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THE EFFECT OF DIFFERENT LEVELS OF CRUDE PROTEIN AND METABOLIZABLE ENERGY ON PRODUCTIVE PERFORMANCE OF LOCAL SINAI CHICKENS DURING STARTER PERIOD AND SUBSEQUENCE LAYER PERIOD

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ABSTRACT: A total number of 270 local Sinai chicks 1-day-old were weighed and divided into six dietary treatments to determine the nutritional requirements of crude protein (CP) and metabolizable energy (ME) on growth performance during the starter period (1-6 weeks of age) and subsequent effect during grower and laying period from 7 to 32 weeks of age. The dietary levels of CP and ME included 3x2 factorial design (17, 18 and 19 CP, each contained 2850 and 2900 ME). Results of the current study illustrated that the chicks fed starter diet containing 18 and 19% CP recorded significantly ($P\leq0.05$) higher final BW and BWG than those fed diet contained the low level of CP (17%). The most remarkable result is that the heaviest records of BW and daily WG for chicks fed starter diet contained 19% CP and 2850 Kcal/kg diet. It is clearly observed that increment CP level to 18% resulted in a significant ($P\leq0.05$) improved in feed conversion ratio compared to the low level of CP (17%). Feeding on starter diet contained 18% CP + 2900 Kcal/kg diet recorded the best value of viability where it reached to 95.56%. Both HDL and LDL significantly ($P\leq0.05$) increased due to increasing ME from 2850 to 2900 Kcal/kg diet. Sinai birds fed diet contained 17% CP+2850 Kcal/kg diet and19 % CP+2850 Kcal/kg diet reached to SM earlier (143 and 144 d) respectively compared to the other dietary groups. It is evident that egg number and egg mass significantly ($P\leq0.05$) increased when starter diet containing 19% CP compared to the other different levels of CP (17 and 18% CP). While, decreasing dietary ME level to 2850 Kcal/kg in starter diet showed a significant ($P\leq0.05$) improve in egg number and egg mass. Hatchability of set and fertile eggs % of hens fed starter diet contained 2850 Kcal/kg diet was 86.5 and 89.7%, respectively which was significantly ($P\leq0.05$) higher than those fed starter diet with 2900 Kcal/kg diet. No significant effect of dietary two levels of ME in the starter diet on chick weight at hatch could be detected.

The current study has illustrated that the starter diet contained CP 19 % + ME 2850Kcal / kg diet achieved optimal utilization to protein and energy for Sinai chicks aged between 1 and 6 weeks of age and subsequent effect during the laying period from 21 to 32 weeks of age.

Key Words: Crude protein, Metabolizable energy, Sexual maturity, Laying performance .

INTRODUCTION

Protein and energy nutrition represented a major challenge to poultry production especially protein and dietary energy are major nutrients, representing approximate 85% of total cost of the diets for laying hens. The nutrient requirements of improved local strains such as Sinai chicks are scare (Shaldem, 2003;).

Sinai are laying and meat strain. However, their nutrient requirements during starter period are scare and needs more efforts as feed alone contributes about 60 to 70 % of the total cost of poultry production (Henrichs and Steinfield 2007). Chinrasri (2004) defined nutrient requirement as the amount of nutrients needed by animals to maintain their activities, maximize growth and feed utilization efficiency, improve laying capacity and hatchability and optimize fat accumulation.

Protein requirements vary considerably according to age, body size, sex, breed, and the physiological state of the bird. EL-Sakkaf (1995) fed four local strain Mandrah, Gimmizah, Alexandria and Silver Montazah diets containing 20, 18 and 16% protein *from one day of age* and found that diet containing 20% protein, resulted in a greater body weight (BW) than those fed 18 and 16% protein. Thus, decreasing dietary protein resulted in a highly significant decrease in BW at 12 wk. of age. It is important to note that excess dietary proteins also increase heat production and water consumption which increase moisture content of litter (Lesson and Summers, 2001). EL-Sayed et al. (2001) showed that Gimmizah, Mandara and Silver Montazah chicks fed high CP diet (20 or 19 %) with 2800 to 3000 kcal ME/ kg diet had significantly higher BW at 8 and 12 weeks of age than those fed low CP ration (16, 15 %) with different energy levels. However, Khalifah (2001) found that no significantdifferences among protein leve ls at 6 wk of age, in BW of Gimmizah and Golden Montazah chicks fed diets containing 18, 16 and 14% protein level.

In respect of the dietary ME levels, Hunton (1995) found that nutrients intake can be influenced by different levels of energy in diet. Therefore, deficiency of nutrients may occur in poultry by increasing the energy content in diet. In contrast, feed intake as well as nutrients utilization is increased by low level of energy in the diet. Ozek (2004) found that different levels of ME (2600, 2700, 2800, 2900, 3000, 3100, 3200 kcal) did not significantly affect body weight. From 1 to 8 weeks of age, significantly less feed was consumed by the Partridges bird fed with 3200 kcal ME/kg diet than that for the Partridges fed 2600, 2700, 2800, and 2900 and 3000 kcal ME/kg diets. In the same period, the FCR of the Partridges fed with 3200 kcal ME/kg diet was lower than did the Partridges fed with 2600, 2700, 2800 or 2900 kcal ME/kg diets. He concluded that ME levels from 2700 to 2800 kcal ME/kg might be used in Partridge starter diets.

In fact, most of the works done on local poultry used local ingredients are based mainly on nutrient requirement of exotic breed. Knowing requirements of protein and metabolizable energy will help in the formulation of diets to optimize productivity of these birds. The purpose of the present experiment was determine the requirements of crude protein and metabolizable energy to the local Sinai chicks during the starter period from 1 to 6 weeks of age and the subsequent influence during the growing and laying period from 7 to 32 weeks of age.

