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EFFECT OF FEEDING DIFFERENT LEVELS OF ENERGY AND CRUDE PROTEIN ON SEMEN QUALITY AND FERTILITY OF DOMYATI DUCKS.

By

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***Abstract**: A total number of 243 Domyati ducks at 20- wks-old (54 drake and 189 duck)were used in a factorial (3x3) arrangement design to investigate the effect of using different dietary levels of metabolizable energy (ME) and crude protein (CP) on semen quality, seminal and blood plasma constituents and fertility. All birds were weighed and divided into nine treatment groups of 3 replicates each. The dietary (ME) treatments were 2750, 2850 and 2950 kcal of ME/kg, each with 15, 17 and 19% CP.*

The results indicate that drakes fed the high level of ME or CP had significantly higher ejaculate volume, whereas, concentration of sperms was significantly increased by high-CP only. Advanced motility of sperms was improved significantly by high-ME, whereas CP levels had no effect. Mass motility of sperms was not significantly changed due to varying levels of ME or CP in the diet. Dead, coiled, clumping and total abnormal sperms were significantly decreased by high level of ME and CP in the diet.

Varying levels of ME and CP in Domyati drake's diet had significant effect on all seminal plasma constituents except of albumin content which was not affected by ME levels. Seminal plasma total protein and globulin contents were significantly ($P \leq 0.05$) decreased by either high-ME or CP level in the diet, whereas, seminal plasma albumin content was significantly decreased by high-CP, only. Both of seminal plasma alkaline phosphatase and AST were not significantly affected due varying levels of ME and CP in the diet, whereas, acid phosphatase and ALT were significantly decreased by feeding the high level of CP in the diet.

Blood plasma albumin content was significantly ($P \leq 0.01$) decreased by feeding on high-ME diet, whereas, blood plasma globulin was significantly ($P \leq 0.05$) increased. Also, blood plasma T_3 hormone was significantly increased by medium-ME or medium and high-CP in the diet, whereas, testosterone hormone was increased by high-ME or CP in the diet.

Blood plasma acid and alkaline phosphatase and ALT were not significantly affected due to varying levels of ME and CP in the diet , whereas, AST was significantly decreased by feeding medium level of ME or low CP in the diet. Fertility of eggs was significantly (P < 0.05) improved by feeding high-ME with low-CP in diets. These results indicate that a diet containing 2950 Kcal ME/kg and 15% CP could be used to improve the reproductive performance and fertility of Domyati drakes without adverse effects during laying period.

INTRODUCTION

Genetic selection has been successfully used by the poultry industry to improve expression of highly heritable traits such as body weight, breast muscle yield, and feed efficiency. However, these genetic improvements may be accompanied by a decline in reproductive variables (***Goerzen et al., 1996; Barbato, 1999***) such as delayed sexual maturity and reduced fertility.

Feed has been implicated by some workers (***Hocking and Bernard ,1997***) as one of the factors known to affect semen production and quality in the male bird, so that , adequate nutritional environment is essential to maintain the breeding flock in good reproductive condition. In a previous study, ***Darras et al***.(**2000**) and ***Khazali and Moravej*** (***2003***) have shown that change in energy and protein levels in diets are associated with increased or decreased levels of plasma concentration of T_3 and T_4 in broilers.

Unlike most domestic birds, waterfowls such as ducks and geese have a relatively short reproductive period and low egg production. Drakes and ganders produced a small ejaculate volume with a low spermatozoa concentration and a low number of live normal spermatozoa (***Łukaszewicz, 2000***). Ducks production has been developed in last decade in Egypt, but the low reproductive efficiency has hindered its continued expansion.

The reproductive efficiency of male fowl, needs to be improved (***Redd and Sadjad ,1990***). Semen quality is an important factor affecting fertility, since a semen quality factor (SQF) has been proposed as a predictor of male semen fertilizing ability (***Łukaszewicz and Kruszynski, 2003***). The SQF is a composite of 3 important semen traits: semen volume, semen concentration and the percentage of live and morphologically normal spermatozoa. High-quality semen relies on normal spermatogenesis. It is becoming increasingly evident that estrogen, in addition to testosterone, plays a role in the development and function of the testis and male reproductive tract (***Akingbemi, 2005***). Testosterone level in seminal plasma is a direct reflection of male testicular endocrine activity. The relationships between semen quality and concentration of testosterone in avian seminal plasma have been discussed (***Cecil and Bakst, 1988***).

The objective of this study was set to determine whether different dietary energy and protein levels could affect the semen quality , plasma constituents and seminal plasma parameters as will as fertility of Domyati drakes during laying period .

