. An amount of 0.3% for both synthetic amino acids was added to the control diet which was claimed to contain a percentage of 0.55% Dl-methionine and 0.66% 1-lysine.

The results are concluded as follows :

1. The average livesweight for supplemented ration was significantly higher than those for control, recording a percentage increase of 8.5% for WPR and 19% for WPR x F at 7 weeks old.

2. Amino acid supplementation appeared to reduce variability of final liveweight for chicks and slightly improved feed consumption and feed efficiency.

3. The improvement for ME efficiency was slightly higher than for crude protein efficiency.

4. The net return per chick (difference between selling price of liveweight gain and feed cost) with supplemented ration was higher than the unsupplemented one.

In Egypt, poultry-keepers face a serious shortage in animal protein sources essential for formulating poultry rations particularly with intensive systems. Supplementation of essential amino acids particularly Dl-methionine and L-lysine is adopted to raise the protein quality and to improve the utilization of the feed.

Teckel and Watts (1956) found that the effect of adding Dl-methionine and dried whey to cottonseed meal rations might have a growth stimulating effect, depending upon the nature of protein furnished by the cottonseed meal. Featherston and Stephenson (1960) found that methionine produced a significant or a highly significant increase in growth, the utilization of feed was also significantly more efficient. Combs and Nicholson (1963) also reported that a high sulfur amino acid level was needed for growth during the starting and finishing periods.

In a review of the amino acids requirement, Crau *et al.* (1946) reported that the lysine requirement for chicks was 0.96% of the diet. Sesame meal was used as the source of protein in the experimental diet, since, except for lysine, it is adequate in all essential amino acid. Milligan *et al.* (1951) showed evidently that Leghorn or Rhode Island Red chicks, fed a diet containing cottonseed meal as a source of supplementing protein, required 1% of lysine in the diet having 21.1% crude protein during the first 6 weeks of age. However, Edwards *et al.* (1956) proved that lysine requirement for chicks was markedly related to the rate of growth. They concluded that in the slow growth, the requirement appeared to be 0.9% of the diet, while for more rapid growth the requirement appeared to be approximately 1.1% of the diet.

The aim of this study was to investigate the effect of adding Dl-methionine and L-lysine to a relatively low energy-protein rations on growing chicks.

Material and Methods

A number of 95 White Plymouth Rock (WPR) and 108 crossbred of WPR × Fayoumi (F) were involved in this experiment. They were fed for the first week of age a commercial ration containing 20% crude protein. The distribution of chicks was initiated at one week old. They were divided into two treatments (Tr.) showing, the effect of Dl-methionine and L-lysine to a relatively low protein-energy ration (17.54% and 2172 kcal metabilizable energy (ME) per kg diet for Tr. 1 as shown in Table 1). The level of amino acids was raised from 0.32% Dl-methionine and

0.66% L-lysine in the control (calculated) to become 0.62% and 96% respectively after supplementation.

TABLE 1 Percentage composition and proximate analysis of Experimental control ration (Ration 1).

Ingredient	%	Ingredient	%
Yellow corn	25	Lime stone	1.5
Rice bran (extracted)	32	Sodium chloride	0.5
Wheat bran	20	Mineral mixture*	0.5
Corn gluten feed	5	Vitamins**	++
Dec. cotton seed meal	8	Manganese Sulphate.p.p.m.	150
Sesame seed meal	3	Amino acid supplement for	
Fish meal	2.5	Ration 2, Treatment 2:	
Blood meal	1	Dl-methionine	0.3
Bone meal	1	L-lysine	0.3
	Proximate analysis		
Moisture %	9.49	Crude protein (Nx6.25)	17.54
Ash %	10.54	Ether extract	3.43
N-free extract %	52.15	Kcal ME/Kg.	2172
	Calculated amino acid content***		
	Control ration (Tr. 1)	Supplemented ration (Tr. 2)	
Dl-methionine %	0.32		0.62
L-cystine %	0.23		0.23
L-lysine %	0.66		0.96

* Commercial source

** One kg. vitamin mixture A+D_3 per ton feed (each gram of this mixture contained 5000 I.U. vit. A and 1000 I.U. vit. D_3)

One kg. vitamin B mixture per ton feed (each kg of this mixture contained 8.82 g. riboflavin, 8.114 g. pantothenic acid, 52.9 g. niacin and 229.3 g. choline chloride.

*** Amino acids were calculated using data presented by Titus, (1961).

The chicks were distributed into four tiars of electric-commercial type battery, starting from the heavier to lighter birds (the weight of chicks was graded and ranged within about 1.0 g). Until equal numbers and similar liveweights were allocated to two replicates for each treatment.

