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# EFFECT OF CORN GLUTEN MEAL (CGM) LEVELS ON BROILER CHICKS PERFORMANCE

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## ABSTRACT

A total number of 480 one day unsexed Cobb broiler chicks were used to study the effect of feeding different levels of corn gluten meal on growth performance, feed efficiency, relative carcass and economic evaluation of broiler chicks from 1 to 30 days of age. Chicks were divided randomly equally into four experimental groups each of 120 chicks with three replicates each of 40 chicks. Group A was fed the basal diet as control. While, group B, C and D were received diets containing 4, 8, and 12% corn gluten meal, respectively. Results obtained can be summarized as follow: Live body weight at 10 and 30 days of age and body weight gain during 10-30 and 1-30 days of age were significantly ($P<0.05$) affected due to different dietary corn gluten meal levels in Cobb broiler chick diets. Feed consumption and conversion were not affected significantly by any of the tested levels of corn gluten meal, during all the experimental periods except feed conversion during 1-10 days of age. Broiler chicks fed on diet contained 4% corn gluten meal recorded the highest value of protein efficiency ratio than those fed the control diets followed by chicks fed diets contained 8% and 12% corn gluten meal. Efficiency of energy utilization of broiler chicks, during 10-30 and 1-30 days of age were significantly ($P<0.05$) influenced by dietary corn gluten meal levels. Where, during the period 1-30 day old, 4 or 8% CGM diets resulted in the best values of EEU as compared to the other dietary treatments or control. No significant differences emerged in all carcass characteristics studies (carcass, dressing, giblets, liver, gizzard and heart percent) of chickens by using the different levels of corn gluten meal. Broiler chicks fed corn soy diet with inclusion 4% maize gluten meal achieved the best values of net return (6.55) and economic efficiency (67.85%) as compared to the other diets. So, it can be concluded that 4% corn gluten meal was suitable to get the best growth performance, feed utilization and economic efficiency of broiler chicks during the starter and grower periods (1-30 days of age).

**Key words:** Broiler, growth performance, economic evaluation, corn gluten meal.

## INTRODUCTION

Recently, the search for an alternative protein source to replace animal derived by-products (meat and fish meal *etc.*) used in feeding animals has become a focus for several reasons. Corn is not only important nutrition in the diet of ruminant animals and poultry, but it is also important as a raw material for a number of products for various needs of the people. Today, corn is much used for the production of ethanol. The by-product of corn processing has its own use value, especially in the poultry diet (gluten, germs, animal meal, dry corn marc, *etc.*). The new or similar products so far occur with more or less changed content and changed nutrient values in relation to the existing in products of corn (Waldroup *et al.*, 1981; NRC, 1994; Sauvant *et al.*, 2002; Spiehs *et al.*, 2002; Strugar *et al.*, 2006; Milosevic *et al.*, 2006, Milosevic *et al.*, 2007).

Corn gluten meal (CGM), is a by-product from manufacturing corn starch and corn syrup, it is a rich source of plant proteins, since it contains 43–65% crude protein, depending on its grade. It is, also, rich in methionine (1.5– 1.6%), although its content in lysine (1.0–1.1%) and tryptophan (0.30–0.36%) is rather low (in fresh

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matter). Its content of crude fat and fiber ranges from 1–3% and 2–4%, respectively (CRA, 1989; Novus, 1994; NRC, 1994). Moreover, CGM is relatively rich in linoleic acid and abundant in carotenes and xanthophylls (200–500 mg/ kg), particularly when made from yellow corn (Parkhurst and Mountney, 1987). On the other hand, the annual production of CGM has been steadily increasing all over the world. USA alone produces annually more than 5 million tons of corn gluten meal and corn gluten feed, while in Greece its production amounted to 4200 tons (SPAIS, 1997).

