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0EFFECT OF FEEDING SYSTEM ON PERFORMANCE OF GROWING JAPANESE QUAIL

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ABSTRACT

A total number of 400 unsexed one day-old Japanese quail chicks (*Coturnix coturnix japonica*) were used to study the effect of feeding system on performance of growing quail. Quail chicks were randomly distributed into 4 equal experimental groups of 100 chicks each. Every group was sub-divided into four replicates (25 chicks/ replicates).

The first group was fed on a diet containing 24 % crude protein only as starter diet during the whole experimental period (0-6 weeks of age).Group 2 was on a fed starter diet (24% CP) for the four weeks and then switched to the finisher diet (22% CP) for the last 2 weeks. Group 3 was fed on starter diet (24% CP) for the two weeks and then switched to on a finisher diet (22% CP) for the last 4 weeks. Group 4 was fed a diet containing 22 % crude protein as finisher diet only of during the whole experimental period (0-6 weeks of age).The experimental diets were formulated isofibrous and isocaloric (2900 kcal ME/kg).

The main results obtained could be summarized as follows:

- Live body weights and body weight gain during the whole experimental period was significantly varied (P<0.05) among the experimental groups. Group 2 for the four weeks and then switched to the finisher diet for the last 2 weeks) recorded the highest live body weight and body weight gain.
- Feed intake (g) during the whole experimental period (0-6 weeks) was increased by G4 (fed finisher diet only 22 % CP). Feed conversion ratio (g feed/g gain) were improved with the G2 (starter diet for the four weeks and then given the finisher diet for the last 2 weeks), while it is became worst by G4 (fed finisher diet only 22 % CP).
- Protein intake(g) was increased by G1 (fed starter diet only 24% CP) recorded a highest values, while, the G4 (fed finisher diet only 22 % CP) recorded lower ones. Best protein efficiency utilization ratio was obtained with the G2 during the experimental period (0-6 weeks of age).
- Different growing period for quail recorded a non significant differences in all carcass traits.
- Digestibility coefficients of DM, OM, CP, CF %, the nutritive values expressed as DCP, TDN % and ME (kcal/kg) were significantly (P<0.05) decreased among the experimental diets. However, digestion coefficient of NFE and EE was not significantly influenced by the different diets.
- Serum TP, AL, Cr and uric acid recorded a non-significant differences between quail groups, while serum AST, ALT enzymes recorded ones varied (P<0.05) among the experimental groups.
- The group 2 (starter diet 24 % CP) for the four weeks and then given the finisher diet (22 % for the last 2 weeks) showed the best net return as well as the highest value of economic efficiency among all experimental groups.
- Results obtained in the present study, indicated that a starter diet with moderate protein level (24 % CP) for the four weeks and then given a finisher diet (22 % CP) for the last two weeks in the growing quail period had no adverse effect on growth performance and carcass quality. This system of feeding resulted in an improvement in economic profitability efficiency.

Keywords: Quail, the performance, digestibility trials, carcass traits and some physiological parameters.

INTRODUCTION

The Poultry performance depends on many factors, the feeding system is considered one of the major factors. The production of quail provides diet one only during the growing period. which is not a common practice in the poultry nutrition.

The problem with providing a feed having the same level of protein is that the bird need to change protein with age advance. Feed having excess protein may not be physically harmful to the bird, but feed cost increases with the increase of the dietary protein content in diet.

Therefore, destination of the nutritional and economical efficiency became necessary division of the growth in the quail into two periods, the starter and finisher periods and their time of change as the rest of other types of poultry. It is expected that great effort will be made to reduce of protein level without reducing the birds performance, young chicks to be more affected than adult birds, this effect depends on the age (Rotter *et al*.,1990 and Salih *et al.,*1991)

There are many inconsistent reports in the literature about how much dietary protein is necessary for quail during growing period. The most recommendations indicated a range of 24-22 crude protein as optimum level in diets of growing quail. Mark (1993) found that quail received diets containing 24 % CP or higher was significantly larger than those receiving the 18 and 21 % CP diets. The NRC (1994) suggests a protein requirement of 24 for Japanese quail in the growing period. On the other hand, Murakami *et al.*(1993) found that 20 % CP level resulted in best performance from 1 to 42 days of age, while Boztepe and Ozturk (1993) found that quail body weight, body weight gain and feed conversion were improved by recorded a 22 % crude protein at 35 days old.

The present study aimed to investigate the effect of feeding system on performance, carcass traits, digestibility trials, some physiological parameters, economic efficiency on growing Japanese quail.