The chicks were reared in the electric battery until 7 weeks old. Feed and water were supplied *ad. libitum.* Individual chick weight and feed consumption for each treatment (or two replicates each) were weekly recorded until the end of the experiment. The efficiency of utilized feed was expressed as the amount of gain per unit of feed intake or per Megacalories (Mcal-1000 Kcal metabolizable energy intake).

Eye-drops and intramuscle Newcastle vaccines were used at hatching and 6 weeks of age respectively. Mortality was recorded whenever occurred.

Chemical analysis were carried out according to A.O.A.C. 1965, ME was determined using the adiabatic bomb calorimeter as described by Abou-Raya *et al.* (1971). Statistical analysis was carried out according to Snedecor (1959).

Results and Discussion

The effect of supplementing some essential amino acids, *i.e.* Dl-methionine and L-lysine to low protein-energy ration on growth, including liveweight gain as well as the efficiency of utilization for feed, ME and CP was investigated during the early stage of rapid growth up to 7 weeks.

Growth

Table 2 shows the initial chick liveweight (± standard error) at one week old which was similar for each breed, showing 59.6 ± 1.03 and 60.2 ± 1.07 g with WPR and 50.4 ± 0.76 and 50.7 ± 0.69 g with WPR × F. for Tr. 1 and 2 respectively. For both breeds, the final average liveweight for supplemented ration (Tr. 2), surpassed that of the control (Tr. 1) throughout the experimental period .The average liveweight at 7 weeks old was 483.3 ± 9.9 and 524.4 ± 9.8 with WPR and 438.0 ± 8.6 and 521.4 ± 8.0 with WPR × F for Tr. 1 and 2 respectively. The average liveweight with supplemented ration was 8.5 and 19.0% higher than that of the control with WPR and crosses respectively. The effect of supplementation was greater with crosses than with the pure breed.

This was also proved by the fact that without supplementation the average liveweight of WPR was significantly higher (10.3%) than that of the crosses, whereas after supplementation results with WPR were not significantly different (0.57% higher) from that of the crosses. Testing the significance of differences for final liveweights between treatments, indicated a highly significant difference for both breeds (t = 2.95 with WPR and 7.06 with crosses).

TABLE 2. Effect of supplemenation with Dl-methionine and L-lysine on the growth of WPR and WPR×F chicks from 1 to 7 weeks (Control Ration) Fr. 1 and supplementing ration 2 (Tr. 2).

Age in weeks	W.P.R.		WPR x F	
	Tr. 1	Tr. 2	Tr. 1	Tr. 2
Liveweight (g.)				
1	59.6	60.2	50.4	50.7
	± 1.03	± 1.07	± 0.76	± 0.69
2	93.4	98.4	86.4	95.2
3	149.7	169.5	145.6	167.5
4	222.5	251.1	209.8	248.2
5	317.1	338.8	286.6	340.L
6	398.4	422.7	372.7	430.8
7	483.3	524.4	438.0	521.4
	± 9.9	± 9.8	± 8.6	± 8.0
Variability:				
Initial	12.1	12.1	11.3	9.8
Final	14.2	12.5	14.3	10.9
Number of chicks:				
Initial	49	46	56	52
Final	48	45	53	50
Mortality %	2.0	2.2	5.4	3.8

It could be concluded that supplementing the low protein-energy diet with Dl-methionine and L-lysine, showed a significant improvement in liveweight particularly with crosses. Moreover, the liveweight at 7 weeks of old after supplementation (tr. 2) was very much the same as that obtained by Selim (1971) and Selim *et al.*

(1971) with the same breeds, using both higher crude protein and metabolizable energy level (20.96% CP and 2502 kcal ME/kg) keeping the same C/P ratio. It appeared therefore, that supplementing such essential amino acids in the ration, would render the protein and energy more utilizable.

Mortality rate was very low, averaging 2.1% with WPR and 4.6% with WPR × F. This indicated no effect of the treatment on mortality.

The variability of liveweight (Table 2), indicated slightly lower variability for both breeds and treatments for the initial liveweight than for the final one. However, slight higher variability of the final liveweight was observed for the unsupplemented than for the supplemented ration. It seemed that raising the level of both amino acids gave more uniformed liveweights. This was also reported by Hammond and Bird (1942), who found that unbalanced rations of amino acids increased the variability in growth of chicks.

Figures 1 and 2 show the relationship between liveweight (Y) and age (T) in weeks. The following regressions were found to be highly significant for both treatments and breeds.

