MEDWELL PUBLISHING
Research Journal of Biological Sciences 4 (2): 143-147, 2009
ISSN: 1815-8846

SThe Effect of Using Excess Lysine on the Performance and Slaughter Characteristics of Broiler Chickens

[1]Sayed Majid Hosseini, [2]Sayed Mostafa Akbary, [3]Naser Maheri-Sis and [3]Afshar Mirzaei-Aghsaghali
[1]Research Center of Agriculture and Natural Resources, Kohgiloyeh and Bovir Ahmad, Iran
[2]Department of Animal Science, Islamic Azad University, Yasouj-Branch, Yasouj, Iran
[3]Department of Animal Science, Islamic Azad University, Shabestar-Branch, Shabestar, Iran

Abstract: The study was conducted to investigate the effect of excess lysine on performance, viscera weight and abdominal fat in broilers during starter (0-3 weeks) and growing (4-6 weeks) periods. Two hundred and forty days old broiler chicks were reared using completely randomized design with four treatments groups (T_1 = 0%, T_2 = 0.2%, T_3 = 0.4%, T_4 = 0.6% excess lysine) having three replicates of 20 birds in each group for 6 weeks. Results showed that the treatments groups there had no significant differences on feed intake at the rearing period. Weight gain and feed conversion ratio was better ($p<0.05$) in treatment groups than T_1 (control group). There were significant differences in percentage of abdominal fat weight and offal weight between treatments ($p<0.05$) in total period. Overall, we can suggest that T_3 (0.4% excess lysine) had better performance and carcass yield than other treatments.

Key words: Broiler, lysine, feed intake, weight gain, abdominal fat

INTRODUCTION

What makes the effect of protein nourishment so important is the type and order of amino acids, because scientific nourishment of protein in poultry is not based on the crude protein, but on the presence of amino acids in the ration and the biological applicability of every essential amino acid. Lysine as an essential amino acid has an essential role in the growth of chickens. But according to scientific references, the rate of this amino acid in the poultry ration should be reasonable and in proper proportion to arginine amino acid, so that it's excess does not result in the decline of the growth. But recent researches on the use of excess lysine have proved different results to some extent. So, this research intends to find out the effect of the addition of more excess lysine on the mass of breast and thigh as the 2 main sections in broilers.

The amount of the body fat at very low level of lysine was relatively low, but by gradual supplementation of the related rations with these amino acids, the amount of the fat showed an increasing trend. The probable reason is that when the ration is severely deficient in one of the amino acids, the bird's food consumption is greatly reduced. At present the aim for the use of the absorbable and retainable amino acids in commercial rations is to increase their functioning by the addition of small amounts to the ration. The precise amount of amino acids depends on the nature of food, price and the judgment of the nourishment experts. However, there is a point for every amino acid that when that point is reached, more increase of amino acid results in the reduction of fat in the carcass. Therefore, the effect of one amino acid on the amount of the carcass fat depends of the amount of its deficiency. A ration with great deficiency compared with a ration with medium deficiency of amino acid results in greater reduction in the amount of the carcass fat (Boorman and Burgess, 1986; D'mello, 1994; McDonald *et al*., 2002).

Since, amino acids generally enter into complex networks of metabolism reactions, it is therefore, assumed that the excess amounts of amino acids consumed by domestic animals are excreted without producing disease effects, while researches have shown that the use of artificial amino acids as supplements to eliminate the deficiencies present in the feed containing grains, pigs have proved to be more sensitive than poultries against the effects of the imbalance of amino acids. This does not mean that poultries are immune against the effects of the imbalance of amino acids and some researches have shown that rations containing negligent amounts of excess amino acids with the least imbalance are more efficiently consumed by the broilers (Waldroup *et al*., 1976; D'mello, 1994).

Corresponding Author: Naser Maheri-Sis, Department of Animal Science, Islamic Azad University, Shabestar-Branch, Shabestar, Iran

Leclercq (1998) obtained a special effect in the compositions of the body and better conversion coefficient in the broilers when he used higher lysine levels than the required amount in their feed. Corzo *et al.* (2002) in a study on the response of the male chickens of 42-56 days whose lysine ration was increased from 0.75-1.15 showed that the chickens of the above age under treatments were equal in weight and the abdominal fat reserves, cold carcass weight and the breast mass as a result of lysine level conversion, remained unchanged. Also, the strength of the muscles was reduced with an increase in lysine levels. A research was carried out to study, the required level of edible lysine for the improvement of bred broiler production in summer and at the age of 42-56 days. The results showed that the rate of body weight increase and the level of mortality for the chickens did not change, but the conversion coefficient improved linearly and the weight of the cold carcass, abdominal fat and boneless breast did not change (Corzo *et al.*, 2003).