MATERIALS AND METHODS

Birds and housing:

This study was conducted at El-Serw Poultry Research Station, Animal Poultry Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt. Two hundred and seventy Sinai birds from hatch to 6 weeks of age were randomly assigned into six treatments of equal three replicates each. The study was assigned to 2x3 completely randomized design based on three levels of crude protein (17, 18 and 19%) and two levels of metabolizable energy (2850 and 2900 Kcal/kg diet). At the onset of the experiment, chicks were weighed at hatch and assigned to treatments based on body weight so that mean body weight were nearly similar for chicks on all treatments and the birds were kept on deep litter, in an open-sided house, naturally ventilated incubated house and exposed to natural day length.The body weight and body weight gain was measured at 2, 4 and 6 weeks of age and the feed consumption on a pen basis was measured. After weighing chicks at the end of starter period, these chicks were continued in the same house and all treatments were fed on the regular grower and layer diet to evaluate the effect of previous dietary treatments on sexual maturity and productive performance till 90 days of egg production. A daily photoperiod was 16 hr. during the laying period.

Experimental parameters measured:

1-Starter, grower and layer diets:

Starter, grower and layer diets were offered to the birds from 1 to 6, 7 to 19 and 20 to 32 weeks of age, respectively. In the starter diets, six experimental diets were formulated to contain the studied energy and protein levels. The starter diets had 17, 18 and 19 % CP and each contained 2850 and 2900 Kcal/kg diet as shown in Table (1). The grower diet contained 14 % protein, 2650 Kcal ME/Kg, and the layer diet contained 16% CP and 2750 Kcal/kg diet as recommended by NRC (1994) at the period 20-32 weeks of age Table (2).

2- Blood biochemical parameters:

At 6 weeks of age 3 birds for each group were slaughtered and blood samples were collected. The blood was collected in tubes without anticoagulant, then immediately centrifuged at 3500 rpm for 15 min. and the serum was taken for determining the total protein , albumen, globulin, cholesterol, HDL,LDL, triglesrides, AST and ALT. Also, lipid peroxidation was measured by estimating the production of antioxidant capacity.

3-Estimates during the grower laying periods:

Body weight at the sexual maturity, average egg weight, egg mass, feed intake (per hen/ 4 weeks) through the experimental periods were recorded as well as egg quality were estimated. Laying rate and feed conversion ratio were calculated through the same periods.

Statistical analysis:

Data were statistically analyzed using General Linear Models Procedure of the SPSS program (2008), A factorial design

3x2 was used; the following model was used to study the effect of main factors (CP and ME levels) and interaction between them investigated as follows:

Yijk = μ + Ti + Rj + (TR) ij + eij

Where :Yijk=An observation;μ = overall mean ;T= effect of CP level; I = (1,2 and 3); R= effect of ME level; j=(1 and 2); TR= effect of interaction between CP and ME (ij (1,2….6); and ejik= Experimental error.

Differences means among treatments were subjected to Duncan´ s Multiple Range- test (Duncan, 1955).

RESULTS AND DISCUSSION

Body weight and body weight gain:

Influence of dietary different levels of CP and ME through the starter period from hatch to 6 weeks of age on daily weight gain (WG) and daily WG is shown in Table (3). It is clearly observed that the chicks fed starter diets containing 18 and 19% CP recorded significantly higher final body weight (BW) and body weight gain (BWG) than those fed diets contained the low level of CP (17%). In respect to ME, significant differences (P<0.05) in BW and BWG were observed at 2 weeks of age, where feeding on starter diets contained 2900 Kcal/kg diet resulted in the highest BW and daily WG compared to the diets contained 2850 Kcal/kg diet. However, no significant influence of dietary ME levels on BW and daily WG during the collective period (0 - 6 weeks of age). Regarding the interaction between CP and ME, the most remarkable result is that the heaviest records of BW and daily WG were those of chicks fed starter diet contained 19% CP and 2850 Kcal/kg diet being higher than any of other dietary treatments. But, the lower values were recorded by chicks fed diet contained 17% CP and 2900 Kcal/kg diet. Results of the current study are in agreement with EL-Sakkaf (1995) who observed that feeding four local strains of Mandrah, Gimmizah, Alexandria, and Silver Montazah meals with diets containing 20, 18, and protein from one day of age leaded to a higher body weight (BW) than feeding them diets containing 16% protein. According to Hussein et al. (1996), the birds given 19% CP had higher BW at five and 12 weeks of age than those given 16% CP. Additionally, according to Tuan et al. (2010), increasing dietary CP greatly improved the growth performance of chicks since body weight and the amount of protein in the diet were strongly correlated.

On the other hand, according to Khalifah (2001), there were no appreciable variations of the protein levels on the BW of Gimmizah and Golden Montazah chicks fed diets containing 18, 16, and 14% protein levels at 6 weeks of age. According to Shaldam's (2003) research, the ideal CP levels for Golden Montazah males were 22, 20, and 18% in the starter, grower, and finisher diets, respectively, whereas the levels for the Gimmizah strain's crossholdings were 20, 18, and 16% CP.

Feed intake and feed conversion ratio:

Results of different levels of CP and ME on feed intake and feed conversion ratio are showed in Table (4). It could be generally concluded that irrespective of the fluctuations observed in feed intake, it was significantly (P<0.05) increased due to feeding on diet 19% CP compared to the diet contained 17% CP. No significant alternations in average feed intake could be detected by feeding on diets with different levels of ME. It is clearly observed that increasing CP level to 18% resulted in a significant ($P<0.05$) improvement in feed conversion ratio compared to the low level of CP (17%). No significant difference was observed in feed conversion ratio by feeding on starter diets contained 2850 and 2900 Kcal/kg diet. Generally, the results illustrated that the chicks received diet contained 18% CP and 2900 kcal/kg recorded the best feed conversion ratio value as compared to the other interaction groups.

The growth performance of Sinai pullets during the period from 1-6 weeks of age in the current study is in an agreement with other chickens at starter period, according to Hussein *et al*. (1996), where raising the protein level to 13.8, 15.8, and 18.9% during the first two to six weeks of life significantly increased feed intake up to the age of 14 weeks. Shaldam (2003) claimed that raising the CP level significantly increased feed and CP consumption while improving feed conversion. However, compared to high and intermediate CP levels, the same author found that protein utilization was improved by 19.5 and 12.6% at low CP levels. Dewi *et al.* (2010) found that diets with high energy and protein tend to accelerate growth and improve feed conversion. However, Ndegwa *et al.* (2001) reported no effect of varying dietary crude protein levels on growth and feed intake of indigenous chickens.