Breed	Regression equations	Standard deviation of regression coeff.	't' calc.
WPR	$\hat{Y}_1 = 71.16T - 46.3$	4.290	17.06
	$\hat{Y}_2 = 78.95T - 49.4$	3.860	20.45
WPR x F	$\hat{Y}_1 = 67.13T - 41.3$	3.225	20.82
	$\hat{Y}_2 = 80.78T - 58.0$	3.507	23.03

Although the regression coefficient of T (weekly rate of growth) for Tr. 2 with WPR was 7.9% higher than that with control, the difference was not statistically significant (t = 1.002). With crosses, the growth rate for Tr. 2 was 20.3% higher than that for control, the difference being significant (t = 28.58). Although the difference between average liveweight for Tr. 1 and 2 with WPR at 7 weeks old was significant, the difference between the weekly rates of growth was insignificant.

It was also noticeable that the rate of growth for supplemented ration was similar for WPR and the crosses, the difference between the two regression coefficients being statistically insignificant (t = 0.5).

It was obvious from the growth data, as indicated above, that adding 0.3% Dl-methinine and 0.3% L-lysine to a low protein-energy diet (Ration 1, Table 1, having 0.55% total sulfur amino acids, *i.e.* 0.32% Dl-methionine together with 0.23% Cystine and 0.66% L-lysine of the diet) improved growth than the unsupplemented one. The level of total Dl-methionine (0.62%) or total sulfur amino acids of 0.85% and L-lysine 0.96% of the ration for Tr. 2 were within the range of the recommended requirements as reported by Milligan *et al.* (1951), Almiquist (1952), N.R.C. (1960), Nelson *et al.* (1960), Combs and Nicholson (1963), and Shank *et al.* (1968). Present results agreed with the findings of Stephenson 1954, who showed that when the protein level was reduced from 21 to 16%, the addition of Dl-methionine and L-lysine promoted growth. Askelson and Balloum (1965) also claimed that chick performance was improved, however, by supplementing a series of diets having a range of 18 to 22% crude protein with the deficient essential amino acids. Bishop (1968) found that when rearing chicks (from 0-28 days old) on diets varied from 0.63 to 0.83% total sulfur amino acids, the average body weight was closely correlated to the amount of the total sulfur amino acids consumed. Moreover, with L-lysine, Darwish (1969) fed three groups of White Leghorn chicks on a basal diet having 16.76% crude protein and 0.63% L-lysine or when supplemented with 0.263 and 0.563% Lysine, he found that liveweight gains were higher for groups given the higher supplemental lysine level. The present study indicated that supplementation of specific essential amino acids of relatively low crude protein and low energy diets (17.54% and 2172 Kcal ME respectively), would enable to improve growth as well as rations high in crude protein and energy (20.96% CP and 2502 Kcal ME) used by Selim *et al.* (1971). Formulating such supplemented low energy protein diets, would have the privilege to reduce the most expensive ingredients such as animal protein sources.

Feed consumption

It could be seen from Table 3 that the average feed consumption, ME and CP intakes increased with supplemented diets (Tr.

2). The relative intake of ME and CP was practically parallel to that of feed consumption. The increased consumption was accompanied by higher liveweights of birds with the supplemented ration than with the unsupplemented one. Moreover, the respective intakes with crosses and pure breed were practically similar to each treatment.

TABLE 3. Effect of Dl-mathionine and L-lysine supplementation on efficiency of feed, CP and ME utilization together with economic efficiency and net return during the growth period from 1 to 7 weeks old.

Items	WPR		WPR x F	
	Tr.1	Tr.2	Tr.1	Tr.2
Finel liveweight; g	483.3	524.4	438.0	521.4
Total gain, g	433.7	464.2	388.7	470.7
Efficiency of feed utilization:				
Daily feed consumption	36.7	37.6	36.2	38.1
Gain/unit feed, kg	0.275	0.291	0.255	0.294
feed/unit gain, Kg	3.636	3.436	3.921	3.401
feed cost/kg gain, mils	86.9	100.3	93.7	99.4
Efficiency of ME utilization:				
Daily ME intake, Kcal	79.8	82.4	78.9	83.3
Gain/Mcal ME g	126.4	134.0	117.5	135.6
Gain/unit SV, Kg	0.529	0.561	0.492	0.567
SV/unit gain (growth measure). Kg	1.890	1.783	2.032	1.763
Efficiency of CP utilization:				
Daily CP intake, g	6.44	6.35	6.35	6.91
Gain/unit CP intake, kg	1.566	1.624	1.456	1.616
Economic efficiency:				
Units money out Put/unit in put	4.315	3.739	4.002	3.776
Net return				
Selling price/bird, mills	163	174	146	177
Feed cost/bird, mills	38	47	36	47
Money return/bird.	125	127	110	130

Feed efficiency

The feed efficiency (units gain/unit feed) with supplemented ration (Table 3) was higher for both WPR and the cross breed, the difference was relatively higher with crosses. Supplemented ration produced practically similar feed efficiency values of 0.291 for WPR and 0.294 for WPR × F. But with unsupplemented ration, the efficiency values for pure breed were 0.275 against 0.255 for the crossbreed. Similar results were obtained by Bishop (1968) who found that efficiency of feed utilization was improved by raising the level of total sulfur amino acids from 0.63 to 0.83%. Darwish (1969) reported also that efficiency of feed conversion was better with birds given higher lysine level than lower one.

