Effects on chick performance of low protein diet.

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Introduction

Among birds fed 14 to 20% protein, there was no significant difference in final weight, efficiency of feed utilization or muscle composition. Morality was not affected by any of the treatments (Layfield et al. 1971).

Live weights at 16 weeks of age of birds reared on high protein diets were significantly greater than those of birds reared on low protein diets. More of the food was eaten of the high-than of the low-protein rearing diets (Blair et al. 1970).

During the rearing period, the 11% protein diet caused a delay in sexual naturity but did not depress body gain (Smith, 1967).

Differences in body size are more accurately by skeletal dimensions. Shank length is a good criterion of body size, and in particular during the period of growth (Rizk & El Ibiary, 1960). As the protein content of the diet increase from 13 to 21 percent there is a definite increase of the average efficiency of the utilization of feed for growth (Ewing, 1963).

An adequate or a high protein diet should result in greater resistance than a low protein diet. The addition of protein to the diet resulted in greater mortality than in the absence of protein (Hill, 1964).

Increasing the protein level of the diet results in a progressive decrease in body fat content and increase in body protein-and water (Combs, 1965).

Increasing protein levels of the diet increased significantly maternal carcasses weight, pratein, fat, and water contents (Hassan & Raussel, 1974).

Males contained significantly more than females. Breed and diet both had significant effect on the protein content of the carcass while sex did not. Breed, six, and diet had significant effects on the lipid content of the carcass. The females contained more lipids than the males. The high protein diets appeared to produce a bird with a higher ash content. Sex had no effect on the ash content of the carcass (Hardy et al. 1975). The high calcium diet increased plasma calcium and reduced phosphorus (Shane, 1969).

The present study was designed to research effects of normal and low protein diets on performance of the chickens ant their carcass characters.

Material and Methods

100 chickens of the Egyptian breed "Dandarawi" were compared to 100 of the "S.C. white Leghorn" by feeding a low dietary protein level of 7,79% and a normal dietary protein level of 23.50% in two replicates during the winter season. Chickens were reared in starter batteries from day old till 8 weeks and then they were transferred to intermediate batteries where they were kept until the age of 16 weeks.

The two diets (Tables 1 & 2) as well as the water offered daily ad. bibitum.

The vernier caliper was used to find out the tibia Length, depth and width of the breast, and length of the sternum.

Individual blood samples were drawn-for the chemical analysis-from the Jugular Veins of two birds per replicate. Samples were obtained in previously dried test tubes. Method was used to determine the serum protein was identical to that given by the A.O.A.C. (1965). Calcium in the serum was determined by the method described by Howk, Oser and Summerson (1952). Serum phosphorous was estimated by the method of Fiske and Subbarow (1952). Blood hemoglobin was measured by the means that described by Wells (1962). For this analysis portions of fresh blood was obtained from 6 birds per replicate. For the slaughter test, after 16 hours fasting, 6 birds per replicate were killed at the end of the experiment to find out the carcass percent and to analyse meat and bone. Samples from breast-and thigh meat and tibia were taken in duplicate.

Methods were used in determining moisture, crude protein, ether extract, ash, calcium, and phosphorus of the analysed boneless meat samples and ash, calcium, and phosphorus of the analysed bone samples were all identical to those given by the A.O.A.C. (1965).

Feder values were estimated in the meat according to the method described by Pearson (1970). Texture was calculated according to Tsoladze (1972) durch protein water coefficient and protein water fat coefficient.

The data was subjected to the statistical analysis according to Snedecor (1961).

Results and Discussion

Dandarawi chickens on the low protein level shown higher body weight for all intervals than those of Leghorn. The opposite was usually shown on the normal protein level. The two breeds were more heavy on the normal dietary protein level than on the low protein diet, but Leghorn chicken were relative heavier than Damdarawi (Table 3). The differences between the two breeds and the two dietary protein levels were highly significant (F-test). According to the t-test, the difference between the two dietary protein levels were only significant (Table 4).

All of the parameters in Table 5 except liver-and giblets percentages were higher for Dandarawi on the low dietary protein level than for leghorn. Skeletal measurements of Leghorn on the normal dietary protein level were higher than those of Dandarawi, but Dandarawi had higher blood, liver and giblets percentages than those of leghorn. Except dressing percentage of Dandarawi and blood-and giblets percentages were all of the other parameters on the normal dietary protein level of the two breeds higher than on the low protein diet.