Rashki (2007) research on the study of the effects of the duration of starter-grower ration and the level of ration lysine on the production functioning of the broilers showed that the addition of 115% of the recommended lysine resulted in the improvement of the carcass, while it had no significant effect on other compositions of the carcass.

Broiler carcass quality can be improved by conventional selection techniques. Also, the functioning of different genotypes of broilers fed at different levels with crude protein and lysine showed that the increase of lysine in the ration only reduced the abdominal fat during the starter period. Also, contrary to 23% protein rations, the level of lysine was effective for the increase of body weight and for the feed conversion coefficient in 17% protein ration. On the whole, the results showed a interaction effect between the percentage of lysine protein and the chicken genotype in weight increase rate and in the consumed feed and feed conversion coefficient (Tesseraud *et al.*, 1999; Sterling *et al.*, 2006). The study of the effect of the ration protein levels on the Arginine and lysine requirements during the growth stage of broilers showed that when the ration protein level was decreased, the peak point of weight increase decreased accordingly and resulted in the reduction of lysine requirements and when the protein level was decreased, the amount of the carcass fat and abdominal fat increased. When Arginine and protein level of the ration was changed, the percentage of muscular mass increased noticeably. The individual effects of the composition of amino acids in a ration with low protein compared to a ration with high protein level improved the amino acid balance (Hurwitz *et al.*, 1998).

MATERIALS AND METHODS

Birds and diets: Fifteen thousand chickens with the initial weight of 45 g were used at the beginning of the research and all the chickens were fed with the control group starter ration. One day before the entrance of the chickens into the hall, the hall was completely ventilated and the heaters were turned on. The temperature was adjusted at 34°C at 10 cm above the ground when the chickens entered into the hall. At the beginning of the second week and from the 8th day of the experiment, 240 days old broiler chicks were reared using completely randomized design with four treatments groups (T_1 = 0%, T_2 = 0.2%, T_3 = 0.4%, T_4 = 0.6% excess lysine) having three replicates of 20 birds in each group for 6 weeks. The treatment groups were separated and special ration for each treatment group was freely placed before them from the beginning of the second week. In the first few days, mechanical drinkers and special trays as feeders were employed and then permanent round plastic feeders and drinkers replaced them. As the chickens grew older and their height increased, the height of the feeders and drinkers were increased accordingly. The rations for every period of the treatments were adjusted with metabolism energy levels, crude protein, equal amount of calcium and phosphorous and with regard to the provision of the required amino acids on the basis of NRC (1984) (Table 1). Lysine-HCL was added to the ration of the experimental groups at the age of 7 days, so that each group received the experimental matter.

The amount of the feed intake and the average weight of the chickens at the age of 7, 21, 42 and 49 days as well as feed conversion coefficient and weight gain for every repetition were calculated. At the end of the period, 2 female and 2 males from each repetition with a weight near to the average weight of their group were selected, weighed and slaughtered. The weight of the carcass ready for cooking, offal weight and abdominal fat of each chicken was measured separately. According to the diagnosis of veterinarians, some antibiotics and multivitamins were also fed during the experiment. Vaccination through eye and drinking water was carried out according to the schedule to prevent viral diseases. The temperature of the breeding hall in the first week was 34°C and was gradually reduced by 2.3°C every week until it reached 20°C and was kept at this temperature while the lights were on for 24 h.