A considerable attention has been paid to the unconventional feedstuffs as cheap sources of protein to replace soybean meal in formulating poultry diets. Corn gluten meal (CGM) is one of the most valuable by-products of wet milling process after the germ, oil; bran and starch are extracted from the shelled corn. Typically, it contains 62% protein and 3720 kcal ME/ kg on dry basis (NRC, 1994). The increase of this product and its potential use as a feedstuff for poultry may be a feasible solution to minimize the problem of feed shortage (El-Komy, 1995). Poultry farms utilize CGM due to its high content of protein (El-Deek *et al.*, 1996), energy (Hernandez *et al.*, 1981 and Perez *et al.*, 1989) as well as xanthophylls content which is the carotenoid pigment that imparts yellow color to poultry skin (Damron *et al.*, 1990).

The objective of the present study was to investigate the effect of feeding different corn gluten meal levels as a potential protein source on the growth performance, carcass characteristics and economics efficiency of broiler Cobb chicks from 1 to 30 days of age.

## MATERIALS AND METHODS

The experimental design of the present study was conducted in the Poultry department, Faculty of Agriculture, Zagazig University. Corn gluten meal was purchased from the National Company for Maize Products at the 10$^{th}$ of Ramadan City, Egypt.

Four hundred and eighty-unsexed, one-day old, commercial Cobb broiler chicks were randomly distributed into 4 treatment groups of 120 chicks each treatment. Each group contains 3 replicates of 40 chicks each with nearly similar average initial live body weight. Group A served as control and was given 0% corn gluten meal in the diets. Group B, C and D were received 4, 8, and 12% corn gluten meal, respectively.

All experiment diets were formulated almost iso-nitrogenous and iso-caloric, the composition and calculated analysis of the experimental diets are presented in Table 1.

Proximate analyses of corn gluten meal were carried out according to the official methods of Association of Official Analytical Chemists (AOAC, 1985). Amino acids profiles of corn gluten meal were determined according to Duranti and Cerlletti (1979) by amino acids analyzer in Labe of National Research Center.

Chicks were floor breaded and rearing under the same managerial and hygienic conditions. Chicks were fed on the starter diets during the period from 1-10 days of age (starter period) and the grower diets during the period from 10-30 days of age (grower period). Birds were exposed to 23 hours light per day.

Feed and water were offered *ad Libitum*, Live body weights were recorded at 1, 10 and 30 days of age, while feed intake were recorded every 10 days of age on individual replicate basis. Body weight gain and feed conversion ratio were calculated. Mortality was recorded daily. The protein efficiency ratio (PER) was calculated according to the procedure described by Woodham *et al.* (1972) at any studied period as follows: PER = g gain during the studied period /g protein consumed during the same period. Also, efficiency of energy utilization (EEU) was calculated as follows: EEU = ME consumed (Kcal) during the studied period/ weight gain (g) during the same period.

At the end of the experiment (30 days of age) 3 birds from each treatment group representing the average body weight of the treatment were fasted for 12 hours, weighted, slaughtered and their feathers were removed. Empty body weight, abdominal fat and all internal organs were weighted and divided by live weight to calculate relative weight.