Table 6 gave some correlation coefficients. It was found positive correlations between live-body weight and body measurement, and between live-body weight and carcass weights for the two breeds. Between the body measurement-whit one another-were found too positive correlations.

From Table 7, the two breeds chickens fed the low protein diet were superior to those fed the normal protein diet for all of blood protein, moisture, ash, and calcium of the breast muscles; and ash, and calcium of the leg muscles. The opposit was noted for all of blood calcium - and phophorus; fat, and phophorus of the breast muscles; and moisture, and protein of the leg muscles.

The dietary protein affected the blood protein with correlation of- 0.85 and - 0.73 for Dandarawi and Legharn, respectively, but effected slight positive on the meat protein with correlation of + 0.69 and + 0.53 for Dandarawi and Leghorn, respectively.

The dietary ether extract effected positive on the meat moisture (r= + 0.70 and + 0.89 for Dandarawi and Leghorn, respectively) and meat protein (r= + 0.81 for Dandarawi and + 0.99 for Leghorn). The dietary calcium gave positive correlations with the blood calcium of + 0.93 and + 0.97 for Dandarawi and leghorn, respectively. The dietary phophorus had two effects, the first was positive on the blood phosphorus (r= + 0.62 for Dandarawi and + 0.77 for Leghorn), the seco d was negative on the bone phosphorus (r= - 0.86 & - 0.91 for Dandarawi and Leghorn, respectively). Poor positive correlations were found between blood calcium and bleed phosphorus of + 0.57 and + 0.66 for Dandarawi and leghorn, respestively. A negative correlation was found between blood phosphorus and bone phosphorus of - 0.51 and -0.56 for Dandarawi and leghorn, respectively. Between meat moisture and meat protein was found a correlation of + 0.54 and + 0.99 for Dandarawi and leghorn, respectively.

The fat contents of both breast and thigh of the Dandarawi chicks fed the normal protein diet were higher than those of Leghron (Table 8), therefore, the Dandarawi cooked meat was fatty, tasteful, and very suitable for the egyptian relish especially for the egyptian soup. The opposite was noticed on the low protein diet.

The low protein diet was more economic for the two breeds than the normal protein diet. But Dandarawi chickens were more economic than those of Leghorn on the low protein diet and the opposite was clear on the normal protein diet. The protein efficiency ratio was better for the two breeds on the low protein level, specially for Dandarawi chickens, but the feed efficiency was higher for the two breeds, particularly for the Leghorn chickens, on the normal protein level. The growth measurement was good, specially for Leghorn, on the normal protein diet. Mortality was so high for the two breeds on the low protein diet and for the Dandarawi on the normal protein diet.

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Table 1) Angredients and percentage composition of the experimental diet and control diet which have been offered to the experimental chicks (from one-day old onward) in Winter.

Ingredients	Experim-ental diet	Control diet
Corn, yellow	45	35
Bran, wheat	4	15
Bean, hours	4	15
Blood meal	1	18
Fish meal	1	8
Starch	41.5	5.5
Yeast, dried	2	2
Mineral mixture **	0.5	0.5
Calcium carbonate	0.5	0.5
Vitamin A + D_3 **	0.5	0.5
Calculated values:		
Starch equivalent %	71.95	67.19
K. cal. ME / Kg.	3113	2734
Total protein	7.79	23.50
C / P ratio +	177.61	51.71

* The mineral mixture consisted of the following minerals for each kilogram:

Sodium chloride 900.L01 gm.
Ferrous sulphat 6.077 gm.
Potassium iodide 21.000 gm.
Ferric sulphate 1.980 gm.
Copper oxide 199 mg.
Manganese sulphate 199 mg.
Potassium chloride 999 mg.
Zinc oxide 100 mg.
Magnesium sulphate 199 mg.
Cobalt chloride 63 mg.
Sodium borate 21 mg.

** Vitamin A+D_3, each gram contained 5000 I.U. of Vit. A and 500 I.U. of Vit. D_3.

+ C/P ratio = K.cal. ME/ Ib. feed / 1% dietary protein.