MATERIALS AND METHODS

The present work was carried out at Maryiout Experimental Research Station (South West of Alexandria), which belongs to the Desert Research Center. A total number of 400 unsexed one day-old Japanese quail chicks (*Coturnix coturnix japonica*) were randomly distributed into 4 equal experimental groups of 100 chicks each. Every group was sub-divided into four replicates (25 chicks/ each).

Experimental quail chicks were kept under similar managerial, hygienic and environmental conditions. The chicks were housed in cages from hatch up to 6 weeks of age.

The experimental groups were as follows:

Group 1 : fed on diet a containing 24 % crude protein (as a starter diet) during the whole experimental period (0-6 weeks of age).

Group 2 : fed on the starter diet (24% CP) for the first four weeks and then switched to the finisher diet (22% CP) for the last 2 weeks.

Group 3 : fed on the starter diet (24% CP) for the first two weeks and then switched to the finisher diet (22% CP) for the last 4 weeks.

Group 4 : fed on diet a containing 22 % crude protein (as a finisher diet) during the whole experimental period (0-6 weeks of age).

The level of protein for group 1 was formulated to meet the nutrient requirements of growing Japanese quail chicks according to NRC (1994). The experimental diets (Table 1) were isocaloric (2900 kcal ME/kg) and Isofibrous as shown table (1). Crude protein values were 24% and 22 % for starter or finisher diets, respectively. Feed was offered *ad libitum* and fresh water was available all time. Chemical analysis of the experimental diets, meat and dried excreta were analyzed according to A.O.A.C (1990).

During the experimental period, individual live body weight and feed intake were weighed biweekly before offering the feed. Feed conversion ratio (g feed / g gain), protein intake and protein utilization efficiency ratio (g gain/ g protein intake) were calculated. Mortality was recorded at the day it occurred.

At the end of the experimental feeding period, digestion trials were conducted using 8 adult males (4 from each level of crude protein) to determine the digestibility coefficients of the experimental diets as affected by crude protein levels. Males were housed individually in metabolic cages. The digestibility trials extended for 9 days of them 5 days as a preliminary period followed by 4 days as collection one. The individual live body weights were recorded during the main collection one to determine any loss or gain in the live body weights. During the main period, excreta were collected daily and weighed, dried at 60^{o} C bulked, finally ground and stored for chemical analysis. The faecal nitrogen was determined according to Jakobsen *et al.*(1960). Urinary organic matter was calculated according to Abou-Raya and Galal,(1971).Metabolizable energy was calculated according to Titus and Fritz (1971).

The digestion coefficients % of dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) of the experimental diets were estimated. The nutritive values expressed as digestible crude protein (DCP), total digestible nutrients (TDN) and metabolizable energy (ME) were calculated.

The economical efficiency of feed was calculated from the input-output analysis based up on the differences in both feeding cost/kg quail and selling cost / quail.

Ten quail from each treatment were chosen randomly for slaughter test. Dressing percentage was calculated as carcass weight divided by the pre-slaughter weight. Carcass parts were weighed and calculated as a percentage of live body weight, blood samples were collected from birds, samples were collected in glass tubes and left at room temperature for 30 minutes then centrifuged at 3000 rpm for 15 minutes to separate the serum. The collected serum from each quail was transferred to a clean glass vial and stored at -20°C until analyzed.

Table (1): Composition and proximate chemical analysis of the experimental diets.

Ingredient	Experimental diets	
	Starter diet	Finisher diet
Soybean meal (44% CP)	13.50	10.80
Yellow corn	56.60	59.70
Protein concentrate*	10.00	10.00
Corn gluten meal (60% CP)	10.50	9.20
Wheat bran	8.40	9.20
Dicalcium phosphate	0.25	0.26
Vit. and min. premix**	0.30	0.30
L-lysine	0.33	0.36
Dl- methionine	0.12	0.18
Total	**100**	**100**
Proximate chemical analysis %		
Crude protein	24.06	22.10
Crude fiber	3.45	3.40
Ether extract	3.43	3.41
Calculated values		
Metabolizable energy (Kcal/kg)***	2905	2911
C/P ratio	120.74	131.72
Calcium %	0.86	0.87
Available phosphorus %	0.45	0.45
Methionine %	0.52	0.52
Lysine %	1.30	1.30
Methionine + Cystin %	0.75	0.76
Price /ton diet (L.E)****	1550	1470