With WPR (Table 3), the values of ME efficiency were 126.4 and 134.0 g liveweight gain per Mcal ME for Tr. 1 and 2 respectively. The corresponding values for WPR × F were 117.5 and 135.6 g. It was obvious (Table 3) that the supplemented diet produced higher ME efficiency than the unsupplemented one for both breeds; differences were estimated to be about 6.0% with WPR and 15.4% with crosses. Supplemented ration practically showed similar efficiency for both breeds.

Results for protein efficiency (Table 3) were in general following the same trend to those for feed and ME efficiencies. But differences were less with CP efficiency owing to the slight increase of amino acid nitrogen for Tr. 2. Treatment 2 produced about 3.7 and 10.9% higher efficiency for supplemented ration than control for WPR and crosses respectively.

The overall results regarding efficiency of utilizing feed, ME, and CP were in favour of supplemented rations producing similar efficiency values for both pure and cross breeds.

Economic efficiency

This is defined as money output against money input, *i.e.*, the units of money returned as output in the product per unit money input for instance in feed used to produce it. Assuming the price per kg. liveweight of birds to be 375 mils (official and obligatory prices) and that the calculated price per kg ration (present prices) to be 23.9 mils for control and 29.2 mils for supplemented rations, the data of economic efficiency were shown in Table 3. It is indicated that economic efficiency was in favour of the control ration. But when calculating the net return per chick (difference between the selling price of gain and its feed cost/bird). The results (Table 3) indicated clearly, that the net return per chick with supplemented ration was higher than the unsupplemented one. The difference was markedly higher for crosses (about 18.74%) than for pure breed (1.92%). In practical feeding, one would prefer the ration producing higher net return per bird than that showing higher economic efficiency because the former is expressive to the real production. Therefore, it would be recommended to use net return measurement to justify profitable rations rather than the use of economic efficiency figure which seems misleading.

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تأثير اضافة الميثيونين والليسين لعليقة منخفضة القيمة الحرارية والبروتين على الكتاكيت النامية

احمد عبد الله ابو السعود ، احمد كمال ابو ريا ، عبد الفتاح درويش سليم ، فهمى الحسينى عبد السلام ومحمد عبد الغنى محمود .

وزارة الزراعة ــ وكلية الزراعة ــ جامعة القاهرة

اشتملت هذه التجربة على عدد ٩٥ كتكوت بلموث ابيض ، ١٠٨ كتاكيت خليط البلموث الابيض فى الفيومى وقد قسمت كتاكيت كل نوع الى معاملتين لدراسة تأثير اضافة الميثيونين والليسين لعليقة لمقارنة المخفضة الطاقة الحرارية والبروتين (١٧٫٥٤٪ بروتين خام ، ٢١٧٢ كيلو كالورى طاقة ممثلة لكل كجم عليقة وقد اضيفت لعليقة المقارنة التى تحتوى على ٣٢ر٪ ميثيونين ، ٦٦ر٪ ليسين ، كمية قدرها ٣ر٠٪ لكل منهما . وكانت النتائج المتحصل عليها كالاتى :

١ ــ كان متوسط الوزن الحى لكتاكيت العليقة المضاف الها الاحماض الامينية اعلى معنويا عن كتاكيت عليقة المقارنة ، حيث كانت الزيادة ٥ر٨٪ للبليموث الابيض ، ١٩٪ لخليط البليموث الابيض فى الفيومى عند عمر ٧ أسابيع .

٢ ــ ظهر ان اضافة الاحماض الامينية تقلل معامل الاختلاف عند نهاية التجربة كما ظهر تحسن طفيف فى استهلاك الغذاء وكفاءته الغذائية

٣ ــ كان التحسن فى الكفاءة التحويلية للطاقة اعلى منه فى البروتين الخام عند اضافة الميثونين والليسين .

٤ ــ كان الدخل الصافى لكل كتكوت (الفرق بين سعر البيع للزيادة ، الوزن وتكلفة الغذاء المستهلك) أعلى عند اضافة الاحماض الامينية عنه فى عليقة المقارنة .