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Nutritional Requirements For Gimmizah Males: 1- Protein and Metabolizable Energy

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ABSTRACT

This research aimed to determine protein and energy requirements for Gimmizah cocks and their effects on productive, reproductive, some physiological and immunological traits. Seventy two, 26-weeks old Gimmizah cocks with similar body weights were individually caged in a naturally ventilated poultry house. Cocks were divided into three groups each of 24 cocks according to dietary protein level (12, 13 and 14%), then, each group was sub-divided into two subgroups according to dietary ME level (2600 and 2700 kcal/kg). The experimental period lasted for 16 weeks. Body weight change and feed intake were calculated. Semen physical characteristics, Newcastle disease virus (NDV) titre, some blood constituents and hematological indices were estimated. Results indicated that BW changes, plasma levels of total protein, albumin, glucose, triglycerides, cholesterol and HDL, as well as activity of liver enzymes (AST and ALT) increased significantly ($P<0.05$) with increasing protein level in diets, while, blood MCH and MCHC were decreased. On the other side, dietary protein level had no significant effect on all semen characteristics. Cocks fed 13% protein (daily CP intake of 17.80 g) achieved significantly ($P<0.01$) the highest NDV titre and plasma globulin concentration. Energy level had significant ($P<0.01$) effects on feed intake, NDV titre, fertility, semen pH, some blood indices (MCH and MCHC), and plasma LDL and uric acid. Cocks fed the diet with 2600 kcal/kg (daily ME intake 358.60 kcal) displayed higher in feed intake, NDV titre, MCH and MCHC, while, cocks fed the diet with 2700 kcal/kg (daily ME intake 365.68 kcal) recorded the higher fertility percentage, semen pH, plasma uric acid and LDL levels. Feeding cocks the diet containing 14% protein and 2700 kcal/kg (daily CP intake 18.96 g and daily ME intake 362.44 kcal) exhibited significantly ($P<0.01$) higher body weight, plasma levels of total protein, albumin, uric acid, LDL, HDL, and triglycerides and activity of AST and ALT the lowest feed intake. On the other side, feeding cocks the diet containing 12% protein with 2600 kcal/kg (daily CP intake 16.65 g and daily ME intake 361.18 kcal) displayed significantly ($P<0.01$) higher feed intake, MCH, MCHC and NDV titre than those fed 13% CP and 2600 kcal/kg diet. Conclusively, it can be concluded that feeding diets with 13% or 14% crude protein and ME 2700 kcal/kg (daily CP intake 17.84 g or 18.96 and daily ME intake 368.73 or 362.44 kcal) can positively affect body weight, feed intake, and fertility percentage of Gimmizah cocks. Alternatively, NDV titre recorded its highest value in cocks fed the diet with 13% CP and 2600 kcal/kg, compared to other levels.

Keywords: Gimmizah cocks, protein, Metabolizable energy, semen quality.

INTRODUCTION

Local chickens had good adaptability to Egyptian conditions, slower feed conversion, growth rate, poor productive and reproductive performance compared to the standard breeds of chickens, but they have good mothering resistance to diseases. In developed local breeds, many studies attempted to evaluate their nutrient requirements under improved managerial conditions. Broiler breeder males are typically fed the same diet as females up to sexual maturity at 24 weeks of age; (Moyle *et al*., 2011). In addition some producers fed cocks the same diet during the entire production period, although they differ from hens in nutrient requirements. The use of specific diets for cocks/ cockerels in the laying period has been shown to be beneficial to the maintenance of their physiological condition and fertility. The requirements of metabolizable energy (ME) in broiler breeders at any age, phase of production and metabolizable energy value of feedstuffs in the diet is essential for optimal production (NRC, 1994). Excess protein intake will increase body weight and can affect fertility negatively because more energy will be needed to support a greater body weight (BW) and maintain sperm production and mating activity (Romero-Sanchez *et al.,* 2007). Crude protein (CP) Furthermore metabolizable energy (ME) and their impacts on fertility of male broiler breeders have been explored for inconsistent findings. Also, analysis illustrated that secondary CP intakes adversely influenced semen qualities as far as motility, viability, ejaculated volume Also focus. (Hocking 1989; Hocking, 1990; Hocking and Bernard, 1997a).

Wilson *et. al*., (1987), however, found no critical impact of CP intake on factors deciding semen quality and fertility (semen volume, concentration and motility). Revington *et. al*., (1991) found that broiler breeder males fed all corn-based diet containing 8% CP and 3220 kcal ME/Kg formulated to meet minimum amino acid requirements for positive nitrogen balance were in adequate for optimal BW gain, but adequate for semen production. On the other hand, semen volume was not influenced by CP levels (12, 15, and 18%) Hocking (1989) reported that proportions of males producing semen reduced with increasing dietary CP level and led to a significant decrease in semen volume and spermatozoa production. Moreover, Buckner *et. al*., (1986) observed no differences in semen volume and sperm concentration of broiler breeder males fed on 5, 7 and 9% CP-diet with *adlibtum* feeding from 20 to 65 weeks of age.

They added that a daily CP of 10.9 g and ME intake of 495 kcal (free access to a 5% protein and 2300 kcal/kg ME diet) maintained semen volume and sperm numbers as well as an iso-caloric daily intake of 18.7 g protein (free access to a 9% protein diet). Protein intake had a critical impact on the rate for decrease in fertility post insemination (Tyler and Becker, 2012). This data in a longer predicted length of the fertile period over all ages when eggs were fertilized with sperm obtained from males that received 12.6% CP diet (14.5 g/d) than males that received 10.5% or 15% CP-diets, (7 and 8.6 g/d respectively). There might have been however, no impact from dietary CP levels on the measures of live sperm with normal motility or macroscopic examination (Tyler and Becker, 2012).