MATERIALS AND METHODS

This study was carried out at El – Serw Water Fowl Research Station , Animal Production Research Institute , Agricultural Research Center, Ministry of Agriculture ,Egypt. It was carried out during summer 2009. A total number of Fifty-four Domyati drakes, 20-wks-old were kept in individual cages (50x50x40cm). One hundred and eighty nine, 20-wks-old female Domyati ducks were randomly divided into 9 groups of 21 duck each and kept in separate open-air pens. Birds were exposed to a daily 17h L : 7h D photoperiod and the Light intensity was adjusted to be 10 Lux as recommended by ***Tag EL-Din et al. (2006)***. According to treatment groups, the drakes were arranged as 3x3 factorials in completely randomized design (three levels of energy and three levels of protein). Drakes received layer diets which were formulated to contain the studied energy levels(2750, 2850 or 2950 Kcal ME / kg) , each contained three levels (15,17 or 19 %) of curd protein levels. The composition and calculated analysis of the experimental diets are shown in Table (1).

Semen Collection and Determination of Semen Quality traits:

The drakes used in this study were selected on the basis of a positive reaction to dorso-abdominal massage (***Kammer et al.,1972***) for artificial collection of semen. Semen was collected 2 times a week during the experimental period .Within 30 min after collection, ejaculate volume, motility (mass and advanced) and spermatozoa concentration were determined for each drake. Semen smears were done to study the morphology of spermatozoa after nigrosin-eosin staining of smears (***Bakst and Cecil, 1997***). Dead spermatozoa(%) ; total abnormalities and the percentages of coiled tail and clumps of sperms were also examined.

Blood samples:

Blood samples were taken, immediately after semen collection, from the wing vein from 3 drakes from each treated group in heparinized test tubes. All samples were centrifuged at 3500 rpm for 15 minutes to obtain blood plasma. They were stored in a deep freezer at approximately -20 ^{o}C until analysis. Plasma T_3 hormone was determined using radioimmunoassay RIA technique according to ***Akiba et al.(1982***) . Testosterone hormone was determined as reported by ***Etches and Cunningham (1977)***.Total protein and albumin were determined calorimetrically using available commercial kits ***(Peters, 1968)***. However , globulin was obtained by the differences. Alkaline phosphatase and Acid phosphatase were determined according to ***Moss (1984)*** and transaminases enzymes activities (ALT and AST) according to ***Reitman and Frankel (1957*****).**

Seminal plasma constituents:

Freshly collected semen samples from each treatment were taken, centrifuged at 4000 rpm for 10 min to collect the seminal plasma. Samples of seminal plasma were stored at −20°C until used for the determination of total protein, albumin, both acid and alkaline phosphatases , alanine-aminotransferase (ALT) and aspartate aminotransferase (AST) activites .The procedures were similar as blood plasma analysis by available commercial kits.

Fertilizing Ability Test:

The nine groups of female Domyati ducks were inseminated with semen from their respective drakes within 30 min of semen collection. Two inseminations were performed within an interval of 3 day. Hatching eggs were collected daily from 2^{nd} day after the second insemination to 4^{th} day after the last insemination. The eggs collected in 10 days were set in an automatic incubator and incubated at 37.8°C. Fertility was determined by candling eggs on the 10^{th} day of incubation.

Statistical analysis:

Data obtained were statistically analyzed using the General linear model of ***SAS (1996)***. In this study , a 3x 3 factorial design was used , considering the energy level and crud protein level as the main effects, as follows:

$Yijk = \mu + Ti + Rj + (TR)ij + eijk$ where : Yijk = An observation ;

μ = Overall mean ; T = Effect of energy level ; i= (1,2 and 3) ; R = Effect of crud protein level ; j = (1, 2 and 3) ; TR=Effect of interaction between energy and crud protein level ; and eijk = Random error.

Significant differences among treatments were tested by Duncan's multiple range test (***Duncan***,***1955***).

RESULTS AND DISCUSSION

Results of Table (2) showed that varying energy levels in Domyati drake's diet had significantly (P < 0.05) affected ejaculate volume and advanced motility of sperms, whereas the concentration and mass motility of sperms were not significantly changed . The highest ejaculate volume was obtained by feeding diet contained medium and high-ME as compared with those fed diet containing low-ME level. Ejaculate semen volume was increased by 18.5 and 22.2 % for medium and high-ME groups, respectively. Whereas, the group fed diet contained medium-ME level had the best value of advanced motility of sperms as compared with those fed high-ME level in the diet.