The ratio of nutrients to dietary energy content is a crucial aspect of chicken nutrition since the amount of feed consumed by poultry generally depends on the amount of energy in the diet (Wu *et al*., 2005). Also, poultry usually consume just enough food to meet their energy requirements since the control of feed intake is believed to be based primarily on the amount of energy in the diet (Nahashon *et al*., 2006). As it is when the level of ME in the diet is increased the birds satisfy their energy by decreasing feed intake where, increasing the dietary energy concentration leads to a decrease in feed intake and vice versa (Veldkamp *et al*., 2005), thus affecting growth as dietary composition and nutrient content are potent regulators of muscle development and metabolism (Grizard et al., 1999).

However, in the current study no significant ($P>0.05$) effect of varying ME on feed intake could be detected, the insignificant effect on feed intake/day due to the tow levels of ME may be limit rang of ME in the study (50 Kcal/Kg diet), this result seems to contradict the results obtained by Bohnsack *et al.* (2002) who clarified that the diets contained high energy tends to lower the amount of feed that poultry consume, but this would prevent them from getting the protein they need. This statistic gave rise to the phrase "poultry's best energy to protein ratio" (Sohail *et al.*, 2003).

Regarding feed conversion ratio (FCR), some studies demonstrated that changes in dietary energy levels have an impact on FCR through two partially interdependent routes as shown below. As dietary energy increases, feed efficiency improves because the chickens use less feed to meet their energy requirements (Dublecz *et al*., 1999). It should be noted that different breeds have differing effective energy levels (Lippense et al., 2002). The dietary energy content had a considerable impact on feed intake, according to Pinhriro et al. (2004), although they also claimed that this wasn't always the case. In the current study, such improvement in the feed efficiency was due to interaction between CP 18%+ME 3900 Kcal/kg diet which has been reported in previous work by Dewi *et al*. (2010), who noted that diets with increment in energy and protein tend to accelerate growth and improve feed conversion ratio. However, Novak *et al.* (2007) reported that no significant effect was observed due to different levels of CP and ME on FCR of Bovans white Leghorn during the starter period.

In fact, this improvement by feeding on diet contained 19% CP+2850 Kcal/kg diet probably was due to the nutrients in the diet that affect the levels of endogenous digestive enzymes (Maiorka *et al.*, 2004). Also, Zhao *et al.* (2007) mentioned that amylase, trypsin and chymotrypsin activity in jejunal fluid of birds adapted to the dietary CP content but not to dietary ME content. Regarding relationship between protein and energy requirements the ratio between CP and ME becomes very important as it affects productivity. For example, According to Prachya *et al*. (1994), between one and 12 weeks of age, FCR was optimized at a separate feed energy to protein ratio of 2625 Kcal ME/kg protein while growth rate in indigenous chickens was optimized at a single dietary energy to protein ratio of 58.6 MJ ME/kg protein.

Viability %:

The effects of dietary varying levels of CP, ME and their interaction on viability are showed in Table (5). The results obtained clearly indicated that viability % had not affected for chicks due to feeding on starter diets contained different levels of CP during 0-2 and 4-6 weeks of age. On the other hand, viability % was significantly decreased due to increasing the CP level in the diet to 19% CP compared to 17 and 18 % CP. Also, no significant alternation was observed due to varying levels of ME in the laying starter diet during 0-2 and 2-4 weeks of age, while, it was significantly improved by the diet contained high level of ME (2900 Kcal/Kg diet).

The results of interaction among varying levels of CP and ME illustrated that feeding on starter diet contained 18% CP and 2900 Kcal/kg diet recorded the best value of viability where it reached to 95.56%.

Serum biochemical traits:

Data obtained on serum biochemical traits as shown in Table (6) clearly indicated that no significant ($P>0.05$) alternations of different levels of CP during starter period on all serum biochemical traits with exception for HDL, LDL and ALT where, increasing CP from 17 to 18 and 19 % resulted in a significant ($P<0.05$) increase in HDL from 55.3 to 73.5 and 70.5 IU/l, respectively. While, LDL significantly increased by feeding on diet contained 18 % CP compared to the low level of CP (17%). Also, some significant ($P<0.05$) alternations were observed in ALT; where, increasing CP in starter diet resulted in a higher value of ALT than the diet contained 17 % CP.

Regarding ME, both HDL and LDL were significantly ($P<0.05$) increased due to increasing ME from 2850 to 2900 Kcal/kg diet.

El-Nagger *et al.* (1997) discovered that dietary CP and ME levels had a substantial impact on total serum proteins and cholesterol. The physiological and nutritional conditions of the bird are likely to have an impact on the level of plasma lipids (Sturkie, 1990). According to El-Husseiny *et al.* (2002), total lipids, total cholesterol, and glucose levels decreased dramatically when energy levels were low. Total plasma protein was not impacted by feeding a low CP diet supplemented with essential and non-essential amino acids, but plasma uric acid was significantly reduced, according to Corzo *et al*. (2005a). In a similar vein, Ismail *et al*. (2006) found that feeding high-ME meals to Japanese quail dramatically raised plasma total lipids and cholesterol while having no discernible effect on plasma total protein or the liver enzymes as ALT and AST.

Productive performance during grower period as a subsequent effect:

Results in Table (7) demonstrated that the subsequent effect of starter dietary varying levels of CP, ME and their interaction on age of sexual maturity (SM), body weight of SM and feed intake (7-19 wks. of age). The results showed that Sinai birds fed starter diet contained 17 and 19% CP significantly ($P<0.05$) reached to SM earlier (149 and 148 days), respectively than those fed diet contained 18% CP (153 day). Also, age at SM significantly ($P<0.05$) decreased by feeding on starter diet contained 2850 Kcal/kg diet compared to diet contained 2900 Kcal/kg. On the other hand, no significant influence of dietary CP and ME in starter diet on BW at SM. In addition, feed intake (7 – 19 wk. of age) was significantly ($P<0.05$) increased by increasing the level of CP up to 19% comparing with 17 and 18%, but it was not affected by the value of dietary ME (2850 and 2900 Kcal/kg) as a subsequent effect during the grower period. In respect of interaction between CP and ME, it is evident that Sinai birds fed diet contained 17% CP+2850 Kcal/kg and19 % CP+2850 Kcal/kg diet reached to SM earlier (143 and 144 d, respectively) than the other dietary treatments. Also, the birds fed diet contained 19% CP+2850 Kcal ME/ kg was consumed 66.51 g feed/ bird/day, which is higher than the other dietary groups.