Cerolini *et. al.,* (1995) found evidence that fertility had decreased in males due to ME deficiency and that problem would happen more frequently at the end of the production period. Wilson *et. al*., (1987) reported that BW of broiler breeder males, semen volume, concentration and sperm numbers were no influenced by feeding diets containing 12 or 15 % CP (14.4 and 18 g CP/day, respectively). However, broiler breeder males receiving a 9 % CP (10.8 g CP/day) ration had significantly lower BW as opposed to birds receiving 12 or 15 % CP. Attia *et. al*., (1993) found that when broiler breeder males fed diets with low ME, the birds were able to maintain BW with little or no excess ME for BW gain. However, worry emerged that those spermatozoa maturation process was altered, where motility might have been affected, resulting in fewer spermatozoa reaching the sperm storage tubules. Brown and McCartney (1986) reported that 1.92 MJ ME/bird/day was essential to maintain BW and optimal breeding performance.

This study aimed to investigate the nutritional requirements for Gimmizah cocks from protein and metabolizable energy on productive, reproductive some physiological and immunological traits.

MATERIALS AND METHODS

The experiment was carried out at Gimmizah Research Station, Animal Production Research Institute, Agric. Res. Center, Ministry of Agric. Seventy two 26-weeks old Gimmizah cocks, similar in body weights, (2068.65 ± 54.79g) were divided into three groups of 24 cocks. The birds were individually caged in a naturally ventilated poultry house and assigned to three dietary protein levels of 12, 13 and 14%, respectively (Table 1), then each group was divided into two equal subgroups according to dietary ME levels of 2600 and 2700 kcal/kg. The experimental period lasted for 16 weeks. Water was provided *adlibtum* and cocks were exposed to 16 hr, light daily. At the end of the experimental period, cocks were individually weighed, then their body weight change was calculated by subtracting initial body weight from the final BW. Average feed intake was calculated once each week during the experimental period to determine protein and ME intakes. Semen was collected (once / week) from each cock using the massage method and by squeezing the capulatory organ to obtain semen as described by Kalamah *et. al.,* (2002). Semen volume (ml) was measured by using a graduated collection tube. Ninety hens fed on a layer diet (16% CP and 2750 kcal/kg) were equally divided into 6 groups, then they were artificially inseminated with a fixed volume of semen collected from 6 cocks representing all the experimental groups.

Three hatches were done at three successive weeks by using eggs of each group of hens. At the 18th day of incubation, fertility rate for eggs of each group was calculated.

Table 1. Composition and calculated analysis of the experimental diets.

Ingredients	Protein and energy diets					
	1	2	3	4	5	6
Yellow corn	65.20	67.00	68.50	60.69	62.00	63.80
Soybean meal (44% CP)	16.30	13.50	9.70	15.40	11.50	8.50
Wheat bran	12.00	13.00	15.00	17.50	19.97	21.00
Dicalcium phosphate.	1.10	1.10	1.10	1.00	1.00	1.00
Limestone	4.64	4.56	4.74	4.65	4.62	4.73
Methionine	0.06	0.04	0.06	0.06	0.06	0.06
Lysine	0.00	0.10	0.20	0.00	0.15	0.21
Vit.&Min.. premix*	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.40	0.40	0.40	0.40	0.40	0.40
Total	100	100	100	100	100	100
Calculated analysis						
ME	2705	2720	2715	2606	2611	2610
CP %	14.15	13.16	12.02	14.01	13.00	12.03
C/P ratio	191	206	225	186	200	216
Ca %	2.00	2.00	2.00	2.00	2.00	2.00
NPP %	0.359	0.357	0.356	0.354	0.354	0.351
Lysine %	0.715	0.722	0.705	.714	0.730	0.70
Methionine %	0.455	0.422	0.455	0.48	.474	0.468
SAA %	0.56	0.535	0.522	0.586	0.544	0.526
Crude Fiber %	4.01	3.957	3.934	4.445	4.462	3.98

*** Each 3 Kg of Vit. and Min. premix contains:**
10000000 IU Vit. A; 2000000 IU.vitD3; 10000mg Vit.E; 1000mg Vit.K3; 1000mg Vit. B1; 5000mgVit. B2; 10 mg Vit. B12; 1500mg Vit . B6; 30000mg Niacin; 10000mg Pantothenic acid; 1000mg Folic acid ; 50mg Biotin; 300000 mg Choline; 4000 mg Copper; 300mg Iodine; 30000 mg Iron; 50000 mg Zinc; 60000 mg Manganese; 100mg Selenium; 100mg Cobalt and CaCO3 as carrier to 3000g

Livability and abnormality sperm count:

Percentages of live, dead, abnormal sperms were estimated by different staining techniques using eosin-nigrosen stain (Kalamah *et. al.,* 2002). Sperm motility was estimated according to an arbitrary scheme of classification in the range from 1-5 grades according to Nagae *et. al.*, (1987). Semen pH was determined with the aid of calibrated pH meter.