***Protein concentrate contained, 52 %Crude protein, 2.03 % Crude fiber, 6.17% Ether extract, ME 2080 (kcal/kg),1.50 % Methionine, 2.0% Methionine & Cystin, 3.0 % Lysine 7.00% Calcium, 2.93 % Available Phosphorus 2.20 % Nacl.**

**** Each 1 kg Vitamins and minerals premix contain, Vit. A 120000 IU, Vit. D_3 22000 IU, Vit.E100 mg,Vit.K_3 20mg, Vit. B_1 10 mg, Vit. B_2 50mg, Vit. B_6 15 mg, Vit.B_{12} 100 µg, Pantothenic acid 100 mg, Niacin 300 mg, Folic acid 10mg, Biotin 500 µg,Iron 300mg, Manganese 600 mg, Choline chloride 500 mg, Iodine 10 mg,Copper 100 mg, Seleneium 1 mg, Zinc 500 mg and 1200 mg Antioxidant.**

***** Calculated according to NRC of poultry (1994).**

******Calculated according to price of feed ingredients at the same time of the experiment (2006).**

The assays of serum total protein (TP) and albumin (AL) were carried out according to the method of Weichselbaum (1946), Dounces *et al*. (1971), respectively. Serum aspartate aminotransferase (AST) and alanine amino-transferase (ALT) activities were determined according to the method of Reitman and Frankel (1957).Serum creatinine(Cr) was determined according to Jaffe (1986). Serum uric acid (Ur) was determined according to Caraway (1963).

Data obtained were subjected to statistically analyzed by the computer program of SAS (1996) using the general Linear Models (GLM) and

differences among means were separated by Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Live body weight and body weight gain.

Feeding quail chicks on diets which differ in their feeding periods, showed different rates live body weigh and body weight gain during the experimental period (0-6 weeks of age) as shown in table (2).

it was observed that values of live body weigh at 2 weeks of age were approximately equal for the values four experimental groups ranging from 48.18 to 51.03 g (table 2).

However, they differed significantly ($P<0.05$) according to the feeding system (starter or finisher) at 4 and 6 weeks of age .The quail chicks of G2 (group 2 which was fed on starter diet 24 % CP for the four weeks and then switched to the finisher diet 22 % CP for the last 2 weeks) were the highest values (197.75 g) and those of G4 (group 4 which was fed on finisher diet during the whole experimental period) had the least values (184.51g) of the live body weight.

The same trend was found also with respect of body weight gain where the G2 had significantly ($P<0.05$) the highest values at all periods studied except at 2 weeks. Throughout the whole experimental period (0-6 weeks), the quail of G2 surpassed those of G1, G3 and G4 in weight gain by about 3.17, 4.24 and 6.94 %, respectively.

These results show that the best feeding regimen to obtain the best live body weight and body weight gain is the G2.

These results are similar with those of Singh and Narayan (2002) who recommended 24% CP between 4 and 5 weeks regimen, while Shim and Vohra (1984) was 24% CP in diets for growing Japanese quail ,which could be decrease to 20 % after three weeks of age.

Hyankova *et al*.(1997) reported that Japanese quails which was fed on 26 and 21.6% crude protein had good performance from 1 to 21 days and from 22 to 35 days of age, respectively. Also, the positive effect of a high CP% diet on body weight was significant only for the first 4 weeks. Soares *et al*. (2003) suggested that the levels of 23.08% of crude protein in the diet of Japanese quail are recommended for the rearing period (7 to 35 days).

Lee *et al*.(1977) is shown that a dietary crude protein level of 24% is needed in starter diet for quail and the protein content may be reduced to 20% by 3 weeks of age.

Feed intake and feed conversion ratio.

Results on feed intake at 2 weeks of age were approximately equal for the values four groups (Table 2).However, they differed significantly ($P<0.05$) according to the feeding system (starter or finisher) at 4 and 6 weeks of age.

Table (2): Effect of the feeding system on growth performance (mean ±SE) of quail.