The different levels of CP in Domyati drake's diet has significantly (P < 0.05) affected ejaculate volume and concentration of sperms, whereas, mass and advanced motility of sperms were not significantly affected. The group fed diet contained high-CP level had the higher ejaculate volume and concentration of sperms as compared with those fed on medium and low-CP level . On the other hand, the combination of high-ME with high-CP in the diet resulted in the best ejaculate volume and concentration of sperms as compared to other combinations, however, the motility scores were not affected . It appears that the dietary energy level effect was more obvious on semen volume and advanced motility score, while the protein level exerts its effect on both volume and concentration. Moreover, the interaction between both medium ME and CP levels showed an interesting results in enhancing the concentration of spermatozoa and hence the number of artificially inseminated females per male. The present results are in close agreement with those reported by ***Wilson et al.(1987),*** and ***Zhang et al.(1990)***. The latter claimed that the low CP level (12%) gave better semen quality than the high dietary CP diet (16%). *Also**, McDonald (1980)*** reported that the nutritional deficiencies could depress the production and quality of semen in the male because nutrition affects the endocrine rather than the spermatogenic function of the testis *(**Hafez, 1987**).*

Results presented in Table (3) revealed significant differences in the percentages of dead, coiled , clumping and total abnormalities in Domyati drakes as affected by feeding on diets containing varying levels of ME and CP during laying period. Dead sperms percentage was significantly decreased by about 10.24 and 9.38 % for drakes fed diet contained high-ME and high-CP, respectively. The drakes fed diet contained the combination of high-ME with high-CP had the lowest group of dead sperms percentage than other groups, whereas, the groups fed diets contained both low level of ME and CP had the highest dead sperm percentage. The same trend was occurred for coiled, clumping and total abnormality percentages of sperms due to feeding on varying levels of ME and CP and their interaction. The drakes fed diet contained high-ME or CP had significantly lowered percentages of coiled, clumping and total abnormality of sperms as compared with those fed low-ME or CP in the diet .It is likely that the higher ME and CP levels are important for producing a good quality sperms with lower dead and abnormal spermatozoa. These holds true as both (ME&CP) are the main sources for all physiological and endocrinological mechanisms in the body.

Data of seminal constituents of Domyati drakes as affected by feeding diet contained varying levels of ME, CP and their interactions are presented in Table (4).The results revealed significant differences in all seminal plasma traits due to varying levels of ME or CP and their interaction except of albumin content which was not affected significantly by ME level only. Seminal plasma total protein and globulin content were significantly ($P \leq 0.05$) decreased by feeding high-ME or CP level ,whereas , albumin content of seminal plasma was significantly decreased by feeding high-CP . Seminal plasma total protein, albumin and globulin content had the lowest values in drakes fed diet contained the combination of high level of both ME and CP . Both of seminal plasma alkaline phosphatase and AST were not significantly affected by varying levels of ME and CP, whereas, acid phosphatase and ALT were significantly decreased by feeding on high level of CP. Drakes fed diet contained the combined high levels of both ME and CP had the lowest values of seminal plasma acid phosphatase and ALT as compared with other combinations

In addition, ALT concentrations in seminal plasma was significantly higher in both low and medium ME and CP groups . This enzyme was reported by many workers to be related to the number of dead and abnormal spermatozoa in semen. It is librated in response to cell injury or enzyme leakage from dead sperm cells. In accordance with these results are the findings of ***Biligi et al.(1985)*** and ***El – Wardany et al.(1995)*** who reported a significant correlation between these enzymes and dead spermatozoa and abnormalities(%). This trend was also observed in blood plasma parameter, which support the earlier knowledge that the seminal plasma constituents are a reflixable mirror of blood plasma contents and (or) vice versa. That the higher CP levels reduced both seminal plasma total protein, albumin and globulin are consistent the results of ***Wilson et al.(1987)*** and ***Arscott and Parker (1963)*** who reported that decreasing dietary CP level had an adverse effect on semen quality.

In this respect, data of blood plasma constituents of Domyati drakes as affected by feeding diet contained varying levels of ME, CP and their interactions are presented in Tables (5). Blood plasma albumin content of Domyati drakes was significantly ($P \leq 0.05$) decreased by feeding on high-ME diet, whereas, blood plasma globulin was significantly ($P \leq 0.05$) increased. The interaction between ME and CP resulted in significant effects on blood plasma total protein, albumin and globulin content. The lowest values of blood plasma parameters were occurred by feeding diet contained high ME and CP level.

