

Effects of different dietary protein levels on some ingredients of blood, meat, and bone of 16 weeks old chickens

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Introduction

The physiologically optimum of protein in the diet of the growing chicks is approximately 21% (Titus, 1961). With phosphorus at 0.4% and calcium at 0.76% or less, bone development was not satisfactory, low bone ash values were usually noted. The over all data indicate that 0.7% phosphorus and 1.2% calcium in poult starters are adequate for bone formation, including maximum bone ash (Supplee, 1963).

Calcium and phosphorus in bone ash is remarkably resistant to dietary changes, blood calcium tends to reflect changes, blood phosphorus is relatively sensitive (Ewing, 1963). The present study was aimed to research the contents variation of blood, meat and bone of ash, Ca⁺⁺, P⁺⁺⁺, acidity, and or water holding capacity (WHC).

Materials and Methods:

A total of 412 chickens of aegyptian breed "Dandarawi" were compared with 424 chickens of the S.C. White leghorn in two different seasons, four dietary protein levels and three replicates. Chicks were reared in starter batteries from day old till they were 8 weeks and then they were transferred to intermediate batteries where they kept until the age of 16 weeks. Experimental diets (tables 1 and 2) as well as water were offered daily ad libitum. Individual blood samples were from Jugular veins of two birds per replicate. Samples were obtained in previously dried test tubes for the blood chemical analysis.

Calcium in the serum was determined by titrative method as described by Hawk et al. (1952).

Serum phosphorus was estimated by the method of Fiske and Subbarow (1952).

After fasting of 16 hours, 5 chicks per replicate were killed at the end of the first experiment (Spring) to the analysis of meat (from breast and thigh) and tibia. For the same purpose, 6 birds/replicate were autopsied in the second experiment (Winter). Samples were taken in duplicate. Meat acidity and ash, Ca⁺⁺ and P⁺⁺⁺ of the analysed tibia samples were determined according to the Association of the Official Agricultural Chemists (1965)

Results and Discussion:

It is appear from Tables 3 and that the dietary protein levels have no apparent effect on the serum calcium or phosphorus. But serum calcium in winter was almost higher than of spring, and female have higher values than male chicks. Dandarawi chicks have higher serum calcium than leghorn. Serum phosphorus was in females partly lower than in males, in spring higher values than in winter, and leghorn have higher values than in Dandarawi chicks.

Table 5 explain that no effect of dietary protein levels on meat acidity (as g oleic acid/100 g sample). Differences between sexes are not observed. Leghorn have higher acidity than Dandarawi chicks. Breast meat has higher acidity than thigh meat.

Table 6 show results of water holding capacity percentage (WHC) of the meat. The increasing of dietary protein levels affected negative on WHC of the two meat sorts (white and red). Female chicks have partly higher WHC of the two meat kinds than males. Leghorn have higher WHC than Dandarawi chicks. Red meat-WHC was higher than of white meat samples. It was found a negative correlation between meat WHC and dietary protein levels of 0.93 and 0.98 for Dandarawi and Leghorn, respectively. It was also found that a negative correlation between meat WHC and dietary ash of 0.92 and 0.98 for Dandarawi and Leghorn, respectively. It was shown too a negative correlation between meat WHC and meat moisture of 0.90, between meat WHC and meat ash of 0.91 for leghorn and between meat WHC and meat protein of 0.91 and 0.76 for Dandarawi and leghorn, respectively.

Meat of the Dandarawi chicks of the all different dietary protein levels had gave a strong fishy flavour but did not so clear in the leghorn flesh. This is naturally because of the high level of fish meal in the rations (6-8%).

Chicks on the high protein level gave a very wet faeces than that low protein level.

Tibia ash results are present in Table 7. Increasing dietary protein levels affected partly, negative on the tibia ash of the Dandarawi chicks. Dandarawi female chicks had lower values than males but the opposite was found for the leghorn chicks. The leghorn had higher values than the Dandarawi chicks. Spring chicks showed higher ash percent than that of winter.

From Tables 8, and 9 it was not found a seeable effect of the dietary protein levels on the tibia calcium or phosphorus. The leghorn females had higher tibia calcium and phosphorus than that of the male chicks. The leghorn chicks appeared a higher calcium and phosphorus of the tibia than that of the Dandarawi. Spring chicks showed higher values than that of winter chicks.

% water + % fat

Calculations were estimated on dry basis.

References:

- 1) Association of Official Agricultural Chemists
Official Methods of Analysis, 10th Ed. (1965)
- 2) Ewing, W.R., Poultry Nutrition, 5th Ed. California (1963).
- 3) Fiske, C.H. and Y. Subbarow, J. Biol. Chem. 66 (1952).
- 4) Supplee, W.C., Proceeding Maryland Nutrition Conference For Feed Manufacturers, 14-15 (1963).
- 5) Titus, H.W., The Scientific Feeding of Chickens, 4th Ed. ,
Illinois (1961).
- 6) Hawk, Oser and Summerson, Practical Physiological Chemistry (1952).

Table 1) Ingredients and percentage composition of the experimental rations which have been offered to the experimental chicks (from one day old onward) in Spring and Winter.