Items	Groups				
	G1	G2	G3	G4	sig
Starter wk.	6	4	2	0	
Finisher wk.	0	2	4	6	
Live body weight (g)					
Initial	8.32±0.28	8.25±0.32	8.34±0.25	8.30±0.46	ns
2 weeks	50.48±0.78	51.03±1.14	50.45±1.29	48.18±1.32	ns
4 weeks	113.57±1.12^{a}	115.18±1.23^{a}	109.81±2.01^{ab}	105.78±2.40^{b}	*
6 weeks	192.01± 1.33^{a}	197.75±1.50^{a}	190.14±1.90^{ab}	184.51±2.02^{b}	*
Weight gain (g /period / bird					
0-2 weeks	42.16±0.05	42.78±0.81	42.11±1.20	39.88±1.14	ns
2-4 weeks	63.09±0.77^{a}	64.15±0.38^{a}	59.36±1.32 ^{ab}	57.60±0.94^{b}	*
4-6 weeks	78.44±0.95^{b}	82.58.±0.53^{a}	80.33±1.40^{ab}	79.73±1.36^{b}	*
0-6 weeks	183.69±1.12 ^{ab}	189.51±1.41^{a}	181.80±2.40^{ab}	177.21±1.98^{b}	*
Feed intake (g)/ period / bird					
0-2 weeks	122.50±1.20	121.24±1.19	121.55±1.85	122.34±1.42	ns
2-4 weeks	233.94±1.08 ^{b}	235.05±1.10^{ab}	240.28±1.25^{ab}	244.35±2.01^{a}	*
4-6 weeks	328.98±1.63 ^{b}	332.45±2.0^{ab}	334.60±2.21^{a}	340.20±1.67^{a}	*
0-6 weeks	685.42±2.78^{b}	688.74±2.14^{ab}	696.43±2.45^{a}	706.89±2.88^{a}	*
Feed conversion ratio					
0-2 weeks	2.91±0.04	2.83±0.05^{b}	2.89±0.04	3.07±0.07	ns
2-4 weeks	3.71±0.06^{b}	3.66±0.07 ^{b}	4.05±0.05 ^{a}	4.24±0.06^{a}	*
4-6 weeks	4.19±0.08^{ab}	4.03±0.06 ^{b}	4.17±0.04^{ab}	4.27±0.07^{a}	*
0-6 weeks	3.73±0.09^{ab}	3.63±0.08 ^{b}	3..83±0.06^{a}	3.99±0.08 ^{a}	*
protein intake (g /period / bird					
0-2 weeks	29.48±2.01	29.17±1.09	29.24±1.06	27.04±2.01	ns
2-4 weeks	56.29±1.10^{a}	56.55±1.03^{a}	53.10±1.16^{b}	54.00±1.09 ^{ab}	*
4-6 weeks	79.15±1.80^{a}	73.47±1.17^{b}	73.95±1.26^{b}	75.18±1.25 ^{ab}	*
0-6 weeks	164.91±1.90^{a}	159.19±1.51^{ab}	156.29±1.46 ^{b}	156.22±1.91^{b}	*
protein efficiency ratio					
0-2 weeks	1.43±0.02	1.47±0.03	1.44±0.05	1.47±0.06	ns
2-4 weeks	1.12±0.03	1.13±0.04	1.12±0.09	1.07±0.07	ns
4-6 weeks	0.99±0.06	1.12±0.05	1.09±0.08	1.06±0.09	ns
0-6 weeks	1.11±0.08	1.19±0.09	1.16±0.09	1.13±0.05	ns
Morality rate %					
0-6 weeks	4.25±0.36	3.99±0.39	3.17±0.41	3.01±045	ns

$^{a, b}$ Means with different letters in the same row are significantly different.
Sig= Significance, * (P< 0.05), n.s= non significant.

Feed intake (g) during the whole experimental period was quail chicks of the G4 (fed finisher diet only 22% CP during the whole experimental period) consumed more feed intake than the other groups, followed by G3, G2, respectively, while G1 (fed starter diet only 24% CP) recorded the lowest values.

These results are in agreement with those Ali *et al*. (2000) who found that quail fed low protein level (22%) significantly (P< 0.05) consumed more feed compared with fed diets contained 24% crude protein. Hassanein (2004)

and Abdel-Azzeem *et al*.(2001) found that increasing protein level content in the quail diet gradually improved feed conversion ratio and decreased feed intake. Also, this observation is in–harmony with the finding of Shalan (1993). Mohammed (1990) who found that increasing level of protein in the quail grower diets caused a decrease in the amount of feed consumption .

Feed conversion ratio (g feed/g gain) revealed a significant difference ($P<0.05$) among the experimental groups during the whole experimental period (0-6 weeks). it was observed that values feed conversion ratio was improved by differing the feeding regimen G2 recorded best (3.63) values, while it is became worst (3.99) by G4 during the whole experimental period.

On the basis of the present data, it seems that quail received diets of G3 and G4 were to some extent less in feed conversion compared to the other groups.