Table 2) Average scores of the chemical analysis of the experimental diet and control diet (on wet weight basis) offered in Winter

Constituents percentage	Experimental diet	Control diet
Crude protein	8.42	22.98
Ether extract	2.30	3.23
Acidity ⁑	0.059	0.114
Crude fiber	3.28	2.99
Ash	3.82	8.95
Calcium	0.21	0.77
Total phosphorus	0.34	0.61

⁑ Gram Oleic acid per 100 gram of sample.

Table 3) Mean live body weight (in grams) of Dandarawi and leghorn chicks reared in Winter and fed the experimental and control diets

Age in week	Experimental diet					Control diet				
	Dandarawi		leghorn		% of leghorn	Dandarawi		leghorn		% of leghorn
	n	$\bar{x}$ ±S.e.	n	$\bar{x}$ ± S.e.		n	$\bar{x}$ ± S.e.	n	$\bar{x}$ ± S.e.	
4	38	91.5 ± 18.45	42	77.8 ± 16.26	117.68	40	177.1 ±20.91	45	191.4 ± 26.76	92.64
8	35	254.8 ± 35.12	39	155.6 ± 51.32	163.71	19	376.1 ±70.41	43	514.1 ± 75.11	72.95
12	25	511.4 ± 52.22	37	292.3 ± 96.29	174.96	15	718.9 ±103.77	43	891.3 ±143.16	80.77
16	23	716.8 ± 77.64	19	503.4 ±113.08	142.39	15	1062.2 ±164.75	40	1201.8 ±224.93	88.74

Table 4) Analysis of variance and t - test of body weights at 8 and 16 weeks of age for Dandarawi and leghorn chicks reared in Winter on the tested and contral diets

Source of variance	At 8-weeks of age				At 16 weeks of age			
	d.f.	S.S.	M.S.	t	d.f.	S.S.	M.S.	t
Total	135	3400448			96	11384667		
Between treatments	1	2432693	2432693**	2.211*	1	7751947	7751947**	2.150*
Between breeds	1	87416	87416**	0.252	1	651155	651155**	0.378
Error	133	880339	6619		94	2981565	31719	

** Highly significant (P < 0.01).

* Significant (P < 0.05).

Table 5) Average scores of different body measurements and dressing percentages of 16-week old Dandarawi and leghorn chicks bred on the experimental and control diets in Winter

Items	Experimental diet		Control diet		Mean
	Dandarawi	leghorn	Dandarawi	leghorn	
Tibia length cm.	9.02	8.07	9.67	10.01	9.19
Breast width cm.	4.22	3.47	4.42	4.97	4.27
Breast depth cm.	8.81	7.72	9.91	10.33	9.19
length of sternum cm.	6.65	6.27	7.85	8.42	7.30
Blood percentage	3.56	2.96	4.02	2.71	3.31
Dressing percentage*	65.55	60.94	61.39	63.20	62.77
Liver percentage	2.48	2.58	2.87	2.63	2.64
Giblets percentage	6.06	6.47	6.74	6.20	6.37

* After bleeding, dry picking the feathers, eviscerating and removing head and legs.

Table 6) Correlation coefficient between live body-weight and body-measurements and between live body-weight and carcass weights of Dondarawi and leghorn chicks reared in Winter +

Trait	Body weight		Tibia length		Sternum length		Breast width	
	D.	L.	D.	L.	D.	L.	D.	L.
Breast depth	+0.77** ±0.08	+0.84* ±0.05	+0.64 ±0.11	+0.76 ±0.08	+0.59 ±0.12	+0.82 ±0.06	+0.29** ±0.17	+0.81 ±0.06
Breast width	+0.51** ±0.14	+0.77* ±0.08	+0.96** ±0.01	+0.66* ±0.10	+0.51* ±0.14	+0.79 ±0.07		
Sternum length	+0.73** ±0.09	+0.83* ±0.06	+0.76 ±0.08	+0.81 ±0.06				
Tibia length	+0.84** ±0.05	+0.93* ±0.06						
Blood weight	+0.78* ±0.08	+0.75* ±0.08						
Dressing weight●	+0.99 ±0.01	+0.99 ±0.01						
Liver weight	+0.63* ±0.12	+0.82* ±0.06						
Giblets weight	+0.87* ±0.05	+0.95 ±0.02						

● After bleeding, dry-picking the feathere, eviscerating and removing head and legs. * P < 0.05

** P < 0.01 D= Dandarawi L= Leghorn.

+ Number of records completed the analysis was 106.