Laying performance as a subsequent effect to the starter diets:

Subsequent effect of different levels of CP showed significant influence on laying performance from SM to 36 weeks of age as shown in Table (8). Generally, it is evident that egg number and egg mass significantly increased when chickens were fed a starter diet contained 19% CP compared to the other different levels of CP (17 and 18% CP). While, decreasing dietary ME level to 2850 Kcal/kg starter diet resulted in a significant improvement in egg number and egg mass during the interval and collective periods compared to the high level of ME.

It is interesting to note that the hens fed previously laying starter diet contained 19% CP + 2850 Kcal/Kg was higher in egg number than those fed the other starter diets during the collective period. In addition, egg mass was significantly improved by feeding the same diet (19% CP + 2850 Kcal/Kg). This result is not strange as the egg mass closely related to egg weight and egg number thus the hens fed layer diet contained 14% CP + 2650 Kcal/Kg ME returned the first position in egg mass compared to other experimental groups. Meanwhile, the worst record to egg number and egg mass was observed with starter diet containing CP 17%+ ME 2900 Kcal /Kg diet.

Feed intake and feed conversion ratio during laying period:

As shown in Table (9) and regardless the fluctuations observed in feed intake during the interval periods, statistical analysis revealed no significant differences due to feeding layers on starter diets contained different levels of CP. On the other hand, the hens fed starter laying diet included 2850 Kcal/kg recorded significantly ($P<0.05$) the highest value of feed intake compared to the high level of ME.

Subsequent significant effect was detected on feed conversion ratio due the using different levels of CP; where it was significantly improved by increasing CP up to 19% compared to 17 and 18%. Conversely, feed conversion ratio was significantly improved by decreasing ME from 2900 to 2850 Kcal/kg starter diet. In fact, the best value of feed conversion ratio was achieved by feeding on starter diet contained 19 % CP+ 2850 Kcal/kg as a subsequent effect during the laying period.

The improvement in feed conversion during the laying period as a result of previous feeding on starter diet contained CP 19%+ 2850 Kcal/Kg may be due to the improvement in body weight and body weight gain at 6 weeks of age (Table 3) also, decreasing the age of sexual maturity (Table 6) and eventually birds welfare. As described above, the final boy weight at 6 weeks of age levels of ME on chick weight at hatch could be detected.

Moreover, the best value of fertility as a subsequent effect was observed as a result of feeding on diet contained 17 %+2900 Kcal/kg and 19 %+2850 Kcal/kg diet during the starter period. While, hens fed the starter diet contained 18 %+2850 Kcal/kg diet had the highest value of hatchability % compared to other dietary groups.

was increased due to the grower diet with CP 19%+ME 2850 Kcal/Kg thus it could be mentioned that positive effect during the laying period as a sequent effect attributed to the moderate increment in body weight (413.3 g/chick) which consistent with the sexual maturity. Although low dietary energy content would minimize the cost of feed per egg production unit, it should be increased to maximize benefits (Novak *et al.,* 2004).

Reproductive traits:

Dietary different levels of CP and ME resulted in a significant ($P<0.05$) influence on fertility % (Table 10) where, it was significantly improved by feeding on starter diet contained 17 % CP compared to the diet with 18% CP but, no significant effect was observed compared to the diet with 19% CP. In addition, hatchability of set eggs % from hens fed on previous starter diet contained 17% CP was significantly ($P<0.05$) higher than the eggs from hens fed diet contained 18 and 19 % CP. Nearly, the same trend was observed in respect of hatchability of fertile eggs %.

On the other hand, the results showed that ME hadn't statistically ($P>0.05$) influenced on fertility % as a subsequent effect during the laying period. However, hatchability of set and fertile eggs % of hens fed starter diet contained 2850 Kcal/kg was 86.5 and 89.7 %, respectively which was significantly ($P<0.05$) higher than those fed starter diet with 2900 Kcal/kg. No significant effect of both dietary

Egg quality:

Data obtained of the egg quality traits as a sequent influence to dietary different levels of CP and ME during the starter period are showed in Table (11). Generally, no significant ($P>0.05$) response in egg quality traits due to dietary treatments could be demonstrated. However, the most pronounced sequent effect was in eggshell % where, it was significantly increased by increasing CP in starter diet to 19 % compared to the other two levels of crude protein.

CONCLUSION

The current study has shown that a diet contained CP 19 % + ME 2850Kcal / kg diet achieved optimal utilization of protein and energy for Sinai chicks aged between 1 and 6 weeks of age and subsequent effect during the laying period from 21 to 32 weeks of age.

Table (1): Composition and calculated analysis of the experiment diets fed to local Sinai pullets throughout the growing period (1-6 weeks of age)

Ingredients	Crude protein % + ME (Kcal/kg diet)					
	17		18		19	
	2850	2900	2850	2900	2850	2900
Yellow corn	66.50	68.78	65.32	67.08	63.81	63.35
Soybean meal (44%)	25.50	26.20	28.70	29.30	31.8	32.26
Wheat brain	4.38	1.35	2.38	0.00	0.80	0.00
Soybean oil	0.00	0.00	0.00	0.00	0.00	0.80
Limestone	1.30	1.30	1.30	1.30	1.30	1.30
Di-calcium phosphate	1.50	1.55	1.50	1.52	1.50	1.50
Sodium chloride(Na Cl)	0.32	0.32	0.32	0.32	0.32	0.32
Sodium bicarbonate	0.10	0.10	0.10	0.10	0.10	0.10
Premix[1]	0.30	0.30	0.30	0.30	0.30	0.30
Choline chloride 60%	0.05	0.05	0.05	0.05	0.05	0.05
Dl-methionine	0.05	0.05	0.03	0.03	0.02	0.02
Total	100	100	100	100	100	100
Calculated nutritional values [2]						
Crude protein%	17	17	18	18	19	19
ME (Kcal / Kg)	2850	2900	2850	2900	2850	2900
Crude fiber%	3.77	3.55	3.78	3.60	3.80	3.73
Crude fat%	2.85	2.80	2.78	2.92	2.70	3.44
Calcium %	0.90	0.90	0.90	0.90	0.90	0.90
Av. Phosphorus (%)	0.40	0.40	0.40	0.40	0.40	0.40
Lysine %	0.85	0.85	0.85	0.85	0.85	0.85
Methionine%	0.30	0.30	0.30	0.30	0.30	0.30
Methionine + Cystine %	0.65	0.65	0.65	0.65	0.65	0.65
Sodium %	0.18	0.18	0.18	0.18	0.18	0.18
Chloride %	0.22	0.22	0.22	0.22	0.22	0.22
Potassium	0.75	0.75	0.72	0.75	0.80	0.83