The reduction observed in feed conversion ratio may be result from the decrease in body weight gain and the increase in feed intake.

These results agreed with those obtained by Hussein *et al*.(2000) who found that protein level of 22% gave the best feed conversion ratio. Shalan (1993) and Hassanein (2004) found that increasing protein content in the quail diet gradually improved feed conversion ratio and decreased feed intake. Zeweil (1996) who reported that feeding growing Japanese quail on a diet contained a high level of protein (24%) led to a remarkable improvement of body weight and feed conversion ratio as compared with quails received the lower protein level (21%).Salmon *et al.*(1983), Francher and jensen (1989) and Aggoor *et al*.(1997) who found that increasing protein levels improved feed conversion of broiler diets.

Protein intake and Protein efficiency utilization

Protein intake (g) during the whole experimental period (0-6 weeks of age) was significantly ($P<0.05$) among the different experimental groups (Table 2).it was observed that values of protein intake (g) during 2 weeks of age were approximately equal for the values four experimental groups ranging from 29.48 to 27.04 g. However, they differed significantly ($P<0.05$) according to the feeding system (starter or finisher) at 4 and 6 weeks of age

It is clear that protein intake during the whole experimental period was increase by G1(fed starter diet only) recorded highest values followed by G2 and G3, respectively, while G4 (finisher diet only at the 0-6 weeks) recorded lowest values**,** this may be due to that the protein intake was increase with increased percentage of protein level in diets.

Protein utilization efficiency (g weight gain / g protein intake) during the whole experimental period was improved by differing the feeding regimen, G1 which was fed on starter diet only recorded least (1.11) values. The best protein utilization efficiency was achieved by the quail of G2 (1.19) followed by there of G3, G4 and G1, respectively.

These results show that the best feeding regimen to obtain the best protein utilization efficiency with the G2.

These results are in agreement with those of Aggoor *et al*.(1997) found that CP intake increased with increasing protein level while, protein efficiency ratio decreased with increasing protein level. on the other hand,

Zeweil (1996) found that protein utilization efficiency improved significantly ($P<0.01$) by decreasing protein level of quail diet.

These criteria indicated that the advisable system for feeding growing quail is to formulate diets according to period of growth. Regarding the previous results a starter diet with 24% CP for the four weeks and then switched to a finisher diet with 22 %CP for the last two weeks in the growing quail period is suitable.

Mortality rate

Results on mortality rate % recorded a non significant difference among experimental groups (Table 2).However, quail fed group 4 (finisher diet only) recorded the lowest value, while the G1 recorded the highest one. Vohera and Roudybush (1971), Johri and Vohra (1977) and Mohammed (1990) found that the mortality rate during growing period of Japanese quail did not significantly influence by dietary protein levels.

Carcass traits and chemical analysis of meat

Results on carcass traits and chemical analysis of quail meat are summarized in table(3).

Results on different growing period for quail recorded a non significant differences in all carcass traits.

It is worthy noting that the G2 recorded highest values of dressing percentage, while G4, G3 and G1 recorded lowest values, respectively, this may be due to the decrease in live body weight.

The edible giblets ranged from about 5.61 to 6.56 %,.these results did not differ statistically among the experimental groups, the G4 recorded highest percentage (6.56%), while G1 recorded lowest (5.61%) value. These results indicated that edible giblets decreased with these feeding regimen.

The increasing in edible giblets ranged was due to the decrease in protein levels.

Abdel-Azzeem *et al*.(2001) found that total edible parts were increasing with decreased protein levels for quail diets**.** Sherif (1989) found that protein levels had insignificant effect on viscera and giblets percentages.

Similar results were obtained by Zeweil *et al*.(1993) and Zeweil (1996) who found that liver, gizzard and heart were insignificantly affected by different protein levels. El-Gendi *et al*.(2000); Abd-Elsamee(2001); El-Ghamry *et al*.(2002); Abd El-Hady and Abd El-Ghany (2003) who found that there were no significant differences in carcass characteristics due to dietary protein levels. Hussein *et al*.(2000) found that no significant difference with dressing percentage and higher abdominal fat by increasing the levels of protein. Lee *et al*.(1990) and Mahapatra *et al.*(1984) also, observed similar results and reported that the diet containing different protein level had no significant difference on eviscerated carcass weight.