On the other hand , blood plasma acid and alkaline phosphatases and ALT were not significantly affected due varying levels of ME and CP in the diet , whereas, AST was significantly decreased by feeding medium level of ME or low CP in the diet. Drakes fed diet contained the combination of medium level of both ME and CP had significantly the lowest value of blood plasma alkaline phosphatase, whereas, the combination of low-ME and medium-CP had the lowest value of AST as compared with other combinations . It is likely that the effect of dietary ME and CP levels on blood enzymes was not greater enough to reflect any deleterious effects on liver and (or) kidney function tests .The obtained increases or decreases in AST level and to some extent alkaline phosphatase level in blood may be a result of protein degradation and energy metabolism in the body which may affect kidney and liver function.

Results of Tables (6) show significant differences between the experimental groups in blood plasma hormones of drakes along with the hatchability traits of incubated eggs .Thyroid hormone (T_3) was significantly increased by feeding diet contained medium-ME or medium and high-CP , whereas, testosterone increased with high-ME or CP level. Drakes fed diet contained the combination of medium-ME and high-CP level had the highest value of blood plasma T_3, whereas, the combination of medium-ME and high-CP had the highest testosterone as compared with other combinations . These changes in both T_3 and testosterone levels may be attributed to the effect of both dietary manipulations (treatments) or to the summer environmental temperature during the experimental period. It is well recognized that thyroid hormones decreased during summer season as an adaptive behavior to alleviate heat stress. A similar observation was reported for testosterone indicative of lower sex lipido resulting from a possible hormone decrease. However, our results show that dietary modulations by the interaction between different dietary ME and CP levels may overcome these effects on sexual activity of drakes, hence the combined effect between lower ME and high CP levels was the best for T_3

concentration,while , the medium ME with high CP gave the higher testosterone level. These results are in harmony with the obtained data for semen quality evaluation. Our results are in agreement with those obtained by ***Moravej et al.(2006)*** who showed that plasma concentrations of T_3 were significantly decreased in male broilers fed on high-energy and protein diets during laying period and ***Williams and Njoya (1998)*** who reported that energy content of the diet clearly affects on the plasma concentration of T_3 .They demonstrated that low-energy diet resulted in higher plasma T_3 and lower plasma T_4 concentrations .

Fertility of eggs produced after artificial insemination of ducks by drake semen was significantly ($P < 0.05$) improved by feeding diet contained high-ME or low-CP , whereas, hatchability percentage of fertile eggs was significantly improved by high-ME and insignificantly affected by varying levels of CP (Table 6). Interaction between ME and CP level resulted in the best value of fertility percentage by feeding diet contained high-ME accompanied with the either CP levels, whereas, the best value of hatchability was occurred by high level of ME and CP.

CONCLUSION

It is concluded that the ME and CP level in the diet are important for producing good quality sperms with lower dead and abnormal spermatozoa from Domyati drakes which cause an improvement of fertility. It is suggested that a diet containing 2950 Kcal ME/kg and 15% CP could be used to improve the reproductive performance and fertility of Domyati drakes without adverse effects during laying period.

Table (1): Composition and calculated analysis of the experimental diets

Ingredients %	**Energy level**								
	Low			**Medium**			**High**		
	Protein level								
	Low	**Med**	**High**	**Low**	**Med**	**High**	**Low**	**Med**	**High**
Yellow corn	67.5	64.5	60.5	71.0	67.3	63.0	73.5	69.5	65.5
Soya bean meal (44%)	19.5	24.5	25.5	16.7	18.2	18.3	9.3	10.0	10.5
Gluten (62%)	0.0	1.0	4.0	2.3	5.0	8.7	7.2	10.5	14.0
Wheat bran	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Di-calcium phosphate	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Limestone	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Vit & Min. premix *	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Salt (NaCl)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
DL. Methionine(97%)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100	100	100	100	100
Calculated Analysis									
Crude protein %	14.99	17.08	19.04	15.01	17.03	19.00	15.00	17.02	19.07
ME (Kcal / kg)	2743	2752	2752	2845	2854	2858	2946	2950	2957
Total Calcium %	3.30	3.31	3.31	3.29	3.29	3.29	3.27	3.27	3.27
Av. Phosphorus %	0.43	0.44	0.44	0.42	0.43	0.43	0.41	0.42	0.42

*Each 3 kg of the Vit and Min. premix manufactured by Agri-Vit Company, Egypt contains: Vitamin 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 chloride 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..
** According to NRC (1994)

Table (2): Effect of energy and protein levels on semen quality traits of Domyati drakes .