1- Each 3 kg of the Vit and Min. contains : Vit. A 10 MIU, Vit. D 2 MIU, Vit E 10 g, Vit. K 2 g, Thiamin 1 g, Riboflavin 5 g, Pyridoxine 1.5 g, Niacin 30 g, Vit. B_{12} 10 mg, Pantothenic acid 10 g, Folic acid 1.5 g, Biotin 50 mg, Choline 250 g, Manganese 60 g, Zinc 50 g, Iron 30 g, Copper 10 g, Iodine 1g, Selenium 0. 10 g, Cobalt 0.10 g. and carrier $CaCO_3$ to 3000 g.

2- According to Feed Composition Tables For Animal and Poultry Feedstuffs Used In Egypt, (2001).

Table (2): Composition and calculated analysis of the basal layer diets fed to local Sinai hens throughout the layer period (20-32 wks.).

Ingredients (%)	**Grower (7-19 wks.)**	**Layer (20 – 32 wks.)**
Yellow corn	65.93	64.70
Soybean meal (44 %)	16.64	24.75
Wheat bran	14.07	1.00
Di-calcium phosphate	1.29	1.50
Limestone	1.44	7.40
Vit. & Min. premix[1]	0.30	0.30
Sodium chloride (Na Cl)	0.29	0.30
DL- Methionine (99%)	0.04	0.05
Total	100	100
Calculated Analysis[2]		
Crude protein %	14.55	16.02
ME (Kcal / kg)	2763	2732
Crude fiber %	3.94	3.41
Ether extract %	3.26	2.99
Calcium (%)	0.9	3.20
Available Phosphorus (%)	0.38	0.398
Methionine %	0.28	0.33
Methionine + Cystine %	0.51	0.587

1- Each 3 kg of Vit. and Min. premix contains 100 million IU Vit. A; 2 million IU Vit. D3; 10 g Vit. E; 1 g Vit. K_3; 1 g Vit. B1; 5 g Vit. B2; 10 mg Vit. B12; 1.5 g Vit. B6; 30 g Niacin; 10 g Pantothenic acid; 1 g Folic acid ;50 mg Biotin; 300 g Choline; 50 g Zinc; 4 g Copper; 0.3 g Iodine; 30 g Iron; 0.1 g Selenium; 60 g Manganese; 0.1 g Cobalt; and carrier $CaCO_3$ to 3000 g.

2- According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (3): Effect of different levels of crude protein and metabolizable energy on bogy weight and daily weight gain of Sinai local chickens from hatch to 6 weeks of age

Traits / Factors		Body weight (g/bird)				Daily weight gain (g/bird/day)			
		At hatch	2 wk.	4 wk.	6 wk.	0-2 wk.	2-4 wk.	4-6 wk.	0-6 wk.
Crude protein (CP) (%)									
17		35.70	103.12[b]	182.19[b]	353.51[b]	4.81[b]	5.65[b]	9.52	6.91[b]
18		36.00	101.53[b]	199.69[a]	384.47[a]	4.68[b]	7.01[a]	10.27	7.58[a]
19		35.62	109.09[a]	196.82[a]	396.31[a]	5.25[a]	6.27[ab]	11.087	7.84[a]
±SE mean		0.20	1.72	3.95	6.56	0.12	0.30	0.52	0.14
Significant		NS	0.05	0.05	0.05	0.05	0.05	NS	0.05
Metabolizable energy (ME) (Kcal/kg diet)									
2850		35.68	102.59	196.12[a]	381.17	4.78	6.68	10.28	7.51
2900		35.88	106.57	189.68[b]	375.03	5.05	5.94	10.30	7.37
±SE		0.17	1.41	3.22	5.35	0.10	0.25	0.42	0.12
Significant		NS	0.05	0.05	0.05	0.05	0.05	NS	NS
Interaction effect (CP x ME)									
CP 17%	2850	35.37	100.69	184.62	366.91	4.67	9.00	10.13	7.21
	2900	36.09	105.56	179.76	340.11	4.96	5.30	8.91	6.61
CP 18%	2850	36.00	92.22	191.11	364.28	4.02	7.06	9.62	7.14
	2900	36.00	110.83	208.27	404.67	5.35	6.97	10.91	8.02
CP 19%	2850	35.67	114.84	212.62	412.32	5.66	6.98	11.10	8.19
	2900	35.56	103.33	181.01	380.30	4.84	5.55	11.07	7.50
±SE		0.29	2.43	5.58	9.27	0.17	0.43	0.73	0.20

a, b :means in the same column bearing different superscripts are significantly different ($p \leq 0.05$).