**Table 1. Composition of broiler starter and grower experimental diets (%)**

| Ingredients % | Corn gluten level | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Starter diets | | | | Grower diets | | | |
| | control | 4% | 8% | 12% | control | 4% | 8% | 12% |
| **Yellow corn** | 48.48 | 52.69 | 56.80 | 60.90 | 51.48 | 55.69 | 59.80 | 63.90 |
| **Soy bean meal 44%** | 42.50 | 35.90 | 29.30 | 22.69 | 39.50 | 32.90 | 26.30 | 19.69 |
| **Corn gluten 60%** | 0.00 | 4.00 | 8.00 | 12.00 | 0.00 | 4.00 | 8.00 | 12.00 |
| **Cotton seed oil** | 5.00 | 3.30 | 1.60 | 0.00 | 5.00 | 3.30 | 1.60 | 0.00 |
| **NaCl** | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Premix*** | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Dicalcium phosphate** | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| **Limestone** | 1.00 | 1.00 | 1.10 | 1.10 | 1.00 | 1.00 | 1.10 | 1.10 |
| **L- lysine** | 0.02 | 0.16 | 0.30 | 0.45 | 0.02 | 0.16 | 0.30 | 0.45 |
| **Dl- Methionine** | 0.20 | 0.15 | 0.10 | 0.06 | 0.20 | 0.15 | 0.10 | 0.06 |
| **Choline chloride 50%** | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| **Total** | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Calculated analysis**** | | | | | | | | |
| **Crude Protein,%** | 23.10 | 23.11 | 23.11 | 23.11 | 22.04 | 22.05 | 22.06 | 22.07 |
| **ME K. cal / Kg** | 3020 | 3017 | 3012 | 3015 | 3053 | 3051 | 3045 | 3040 |
| **Calcium,%** | 0.94 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| **P Available %** | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| **Lysine %** | 1.38 | 1.38 | 1.38 | 1.38 | 1.38 | 1.38 | 1.38 | 1.38 |
| **Methionine+Cystine%** | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| **Choline, mg / Kg** | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| **Therionine%** | 0.88 | 0.87 | 0.85 | 0.84 | 0.84 | 0.82 | 0.81 | 0.79 |
| **Tryptophan%** | 0.28 | 0.26 | 0.23 | 0.21 | 0.26 | 0.24 | 0.22 | 0.19 |
| **Linoleic acid %** | 1.43 | 1.52 | 1.60 | 1.68 | 1.47 | 1.55 | 1.64 | 1.72 |
| **Price /ton diet, L.E***** | 3868 | 3849 | 3903 | 3910 | 3922 | 3931 | 3957 | 3963 |

* Grower vit.and Min. Premix: Each 3 Kg consists of: Vit. A 12000.000 IU; Vit. $D_3$, 2000.000 IU, Vit.E 10g; Vit. $K_3$, 2000mg; Vit. $B_1$, 1000 Mg; Vit. $B_2$, 5000 Mg; Vit. $B_6$, 1500Mg, Vit. $B_{12}$,10Mg; Biotin 50 Mg; Pantothenic acid, 10g; Niacin, 30 g; Folic acid, 1000Mg; Mn, 60 g; Zn, 50 g; Cu; 10g; I, 1000Mg; 100Mg; Co.100Mg.

** Calculated according to NRC (1994).

*** Calculated according to the price of feed ingredients during the year 2013.

At the end of experiment economical evaluation of each experimental groups was calculated from the input and output analysis based upon the differences in growth rate and feeding cost (Heady and Jensen, 1954) where: Total feed cost = feed intake× cost of kg feed.

Meat market price = total body weight gain× cost of kg meat (10 LE).

Net return = difference between meat market price and total feed cost.

Economic efficiency = (net return / total cost) × 100.

Data obtained were subjected to analysis of variance using general linear model procedure (SAS, 1996). Mean differences among treatments were determined using Duncan New Multiple Range test (Duncan, 1955).

## RESULTS AND DISCUSSION

### Chemical Composition of Corn Gluten Meal

Present results in Table 2 showed the chemical composition obtained of (CGM) as compared with some other sources of plant protein, the value of CP % in gluten meal as fed was 62% in average higher than that of SBM (44%), while it lower than that of wheat gluten meal (73.4%) as referred by (Afsher and Moslehi, 2012). Meanwhile results showed that, the values of each ether extract and crude fiber were 3.09% and 2.0% respectively, and better than that of the other sources. However, Mohamed (1992) suggested that corn gluten meal protein ranged from 38 to 64% with an average of 50% similar values were also reported by Younis (1992); NRC (1994); El-komy (1995) and El-Deek *et al.* (1996 and 2009).