Physiological parameters

At the end of the experimental period, blood samples were collected from the wing veins of 5 cocks from each treatment into heparinized tubes. Blood plasma samples were separated by centrifugation at 4000 rpm for 10 minutes. Plasma concentration of total protein, albumin, glucose, triglycerides, cholesterol, Low-density lipoprotein (LDL), high-density lipoprotein (HDL), uric acid, activity of alanine amino transferase (ALT), and aspartate amino transferase (AST) were colorimetrically determined using commercial (Bio-Merieux Morcyl Etiols Charbon Rains/France). Blood Plasma globulin was calculated by subtracting the level of plasma albumin from the total protein content (Coles, 1974). In addition, Hemoglobin (HB), Hematocrit (HT) Leukocytes (WBCs) Erythrocytes (RBCs) Mean corpuscular volume (MCV), Mean corpuscular hemoglobin (MCH) and Mean corpuscular hemoglobin concentration (MCHC) were also estimated.

Determination of Newcastle disease virus (NDV) antibody titre:

Serum samples from cocks at 42-weeks old were used for determination NDV antibody titre by using the method described by Liu *et. al., (*1999).

Statistical analysis:

The data were analyzed according to General Linear Model (GLM) procedure by using **SPSS (2003**). In this research, a 3 x 2 factorial design was used, considering the crude protein level and energy level as the main effects, as follows: Yijk=μ+Ti+Rj+(TR)ij+eijk where: Yijk=An observation; μ=Overall mean; T=Effect of crude protein level; i=(1, 2 and 3); R=Effect of energy level; j=(1 and 2); TR=Effect of interaction between crude protein and energy levels; and eijk=Random error. Significant differences among treatments were tested by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Body weight of cocks:

At the end of the experiment, differences among the three CP levels in body weight were significant. Cocks fed the lowest CP level (12 %) had significantly the lowest in body weight (P<0.05), while the highest body weight was recorded for cocks fed the highest CP level (14 %) followed by those fed 13% CP as shown in Table 2.

Table 2. Effect of dietary protein and energy levels and their interactions on live body weight and feed intake of Gimmizah cocks.

Treatments	Initial BW (g)	Final BW (g)	Chang in BW (g)	Daily feed intake (g)	Daily protein intake (g)	Daily energy intake (kcal)
Protein levels						
P 1 12	2066.13±09.69	2394.63±10.32^{b}	328.50±15.20^{b}	136.57±0.70	16.42±0.09^{c}	363.53±1.38
P 2 13	2068.50±14.06	2420.96±8.65^{ab}	352.29±7.56^{ab}	136.06±0.54	17.80±0.07^{b}	362.64±2.29
P 3 14	2071.33±09.69	2451.38±18.00^{a}	380.04±13.88^{a}	135.69±0.65	19.11±0.07^{a}	360.25±1.25
Sig.	NS	**	*	NS	**	NS
Energy levels						
E 1 2600	2075.17±09.87	2404.97±8.83^{b}	329.81±8.61^{b}	137.45±0.41^{a}	17.88±0.26	358.60±1.08^{b}
E 2 2700	2062.14±08.33	2439.67±12.35^{a}	377.42±11.38^{a}	134.77±0.39^{b}	17.67±0.28	365.68±1.16^{a}
Sig.	NS	*	**	**	NS	**
Interactions						
P1XE1	2080.08±11.68	2377.83±12.85^{b}	297.75±16.73^{c}	138.38±0.36^{a}	16.65±0.04^{d}	361.18±0.95^{bcd}
P1XE2	2052.17±14.85	2411.42±15.14^{b}	359.25±22.69^{ab}	134.76±0.85^{cd}	16.20±0.10^{e}	365.87±2.31^{ab}
P2XE1	2074.08±18.09	2410.67±10.06^{b}	336.58±09.10^{bc}	136.56±0.92^{abc}	17.75±0.12^{c}	356.56±2.41^{d}
P2XE2	2062.92±22.23	2431.25±13.88^{ab}	368.33±10.55^{ab}	135.56±0.57^{bcd}	17.84±0.07^{c}	368.73±1.56^{a}
P3XE1	2071.33±13.96	2426.42±19.13^{ab}	355.08±13.74^{ab}	137.40±0.65^{ab}	19.25±0.09^{a}	358.06±1.71^{cd}
P3XE2	2071.33±14.06	2476.33±29.60^{a}	405.00±22.44^{a}	133.99±0.53^{d}	18.96±0.07^{b}	362.44±1.44^{bc}
Sig.	NS	**	**	**	**	**

a,b….For each of the main effects, means in the same column bearing different superscripts differ significantly
NS = not significant *:P< 0.05, **:P< 0.01).

A gain, body weight of cocks was significantly decreased as ME level was decreased. Cocks fed the low ME (2600 kcal/kg-diet) were significantly lighter (P<0.05) than cocks fed the high ME diet (2700 kcal/kg).

The rate of change in body weight of cocks was reduced significantly (P<0.05) upon decreasing the CP and ME levels of the diet (Table 2).

Cocks fed the diet having 14% CP plus ME of 2700 kcal/kg achieved significantly higher (P<0.05) body weight gains when compared with other experimental diets (Table 2). The rate of change in body weight of cocks was positively related to the levels of dietary CP and ME. Final body weight and change in body weights were increased with increasing dietary protein or energy. However, a significant interaction between protein and energy indicated the importance of a balanced ratio between energy and protein to achieve optimum performance.

Results obtained agree with those of Romero-Sanchez *et. al*., (2007), who reported that excess protein intake increase body weight of rooster males. This may be logically attributed to the positive correlation between the amount of either feed consumed or protein intake and the rate of fat deposition. These findings are also consistence with results of many researchers (Wilson *et. al*., 1987; Zhang *et. al*., 1999; Romero- Sanchez *et al*., 2008), who indicated that body weight of cocks has been restricted by CP.