NS= non-significant

Table (4): Effect of different levels of crude protein and metabolizable energy on feed intake and feed conversion ratio of Sinai local chickens from hatch to 6 weeks of age

Traits / Factors		Feed intake (g/bird/day)				Feed conversion ratio			
		0-2 wk.	2-4 wk.	4-6 wk.	0- 6 wk.	0-2 wk.	2-4 wk.	4-6 wk.	0-6 wk.
Crude protein (CP) (%)									
17		13.50	25.86[a]	36.58[c]	25.31[b]	2.40	4.59[a]	3.865	3.80[a]
18		14.67	18.22[b]	39.27[b]	24.06[b]	3.18	2.65[b]	3.974	**3.30[b]**
19		13.67	27.67[a]	41.24[a]	27.63[a]	2.67	4.54[b]	3.722	3.68[a]
±SE mean		1.14	1.34	0.58	0.63	0.23	0.26	0.22	0.09
Significant		NS	0.05	0.05	0.05	NS	0.05	NS	0.05
Metabolizable energy (ME) (Kcal/kg diet)									
2850		14.43	22.66[b]	40.60	25.90	3.06	3.46	4.00	3.58
2900		13.67	25.17[a]	37.47	25.43	2.71	4.39	3.71	3.61
±SE		0.93	1.10	0.47	0.52	0.19	0.21	0.18	0.08
Significant		NS	0.05	0.05	NS	NS	0.05	0.05	NS
Interaction effect (CP x ME)									
CP 17%	2850	13.83	27.38	36.94	26.05	2.95	5.57	3.657	3.76
	2900	13.18	24.34	36.23	24.58	2.66	4.60	4.074	3.85
CP 18%	2850	13.89	15.00	42.06	23.65	3.47	2.14	4.482	3.43
	2900	15.46	21.45	36.48	24.46	2.90	3.16	3.466	3.17
CP 19%	2850	15.57	25.62	42.79	27.99	2.75	3.68	3.858	3.54
	2900	12.38	29.72	39.68	27.26	2.58	5.40	3.586	3.81
±SE		1.61	1.90	0.82	0.89	0.33	0.36	0.31	0.13

a, b :means in the same column bearing different superscripts are significantly different ($p \leq 0.05$).
NS= non-significant

Table (5): Effect of different levels of crude protein and metabolizable energy on viability % of Sinai local chickens from hatch to 6 weeks of age .

Traits / Factors		Viability %			
		0-2 wk.	**2-4 wk.**	**4-6 wk.**	**0-6 wk.**
Crude protein (CP) (%)					
17		98.90	93.25	97.61	90..00
18		96.67	97.78	96.67	94.44
19		95.56	86.43	100.00	82.22
±SE mean		2.87	1.95	1.31	2.13
Significant		NS	0.05	NS	0.05
Metabolizable energy (ME) (Kcal/kg diet)					
2850		95.52	91.64	96.18	86.67
2900		95.56	93.33	10.00	91.11
±SE		2.34	1.60	1.07	1.74
Significant		NS	NS	0.05	0.05
Interaction effect (CP x ME)					
CP 17%	2850	97.78	93.18	95.21	86.67
	2900	100.00	93.33	100.00	93.33
CP 18%	2850	100.00	100.00	93.33	93.33
	2900	93.33	95.56	100.00	95.56
CP 19%	2850	97.78	81.75	100.00	80.00
	2900	93.33	91.11	100.00	84.44
±SE mean		4.06	2.76	1.85	3.01

Table (6): Effect of different levels of crude protein and metabolizable energy on serum biochemical of Sinai local chickens at 6 weeks of age

Traits / Factors		Serum biochemical								
		TP g/dl	Alb. g/dl	Glob. g/dl	Cho. (mg/dl)	Trig. (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	AST U/ml	ALT mM/L
Crude protein (CP) (%)										
17		3.5	1.18	2.31	149.0	91.3	55.3^{b}	53.3^{b}	258.0	11.2^{a}
18		3.6	1.23	2.34	153.8	86.0	73.5^{a}	61.8^{a}	266.5	8.9^{b}
19		3.5	1.24	2.24	162.5	98.8	70.5^{a}	56.0^{ab}	259.0	9.3^{b}
±SE mean		0.18	0.06	0.18	4.49	6.96	1.48	2.58	8.01	0.37
Significant		NS	NS	NS	NS	NS	0.05	0.05	NS	0.05
Metabolizable energy (ME) (Kcal/kg diet)										
2850		3.5	1.28	2.21	150.8	100.3	63.7	54.0	273.3	9.8
2900		3.5	1.15	2.38	159.3	83.7	69.2	60.0	249.0	9.3
±SE mean		0.14	0.05	0.14	3.66	5.64	1.21	2.10	6.54	0.36
Significant		NS	NS	NS	NS	NS	0.05	0.05	NS	NS
Interaction effect (CP x ME)										
CP 17%	2850	3.3	1.22	2.08	142.5	108.5	49.5	39.0	269.5	10.3
	2900	3.7	1.14	2.55	155.5	74.0	61.0	67.5	246.5	12.2
CP 18%	2850	3.8	1.32	2.44	155.0	87.5	73.5	68.5	282.5	9.6
	2900	3.4	1.14	2.24	152.5	84.5	73.5	55.0	250.5	8.3
CP 19%	2850	3.4	1.30	2.12	155.0	105.0	68.0	54.5	268.0	9.5
	2900	3.5	1.17	2.36	170.0	92.5	73.0	57.5	250.0	9.1
±SE mean		0.25	0.09	0.25	6.35	9.76	2.09	3.64	11.33	0.52

a, b :means in the same column bearing different superscripts are significantly different ($p \leq 0.05$). NS= non-significant, TP= Total protein; Alb= Albumin; Glob= Globulin; Cho= Globulin; Trig= Triglycerides; HDL= High density lipoprotein; LDL= Low density lipoprotein; AST= Aspartates transaminase; ALT= Alanine transaminase

Table (7): Subsequent effect of feeding on different levels of crude protein and metabolizable energy during starter period on productive performance of Sinai local chickens during growing period

Factors \ Traits		Age at sexual maturity	BW at sexual maturity	FI/h/d (6-19wk.)
Crude protein (CP) (%)				
17		149[b]	1319.8	57.04[b]
18		153[a]	1355.8	54.41[b]
19		148[b]	1369.3	63.00[a]
±SE mean		0.61	29.18	1.04
Significant		0.05	NS	0.05
Metabolizable energy (ME) (Kcal/kg diet)				
2850		145[b]	1333.7	58.87
2900		156[a]	1362.9	57.36
±SE		0.50	23.83	0.85
Significant		0.05	NS	NS
Interaction effect (CP x ME)				
CP 17%	2850	143	1339.5	56.19
	2900	156	1300.0	57.88
CP 18%	2850	147	1295.0	53.91
	2900	159	1416.7	54.71
CP 19%	2850	144	1366.7	66.51
	2900	152	1372.0	59.49
±SE mean		0.86	41.3	1.48

a, b :means in the same column bearing different superscripts are significantly different ($p \leq 0.05$).
NS= non-significant. SM=