**Table 2. Chemical composition, apparent metabolizable energy value and amino acids profile of corn gluten meal used in experiment compared to other plant sources**

| Nutrients, % | CGM | CGM[1] | SBM[2*] |
|---|---|---|---|
| **Dry matter** | 89.0 | 90.0 | 89.0 |
| **Crude protein (CP)** | 62.0 | 62.0 | 44.0 |
| **Ether extract** | 3.09 | 2.5 | 0.8 |
| **Crude fiber** | 2.0 | 1.3 | 7.0 |
| **Ash** | 2.5 | -- | -- |
| **NFE** | 20.4 | -- | -- |
| **AME(Kcal/Kg)[3]** | -- | 3,720 | 2,230 |
| **Amino acids profile, %** | | | |
| **Alanine** | 4.80 | -- | -- |
| **Arginine** | 1.80 | 1.82 | 3.14 |
| **Aspartic acid** | 3.44 | -- | -- |
| **Cystine** | 0.90 | 1.10 | 0.66 |
| **Glutamic acid** | 12.4 | 12.0 | -- |
| **Glycine** | 1.62 | 1.67 | 1.90 |
| **Histidine** | 1.20 | 1.20 | 1.17 |
| **Isoleucine** | 2.21 | 2.45 | 1.96 |
| **Leucine** | 9.03 | 10.04 | 3.39 |
| **Lysine** | 1.02 | 1.03 | 2.69 |
| **Methionine** | 1.8 | 1.49 | 0.62 |
| **Phenylalanine** | 3.45 | 3.56 | 2.16 |
| **Proline** | 5.09 | -- | -- |
| **Serine** | 2.40 | 2.96 | 2.29 |
| **Therionine** | 1.73 | 2.0 | 1.72 |
| **Tryptophan** | 0.28 | 0.36 | 0.74 |
| **Tyrosine** | 2.52 | 3.07 | 1.91 |
| **Valine** | 2.53 | 2.78 | 2.07 |

CGM: corn gluten meal (as-fed basis) [1]CGM: corn gluten meal according to NRC, (1994)
[2]SBM: soybean meal **(NRC, 1994) [3]AME (Kcal/Kg): apparent metabolizable energy

Amino acids profile of corn gluten meal presented in Table 2, indicated that arginine, glycine, lysine and tryptophan content were about 81.81 and 57.32; 72.64 and 85.26; 36.55 and 37.91 and 9.82 and 37.83% of those reported by NRC (1994) for wheat gluten and soybean meal, respectively. Meanwhile, corn gluten meal methionine, phenylalanine, valine, leusine, isoleusine, cystine and histidine contents were about 2.90, 1.59, 1.22, 2.66, 1.12, 1.36 and 1.02 fold of that soybean meal contents, respectively. Also, methionine, phenylalanine, therionine and leusine of maize gluten meal were about 1.14, 1.12, 1.03 and 3.10 time as those of wheat gluten meal, respectively. These findings were in good agreement with the results of NRC (1994) and El-Deek *et al.* (1996 and 2009).

Methionine is the first limiting amino acid in most poultry diet. Corn gluten meal has an excellent methionine to protein ratio, whereas methionine to crude protein ratio in maize gluten meal was about 2.90% compared to wheat gluten meal and soybean meal which were about 2.08 and 1.4%, respectively. Moreover, the methionine in corn gluten meal is highly digestible vs. soybean meal, where the digestibility of methionine in corn gluten was 97% compared to 92% of soybean meal. Likewise, cystine digestibility in corn gluten was recorded the highest value 86% contrary to cystine digestibility in soybean meal which recorded the lowest value 82%. Soybean meal has an excellent lysine to protein ratio, whereas this ratio was about 6.11% versus the ratio of lysine to protein in corn gluten meal and wheat

gluten meal which recorded 1.64 and 3.70%, respectively. Therefore, soybean meal has the highest lysine digestibility (91%) as comparison with other protein sources, such as corn gluten meal (88%), sesame meal (88%) and sunflower meal (84%) (NRC, 1994).

Corn gluten can serve as the sole source of supplement protein (62%) and metabolically energy (3720kcal/kg) for all types of poultry at any stage of growth or production.