Statistic analysis: The recorded data of the measured criteria were processed through the SPSS Software (2002) and analyzed by the one-way ANOVA as well as through

Table 1: Ingredients and chemical composition of the experimental diets in starter and growing period

	Period							
	Starter (%)				Growing (%)			
Treatment	1	2	3	4	1	2	3	4
Ingredients								
Corn	64.9	64.7	64.5	64.3	70	69.8	69.6	69.4
Soybean	26.8	26.8	26.8	26.8	24.7	24.7	24.7	24.7
Fish meal	5	5	5	5	5	5	5	5
Oyster meal	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Salt	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Vitamin complex	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Mineral complex	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Methionine	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lysine (HCL)	0.0	0.2	0.4	0.6	0.0	0.2	0.4	0.6
Chemical analysis								
Metabolizable energy (kcal kg^{-1})	2900	2900	2900	2900	2948	2948	2948	2948
Protein (%)	20.72	20.72	20.72	20.72	18.30	18.30	18.30	18.30
Energy to protein ratio	139.9	139.9	139.9	139.9	161	161	161	161
Calcium (%)	1	1	1	1	0.95	0.95	0.95	0.95
Available phosphorous (%)	0.42	0.42	0.42	0.42	0.40	0.40	0.40	0.40
Calcium-phosphorous ratio	2.38	2.38	2.38	2.38	2.37	2.37	2.37	2.37

The treatment comparison test by Duncan test method (Steel *et al*., 1997) and was statistically analyzed by the same software.

RESULTS AND DISCUSSION

Average feed intake: The results of the measured feed intake during 2 periods of testing are depicted in Table 2. With regard to this, no significant difference between treatments at the starter period and the growing period were observed.

As it is observed there is no significant difference in feed intake among the treatments during the starter period as well. In the starter period the 0.4% treatment (treatment 3) had the most and the control group under treatment had the least diet consumption but during the growth period the most diet consumption belonged to the treatment of the control group and the least consumption to the 0.4% treatment group. With regard to the high speed of growth in the starter period and body metabolism resulting in the feed intake in this period, the feed intake from the control group to 0.4% treatment group and then the reduction to 0.6% treatment group can be related to more energy need of the broilers for better metabolism of excess lysine resulting in an increase in the consumption of the diet. These results conform to Leclercq (1998), Si *et al*. (2001), Gonzalez-Esquerra *et al*. (2005) and Rashki (2007) researches. On the other hand, with regard to the compensation of the reduction in the feed consumption between the treatments in the starter and growth periods and development of the digestive tract and development of caecum during the growth period, the increase in the consumption of the diet from 0.4% treatment to the control group is observed in these 2 periods.

Table 2: Effect of different Lysine levels on average of feed intake in starter and growing period

Dietary treatment	Excess lysine (HCL) %	Average feed intake (g)		
		Starter period	Growth period	Total
1	0.0	748±4.00	2890±15	3638.8±162
2	0.2	749±1.00	2879±13	3628.59±98
3	0.4	750±1.73	2715±41	3465.82±16
4	0.6	748±2.64	2813±66	3561.33±67

Table 3: Effect of different Lysine levels on average weight gain at the end of starter, growing and total period

Dietary treatment	Excess lysine (HCL) %	Average weight gain (g)		
		Starter	Growing	Total
1	0.0	510±10^{c}	1457±65.0	1967±55^{b}
2	0.2	539±10^{ab}	1515±11.0	2054±21^{a}
3	0.4	551±2.6^{a}	1521±2.8	2072±3^{a}
4	0.6	530±10^{b}	1494±9.5	2024±1^{a}

^{a,b,c}Means in the same row and column with different superscripts differ ($p<0.05$)

Average weight gain: The results of average weight gain (Table 3) showed that the body weight was significantly under the influence of the lysine levels. Contrary to the growth period, the use of excess lysine produces a difference in the average body weight in the starter period ($p<0.05$).

As it is observed in Table 3, at the end of the third week there is a significant difference ($p<0.05$) between the 0.4% treatment on the one hand and the 0.6% treatment on the other hand and also among all treatments with control group. At this stage and at the end of the 6th week, the 0.04% treatment had the most and the control group had the least weight gain.

The research results conform to the results obtained by Gonzalez-Esquerra *et al*. (2005). With regard to the small amounts of the control group weight average, there is a possibility that the digestion of some amino acids and especially Methionine, Cys and lysine amino acids in the

ingredients used in the diet are affected by factors such as improper processing, high heating and high pressure during processing and are also affected by Maeylard reaction and with the reduction of their digestion ability there might be an imbalance in their amino acid patterns, because Cys and lysine are of the amino acids that are more sensitive to heat and pressure and higher heating and high pressure during processing results in the reduction of their digestive ability. Of course, it seems that with regard to the small amount of sugar in the diet which is also drastically reduced during pellet preparation, the rate of Maeylard reaction in the content of lysine amino acid is also, not so great, but the isomerization resulting from high heating and high pressure during processing which leads to the change of L-lysine isomer to D- and L-lysine isomers is inaccessible in animal metabolism and can be a reason for the reduction of digestive ability of lysine resulting from unsuitable products leading to the reduction of weight gain arising from the imbalance of amino acids (NRC, 1984; Gonzalez-Esquerra *et al*., 2005; Rashki, 2007).