Table 7) Chemical constituents of blood, bone-less meat and bone of 16-week old Dandarawi and leghorn chicks reared on the experimental and control diets in winter

Contents	Experimental diet		Control diet		Mean
	Danda-rawi	leghorn	Dandar-awi	leghorn	
Blood protein g/100ml.serum	4.19	5.46	2.55	1.53	3.43
Blood Hemoglolin g/100ml.blood	9.20	9.55	9.33	8.49	9.14
Blood calcium mg./100ml.serum	8.50	9.00	12.50	12.50	10.63
Blood phosphorus (in-organic) mg./100 ml. serum	2.17	1.92	2.79	2.34	2.31
Breast muscles moisture %	72.86	73.10	72.50	71.87	72.58
" " protein% on dry basis	71.81	80.80	77.53	80.57	72.67
Breast muscles fat% on dry basis	1.13	2.09	2.87	2.74	2.21
Breast muscles ash%on dry basis	2.93	4.42	2.71	2.46	3.13
Breast muscles calcium % on dry basis	7.56	7.74	6.32	7.14	7.19
Breast muscles phosphorus % on dry basis	0.54	1.33	0.35	1.47	0.87
Leg muscles moisture %	70.21	68.23	70.44	72.47	70.34
" " protein%on dry basis	70.62	64.78	71.08	73.66	70.04
" " fat% on dry basis	4.79	11.24	9.71	8.38	8.53
" " ash% on dry basis	2.85	2.83	2.47	2.40	2.64
" " calcium% on dry basis	6.51	9.17	6.30	6.18	7.04
" " phosphorus%on dry "	0.46	1.29	0.57	1.07	0.85
Tibia ash%on dry fatness basis	30.53	27.25	26.56	28.49	28.23
Tibia calcium%on dry fatness basis	9.52	12.69	10.40	11.39	11.00
Tibia phosphorus% on dry fatness basis	6.85	5.89	6.33	6.09	6.29

Table 8) Physical evaluation of the boneless meat of 16-week old Dandarawi and leghorn chicks reared on the experimental and control diets in Winter

Physical properties	Type of meat	Experimental diet Dandarawi	Experimental diet leghorn	Control diet Dandarawi	Control diet leghorn	Mean
Feder value (x)	Breast	3.16	3.58	3.31	3.13	3.30
	Thigh	3.17	3.85	4.05	4.33	3.80
Texture indices:						
Protein water- (xx) coefficient	Breast	0.99	0.83	1.07	1.12	1.00
	Thigh	1.01	0.95	1.01	1.02	1.00
Protein water- (xxx) fat coefficient	Breast	0.97	0.81	1.03	1.08	0.97
	Thigh	0.94	0.82	0.89	0.91	0.89

$$(x) = \frac{\%\ \text{water}}{100 - (\%\ \text{fat} + \%\ \text{ash} + \%\ \text{moisture})}$$

$$(xx) = \frac{\%\ \text{protein}}{\%\ \text{water}}$$

$$(xxx) = \frac{\%\ \text{protein}}{\%\ \text{water} + \%\ \text{fat}}$$

Calculations were estimated on dry basis.

Table 9) Some items which have been affected by varying dietary protein levels, carried out from hatch time till the age of 16-week once for all, for Dandarawi and leghorn chicks reared in Winter

Item	Experimental diet D.	Experimental diet L.	Control diet D.	Control diet L.
Economic efficiency 1)	75.2	50.4	82.6	122.0
Protein efficiency ratio 2)	1.12	0.85	0.40	0.66
Feed efficiency 3)	0.12	0.09	0.14	0.23
Growth measurement 4)	8.22	10.91	7.32	4.41
Mortality rate %	41.0	51.1	62.5	8.9

D. = Dandarawi

L. = Leghorn

1) = gain price x 100/ consumed feed price

2) = gain weight/ protein intake

3) = gain weight / units of starch equivalent

4) = Kilogrammes starch equivalent/ Kilogramme gain weight