## Live Body Weight

Results in Table 3 showed that, live body weight was significantly (P<0.05) affected due to different dietary corn gluten meal levels in Cobb broiler chicks diet. It could be noticed that, chicks fed the highest corn gluten (12%) resulted in the heaviest live body weight at 10 days of age (270.16g/chick) as compared to those fed the other levels of corn gluten or control. The improvement in live body weight with the high level of corn gluten meal might be due to the availability and balanced amino acids provided through tested diet. Contrary, the heaviest live body weight (1270.73g) at 30 days of age was recorded by chicks fed the 4% corn gluten level, while the lightest value (1127.34g) was achieved with chicks fed the 12% corn gluten at the same age. These results partially agreed with those obtained by Hillman *et al.* (1973) who reported that growth performance of chicks was improved with 7.5% corn gluten meal level compared to other groups, likewise, Owings *et al.* (1988) found no statistically differences in live body weight of growing chicks when they studied the isocaloric and isonitrogenous in 10 and 20% corn gluten meal in corn-soybean diets. Moreover, Ismail *et al.* (2005) conducted that maize gluten meal in the diets of broiler had great effect on growth performance, whereas maximum live body weight was recorded in broiler fed on diet contained 9% maize gluten meal vs. other levels during the whole period (1-6 wk of age). Also, Koelkebeck *et al.* (1999) noted that live body weight of chickens fed the diet contained 7.2% corn gluten was greater than those fed the basal corn diet from the period of 15 to 35 days. On the other hand, El- Deek *et al.* (2009) found that body weight did not significantly affected by dietary corn gluten levels in broiler chicks diet through out the entire experimental period (7-42 days of age).

## Daily Body Weight Gain

Results presented in Table 3 indicated that, daily body weight gain was significantly (P< 0.05) influenced by the different dietary corn gluten meal levels during all the experimental period except the period from 1-10 day–old. It worthy nothing that the highest body weight gain values (50.64 and 41.00g/chick/day) during 10-30 and 1-30 days of age were recorded by chicks consumed the 4% corn gluten meal diet, respectively. These results are in accordance with those findings of Salama (2002) who found that diet of 4% corn gluten feed improved daily weight gain of broiler chicks during the experimental periods (starter/finisher) without significant difference when compared with that fed on 2 or 6% corn gluten feed diets.

## Feed Consumption and Feed Conversion Ratio

Daily feed consumption of broiler chicks during the experimental period (1-30 days of age) are presented in Table 3. Level of dietary corn gluten meal had no significant effect on feed consumption and conversion through all the experimental periods except feed conversion during 1-10 days of age, where broiler chicks consumed 12% corn gluten meal diet recorded the best value of feed conversion (1.36 g feed/ g gain) compare to the other treatments or control. These results agreed with those of Owings *et al.* (1988) who found that there was no significant difference in feed intake of turkey fed on different diets contained 10 and 20% corn gluten feed from 16 weeks of age or from 9 to 16 weeks of age. Thus may be due to amino acids imbalance, reduction of protein and lysine consumption and unbalanced ratio of energy to amino acids which are followed by considerable decrease in feed consumption in the diets that contained high levels of corn gluten meal. This is in correspondence with Kidd and Kerr (1998).

Also these results agreed with those of Salama (2002) who found that broiler chicks fed on 4% corn gluten feed diet given the highest feed intake values during the different experimental periods. On the contrary chicks fed on 2% corn gluten diet gave the lowest feed intake

**Table 3. Growth performance and feed utilization ($\bar{X}$ ±SE) for broiler chicks as affected by different corn gluten meal levels during the experimental period (1-30d-old)**