Treatment		Parameters			
		Volume (ml)	**Concent. (mlx10^9)**	**Mass motility**	**Advanced motility**
Energy level					
Low		0.27±0.02^b	4.5±0.1	4.7±0.1	95.7±0.3^{ab}
Medium		0.32±0.01^a	4.6±0.1	4.8±0.1	96.6±0.4^a
High		0.33±0.03^a	4.6±0.1	4.9±0.1	95.3±0.3^b
Significance		**0.05**	**NS**	**NS**	**0.05**
Protein level					
Low		0.27±0.1^b	4.4±0.1^b	4.7±0.1	95.2±0.3
Medium		0.29±0.1^b	4.5±0.1^b	4.8±0.1	96.0±0.5
High		0.36±0.1^a	4.7±0.1^a	4.9±0.1	96.3±0.3
Significance		**0.05**	**0.05**	**NS**	**NS**
Interactions					
Energy	Protein				
Low	Low	0.24±0.03^c	4.4±0.2^b	4.7±0.2	95.0±0.6
	Med.	0.27±0.03^{cb}	4.5±0.1^b	4.7±0.2	96.0±0.6
	High	0.31±0.01^{cb}	4.5±0.2^b	4.7±0.2	96.0±0.6
Med	Low	0.31±0.01^{cb}	4.5±0.2^b	4.7±0.2	95.7±0.9
	Med	0.31±0.02^{cb}	4.6±0.1^{ab}	4.8±0.2	97.0±1.0
	High	0.33±0.03^b	4.7±0.2^{ab}	5.0±0.3	97.0±0.6
High	Low	0.27±0.02^{cb}	4.5±0.1^b	4.8±0.2	95.0±0.6
	Med	0.29±0.02^{cb}	4.3±0.1^b	4.9±0.1	95.0±0.6
	High	0.44±0.03^a	5.0±0.1^a	5.0±0.3	96.0±0.6
Significance		**0.05**	**0.05**	**NS**	**NS**

a,b,c,d,e :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

Table (3): Effect of energy and protein levels on semen quality traits of Domyati drakes .

Treatment		%			
		Dead sperms	**Coiled**	**Clumping**	**Total abnormal**
Energy level					
Low		12.7±0.4[a]	7.7±0.3[a]	6.7±0.4[a]	14.3±0.5[a]
Medium		12.0±0.4[ab]	6.3±0.3[b]	6.0±0.4[a]	13.4±0.4[a]
High		11.4±0.3[b]	4.1±0.4[c]	4.2±0.3[b]	11.4±0.3[b]
Significance		**0.05**	**0.05**	**0.05**	**0.05**
Protein level					
Low		12.8±0.5[a]	6.7±0.5[a]	6.7±0.5[a]	14.0±0.6[a]
Medium		11.8±0.3[ab]	6.0±0.7[ab]	5.3±0.4[b]	12.7±0.5[b]
High		11.6±0.4[b]	5.4±0.6[b]	4.9±0.4[b]	12.4±0.5[b]
Significance		**0.05**	**0.05**	**0.05**	**0.05**
Interactions					
Energy	Protein				
Low	Low	14.0±0.6 [a]	8.0±0.6 [a]	8.0±0.6 [a]	16.0±0.6 [a]
	Med.	12.0±0.6 [ab]	8.0±0.6 [a]	6.0±0.6 [bc]	14.3±0.6 [b]
	High	12.0±0.6 [ab]	7.0±0.6 [ab]	6.0±0.6 [bc]	13.0±0.6 [bcd]
Med	Low	12.3±0.9 [ab]	7.0±0.6 [ab]	7.0±0.6 [ba]	14.0±0.6 [b]
	Med	12.0±0.6 [ab]	6.0±0.6 [bc]	6.0±0.6 [bc]	13.0±0.6 [bcd]
	High	11.7±0.9 [b]	6.0±0.6 [bc]	5.0±0.6 [cd]	13.3±0.9 [bc]
High	Low	12.0±0.6 [ab]	5.0±0.6 [cd]	5.0±0.6 [cd]	12.0±0.6 [cde]
	Med	11.3±0.3 [b]	4.0±0.6 [d]	4.0±0.6 [d]	11.33±0.3 [de]
	High	11.0±0.6 [b]	3.0±0.3 [d]	3.7±0.3 [d]	11.0±0.6 [e]
Significance		**0.05**	**0.05**	**0.05**	**0.05**

a,b,c,d,e :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

Table (4): Effect of energy and protein levels on seminal plasma traits of Domyati drakes.