Chemical analysis of meat did not show significant difference among experimental groups in moisture, protein, ether extract and ash as shown in table (3). Kirkpinar and Oguz (1995) found that the Moisture content of the carcass decreased with increasing dietary protein concentrations, while the carcass protein content increased with higher dietary protein.

Table (3): Carcass traits and chemical analysis of meat (mean ±SE) of quail as affected by feeding system.

Items	Groups				Sig
	G1	G2	G3	G4	
Starter wks 6 Finisher wks 0		4 2	2 4	0 6	
body weight(g)	190.5±1.22[a]	195.91±1.2 [a]	185.15±1.1[ab]	180.33±1.4[b]	*
Dressing %	72.26±0.03	72.59±.0.09	72.20±0.41	71.55±0.49	ns
Heart %	0.77±0.02	0.81±0.12	0.80±0.1	0.80±0.1	ns
Gizzard %	2.35±0.03	2.72±0.04	2.75±0.04	2.850±0.4	ns
Liver %	2.75±0.14	2.52±0.08	2.52±0.08	2.42±0.12	ns
Edible giblets* %	5.61±1.10	6.18 ± 1.29	6.35±.1.43	6.56±1.45	ns
Abdominal fat %	1.05±.0.9	1.01±.0.7	0.85±0.75.	0.80±0.81.	ns
Moisture %	72.35± 0.39	72.33±0.49	72.20±0.50	72.03±0.54	ns
Protein %	22.12± 1.05	22.02± 1.41	22.01± 1.68	21.64± .07	ns
Ether extract %	3.22± 0.60	3.18± 0.8	3.14± 0.12	3.09± 0.16	ns
Ash %	1. 39± 0.50	1.37± 0.55	1.36± 0.56	1.33± 0.6	ns

[a, b] Means with different letters in the same row are significantly different.
Sig= Significance, n.s= non significant.
*** Edible giblets = liver, heart and gizzard weights.**

On the other hand, Zeweil *et al*.(1993) indicated that water content of carcass decreased, while protein carcass increased with the higher level of protein and protein levels did not affect Ash content. Zelenka *et al*.(1984) who applied feeding with varied crude protein level did not demonstrate significant differences in the breast muscle content or carcass fat content in quail.

Digestibility and nutritive values of the experimental diets.

The digestion coefficients % and nutritive values between of the experimental diets are shown in table (4). The digestibility of DM, OM, CP and CF% showed a significant ($P<0.05$) decreasing among experimental diets with increases protein level.

These results are in agreement with those of Aggoor *et al*.(1997), Ghazalah *et al*.(1988) and Attia (1986) who found that increasing protein levels decreased digestibility of CP and CF%. Hassanen (2004) who found that increasing protein levels decreased digestibility of DM, OM, CP, CF% and nutritive values in quail diets.

From these results it can be concluded that when the diets protein level increases the protein digestibility decreases .This may be due to the maximum utilization of dietary protein at low level of protein intake. It can also seen that as the dietary protein level increases the amount of uric acid increases and consequently the digestion coefficient decreases.

These results also indicated that the increase of protein level in the diets decreased the fat digestibility. Fisher (1935) indicated the relation between the amount of nitrogen ingested and the amount of uric acid. Mitchell (1942) found that when protein intake exceeds the efficiency of protein requirement, its utilization decreases rapidly, since protein can be not stored in body to any appreciable extent.

Table (4): Digestibility coefficients and nutritive values (mean ±SE) of experimental diets.

Items	levels of protein %		Sig
	24% (Starter diet)	22% (Finisher diet)	
Digestion coefficients%			
DM	68.25±2.09 [a]	71.32±2.41 [b]	*
OM	69.56±1.02 [a]	73.05±1.01 [b]	*
CP	81.91±1.24 [a]	82..54±2.45[b]	*
CF	24.45±1.45[a]	26.80±1.63[b]	*
EE	87.12±1.82	87.93±1.42	ns
NFE	86.72±1.12	85.49±1.33	ns
Nutritive values			
DCP%	19.71±0.80 [a]	18.24 ±0.92 [b]	*
TDN%	67.10 ±1.26[a]	66.34±1.52 [b]	*
ME (kcal/kg)	2830±30.21[a]	2794±25.57[b]	*

[a, b] Means with different letters in the same row are significantly different.
Sig= Significance, * (P< 0.05), ns= non significant.

On the other hand, It is worthy noting that there were no significant differences in digestibility of EE and NFE among the different experimental diets.

It is of great importance to note that the results of the digestion trials were coincided generally with growth performance and feed conversion ratio.