| Corn gluten meal levels % | 0 | 4 % | 8% | 12% | Sign. |
|---|---|---|---|---|---|
| **Live body weight (g) at** | | | | | |
| 1d-old | 40.38±0.81 | 41.00±0.81 | 40.83±0.78 | 40.83±0.66 | N.S. |
| 10d-old | 260.49±4.42$^{ab}$ | 257.89±4.17$^{ab}$ | 253.03±4.83$^{b}$ | 270.16±3.70$^{a}$ | * |
| 30d-old | 1245.15±15.07$^{a}$ | 1270.73±15.12$^{a}$ | 1143.12±14.93$^{b}$ | 1127.34±15.07$^{b}$ | * |
| **Daily body weight gain (g)** | | | | | |
| 1-10d | 21.99±.03 | 21.77±0.31 | 21.14±0.35 | 22.91.±0.40 | N.S. |
| 10-30d | 49.24±1.32$^{a}$ | 50.64±1.06$^{a}$ | 44.41±0.20$^{ab}$ | 42.86±0.35$^{b}$ | * |
| 1-30d | 40.10±0.17$^{a}$ | 41.00±0.89$^{a}$ | 36.74±5.62$^{b}$ | 36.20±0.54$^{b}$ | * |
| **Daily feed consumption (g)** | | | | | |
| 1-10d | 31.03±.01 | 30.87±0.27 | 30.75±0.12 | 31.28±0.30 | N.S. |
| 10-30d | 70.06±0.41 | 69.76±0.10 | 69.26±0.33 | 69.25±0.51 | N.S. |
| 1-30d | 66.03±0.81 | 67.00±1.73 | 63.16±1.07 | 64.28±1.14 | N.S. |
| **Feed conversion ratio (g feed/ g gain)** | | | | | |
| 1-10d | 1.40±0.00$^{b}$ | 1.40±0.01$^{b}$ | 1.43±0.00$^{b}$ | 1.36±0.01$^{a}$ | * |
| 10-30d | 1.50±0.04 | 1.50±0.03 | 1.59±0.01 | 1.62±0.00 | N.S. |
| 1-30d | 1.58±0.02 | 1.57±0.05 | 1.66±0.05 | 1.69±0.005 | N.S. |
| **Protein efficiency ratio ( g gain /g protein)** | | | | | |
| 1-10d | 3.07± .040 | 3.05±.040 | 2.97±.043 | 3.13±0.40 | N.S. |
| 10-30d | 2.97±.043$^{a}$ | 3.00±.040$^{a}$ | 2. 84±.037$^{ab}$ | 2.78±.040$^{b}$ | * |
| 1-30d | 2.68±.037$^{b}$ | 2.71±.037$^{b}$ | 2.98±.037$^{a}$ | 2.49±.040$^{c}$ | * |
| **Efficiency of energy utilization (ME Kcal /g gain)** | | | | | |
| 1-10d | 4.26± .057 | 4.27±.057 | 4.38±.058 | 4.11±0.055 | N.S. |
| 10-30d | 4.65±.057$^{b}$ | 4.59±.058$^{b}$ | 4.85±.057$^{a}$ | 4.94±.063$^{a}$ | * |
| 1-30d | 5.00±.037$^{ab}$ | 4.95±.047$^{b}$ | 4.47±.037$^{c}$ | 5.27±.040$^{a}$ | * |

Means in the same column within each classification bearing different letters are significantly different (P<0.05 or 0.01).
* = significant (P<0.05), and NS = not significant.

one during the experimental periods, while daily feed intake of chicks fed the control diet was medium value. Moreover, Silva *et al.* (2003) observed positive effect of dietary corn gluten meal and reported that feed efficiency ratio significantly improved with increasing corn gluten meal in broiler diets. Furthermore, Koreleski (2003) characterized higher feed efficiency meal in broilers fed on ration contained higher corn gluten meal. Also, El-Deek *et al.* (2009) noted that corn gluten meal 25 and 50% inclusions have significantly (P<0.01) improved feed conversion ratio throughout the experimental period (1-42 days of age).

## Protein Efficiency Ratio and Efficiency of Energy Utilization

Results presented in Table 3 showed that broiler chicks fed on diet contained 4% corn gluten meal recorded the highest value of protein efficiency ratio than those fed the control diets followed by chicks fed diets contained 8% and 12% corn gluten meal through out 10 to 20 days of age. However, broiler chicks fed 8% corn gluten meal diet was significantly (P<0.005) increased compared with those received the control, 4 and 12% corn gluten meal diets during the whole period.