Ingredients	Experimental Rations			
	A	B	C	D
Yellow corn	47	40	35	30
Wheat bran	16	15	15	15
Horse bean	15	15	15	15
Blood meal	8	13	18	23
Fish meal	6	7	8	8
Starch	4.5	6.5	5.5	5.5
Dried yeast	2	2	2	2
Mineral mixture *	0.5	0.5	0.5	0.5
Calcium carbonate	0.5	0.5	0.5	0.5
Vitamin A + D ₃ **	0.5	0.5	0.5	0.5
Calculated values:-				
Starch equivalent %	67.98	67.63	67.19	66.69
K.cal. ME/Kg.	2770	2766	2734	2708
Total protein	17.4	20.4	23.5	26.3
C / P ratio +	70.75	60.26	51.71	45.76

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

Sodium chloride	900.10/gm.	Ferrous sulphate	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+D₃, each gram contained 5000 I.U. of Vit. A and 500 I.U. of Vit. D₃ .

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

Table 3) Average blood calcium contents (mg./100 ml. serum) of 16-week old Bandarawi and leghorn chicks reared in spring and winter and fed on different dietary protein levels.

Table 2) Average scores of the chemical analysis of the experimental rations (on wet weight basis).

Table 2) Average scores of the chemical analysis of the experimental rations (on wet weight basis).

Constituents percentage	Experimental rations			
	A	B	C	D
Crude protein	16.97	20.12	22.98	25.91
Ether extract	3.64	3.37	3.23	3.04
Acidity ^x	0.166	0.096	0.114	0.096
Crude fiber	3.34	3.09	2.99	2.89
Ash	8.04	8.51	8.95	9.45
Calcium	0.68	0.73	0.77	0.78
Total phosphorus	0.61	0.60	0.61	0.60

^x Gram Oleic acid per 100 gram of sample.

Table 3) Average blood calcium contents (mg./100 ml. serum) of 16-week old Dandarawi and leghorn chicks reared in spring and winter and fed on different dietary protein levels.

Breed	Season	Sex	Dietary protein levels				Mean
			17.4%	20.4%	23.5%	26.3%	
Dandarawi	Spring	Male	10.50	11.70	11.20	12.70	11.53
		Female	11.50	12.50	11.70	11.20	11.73
		Mean	11.00	12.10	11.45	11.95	11.63
	Winter	Male	12.50	11.50	13.80	13.10	12.73
		Female	12.50	13.70	11.20	12.70	12.53
		Mean	12.50	12.60	12.50	12.90	12.63
Leghorn	Spring	Male	11.20	10.20	10.50	10.50	10.60
		Female	11.40	11.70	11.10	10.80	11.25
		Mean	11.30	10.95	10.80	10.65	10.93
	Winter	Male	11.30	9.80	11.30	11.30	10.93
		Female	11.10	13.20	13.70	12.30	12.58
		Mean	11.20	11.50	12.50	11.80	11.76

Table 4) Average blood phosphorus* contents (mg./100 ml. serum) of 16-week old Dandarawi and leghorn chicks reared in spring and winter and fed on different dietary protein levels.

Breed	Season	Sex	Dietary protein levels				Mean
			17.4 %	20.4 %	23.5 %	26.3%	
Dandarawi	Spring	Male	3.43	2.98	3.05	3.23	3.17
		Female	3.39	2.61	3.09	2.43	2.88
		Mean	3.41	2.80	3.07	2.83	3.03
	Winter	Male	3.08	2.82	2.86	2.82	2.90
		Female	4.57	2.35	2.71	2.67	3.08
		Mean	3.83	2.59	2.79	2.75	2.99
Leghorn	Spring	Male	3.16	3.06	3.83	3.72	3.44
		Female	2.59	3.13	3.59	3.21	3.13
		Mean	2.88	3.10	3.71	3.47	3.29
	Winter	Male	2.22	3.02	1.72	3.63	2.65
		Female	2.76	2.67	2.96	2.29	2.67
		Mean	2.49	2.85	2.34	2.96	2.66

* Inorganic phosphorus.

Table 5) Average meat acidity of 16-week old Dandarawi and leghorn chicks reared in spring and fed on different dietary protein levels (as gm. Oleic acid/ 100 gm. sample).

Type of meat	Breed	Sex	Dietary protein levels				Mean
			17.4 %	20.4 %	23.5 %	26.3 %	
(white meat)	Dandarawi	Male	0.1692	0.2256	0.1692	0.1692	0.1833
		Female	0.1692	0.2256	0.1692	0.1692	0.1833
		Mean	0.1692	0.2256	0.1692	0.1692	0.1833
	leghorn	Male	0.1692	0.1692	0.2256	0.3383	0.2256
		Female	0.2820	0.2256	0.2820	0.2820	0.2679
		Mean	0.2256	0.1974	0.2538	0.3102	0.2468
Leghorn (Red meat)	Dandarawi	Male	0.0564	0.1130	0.0564	0.0564	0.0706
		Female	0.0564	0.1130	0.1130	0.0564	0.0847
		Mean	0.0564	0.1130	0.0847	0.0564	0.0777
	leghorn	Male	0.1128	0.1128	0.0564	0.1128	0.0987
		Female	0.0564	0.0564	0.0564	0.0564	0.0564
		Mean	0.0846	0.0846	0.0564	0.0846	0.0776

Table 6) Average percentage of the water holding capacity (WHC)* of the meat of 16-week old Dandarawi and leghorn chicks reared in spring and fed on different dietary protein levels.