Fazhana and Azhar (2014) found that dietary protein had significant effect on body weight gain of cocks. Birds fed the 10% protein diet had the lowest weight gain while birds fed 16 and 20% protein had higher body weight gain during the experimental period. Zhang *et. al.,* (1999) and Romero-Sanchez *et. al.,* (2007), observed that dietary crude protein levels caused significant changes in body weights of male chickens. Brown and McCartney (1986) reported that body weights of broiler breeder males were significantly decreased as feed intake decreased.

Teteh *et. al*., (2010) found that, the faster growth rate of chicks fed high metabolizable energy diet may be due to the use of energy for efficient retention of protein; since protein is the building blocks needed for growth. Attia *et. al*., (1993) reported that when broiler breeder males received diets with low ME, the birds were able to maintain their body weight with little or no excess ME for body weight gain.

Feed, protein and energy intakes:

Feed intake was not significantly affected by CP levels. On the other hand, feed intake was significantly increased (P<0.05) in cocks fed the low-energy diet (2600 kcal/kg) than those fed on the high energy diet (2700 kcal/kg). In addition**,** feed intake decreased as energy level increased (Table 2), however the interaction between studied factors had a significant effect on feed intake. Cocks fed the 12% protein and 2600 kcal/kg diet consumed significantly more feed. While, the lowest value was recorded by cocks fed 14% CP and 2700 kcal/kg diet.

Daily CP intake significantly increased by increasing CP level in diet (from 16.42 to 19.11 g) while daily ME intake significantly decreased by the increasing of ME levels (from 358.60 to 365.68). Interaction between studied factors had a significant effect on daily protein intake. Feeding cocks 14% CP level and 2600 kcal/kg ME had the highest daily CP intake (19.25 g), while, the lowest value was recorded by cocks fed 12% CP level and 2700 kcal/kg ME (16.20 g).

Cocks fed diet contained ME of 2600 kcal/kg had significantly higher feed intake (137.45 g) and daily CP intake (17.88 g) compared with cocks fed diet with ME of 2700 kcal/ kg in which feed intake (134.77g) and daily CP intake (17.67 g) were recorded. Feeding cocks the diet with 2600 kcal ME/kg resulted in significantly lower daily ME intake (358.60 kcal) compared with cocks fed the high ME-diet (2700 kcal/ kg) where daily ME intake was 365.68 kcal.

Interaction between studied factors had significant effect on daily protein intake and daily energy intake (Table 2). Significant positive correlations were found between CP and ME levels and the variables of feed intake, daily protein intake and daily energy intake. Feed intake, CP intake and ME intake were positively correlated with dietary CP and ME levels.

Results obtained agree with those of Singh (2005), who reported that when dietary energy increased from 10.6 to 12.2 MJ/kg, feed intake was decreased 7g/d during 18 – 30 weeks of age, 9 g/d during 30 - 42 weeks of age, 16 g/d during 42 –54 weeks of age and 17 g/d during 54 - 66 weeks of age. Over the whole experimental period, feed intake decreased from 123 to 113 g/d as dietary energy increased from 10.6 to 12.2 MJ/kg. Feed intake by birds fed on lower energy diets (up to 11.4 MJ/kg) were not significantly different; however, at the higher energy levels feed intake was significantly affected, being 120 g/d for birds fed on 11.4 MJ/kg diet as compared to 113 g/d for birds fed on 12.2 MJ/kg diet. Daily feed consumption decreased as the energy level of the diet increased. In addition, Fazhana and Azhar (2014) observed that feed intake was unaffected by dietary protein levels (10 and 20%).

Semen characteristics :

There were no significant effects of feeding the diets containing12%, 13% or 14% protein on semen volume, motility, live sperm, dead sperm, abnormality, semen pH and fertility (Table 3).

Table 3. Effect of dietary protein and energy levels and their interactions on semen quality for cocks and fertility of eggs.

Treatments	Volume (ml)	Motility %	Live sperm %	Dead sperm %	Abnormality %	Semen pH	Fertility %
Protein levels							
P 1 12	0.39±0.03	81.25±0.03	84.78±0.03	15.22±0.03	9.30±0.01	7.86±0.08	93.99±0.004
P 2 13	0.39±0.02	80.30±0.02	84.51±0.02	15.49±0.02	8.70±0.01	7.81±0.06	93.95±0.004
P 3 14	0.39±0.02	79.50±0.03	82.83±0.02	17.17±0.02	8.81±0.01	7.85±0.04	94.06±0.004
Sig,	NS	NS	NS	NS	NS	NS	NS
Energy levels							
E 1 2600	0.37±0.02	79.39±0.02	83.15±0.02	16.85±0.02	9.22±0.05	7.66±0.06^{b}	92.96±0.003^{b}
E 2 2700	0.41±0.01	81.30±0.02	84.93±0.01	15.07±0.01	8.65±0.00	8.02±0.03^{a}	95.06±0.002^{a}
Sig.	NS	NS	NS	NS	NS	**	**
Interactions							
P1XE1	0.38±0.05	80.88±0.09	83.27±0.07	16.73±0.07	10.18±0.01	7.64±0.15^{c}	93.29±0.007^{b}
P1XE2	0.39±0.03	81.62±0.05	86.23±0.03	13.77±0.03	8.46±0.01	8.08±0.04^{a}	94.68±0.004^{a}
P2XE1	0.36±0.03	80.27±0.06	83.96±0.05	16.04±0.05	8.61±0.02	7.70±0.08^{bc}	92.81±0.006^{b}
P2XE2	0.42±0.03	80.34±0.03	85.05±0.01	14.95±0.01	8.78±0.02	7.92±0.08^{ab}	95.08±0.002^{a}
P3XE1	0.36±0.02	76.94±0.03	82.20±0.03	17.80±0.03	8.84±0.01	7.64±0.06^{c}	92.79±0.003^{b}
P3XE2	0.42±0.03	81.94±0.07	83.45±0.03	16.55±0.03	8.71±0.01	8.06±0.04^{a}	95.42±0.003^{a}
Sig.	NS	NS	NS	NS	NS	**	**

a,b….For each of the main effects, means in the same column bearing different superscripts differ significantly NS = not significant **:P< 0.01).