Treatment		Seminal plasma traits: Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Acid phosph- (U/L)	Alkalinephos. (U/L)	ALT (U/L)	AST (U/L)
Energy level								
Low		2.7±0.2 ^{a}	1.2±0.1	1.6±0.1^{a}	119.6±4.5^{ab}	29.8±1.9	9.5±0.3^{a}	103.4±3.3
Medium		2.6±0.1^{ab}	1.2±0.4	1.4±0.1^{b}	112.3±5.2^{b}	28.9±1.3	8.1±0.4^{ab}	103.7±2.2
High		2.5±0.1^{b}	1.1±0.4	1.4±0.3^{b}	125.4±2.2^{a}	28.7±1.8	7.4±0.3^{b}	103.8±2.9
Significance		**0.05**	NS	**0.05**	**0.05**	**NS**	**0.05**	**NS**
Protein level								
Low		2.7±0.1^{a}	1.2±0.04^{a}	1.5±0.1^{b}	119.2±4.4^{ab}	28.4±1.4	8.2±0.3^{a}	102.5±2.4
Medium		2.8±0.1^{a}	1.2±0.1^{ab}	1.6±0.4^{a}	126.0±4.1^{a}	29.2±1.9	8.5±0.3^{a}	104.9±3.5
High		2.4±0.1^{b}	1.1±0.1^{b}	1.3±0.1^{b}	112.1±3.8^{b}	29.7±1.6	7.3±0.3^{b}	103.5±2.4
Significance		**0.05**	**0.05**	**0.05**	**0.05**	**NS**	**0.05**	**NS**
Interactions								
Energ.	Prot.							
Low	Low	3.0±0.1^{ba}	1.3±0.1^{a}	1.7±0.01^{ab}	128.3±4.6^{a}	30.3±1.1	8.8±0.4^{a}	105.4±1.7
	Med.	3.1±0.2^{a}	1.3±0.1^{a}	1.9±0.1^{a}	119.7±12.0^{abc}	28.9±5.4	8.4±1.0^{a}	103.8±10.
	High	2.7±0.2^{bc}	1.1±0.1^{ab}	1.6±0.1^{bc}	110.7±0.9^{abc}	30.3±3.2	8.3±0.1^{a}	100.8±2.7
Med	Low	2.4±0.1^{cd}	1.1±0.01^{ab}	1.5±0.1^{bcd}	105.7±7.5^{bc}	30.3±2.6	7.6±0.3^{a}	106.8±4.6
	Med	2.7±0.1^{bc}	1.2±0.1^{ab}	1.6±0.1^{bc}	128.4±4.2^{a}	26.3±1.9	8.4±0.03^{a}	100.2±1.6
	High	2.7±0.2 ^{bcd}	1.2±0.1^{ab}	1.5±0.1^{bcd}	122.7±7.0^{ab}	30.1±2.1	7.4±0.03^{a}	104.0±5.0
High	Low	2.7±0.1^{bcd}	1.2±0.1^{ab}	1.5±0.1^{bcd}	123.4±3.9^{ab}	24.6±2.3	8.3±0.6^{a}	95.2±2.6
	Med	2.4±0.1^{cd}	1.0±0.04^{bc}	1.4±0.1^{cde}	129.9±2.5^{a}	32.5±1.0	8.6±0.04^{a}	110.6±1.1
	High	2.3±0.1^{de}	0.9±0.1^{c}	1.1±0.1^{e}	102.9±4.4^{c}	28.8±3.9	6.4±0.2^{b}	105.6±5.8
Significance		**0.05**	**0.05**	**0.05**	**0.05**	**NS**	**0.05**	**NS**

a,b,c,d,e :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

Table (5): Effect of energy and protein levels on blood plasma traits of Domyati drakes .