Table 7) Average tibia ash percentage of 16-week old Dandarawi and leghorn chicks reared in spring and winter and fed on different dietary protein levels.

Table 6) Average percentage of the water holding capacity (WHC)^{*} of the meat of 16-week old Dandarawi and leghorn chicks reared in spring and fed on different dietary protein levels.

Type of meat	Breed	Sex	Dietary protein levels %				Mean
			17.4	20.4	23.5	26.3	
Breast (white meat)	Dandarawi	Male	72.34	64.02	72.24	67.12	68.93
		Female	68.51	72.75	77.07	69.60	71.98
		Mean	70.43	68.39	74.66	68.36	70.46
	leghorn	Male	75.61	79.91	73.17	70.97	73.42
		Female	73.76	78.12	79.96	69.44	76.57
		Mean	77.68	75.52	76.56	70.21	74.99
Thigh (red meat)	Dandarawi	Male	77.45	76.79	74.97	82.60	77.95
		Female	85.71	79.57	68.03	70.42	75.93
		Mean	81.58	78.18	71.50	76.48	76.94
	leghorn	Male	87.89	78.18	79.10	69.87	78.76
		Female	83.45	86.64	77.76	81.77	82.40
		Mean	85.65	82.41	78.43	75.83	80.58

$$* WHC = \frac{W_2}{W_1} \times 100$$

Where W_1 = weight of the meat sample, and
 W_2 = weight of the meat sample after the pressing by
 5 Kgs. for 10 minutes between 2 filter papers.

Table 7) Average tibia ash percentage of 16-week old Dandarawi and leghorn chicks reared in spring and winter and fed on different dietary protein levels.

Breed	Season	Sex	Dietary protein levels				Mean
			17.4%	20.4%	23.5%	26.3%	
Dandarawi	Spring	Male	36.90	33.41	30.70	33.41	33.61
		Female	34.71	27.61	21.90	36.19	30.10
		Mean	35.81	30.51	26.30	34.80	31.86
	Winter	Male	28.52	27.88	29.88	21.97	27.06
		Female	21.92	24.55	23.44	23.91	23.46
		Mean	25.22	26.22	26.66	22.94	25.26
leghorn	Spring	Male	27.62	41.09	34.48	38.40	35.40
		Female	31.98	44.31	39.52	39.20	38.75
		Mean	29.80	42.70	37.00	38.80	37.08
	Winter	Male	25.92	20.00	30.16	27.32	25.85
		Female	30.19	29.98	26.81	35.20	30.55
		Mean	28.06	24.99	28.49	31.26	28.20

Table 8) Average tibia calcium percentage of 16-week old Dandarawi and leghorn chicks reared in spring and winter and fed on different dietary protein levels.

Breed	Season	Sex	Dietary protein levels				Mean
			17.4%	20.4%	23.5%	26.3%	
Dandarawi	Spring	Male	16.51	14.92	16.71	18.10	16.56
		Female	16.43	15.82	14.80	15.92	15.74
		Mean	16.47	15.37	15.76	17.01	16.15
	Winter	Male	14.28	11.78	12.05	10.97	12.27
		Female	9.33	9.74	8.74	10.98	9.70
		Mean	11.81	10.76	10.40	10.98	10.99
leghorn	Spring	Male	12.60	18.93	17.41	18.30	16.81
		Female	23.70	22.62	22.82	18.21	21.84
		Mean	18.15	20.78	20.12	18.26	19.32
	Winter	Male	12.31	12.04	11.77	11.09	11.80
		Female	13.07	14.40	11.00	15.26	13.43
		Mean	12.69	13.22	11.39	13.18	12.62

Table 9) Average tibia phosphorus percentage of 16-week old Dandarawi and leghorn chicks reared in spring and winter and fed on different dietary protein levels.

Breed	Season	Sex	Dietary protein levels				Mean
			17.4%	20.4%	23.5%	26.3%	
Dandarawi	Spring	Male	6.30	5.18	6.22	6.81	6.13
		Female	6.20	5.82	5.18	5.12	5.58
		Mean	6.25	5.50	5.70	5.97	5.86
	Winter	Male	5.69	4.86	5.77	5.64	5.49
		Female	5.62	5.68	6.88	5.56	5.94
		Mean	5.66	5.27	6.33	5.60	5.71
leghorn	Spring	Male	4.73	6.80	6.50	7.10	6.28
		Female	8.15	8.01	7.13	7.32	7.65
		Mean	6.44	7.41	6.82	7.21	6.97
	Winter	Male	5.21	5.42	5.08	5.50	5.30
		Female	6.34	6.52	7.10	7.41	6.84
		Mean	5.78	5.97	6.09	6.46	6.07

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 B. PALMFORSS
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 INTRODUCTION
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