Regarding the nutritive values, it is clear that DCP was increased significantly (P<0.05) by increasing of protein level up to 24 % and the vice-versa in case of TDN and ME values.

Biochemical parameters

Serum total protein (TP), Albumin (Al), Creatimine (Cr) and Uric acid (Ur) recorded a non-significant difference between quail groups, while Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) enzymes recorded were values (P<0.05) among the experimental groups (Table 5).

Similar results were noticed by Abdel-Azeem *et al.* (2001) who found that the different protein levels showed significant effect on ALT, AST in quail diets.

On the other hand, recorded Abou-Zeid *et al*.(2000) found that increasing protein level in the diets did not significant different biochemical blood components.

Table(5): Some biochemical parameters in serum (mean ±SE) of growth quail.

Criteria	G1	G2	G3	G4	Sig.
TP (g/100 ml)	3.75±0.08	3.73±0.2	3.69±0.13	3.66 ± 0.06	n.s
Al (g/100ml)	1.74±0.21	1.71±0.18	1.70±0.18	1.68±0.05	n.s
AST (u/ml)	34.48±1.13[a]	32.95±1.18[a]	31.35±0.89[ab]	29.33±1.04[b]	*
ALT (u/ml)	10.01±0.93[a]	9.91±1.16[a]	8.07±0.63 [ab]	7.33±0.91[b]	*
Cr (mg/100ml)	0.85±0.09	0.83±0.05	0.83±0.07	0.81±0.08	n.s
Ur (mg/100ml)	1.58±0.08	1.56.52±0.06	1.53±0.03	1.52±0.05	n.s

[a, b] Means with different letters in the same row are significantly different (P< 0.05).
Sig= Significance, n.s= non significant.

Economic efficiency

Feeding cost and the final body weight are the most important factors involved in the achievement of maximum efficiency of meat production. The effects of different treatments on economic efficiency are shown in table (6).

Results indicated that feed cost was decreased gradually with these the feeding regimen for starter diet versus finisher one.

Table (6): Effect of different levels of protein on the economic efficiency by growing quail.

Items	groups			
	G1	G2	G3	G4
Starter diet	**0-6**	**0-4**	**0-2**	**0**
Feed intake (kg/quail)	0.685	0.356	*0.122*	---
Cost of kg feed (L.E)	1.550	1.550	1.550	--
Feed cost of one quail (LE)	1.062	0.552	0.188	--
Finisher diet	**0**	**4-6**	**2-6**	**0-6**
Feed intake (kg/quail)	--	0. 332	0.575	0707
Cost of kg feed (L.E)	--	1.470	1.470	1.470
Feed cost of one quail (LE)		0.488	0.845	1.039
Total (starter and finisher diets period)	**0-6**	**0-6**	**0-6**	**0-6**
feed cost of one quail (LE)	1.062	1.040	1.033	1.038
Fixed quail (LE)	0.35	0.35	0.35	0.35
Total feed cost of one quail (LE) A	1.412	1.390	1.383	1.389
Body weight (kg)	0. 192	0. 198	0.190	0.186
Price /kg body weight (LE)	15.00	15.00	15.00	15.00
Selling cost /bird.(LE) b	2.880	2.970	2.850	2.790
Net return (A-B) LE/ quail (LE)	1.468	1.580	1.467	1.401
Economic efficiency (A-B) /A x 100	103.97	113.67	106.07	100.86

It is worthy to note that the net return and economic efficiency percentage during the whole experimental period (0-6 weeks) on diets which differ in their feeding periods, the G2 (starter diet only 24% CP for the four weeks and then switched to the finisher diet (22 % CP) for the last 2 week) was recorded the highest values, while the G4 recorded lowest ones (finisher diet only from the 0-6 weeks), followed by G3 and G1, respectively.

In conclusion and application, Based on results obtained in the present study, it could be concluded that moderate protein level in starter diet (24 % CP) for the four weeks and then switched to the finisher diet (22 %CP) for the last two weeks in the growing quail diet had no adverse effect on growth performance and carcass quality, This system of feeding resulted in an improvement in economic profitability efficiency.