Treatment		Blood plasma traits						
		Total protein (g/dl)	**Albumin (g/dl)**	**Globulin (g/dl)**	**Acid phos- (U/L)**	**Alkaline phos. (U/L)**	**ALT (U/L)**	**AST (U/L)**
Energy level								
Low		5.5±0.2	2.8±0.2^{a}	2.7±0.1^{b}	16.3±5.4	54.0±1.9	13.8±0.8	78.5±4.2^{a}
Medium		5.7±0.1	2.6±0.1^{ab}	3.1±0.1^{a}	15.3±5.1	53.4±1.8	13.5±0.5	74.3±2.3^{b}
High		5.4±0.1	2.4±0.1^{b}	3.0±0.1^{a}	14.7±4.9	57.0±1.5	13.5±0.5	79.1±3.0^{a}
Sig.		NS	**0.05**	**0.05**	**NS**	**NS**	**NS**	**0.05**
Protein level								
Low		5.4±0.1^{b}	2.5±0.1	2.9±0.1	15.8±0.7	58.8±1.0^{a}	13.1±0.4	73.0±2.4^{c}
Medium		5.8±0.1^{a}	2.8±0.2	3.0±0.1	15.7±0.5	50.9±0.1^{b}	13.6±0.5	76.9±3.5^{b}
High		5.3±0.2^{b}	2.5±0.1	2.8±0.1	14.9±0.9	54.7±1.6^{b}	14.0±0.8	81.9±2.4^{a}
Sig.		**0.05**	NS	NS	**NS**	**0.05**	**NS**	**0.05**
Interactions								
En.	Pr.							
Low	Lo	5.1±0.2^{cd}	2.6±0.1^{b}	2.5±0.1^{b}	15.2±1.7	58.4±1.8^{a}	11.6±0.5	79.9±3.7^{b}
	Me	6.1±0.2^{a}	3.3±0.3^{a}	2.8±0.1^{ab}	16.5±1.3	48.7±2.3^{b}	14.3±0.7	64.2±1.5^{d}
	Hi	5.3±0.3b^{c}	2.6±0.2^{b}	2.7±0.3^{ab}	17.2±2.4	54.8±3.5^{a}	15.4±1.7	91.4±1.7^{a}
Med	Lo	5.5±0.3^{ab}	2.6±0.1^{b}	3.0±0.1^{ab}	16.8±08	58.5±1.0^{a}	14.1±0.2	66.5±1.2^{c}
	Me	5.8±0.2^{ab}	2.6±0.1^{b}	3.2±0.1^{a}	15.4±0.6	47.5±1.3^{b}	12.7±0.1	76.5±2.1^{b}
	Hi	5.7±0.1^{ab}	2.7±0.2^{b}	3.2±0.2^{a}	13.8±0.5	54.4±2.3^{a}	13.7±0.5	80.1±2.6^{b}
Hig	Lo	5.6±0.3^{ab}	2.4±0.1^{b}	3.2±0.3^{a}	15.3±1.1	59.7±2.6^{a}	13.7±0.6	72.7±2.2^{c}
	Me	5.5±0.1^{ab}	2.4±0.1^{b}	3.2±0.2^{a}	15.2±0.2	56.5±1.3^{a}	13.8±0.3	90.2±1.1^{a}
	Hi	4.9±0.1^{d}	2.4±0.1^{b}	2.6±0.2^{b}	13.7±0.6	54.9±3.4^{b}	13.0±0.3	74.3±2.6^{b}
Sign.		**0.05**	**0.05**	**0.05**	**NS**	**0.05**	**NS**	**0.05**

a,b,c,d,e :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

Table (6): Effect of energy and protein levels on blood plasma hormones of Domyati drakes and hatchability traits of incubated eggs .

Treatment		Blood plasma hormones		Hatchability traits	
		T_3 (ng/dl)	**Testosterone (ng/dl)**	**Fertility %**	**Hatchability of fertile egg %**
Energy level					
Low		3.6±0.2^{b}	2.8±0.2^{b}	89.26±0.36^{b}	74.24±1.01^{b}
Medium		4.2±0.1^{a}	3.2±0.1^{a}	89.75±0.32^{b}	72.94±0.72^{c}
High		3.4±0.4^{c}	3.0±0.2^{ab}	91.77±0.42^{a}	80.89±0.73^{a}
Significance		**0.05**	**0.05**	**0.05**	**0.05**
Protein level					
Low		3.5±0.2^{b}	2.9±0.2^{b}	90.97±0.50^{a}	75.94±1.19
Medium		3.8±0.4^{a}	3.0±0.2^{ab}	90.18±0.43^{ab}	75.49±1.27
High		3.8±0.2^{a}	3.2±0.2^{a}	89.64±0.54^{b}	76.65±1.85
Significance		**0.05**	**0.05**	**0.05**	**NS**
Interactions					
Energy	protein				
Low	Low	3.0±0.1^{c}	2.3±0.1^{e}	90.16±0.57^{bcd}	77.34±0.55^{cd}
	Med.	3.8±0.2^{b}	2.6±0.2^{de}	89.30±0.49^{cd}	74.36±0.53^{e}
	High	4.4±0.2^{a}	3.4±0.2^{a}	88.33±0.38^{d}	71.03±1.31^{f}
Med	Low	4.4±0.1^{a}	3.3±0.1^{ab}	90.43±0.45^{abc}	71.46±0.67^{f}
	Med	3.8±0.3^{b}	2.8±0.2^{dc}	89.72±0.40^{bcd}	71.90±0.69^{f}
	High	4.4±0.2^{a}	3.7±0.1^{a}	89.09±0.53^{cd}	75.46±0.67^{ed}
High	Low	3.2±0.2^{c}	3.0±0.2^{bc}	92.31±1.05^{a}	79.03±0.68^{bc}
	Med	3.9±0.1^{b}	3.6±0.1^{a}	91.52±0.70^{ab}	80.19±0.61^{b}
	High	3.1±0.2^{c}	2.5±0.2^{de}	91.49±0.59^{ab}	83.44±0.61^{a}
Significance		**0.05**	**0.05**	**0.05**	**0.05**