Table (8): Subsequent effect of feeding on different levels of crude protein and metabolizable energy during starter period on egg production of Sinai local chickens from SM to 36 wk. of age

Traits / Factors	Egg number/h/period					Egg mass (egg number*egg weight)				
	SM-24 wk.	**24-28 wk.**	**28-32 wk.**	**32-36 wk.**	**SM-36 wk.**	**SM-24 wk.**	**24-28 wk.**	**28-32 wk.**	**32-36 wk.**	**SM-36 wk.**
Crude protein (CP) (%)										
17	1.9^{b}	10.1^{ab}	12.8^{b}	13.8^{b}	38.5^{b}	65.7^{b}	402^{b}	576	653^{b}	1697^{b}
18	1.3^{c}	9.4^{b}	14.0^{b}	13.6^{b}	38.2^{b}	43.3^{c}	3801^{b}	620	649^{b}	1694^{b}
19	3.53^{a}	11.6^{a}	16.1^{a}	15.5^{a}	46.6^{a}	122.6^{a}	478^{a}	744	740^{a}	2084^{a}
±SE mean	0.17	0.54	0.47	0.56	1.53	5.48	22.39	21.54	27.06	67.57
Significant	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Metabolizable energy (ME) (Kcal/kg diet)										
2850	3.7	13.4^{a}	15.6	15.3	48.0^{a}	127.1	549	710	729	2116
2900	0. 8	7.3^{b}	12.9	13.2	34.2^{b}	27.3	291	584	632	1534
±SE	0.14	0.44	0.38	0.45	1.25	4.47	18.28	17.58	22.10	55.17
Significant	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Interaction effect (CP x ME)										
CP 17% 2850	3.4	14.3	15.3	14.6	47.6	114.0	569	690	689	2062
CP 17% 2900	0.44	5.9	10.2	12.9	26.4	17.5	235	462	616	1331
CP 18% 2850	2.34	12.0	15.6	15.6	45.5	78.5	491	696	743	2008
CP 18% 2900	0.24	6.8	12.3	11.6	30.9	8.15	270	546	555	1379
CP 19% 2850	5.34	13.9	16.0	15.7	50.9	188.8	587	745	755	2276
CP 19% 2900	1.7	9.3	16.2	15.2	42.3	56.4	368	743	725	1892
±SE	0.24	0.77	0.66	0.79	2.16	7.75	31.67	30.46	38.27	95.55

a, b :means in the same column bearing different superscripts are significantly different ($p \leq 0.05$).
NS= non-significant

Table (9): Subsequent effect of feeding on different levels of crude protein and metabolizable energy during starter period on feed intake and feed conversion ratio of Sinai local chickens from SM to 36 wk. of age

Traits / Factors		Feed intake (g/h/d)					Feed conversion ratio				
		SM-24 wk.	24-28 wk.	28-32 wk.	32-36 wk.	SM-36 wk.	SM-24 wk.	24-28 wk.	28-32 wk.	32-36 wk.	SM-36 wk.
Crude protein (CP) (%)											
17		80.8[ab]	79.7	103.2[a]	106.9[b]	92.7	15.4	6.6[a]	5.2[a]	4.6	8.0[a]
18		85.9[a]	86.7	95.7[b]	100.6[c]	92.3	17.0	6.8[a]	4.4[b]	4.5	8.2[a]
19		74.4[b]	74.4	106.1[a]	112.1[a]	91.8	9.2	4.6[b]	4.0[b]	4.3	5.5[b]
±SE mean		2.72	1.98	1.38	1.34	1.63	0.90	0.16	0.14	0.13	0.32
Significant		0.05	0.05	0.05	0.05	NS	0.05	0.05	0.05	NS	0.05
Metabolizable energy (ME) (Kcal/kg diet)											
2850		80.8	85.7	102.0	107.8	95.3	12.5	4.5	4.0	4.2	6.3
2900		74.4	76.5	101.3	105.5	89.1	15.3	7.5	5.0	4.7	8.1
±SE mean		2.22	1.61	1.13	1.10	1.33	0.74	0.13	0.11	0.11	0.19
Significant		0.05	0.05	NS	NS	0.05	0.05	0.05	0.05	0.05	0.05
Interaction effect (CP x ME)											
CP 17%	2850	85.0	82.8	108.2	113.2	97.3	13.9	4.089	4.4	4.6	6.7
	2900	76.5	76.5	98.2	100.5	88.0	17.3	9.107	6.0	4.6	9.2
CP 18%	2850	95.2	96.8	92.7	97.2	95.5	17.0	5.595	3.7	3.7	7.5
	2900	76.5	76.5	98.6	104.9	89.1	17.1	7.934	5.1	5.3	8.9
CP 19%	2850	77.4	77.4	105.1	113.0	93.2	7.0	3.701	4.0	4.3	4.7
	2900	71.3	71.4	107.1	111.1	90.3	11.4	5.442	4.1	4.3	6.3
±SE mean		3.85	2.80	1.95	1.90	2.31	1.28	4.09	0.19	0.18	0.33

a, b, c :means in the same column bearing different superscripts are significantly different ($p \leq 0.05$).

NS= non-significant

Table (10): Subsequent effect of feeding on different levels of crude protein and metabolizable energy during starter period on reproductive performance of Sinai laying hens

Traits / Factors		Reproductive traits			
		Fertility %	**Hatchability of set eggs**	**Hatchability of fertile eggs**	**Chick weight**
Crude protein (CP) (%)					
17		97.80[a]	88.17[a]	90.13[a]	30.35[b]
18		94.17[ab]	83.57[b]	88.76[ab]	30.72[a]
19		96.40[b]	82.74[b]	85.87[b]	30.60[ab]
±SE mean		0.98	1.23	1.01	0.10
Significant		0.05	0.05	0.05	0.05
Metabolizable energy (ME) (Kcal/kg diet)					
2850		96.63	86.54[a]	89.66	30.40
2900		95.62	83.11[b]	86.85	30.71
±SE		0.80	1.01	0.82	0.08
Significant		NS	0.05	0.05	NS
Interaction effect (CP x ME)					
CP 17%	2850	96.94	86.74	89.44	30.70
	2900	98.67	89.59	90.81	30.00
CP 18%	2850	94.27	89.76	95.23	30.60
	2900	94.05	77.38	82.29	30.83
CP 19%	2850	98.67	83.13	84.30	29.90
	2900	94.14	82.35	87.45	31.30
±SE mean		1.38	1.74	1.42	0.14

a, b :means in the same column bearing different superscripts are significantly different ($p \leq 0.05$).