Efficiency of energy utilization of Cobb broiler chicks, during 10-30 and 1-30 days of age was significantly (P<0.05) influenced by dietary corn gluten meal levels (Table 3). The results indicated that diet without CGM or that with 4% CGM showed the best values of EEU (4.65 and 4.59) respectively, during the period from 10-30 day of age. Cobb chicks which consumed 8 or 4% CGM diets showed the best values of EEU (4.47 and 4.95) respectively, as compared to the other treatment groups or control during the whole period. These results agreed with those obtained by Salama (2002) who reported that broiler chicks fed on 4% corn gluten meal achieved the best value of EEU compared to those fed on 2 and 6% corn gluten meal during 4-6 and 1-6 wk of age.

## Carcass Characteristics

Table 4 showed insignificant differences emerged in all studied carcass characteristics (carcass, dressing, giblets, liver, gizzard and heart percent) of chickens by using the different levels of corn gluten meal at the end of experimental period. These findings are in agreement with results of El-Deek *et al.* (2009) who suggested that the relative weight of carcass, dressing, giblet, gizzard and heart of broiler chicks did not significantly ($P<0.05$) affected due to corn gluten meal levels. Also, Owings *et al.* (1988) found that dietary levels of corn gluten meal did not significantly affect yield of carcass parts or composition of broiler chicks. These results have been fully supported by Silva *et al.* (2003) who found that experience that broiler fed on diet contained increased proportions of maize gluten meal did not affect the weight of internal organs and Yu and chiou (2002) observed insignificant effect on the internal organs of broiler fed on diets containing increasing levels of maize gluten meal. Contrary, Ismail *et al.* (2005) reported that dressing percentage of broilers was significantly ($P<0.01$) affected due to dietary corn gluten meal, since significantly higher dressing percentage (68.95%) was observed in case of broiler fed on diet contained 9% maize gluten meal.

## Economical Evaluation

Results in Table 4 showed that, according to the economical evaluation analysis, it is clear that, net revenue and economical efficiency were linearly decreased with increasing corn gluten meal in diet. Whereas, broiler chicks fed corn soy diet with inclusion 4% maize gluten meal achieved the best values of net return (6.55) and economic efficiency (67.85%) as compared to the other diets.

The improvement of economical efficiency criteria diet containing corn-soy without inclusion corn gluten meal may be due to increase of body weight gain and amino acids balance in. These results disagreed with those obtained by El-Deek *et al.* (2009) who stated that inclusion of 23.86% corn gluten meal in broiler diets slightly increased fed cost when compared to all other tested groups. Also, Ismail *et al.* (2005) observed that 9% corn gluten meal achieved the highest economical efficiency for broiler production. In conclusion, from the nutritional and economical point of view it can be concluded that, using 4% corn gluten meal was suitable to get the best growth performance, feed utilisation and economic efficiency of broiler chicks during the starter and grower periods (1-30 days of age).

**Table 4. Carcass characteristics and economical evaluation for broiler chicks as affected by different corn gluten meal during experimental period**

| CGM% | Carcass traits % | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pre-slaughter weight(g) | Carcass | Dressing | Giblets | Liver | Gizzard | Heart |
| | | | | Corn gluten meal levels | | | |
| 0 | 1234.20±0.98 | 74.42±0.01 | 79.80±0.08 | 5.34±0.10 | 2.93±0.08 | 1.92±0.01 | 0.50±0.00 |
| 4 | 1236.39±41.04 | 75.95±0.07 | 80.84±0.12 | 4.98±0.18 | 2.67±0.13 | 1.82±0.03 | 0.47±0.003 |
| 8 | 1175.70±44.71 | 74.09±0.96 | 77.35±1.79 | 5.04±0.12 | 2.63±0.05 | 1.91±0.05 | 0.48±0.003 |
| 12 | 1234.20±0.98 | 75.30±0.02 | 80.43±0.08 | 5.15±0.02 | 2.75±0.00 | 1.90±0.02 | 0.48±0.00 |
| Sign | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. |
| | | | | Economical evaluation | | | |
| CGM% | Total feed intake (kg) | Cost of kg feed (LE) | Total cost (Total feed cost)[A]+chick price (LE)[B] | Total body weight gain (g) | Meat market price (LE)[C] | Net return (LE)[D] | Economic efficiency (%)[F] |
| | | | | Corn gluten meal levels | | | |
| 0 | 1.984 | 3.895 | 7.727+3 | 1.204 | 16.85 | 6.129 | 63.01 |
| 4 | 1.968 | 3.890 | 7.655+3 | 1.229 | 17.20 | 6.551 | 67.85 |
| 8 | 1.845 | 3.931 | 7.252+3 | 1.102 | 15.42 | 5.176 | 55.94 |
| 12 | 1.921 | 3.936 | 7.561+3 | 1.084 | 15.17 | 4.415 | 46.17 |