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تأثير نظام التغذية على أداء السمان الياباني النامي

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قسم تغذية الحيوان والدواجن – مركز بحوث الصحراء – المطرية - القاهرة

استخدم في هذا البحث عدد ٤٠٠ كتكوت سمان ياباني من الفقس حتى عمر ٦ أسابيع. حيث هدف البحث إلي دراسة *تأثير* نظام التغذية على أداء السمان الياباني .قسمت الكتاكيت إلى أربع معاملات تجريبية متساوية. اشتملت كل مجموعة على ١٠٠ كتكوت سمان (٤ مكررات بكل منها ٢٥ كتكوت).غذيت المجموعة الأولى على عليقه بادئ خلال الفترة التجريبية (٠-٦ أسبوع) و غذيت المجموعة الثانية على عليقه بادئ لمدة أربعة أسبوع ثم غذيت على عليقه ناهي في الأسبوعين الأخيرين و غذيت المجوعة الثالثة على عليقه بادئ لمدة أسبوعين ثم غذيت على عليقه ناهي خلال الأربعة أسابيع الأخيرة بينما المجموعة الرابعة غذيت على عليقه ناهي خلال الفترة التجريبية (٠-٦ أسبوع).الكتاكيت النامية غذيت حتى حد الشبع على علائق بادئ تحتوى على ٢٤ % و الناهي ٢٢ % بروتين خام خلال الفترة التجريبية .العلائق المستخدمة متشابهة في نسبة الألياف الخام والطاقة الممثلة ٢٩٠٠ كيلو كالورى /كيلوجرام.

ويمكن إيجاز أهم النتائج في النقاط التالية :

- أظهرت النتائج أن المجموعة الثانية التي غذيت على عليقه بادئ (٢٤ % بروتين خام) لمدة ٤ أسابيع ثم غذيت بعد ذلك على عليقه ناهي(٢٢ % بروتين خام) في الأسبوعين الأخيرين سجلت افضل القيم في كل من وزن الجسم ومعدل النمو ومعدل التحويل الغذائي بينما سجلت المجموعة الرابعة التي غذيت على عليقه ناهي فقط (٢٢ % بروتين خام) طوال الفترة التجريبية اقل القيم.
- لوحظ زيادة معدل استهلاك الغذاء خلال فترة التجربة زيادة معنويةً (عند مستوى ٥%) حيث سجلت المجموعة الرابعة التي غذيت على عليقه ناهي فقط (٢٢ % بروتين خام) أعلى القيم بينما سجلت المجموعة الأولى التي غذيت على عليقه بادئ فقط (٢٤ % بروتين خام) اقل القيم مقارنة بباقي المجاميع خلال فترة التجربة.
- تحسنت الكفاءة النسبية للبروتين للمجموعة الثانية التي غذيت على عليقه بادئ (٢٤ % بروتين خام) لمدة ٤ أسابيع ثم غذيت على عليقه ناهي(٢٢ % بروتين خام) لمدة أسبوعين بالمقارنة بباقي المجاميع.
- لم يكن هنالك تأثير معنوي بين المجاميع على صفات الذبيحة والتحليل الكيماوي للذبيحة.
- تحقق أعلى عائد اقتصادي للمجموعة الثانية التي غذيت على عليقه بادئ (٢٤ % بروتين خام) لمدة ٤ أسابيع ثم غذيت بعد ذلك على عليقه ناهي(٢٢ % بروتين خام) لمدة أسبوعين حيث سجلت افضل عائد اقتصادي.
- أظهرت معاملات الهضم الظاهرية انخفاضا معنويا (عند مستوى ٥ %) لكل من المادة الجافة ,المادة العضوية, البروتين الخام ,الألياف الخام والقيم الغذائية. بينما لم تتأثر معنويا معاملات هضم المستخلص الخالي من النتروجين و مستخلص الأثير.
- لم يكن هنالك تأثيرا معنويا على محتوى السيرم من البروتين الكلى والالبيومين والكرياتنين وحمض اليوريك.
- ارتفع نشاط إنزيم AST, ALT معنويا (عند المستوى ٥ %) للمجموعات التجريبية.

يمكن التوصية من الوجهة الغذائية والاقتصادية بأفضلية تقسيم مرحلة النمو للسمان النامي إلى فترتين , الفترة الأولى مدتها ٤ أسابيع يتم التغذية خلالها على عليقه بادئ (٢٤ % بروتين خام وطاقة ممثلة ٢٩٠٠ كيلو كالورى/كجم عليقة) و الفترة الثانية يتم تحويل التغذية فيها لعليقه ناهي(٢٢ % بروتين خام وطاقة ممثلة ٢٩٠٠ كيلو كالورى/كجم عليقة) وذلك للأسبوعين الأخيرين , حيث يتحقق بأتباع هذا النظام الغذائي تحسنا إيجابيا على أداء النمو.