Results obtained agree with those of Tyler and Becker (2012), who observed no differences in the number of live sperm with normal motility and morphology in broiler breeder males fed different CP levels. Wilson *et. al.*, (1988) reported that broiler breeder males fed diets containing crude protein (CP) levels from 9-15% showed no significant difference in semen volume or concentration when collected at 48 and 49 weeks of age. Hocking and Benard (1997a) showed that feeding broiler breeder males on high level of CP (16%) had no change semen volume or concentration as compared to the low CP (12%) one. Semen volume has been reported to be higher in males fed 12% vs. 16% CP from 28 to 36 weeks of age, but sperm concentration was not affected (Zhang *et. al.*, 1999). No effects on semen volume or metabolic activity of the spermatozoa were observed in males fed different CP diets from 80 to 400 g CP/kg (Hocking, 1989). No differences were observed in semen volume, sperm concentration, total sperm yield and the proportion of males producing semen when males were fed either 8% or 12% CP (Revington *et. al*., 1991). No effects of feeding 9%, 12% or 15% protein were observed on semen volume, concentration, number of spermatozoa ejaculated or spermatogenic activity (Wilson *et. al*., 1988). Tyler and Becker (2012) observed a longer predicted length of the fertile period over all ages when eggs were fertilized with sperms obtained from males that received 12.6% CP diets (14.5 g/d) than males that received 10.5% and 15% CP (7 and 8.6 g/d, respectively). They also reported that dietary protein level had no effect on the measures of live sperms with normal motility or morphology.

The results of the present experiment show that reducing the calorie level in adult Gimmizah males diets insignificantly reduced the average rates of change in semen volume, motility, live sperms, while dead and abnormal sperms were increased. Semen pH was significantly decreased by decreasing dietary ME level.

The means of semen volume, motility, live sperms, dead sperms, abnormal sperms and pH for the cocks receiving 2700 kcal of ME/kg of diet were 0.41 ml, 81.30%, 84.93%, 15.07%, 8.65%, and 8.02 respectively, when compared with those fed 2600 kcal of ME/kg of diet recorded 0.37 ml, 79.39%, 83.15%, 16.85%, 9.22%, and 7.66% respectively. Consistent result may be due to the fact that energy level had insignificant effect on all semen traits except semen PH. Results obtained agreed with those obtained by Attia and Badawy(1996) reported that Golden or Silver Montazah males fed different dietary energy levels had similar semen quality traits.

Interaction between CP and ME had a significant effect on semen pH with no significant effect on other semen traits Table (3).

Fertility:

Results obtained showed that Gimmizah chicken males fed diets containing crude protein (CP) levels from 12-14% did not differ in fertility percentages (Table 3). Our results agree with those of Hocking and Bernard. (1997b), who reported that there were no differences in fertility between males fed 12% or 16% CP. Excess protein intake will increase rooster BW which can negatively affect fertility because more energy will be needed to support a greater BW and maintain sperm production and mating activity (Romero-Sanchez *et. al*., 2007). On the other hand, Fazhana. and Azhar (2014) reported that fertility in caged Red Jungle Fowls (RJF) was significantly affected by dietary protein. Caged fowls fed low protein diet exhibited significantly lower fertility. They also added that providing high protein diet may adversely affect the fertility in caged (RJF).

Results summarized in Table 3 showed that reducing the calorie level of diets to adult Gimmizah males from 2700 to 2600 kcal/kg significantly reduced fertility percentage.

At the end of the experimental period, cocks fed diets containing 2700 kcal/kg displayed significantly higher fertility percentage (95.06% vs 92.96% than that of cocks fed 2600 kcal/kg diet. It is obviously clear that decreasing ME levels decreased fertility percentage. The current results agree with those of Tadondjou *et. al*., (2013) who found that hypo-energetic diet led to reduced fertility in male broilers. They indicated that higher semen volume and mass motility were recorded for males fed on higher energy diet. This may be attributed to the fact that sperm production needs more energy.

Cerolini *et al*., (1995) provided an evidence that fertility can also be decreased in males due to ME deficiency and that problems would happen more often at the end of the laying period.

Romero-Sanchez *et. al*., (2008) suggested that ME deficiency would affect the largest males more considerably than smaller ones and the largest males in the flock would show reduced semen production and mating activity sooner in the flock. Fertility has been shown to decline when the nutrient intake is inadequate to support the current body weight (Romero-Sanchez *et. al*., 2007). Also, it is worthy to note that metabolizable energy intake was positively correlated with fertility percentage.

There was a significant CP by ME interaction on fertility percentage. There was a highly significant effect of ME on fertility; its means were 95.42, 95.08 and 94.68% for the cocks fed 2700 kcal/kg diet with 14, 13, and 12% CP, respectively. While, males fed 2600 kcal/kg diets displayed significantly lower means of fertility, being 93.79, 92.81 and 92.29% with 14, 13, and 12% CP, respectively. Fertility was positively correlated with CP and ME Table (3).