a,b,c,d,e :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

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الملخــص العربـــي

تأثير التغذية على مستويات مختلفة من الطاقة والبروتين على جودة السائل المنوى والخصوبة فى البط الدمياطى

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أجرى هذا البحث لدراسة تأثير إستخدام علائق تحتوى على ثلاث مستويات مختلفة من الطاقة والبروتين (3x3) فى تغذية ذكور البط الدمياطي خلال فترة انتاج البيض على صفات السائل المنوى ومحتوى بلازما السائل المنوى وبعض مكونات الدم ونسبة الخصوبة . تم استخدام عدد **243** طائر(**54** ذكر و **189** أنثى بط دمياطي) عمر 20 أسبوع وتم وزنهم و تقسيمهم إلى تسع مجاميع تجريبية وبكل مجموعة ثلاث مكررات . تم تكوين العلائق التجريبية المستخدمة بحيث تحتوى على ثلاث مستويات من الطاقة الممثلة (**2750 ، 2850 ،2950** كيلو كالورى / كجم) وبكل مستوى منها ثلاث مستويات من البروتين الخام (**15 ، 17 ، 19** %) وتم تقديمها للمجموعات التجريبية ، وتم تدريب الذكور على جمع السائل المنوى وتم جمع السائل المنوى من الذكور وتم أخذ عينات دم من نفس الذكور بعد جمع السائل المنوى مباشرة لتقدير محتويات بلازما الدم والسائل المنوى من البروتين الكلى والالبيومين والجلوبيولين وهرمونى التراى أيودوتيروزين والتستستيرون وانزيمات الترانس أمينيز والانزيمات الحامضية والقاعدية (AST,ALT Acid and Alkaline phosphatase) وتم اجراء عملية تلقيح صناعى للاناث بالسائل المنوى لتلك الذكور بمعدل مرتين أسبوعيا وتم اجراء عملية تفريخ للبيض الناتج لتقدير نسبة الخصوبة .

وبتحليل النتائج اتضح الآتي :-

تأثرت صفات السائل المنوى معنويا بالمستويات المختلفة من الطاقة والبروتين ، حيث ازداد حجم القذفة من السائل المنوى للذكوربالمستوى العالى لكل من الطاقة والبروتين بينما ارتفع تركيز الاسبرمات بالمستوى العالى من البروتين فقط. تحسنت الحركة التقدمية للحيوانات المنوية معنويا بزيادة مستوى الطاقة بالعليقة بينما لم تتأثر بمحتواها من البروتين . انخفضت نسبة كل من الحيوانات الميتة والمشوهة معنويا بالمستويات العالية من الطاقة والبروتين بالعليقة .

انخفض محتوى بلازما السائل المنوى من البروتين والجلوبيولين وانزيم ALT معنويا بزيادة محتوى العليقة من الطاقة والبروتين بينما لم تتأثر الانزيمات الحامضية والقاعدية وانزيم AST المعاملات.

ارتفع معنويا محتوى بلازما الدم من الجلوبيولين وهرمونات التراى أيودوتيروزين والتستستيرون بالمستويات العالية للطاقة والبروتين بينما انخفض معنويا محتواها من الألبيومين ، لم تتأثر كل من الانزيمات الحامضية والقاعدية و انزيم ALT ببلازما الدم بالمعاملات بينما انخفض معنويا قيمة انزيم AST بالمستويات المتوسطة للطاقة والمنخفضة من البروتين فى العليقة . تحسنت نسبة الخصوبة للبيض الناتج بتغذية الذكور على علائق تحتوى على المستوى الأعلى من الطاقة والمستوى المنخفض من البروتين .

من النتائج السابقة يمكن الاستنتاج بأن إستخدام عليقة تحتوى على 2950كيلو كالورى طاقة ممثلة /كجم علف مع 15% بروتين خام في تغذية البط الدمياطى خلال فترة انتاج البيض يمكن أن يؤدى إلى تحسن في الأداء التناسلى والخصوبة خلال فترة انتاج البيض وبدون أي تأثير معاكس على هذه المقاييس.