NS= non-significant

Table (11): Subsequent effect of feeding on different levels of crude protein and metabolizable energy during starter period on egg quality of Sinai laying hens

Traits / Factors		Serum biochemical						
		Shape index	**Yolk %**	**Albumin%**	**Shell %**	**Shell Thick.**	**Haugh units**	**Yolk color**
Crude protein (CP) (%)								
17		0.77	28.4	60.6	11.4	0.31	62.9	6.4
18		0.78	27.7	61.0	11.2	0.31	63.5	6.4
19		0.78	26.6	60.7	12.7	0.32	66.4	6.5
±SE mean		0.02	1.32	1.41	0.15	0.01	2.11	0.30
Significant		NS	NS	NS	0.05	NS	NS	NS
Metabolizable energy (ME) (Kcal/kg diet)								
2850		0.76	27.1	61.2	11.6	0.31	62.9	6.6
2900		0.80	28.0	60.0	11.9	0.31	65.7	6.3
±SE mean		0.02	1.08	1.15	0.13	0.01	1.72	0.25
Significant		NS	NS	NS	NS	NS	NS	NS
Interaction effect (CP x ME)								
CP 17%	2850	0.72	29.0	59.5	11.5	0.30	59.7	6.2
	2900	0.82	27.8	60.8	11.4	0.31	66.1	6.7
CP 18%	2850	0.78	28.6	60.1	11.3	0.33	64.7	6.7
	2900	0.78	27.0	62.0	11.1	0.30	62.4	6.2
CP 19%	2850	0.79	23.8	64.1	12.1	0.33	64.3	6.8
	2900	0.78	29.3	57.4	13.2	0.31	68.5	6.2
±SE mean		0.03	1.87	2.00	0.22	0.01	2.98	0.43

NS= non-significant

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الملخص العربي

تأثير مستويات مختلفة من البروتين الخام والطاقة الممثلة علي الأداء الإنتاجي لدجاج سينا المحلي خلال فترة البادي والتأثير اللاحق خلال فترة انتاج البيض

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تم استخدام ماجملتة 270 كتكوت من سلالة سينا المحلية عمر يوم و قد تم وزنها وتوزيها علي ستة معاملات تجريبية وذلك بهدف تقدير الاحتياجات الغذائية من البروتين الخام والطاقة الممثلة من خلال التأثيرعلي الاداء الانتاجي خلال فترة البادي (1- 6 أسابيع) من العمر وكذلك التأثير اللاحق خلال فترتي النمو وانتاج البيض (7 – 32 أسبوع) . تم استخدام ثلاث مستويات من البروتين ومستويين من الطاقة في تصميم عاملي (2x3) (17 ، 18 ، 19 % بروتين خام وكل مستوي له مستويان من الطاقة الممثلة 2850 ، 2900 كيلو كالوري / كجم عليقة). أوضحت نتائج التجربة ان الكتاكيت المغذاه علي عليقة محتوية علي 18 و 19% بروتين خام سجلت معنويا (P≤0.05)أعلي وزن نهائي وأعلي وزن يومي مكتسب للجسم مقارنة بالكتاكيت المغذاه علي عليقة محتويه علي المستوي الأقل من البروتين الخام (17%). من الجدير بالذكر ان اعلي وزن للجسم وكذلك اعلي وزن يومي مكتسب قد تحقق للكتاكيت التي تم تغذيتها علي عليقة بادي محتوية علي 19% بروتين خام+2850 كيلوكالوري طاقة ممثلة/ كيلو علف. اوضحت النتائج ان زيادة مستوي البروتين الخام الي 18% ادي الي تحسن معنوي (P≤0.05) في معدل التحويل الغذائي مقارنة بالمستوي الاقل (17%) بروتين خام. حققت التغذية علي عليقة محتوية علي 18% بروتبن خام+2900 كيلوكالوري/كجم علف افضل قيمة للحيوية حيث بلغت 95.56%. ارتفع مستوي كل من الليبوبروتين عالي ومنخفض الكثافة معنويا (P≤0.05) بزيادة مستوي الطاقة من 2850 الي 2900 كيلوكالوري/كجم علف. طيور السينا المغذاه علي عليقة بادي محتوية علي 17 و19% بروتين خام+ 2850 كيلوكالوري/كجم علف بلغت عمر النضج الجنسي مبكرا (143 و 144 يوم) مقارنة بباقي المجاميع التجريبية الاخري. من الملاحظ ان عدد وكتلة البيض الناتج قد ذاد معنويا (P≤0.05) بالتغذية خلال فترة البادي علي 19% بروتين خام مقارنة بالمستوي 17 و 18% بروتين خام. بينما انخفاض مستوي الطاقة الي 2850 كيلوكالوري/كجم علف ادي الي تحسن معنوي (P≤0.05) في عدد وكتلة البيض الناتج. بلغت نسبة الفقس من البيض الكلي والبيض المخصب للدجاجات المغذاه علي عليقة بادي قد احتوت علي طاقة ممثلة 2850 كيلوكالوري/كجم علف 86.5 و89.5% وهو مايعني زيادة معنوية (P≤0.05) مقارنة بتلك التي تغذت علي عليقة بادي محتوية علي 2900 كيلوكالوري/كجم علف. تلاحظ عدم وجود فروق معنوية في وزن الكتكوت عند الفقس نتيجة التغذية علي مستويان مختلفان من الطاقة الممثلة في العليقة البادي.

أوضحت الدراسة الحالية ان العليقة البادي المحتوية علي 19% بروتين خام+2850 كيلوكالوري/كجم علف تحقق أفضل اداء انتاجي في كتاكيت السينا المحلية في عمر من 1 الي 6 اسابيع وكذلك التأثير اللاحق خلال فترة انتاج البيض من 21 الي 32 اسبوع من العمر.