Hematological parameters:

Table 4 showed that all dietary protein and energy levels had no significant effect on HB, HT, WBCs, RBCs, MCV and MCH while they significantly affected MCHC and Newcastle disease virus (NDV) titre. Cocks fed 13% protein level had significantly the highest value of NDV titre (4.38) when compared with those fed diets containing 14% or 12% CP (2.75 or 2.73), respectively. Feeding cocks the low energy diets (2600 kcal/kg) significantly improved NDV titre compared with that of cocks fed ration had the high-energy diets (2700 Kcal/kg). Interaction between studied factors had a significant effect only on MCH, MCHC and NDV titre.

It was observed that cocks fed the lowest protein level (12%) had significantly higher value of MCHC than that of cocks fed the highest level of protein (14%).The lower level of energy (2600 kcal/kg) had the same trend in both positively affected the means of MCH and MCHC compared with those of the cocks fed the high-energy diets (2700 Kcal/kg).

Cocks fed the diet having 13% CP and ME 2600 kcal/kg had the highest value of NDV titre. The lowest value of NDV titre was displayed by cocks fed 14% CP and ME of 2700 Kcal/kg in their diet. MCHC recorded significantly highest values in blood of cocks fed 12% and 2600 Kcal/kg ration.

Interaction between dietary protein and energy levels had a significant effect on blood MCHC and NDV titre.

Gimmizah cocks that attained daily intakes of CP and ME of 19.25 g and 358.06 kcal/kg (free access to a 13% protein and ME of 2600 kcal/kg diet) displayed the highest mean of NDV titre. Cocks that had daily intakes of protein and ME of 16.65 g and 361.18 kcal ME (free access to a 12% protein and ME of 2600 kcal/kg diet) exhibited significantly higher mean of MCHC.

Table 4. Effect of dietary protein and energy levels and their interactions on hematological parameters of Gimmizah cocks.

Treatments	HB g/dl	HT%	WBCs 10^3/mm^3	RBCs 10^6/mm^3	MCV/ (FL)	MCH/ (Pg)	MCHC (g/100 ml)	NDV-Titre
Protein levels								
P 1 12	14.61±0.43	44.81±1.68	15.73 ± 11.02	4.99 ± 0.03	89.70±2.85	29.26±0.71	24.42±0.13^a	2.75±0.26^b
P 2 13	14.73±0.37	45.81±1.51	15.53 ± 11.06	5.01 ± 0.02	91.42±2.56	29.40±0.59	24.21±0.00^{ab}	4.38±0.37^a
P 3 14	15.23±0.29	48.44±1.24	15.35 ± 9.85	5.00 ± 0.02	95.89±2.07	30.15±0.46	24.00±0.11^b	2.75±0.52^b
Sig.	NS	NS	NS	NS	NS	NS	*	**
Energy levels								
E 1 2600	15.03±0.30	46.73±1.20	15.35 ± 9.14	5.02 ± 0.02	92.99±2.02	29.92±0.48^a	24.35±0.09^a	3.83±0.37^a
E 2 2700	14.68±0.30	45.98±1.30	15.72 ± 7.43	5.01 ± 0.02	91.69±2.20	29.29±0.48^b	24.07±0.07^b	2.75±0.32^b
Sig.	NS	NS	NS	NS	NS	*	*	*
Interactions								
P1 X E1	15.13±0.47	46.40±1.65	15.31±09.39	5.02 ± 0.03	92.46±2.82	30.14±0.78	24.63±0.23^a	3.25±0.40^{ab}
P1 X E2	14.10±0.72	43.23±2.95	16.10 ±12.27	4.96 ± 0.05	86.94±4.98	28.38±1.14	24.21±0.00^b	2.25±0.18^b
P2 X E1	14.30±0.54	44.05±2.22	15.57 ± 10.79	4.98 ± 0.04	88.42±3.77	28.72±0.86	24.21±0.00^b	4.75±0.57^a
P2 X E2	15.15±0.48	47.58±1.97	15.50 ± 12.32	5.03 ± 0.03	94.43±3.32	30.08±0.76	24.21±0.00^b	4.00±0.47^a
P3 X E1	15.68±0.47	49.75±1.93	15.16 ± 8.10	5.07 ± 0.03	98.08±3.20	30.91±0.73	24.21±0.00^b	3.50±0.80^{ab}
P3 X E2	14.77±0.28	47.13±1.55	15.52 ±11.04	5.03 ± 0.02	93.69±2.60	29.38±0.41	23.80±0.18^c	2.00±0.57^b
Sig.	NS	NS	NS	NS	NS	NS	**	**

a,b….For each of the main effects, means in the same column bearing different superscripts differ significantly
NS = not significant *:P< 0.05, **:P< 0.01). HB = Hemogloin. HT = Hematocrit. WBCs = Leukocytes.
RBCs = Erythrocytes. MCV: mean corpuscular volume. MCH: mean corpuscular hemoglobin
MCHC: mean corpuscular hemoglobin concentration

No significant correlations were found between CP and ME on the other hematological variables (HB, HT, WBCs and RBCs).

Blood constituents:

Data listed in Tables 5 and 6 showed that most blood constituents increased gradually by increasing protein level. Differences between CP levels were significant in all parameters except plasma LDL and uric acid. Similar findings were obtained by Hada *et. al*. (2013), who reported that broiler fed low-protein diet had lower serum uric acid. Ozek and Bahtiyarca (2004) showed that dietary CP, and especially ME concentrations, significantly affected blood parameters in chukar partridge and significant interactions were observed due to the effects of CP and ME on serum triglycerides. Cocks fed the 14% protein-diet had the highest means of estimated blood parameters, while the lowest means of blood plasma parameters were achieved by the lowest-protein diet (12% CP).