A: Total feed cost= feed intake× cost of kg feed. B: Chick price (3LE)
C: meat market price= total body weight gain×cost of kg meat (14 LE).
D: Net return =difference between meat market price and total feed cost.
F: Economic efficiency= (net return/ total cost)×100.

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## تأثير مستويات كسب جلوتين الذرة على أداء كتاكيت التسمين

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أجريت هذه الدراسة على عدد ٤٨٠ كتكوت تسمين "كب" عمر يوم لدراسة تأثير المستويات المختلفة من كسب جلوتين الذرة على كل من أداء النمو والكفاءة الغذائية وصفات الذبيحة والتقييم الاقتصادى لدجاج التسمين خلال الفترة من ١- ٣٠ يوم من العمر. وتم تقسيم الكتاكيت إلى ٤ مجاميع تجريبية بكل مجموعة ٣ مكررات بكل مكررة ٤٠ كتكوت. حيث تغذت المجموعة أ على عليقة لاتحتوى على كسب جلوتين ذرة (كنترول)، بينما تغذت المجموعة ب ، ج ، د على علائق بها ٤ ،٨، ١٢ % كسب جلوتين ذرة على الترتيب. وفيما يلى ملخص لأهم ما توصلت إليه هذه الدراسة من نتائج: تأثر كل من وزن الجسم الحى والوزن المكتسب معنوياً باختلاف مستويات كسب جلوتين الذرة خلال كل الفترات التجريبية ماعدا الفترة من ١ إلى ٣٠ يوم من العمر. لم يتأثر الغذاء المستهلك للكتاكيت مع المستويات المختلفة من كسب جلوتين الذرة خلال كل الفترات التجريبية، أيضاً لم تتأثر كفاءة التحول الغذائى مع المستويات المختلفة من كسب جلوتين العليقة ماعدا الفترة من ١ إلى ١٠ يوم من العمر. تأثرت كفاءة الاستفادة من الطاقة تأثراً معنويا بمستويات جلوتين الذرة خلال الفترة من ١٠ – ٣٠ والفترة الكلية من ١- ٣٠ يوم من العمر، حيث سجلت الكتاكيت المغذاة على ٤ ، ٨% كسب جلوتين أعلى قيم لكفاءة الاستفادة من الطاقة وذلك عند المقارنة مع بقية المعاملات. لم يظهر أى إختلافات معنوية على صفات الذبيحة (نسبة الذبيحة، والتصافى، والكبد، والقانصة، والقلب) مع المستويات المختلفة من جلوتين الذرة فى نهاية الفترة التجريبية. سجلت المجاميع المغذاة على عليقة خالية من الجلوتين (عليقة الذرة والصويا) أفضل عائد صافى (٥,٨٢٩) وأفضل كفاءة اقتصادية (٨٨,٧٠%) وذلك عند المقارنة مع بقية المعاملات. لذلك نستخلص من هذه الدراسة أن العليقة المحتوية على ٤ % كسب جلوتين ذرة تعتبر مناسبة للحصول على أفضل قيم لأداء النمو والاستفادة الغذائية والكفاءة الاقتصادية لكتاكيت اللحم أثناء فترة البادىء والنامى (١- ٣٠ يوم من العمر).

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