Average feed conversion ratio: The results of feed conversion coefficient measurement are presented in Table 4. It is observed that during the starter and growth periods there is significant difference between different treatments ($p<0.05$). As it is specified in the table, during the starter period there is significant difference ($p<0.05$) between the control groups and all other treatments as well as between 3 and 4 treatments (0.4 and 0.6%). During the growth period, a significant difference ($p<0.05$) between the control group and other treatments is also observed.

Treatment 3 has the least and the control group has the most conversion coefficient during the starter and growth periods. With regard to non significant difference in feed consumption and the presence of a significant difference in the weight gain averages during the starter period and also the lack of a significant difference in feed consumption and weight gain averages during the growth period and also with regard to the relativity of the conversion coefficient unit as expected, a significant difference ($p<0.05$) between the feed conversion coefficients during these 2 periods is observed. The results of the research conform to the results obtained by Waldroup *et al*. (1976), Leclercq (1998), Si *et al*. (2001) and Gonzalez-Esquerra *et al*. (2005) but contradict the results obtained by Rashki (2007) and Sterling *et al*. (2006).

Slaughter characteristics

Offal (viscera) weight percentage: The study of the data concerning the percentage of offal weight to live weight showed that there was a significant difference ($p<0.05$) between different treatments in female, male and the mixed flock presented in Table 5. The data in this table show the reduction percentage of offal weight from the control group to treatment 4 (0.6%). The findings in this section contradict the research done by Rashki (2007), but conform to the research performed by Leclercq (1998).

Table 4: Effect of different Lysine levels on average feed conversion in experimental period

		Average feed conversion		
Dietary treatment	Excess lysine (HCL)%	End of starter period	End of growing period	Total period
1	0.0	1.46±0.02^{c}	1.98±0.04^{c}	1.84±0.03^{c}
2	0.2	1.38±0.02^{ab}	1.9±0.07^{ab}	1.76±0.06^{ab}
3	0.4	1.36±0.06^{a}	1.78±0.11^{a}	1.67±0.03^{a}
4	0.6	1.41±0.02^{b}	1.88±0.04^{ab}	1.75±0.03^{ab}

^{a,b,c}Means in the same row and column with different superscripts differ ($p<0.05$)

Table 5: Effect of different Lysine levels on percent of viscera weight at the end of experiment as percent of live weight

		Viscera weight		
Dietary treatment	Excess lysine (HCL)%	Female	Male	Mean of male and female
1	0.0	15.87±0.72^{a}	15.97±0.72^{a}	15.92±0.32^{a}
2	0.2	13.98±0.59^{ab}	14.09±0.59^{ab}	14.03±0.26^{b}
3	0.4	13.51±0.62^{b}	13.61±0.62^{b}	13.56±0.28^{bc}
4	0.6	13.04±0.66^{b}	13.14±0.66^{b}	13.09±0.29^{c}

^{a,b,c}Means in the same row and column with different superscripts differ ($p<0.05$)

Table 6: Effect of different Lysine levels on percent of abdominal fat weight at the end of experiment as percent of live weight

		Abdominal fat weight		
Dietary treatment	Excess lysine (HCL)%	Female	Male	Mean of male and female
1	0.0	2.47±0.01^{a}	2.27±0.01	2.38±0.04^{a}
2	0.2	2.45±0.01^{a}	2.25±0.01	2.36±0.04^{a}
3	0.4	2.30±0.01^{b}	2.10±0.01	2.25±0.02^{b}
4	0.6	2.28±0.01^{b}	2.08±0.01	2.24±0.01^{b}

^{a,b,c}Means in the same row and column with different superscripts differ ($p<0.05$)

Abdominal fat percentage: The study of the data related to average abdominal fat percentage to live weight was showed a significant difference ($p<0.05$) between the treatments in female and mixed flock, but there was no difference for this factor in males (Table 6).