Dietary energy had a significant effect only on blood plasma uric acid. Data listed in Tables 5 and 6 showed that, cocks fed the high-energy diet (2700 kcal/kg) exhibited higher level of plasma uric acid (p<0.01). Blood plasma levels of LDL and HDL increased by increasing dietary ME level with insignificant differences. Results obtained are accordance with finding of Ghazalah *et.al*., (2007), who reported that dietary supplementation of dry fat to broiler diets increased plasma total cholesterol, high density lipoprotein (HDL) and low density lipoprotein (LDL).

Table 5. Effect of dietary protein and energy levels and their interactions on plasma blood constituents of Gimmizah cocks.

Treatments	Total protein g/dl	Albumin g/dl	Globulin g/dl	Glucose mg/dl	Uric acid mg/dl	Triglyceridesmg /d
Protein levels						
P 1 12	4.43±0.18^b	2.35±0.20^b	2.08±0.10^b	137.50±2.88^b	5.12±0.30	117.00±1.13^b
P 2 13	4.70±0.12^b	2.30±0.07^b	2.40±0.06^a	143.33±1.89^{ab}	5.27±0.15	119.83±1.22^b
P 3 14	5.14±0.11^a	2.87±0.07^a	2.27±0.07^{ab}	146.67±1.89^a	5.33±0.21	124.33±1.89^a
Sig,	*	*	*	*	NS	*
Energy levels						
E 1 2600	4.63±1.45	2.43±1.48	2.20±0.09	141.89±2.19	4.93±0.16^b	119.44±1.34
E 2 2700	4.88±1.42	2.58±1.18	2.30±0.06	143.11±2.26	5.54±0.13^a	121.33±1.70
Sig.	NS	NS	NS	NS	**	NS
Interactions						
P1XE1	4.30±0.31^b	2.23±0.33^{ab}	2.07±0.07	137.00±3.73	4.57±0.38^b	117.33±2.40^b
P1XE2	4.57±0.23^b	2.47±0.27^{ab}	2.10±0.15	138.00±4.36	5.67±0.15^a	116.67±0.67^b
P2XE1	4.63±0.20^b	2.40±0.05^{ab}	2.43±0.15	142.33±3.18	5.17±0.15^{ab}	118.33±1.45^b
P2XE2	4.77±0.15^{ab}	2.40±0.12^b	2.37±0.03	144.33±2.60	5.37±0.27^{ab}	121.33±1.76^{ab}
P3XE1	4.97±0.08^{ab}	2.87±0.08^a	2.10±0.15	146.33±1.86	5.07±0.22^{ab}	122.67±2.40^{ab}
P3XE2	5.30±0.15^a	2.87±0.12^a	2.43±0.03	147.00±3.79	5.60±0.31^a	126.00±3.06^a
Sig.	*	*	**NS**	**NS**	*	*

a,b….For each of the main effects, means in the same column bearing different superscripts differ significantly NS = not significant *:P< 0.05, **:P< 0.01).

Table 6. Effect of dietary protein and energy levels and their interactions on blood plasma constituents of Gimmizah cocks.

Treatments	Cholesterol mg / d	LDL mg / d	HDL mg / d	AST (U/L)	ALT (U/L)
Protein levels					
P 1 12	116.67±1.26^{b}	53.77±1.15	39.50±1.05^{c}	29.33±0.82^{c}	26.83±1.47^{b}
P 2 13	120.00±1.86^{ab}	54.53±1.95	41.50±1.22^{b}	32.00±1.41^{b}	26.33±1.97^{b}
P 3 14	123.00±2.34^{a}	54.63±2.31	43.50±1.05^{a}	34.83±2.71^{a}	29.67±1.97^{a}
Sig,	*	NS	**	**	*
Energy levels					
E 1 2600	118.22±0.32	52.89±1.33	41.44±0.78	31.00±0.55	27.11±0.36
E 2 2700	121.56±0.90	55.73±1.46	41.56±0.56	33.11±1.17	28.11±0.87
Sig.	NS	NS	NS	NS	NS
Interactions					
P1XE1	116.00±2.08	56.47±3.97	39.00±0.58^{d}	29.33±0.67^{c}	26.00±0.58^{b}
P1XE2	117.33±1.76	52.80±3.01	40.00±0.58^{cd}	29.33±0.33^{c}	27.67±0.88^{ab}
P2XE1	117.67±1.76	56.73±2.54	41.67±0.88^{abc}	31.00±0.58^{bc}	26.67±1.33^{b}
P2XE2	122.33±2.96	52.33±2.78	41.33±0.67^{bc}	33.00±0.58^{b}	26.00±1.15^{b}
P3XE1	121.00±2.65	54.00±1.56	43.67±0.88^{a}	32.67±0.33^{b}	28.67±0.88^{ab}
P3XE2	125.00±4.04	53.53±2.04	43.33±0.33^{ab}	37.00±1.15^{a}	30.67±1.20^{a}
Sig.	NS	NS	**	**	*

a,b….For each of the main effects, means in the same column bearing different superscripts differ significantly NS = not significant *:P< 0.05, **:P< 0.01).

Interactions between the different levels of CP and ME had significant effects on plasma concentrations of total protein, albumin, uric acid, triglycerides, HDL, and activity of AST and ALT; the highest values were recorded by cocks fed the diet containing 14% CP and ME of 2700 kcal/kg. Results obtained agree with those of Ozek and Bahtiyarca (2004), who reported that dietary CP and specially ME concentrations significantly affected blood parameters in chukar partridge and significant interactions were observed due to the effects of CP and ME on serum triglycerides.

In conclusion, the results of this study showed that feeding diets with 13% or 14% crude protein and ME 2700 kcal/kg (daily CP intake 17.84 g or 18.96 and daily ME intake 368.73 or 362.44 kcal) can positively affect body weight, feed intake, and fertility percentage of Gimmizah cocks. Alternatively NDV titre recorded its highest value in cocks fed the diet with 13% CP and 2600 kcal/kg, compared to other levels.

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الإحتياجات الغذائية لديوك الجميزة من البروتين والطاقة الممثلة

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عليقة تحتوى على ١٣% بروتين و٢٦٠٠ كيلو كالورى/ كيلوجرام عليقة مقارنة بالمستويات الأخرى. تهدف هذه الدراسة الى تحديد الاحتياجات من البروتين والطاقة الممثلة وتأثيرها على الأداء التناسلى وبعض الصفات الفسيولوجية والمناعية. تم تسكين ٧٢ ديك متساوية فى الوزن تقريبا فى أقفاص فردية قسمت الديوك الى ثلاث مجاميع كل مجموعة بها ٢٤ ديك طبقا لمستويات البروتين (١٢% , ١٣% , ١٤%) وقسمت كل مجموعة إلى مجموعتين طبقا لمستويات الطاقة (٢٦٠٠ , ٢٧٠٠ كيلو كالورى لكل كيلو جرام) وقد استمرت التجربة ١٦ أسبوع. تم وزن الديوك فى نهاية التجربة وحساب معدل التغير فى وزن الجسم كذلك تم حساب المأكول من العليقة وتقدير صفات السائل المنوى خلال فترة التجربة ومستوى المناعة للنيوكاسل وبعض مكونات الدم فى نهاية التجربة وقد كانت النتائج كالتالى:١- أدى زيادة مستوى البروتين فى العليقة إلى زيادة معنوية وزن الجسم والبروتين الكلى والالبيومين والجلوكوز والجلسريدات الثلاثية والكوليسترول وHDL وAST وALT فى بلازما الدم بينما انخفض MCH و MCHC . من جهة أخرى لم يكن لمستوى البروتين أى تأثير معنوى على صفات السائل المنوى.٢- أدى تغذية الديوك على مستوى ١٣% بروتين (١٧,٨٠ جرام بروتين/ يوم) إلى زيادة معنوية فى مستوى المناعة للنيوكاسل وتركيز الجلوبيولين فى بلازما الدم.٣- كان مستوى الطاقة له تأثير معنوى على الغذاء المأكول ومستوى المناعة للنيوكاسل والخصوبة ودرجة تركيز أيون الايدروجين (ph) فى السائل المنوى وبعض صفات الدم (MCHوMCHC) وLDL وحمض اليوريك فى بلازما الدم.٤- أدى تغذية الديوك على٢٦٠٠ كيلو كالورى/ كيلوجرام عليقة (٣٥٨,٦٠ كيلو كالورى/ يوم) الى زيادة استهلاك العليقة ومستوى المناعة لفيروس النيوكاسل و MCH وMCHC بينما تغذية الديوك على عليقة تحتوى على ٢٧٠٠ كيلوكالورى/ كجم عليقة (٣٦٥,٦٨ كيلو كالورى/ يوم) الى زيادة النسبة المئوية للخصوبة ودرجة تركيز أيون الايدروجين (ph) فى السائل المنوى وLDL وحمض اليوريك فى بلازما الدم.٥- أدى تغذية الديوك على عليقة تحتوى على ١٤% بروتين و ٢٧٠٠ كيلو كالورى/ كجم عليقة (١٨,٩٦جم بروتين/ يوم و٣٦٢,٤٤ كيلو كالورى طاقة ممثلة/ يوم) الى زيادة معنوية (p<0.01) فى وزن الجسم وزيادة مستويات البروتين الكلى والالبيومين وحمض اليوريك و HDL والجلسريدات الثلاثية و AST وALT فى بلازما الدم وانخفاض الغذاء المستهلك. على الجانب الآخر أدى تغذية الديوك على عليقة محتوية على ١٢% بروتين و٢٦٠٠ كيلو كالورى/ كجم عليقة (١٦,٦٥ جرام بروتين و ٣٦١,١٨ كيلو كالورى/ يوم) الى زيادة معنوية فى استهلاك العليقة وMCH و MCHC ومستوى المناعة لفيروس النيوكاسل مقارنة بالديوك التى تغذت على عليقة تحتوى على ١٣% بروتين و ٢٦٠٠ كيلو كالورى طاقة ممثلة / كجم عليقة.والخلاصة هى أن تغذية الديوك على عليقة تحتوى على ١٣% أو ١٤% بروتين مع ٢٧٠٠ كيلو كالورى طاقة ممثلة/ كجم عليقة (١٧,٨٤ أو ١٨,٩٦جم بروتين/ يوم و٣٦٨,٧٣ أو ٣٦٢,٤٤ كيلو كالورى طاقة ممثلة/ يوم قد أثرت ايجابيا على وزن الجسم والغذاء المستهلك ونسبة الخصوبة.كما سجل مستوى المناعة للنيوكاسل أعلى قيمة فى الديوك التى غذيت على