Since, there is a point for every amino acid, then when the ration amino acid level reaches the point for that amino acid, the excess increase of that amino acid results in the reduction of the rate of the carcass fat (Boorman and Burgess, 1986), the results of this table conform to the data. On the other hand, the lack of a significant difference in male can be attributed to higher metabolism of male compared to hen. The results obtained in this study contradicted Corzo *et al*. (2002, 2003) and Rashki (2007) findings but conformed to the results obtained by Sterling *et al*. (2006).

CONCLUSION

In an overall conclusion, it seems that using excess lysine HCL in broiler diets can be lead to better performance and carcass quality and quantity. Thus we can suggest use of 0.4% excess lysine as effective and economic level, in broiler diets.

REFERENCES

Boorman, K.N. and A.D. Burgess, 1986. Nutrient requirements of poultry and nutritional research. Butterworths, London, pp: 99-123. ISBN: 0407003479.

Corzo, A., E.T. Moran and D. Hoehler, 2002. Lysine need of heavy broiler males applying the ideal protein concept. Poult. Sci., 81 (12): 1863-1868. http://ps.fass.org/cgi/reprint/81/12/1863.

Corzo, A., E.T. Moran and D. Hoehler, 2003. Lysine needs of summer-reared male broilers from 6-8 weeks of age. Poult. Sci., 82 (10): 1602-1607. http://ps.fass.org/cgi/reprint/82/10/1602.

D'mello, J.P.F., 1994. Amino acids in farm animal nutrition. Wallingford UK, CAB Int., pp: 432. ISBN: 0851988814.

Gonzalez-Esquerra, R., M. Vazquez-Anon, L.F. Azevedo and C.D. Knight, 2005. Six trials demonstrate economic benefits of increasing amino acid fortification in broiler diets under a wide variety of conditions. Abstract book of PSA Anuual Meeting, Auburn, Albama, pp: 116. http://www.poultryscience.org/psa05/abstracts/psabs114.pdf.

Hurwitz, S., D. Sklan, H. Talpaz and I. Plavnik, 1998. The effect of dietary protein level on the lysine and Arginine requirements of growing chickens. Poult. Sci., 77 (5): 689-696. http://ps.fass.org/cgi/reprint/77/5/689.

Leclercq, B., 1998. Lysine: Specific effects of lysine on broiler production: comparison with threonine and valine. Poult. Sci., 77 (1): 118-123. http://ps.fass.org/cgi/reprint/77/1/118.

McDonald, P., R.A. Edwards, J.F.D. Green Halgh and C.A. Morgan, 2002. Animal Nutrition. 6th Edn. Prentice Hall, Publishers Ltd., UK., ISBN: 0582419069.

NRC, 1984. Nutrient Requirements of Poultry. 7th Edn. National Research Council, Washington D.C., ISBN-10: 0309034868.

Rashki, M., 2007. The duration effect of starter-finisher diet and lysine level diet on productive performance. Institute of poultry Information.

Si, J., C.A. Fritts, D.J. Burnham and P.W. Waldroup, 2001. Relationship of dietary lysine level to the concentration of all essential amino acids in broiler diets. Poult. Sci., 80 (10): 1472-1479. http://ps.fass.org/cgi/reprint/80/10/1472.

SPSS, 2002. SPSS for Windows. Released 11.5 SPSS Inc., Chicago, IL., USA.

Steel, G.D. and J.H. Torrie and D.A. Dickey, 1997. Principles and Procedures of Statistics: A biometrical approach. McGraw-Hill Book, pp: 666. ISBN: 0070610282.

Sterling, K.G., G.M. Pesti and R.I. Bakalli, 2006. Performance of different broiler genotypes fed diets with varying levels of dietary crude protein and lysine. Poult. Sci., 85 (6): 1045-1054. http://ps.fass.org/cgi/reprint/85/6/1045.

Tesseraud, S., E. Le. Bihan-Duval, R. Peresson, J. Michel and A.M. Chagneau, 1999. Response of chick lines selected on carcass quality to dietary lysine supply: Live performance and muscle development. Poult. Sci., 78 (1): 80-84. http://ps.fass.org/cgi/reprint/78/1/80.

Waldroup, P.W., R.J. Mitchell, J.R. Dayane and K.R. Hazen, 1976. Performance of chicks fed diets formulated to minimize excess levels of essential amino acids. Poult. Sci., 55: 243-253.