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EVALUATION OF ANIMAL PROTEIN SUPPLEMENTS, LOCALLY PRODUCED BY ANALYTICAL AND COMPARATIVE FEEDING STUDIES WITH GROWING CHICKS

By

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Samples from different animal protein sources produced locally were analysed for the summative composition, Ca, P and Silica. Their distribution was as follows : blood meal : 13, meat meal : 13, fish meal : 6, Sardine meal : 6, shrimp meal : 6 and crab meal : 2 samples.

It was found that the variability of all determinations (except crude protein) is high reflecting the inconsistency of the products and calling for more strict censorship and standardization of the procedure of manufacturing. But fish and sardine meals were closer in meeting the standard specifications than the other products.

A comparative feeding study was performed to investigate the nutritional value and growth responses among blood, fish and meat meals when added to a control basal ration of growing local chicks (18 in each group) to the extent of 1.3,2 and 2% respectivily. Results indicated that with blood meal and fish meal, chicks had the heaviest body weight at the end of the experiment at 19 weeks old, blood meal having the highest efficiency. The inclusion of fish and blood meals in chick rations up to 19 weeks of age caused an appreciable increase in the crude protein percentage in the chick carcass over the controls to the extent of 13.51 and 7.76% respectively. The net protein gain in the carsass was 78.6, 100.4, 80.1 and 108.0 g. for the controls, blood, meat and fish meal groups respectively indicating the superiority of the fish meal. Locally produced meat meal proved to be an unsatsfactory supplement, most likely due to ill preparation.

Introduction

The animal protein sources used for feeding poultry were almost exclusively imported until recently many companies in the U.A.R. started to produce these feedstuffs. With this new experience in producing the animal protein sources it is important to guarautee the quality of the product and to bring it up to the standards, officially specified by the U.A.R, Ministry of Agriculture (1968).

El-Ghoneimy (1969), reviewed the chemical composition of the animal proteoin sources and the factors affecting their chemical composition. The The effects of incorporating the animal protein sources in chick rations on the growth, performance, feed utilization and carcass quality were also outlined.

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This research was carried out to study the chemical composition of some animal protein sources (blood meal, meat meal, fish meal, sardine meal, shrimp meal and crab meal) and the growth promoting ability of blood. meat and fish meals when included in a ration of local chicks.

Material and Methods

A total of 46 samples of different animal protein sources were analyzed being distributed as follows : blood meal : 13, meat meal : 13, fish meal :6, sardine meal : 6, shrimp meal : 6 and crab meal : 2. These samples were obtained from different companies on different dates and intervals to study the vaiation in the chemical composition. Determination of moisture, crude protein (CP), ether extract (EE), crude fiber (CF), ash, nitrogen free extractives (NFE), Ca and P. followed the procedures outlined by the AOAC (1965). The british[1] standard official method (1932), was used for estimating Silica. Determination of *in vitro* digestion coefficient of the animal protein source was performed by incubation for 48 hrs at 37°C in 0.05 N H Cl — persin solution to compare the effect of supplementing blood, fish and meat meals.

Seventy two 2-week old local chicks were used. Chicks were randomly divided into 4 equal groups, winghabded and vaccinated intraocularly against New Castle at the age of one day. The basal ration was composed of 66% maize, 24% decorticated cotton seed meal (DCSM) and 10% fine wheat bran. To the basal ration the following ingredients were added : 1.45% bone meal, 0.50% Na Cl, 0.16% Mn Cl_2 and 0.32% vitamin A, D_3 mixture. The basal ration before supplementation contained 73.22% starch value, 18% crude protein and 14.21% digestible protein (claculated as recommended by Abou-Raya, 1967). After supplementation with animal protein sources the following descriptions of rations were :

Group	Description	Digestible protein	Starch value (SV)
Control	Basal ration + 2% DCSM . .	14.72	73.72
Blood Meal . . .	Basal ration + 1.3%blood meal	14.91	73.32
Meat Meal . . .	Basal ration + 2% meat meal	14.76	73.61
Fish Meal . . .	Basal ration + 2% fish meal .	15.04	73.41

1. Feedingstuffs and fertilizers Act., 1932, British Ministry of Agriculture and Fisheries.

The 4 rations were practically iso-caloric and isonitrogenous. Chicks were placed on the experimental rations at the age of 2 weeks. The experiment lasted till the age of 19 weeks. Chicks were individually weighed at biweekly intervals. Records were kept for feed consumption and mortality. Feed and water were offered *ad libitum*.

At the end of the experiment, two pullets and two cockerels from each experimental group were chosen for slaughter test and chemical analysis of their carcass. Details of the slaughter test and procedure for preparing the carcass for chemical analysis followed those used at the Nutrition Section of this Dept. as described by El-Ghoneimy 1969.

Statistical analysis using variance and covariance analysis was followed as outlined by Snedecor (1959).

Results and Discussion

Analytical studies with animal protein sources :

Blood Meal :

The official specifications of the blood meal are : $\geq$ 80.0% CP, $\leq$ 1.0% EE and $\leq$ 2.0% CF. from Table 1 it can be seen that the CP of the blood meal was lower than specified while the EE and CF were higher than the allowable limits. The ash percentage was high as compared to a value of 2.9% reported by Schneider (1947) and 5.40%(khan *et al.*, 1958) or 3. 17% (U.A.R. Ministry of Agric., 1968). The average CP was lower than the value of 82. 8% (Schneider, 1647), 81. 42% (U.A.R. Ministry of Agric., 1968) and 80.1% (Khan *et al.*, 1958). The variability (C%) in all nutrients, except the CP, was rather high ranging between 11.43 and 37.28 indicating the inconsistency of the product. The high silica and ash percentages call the attention to the soiling of the product. For comparison, fresh blood was collected, during the slaughter of a calf, in a clean bucket and dried on a clean concrete surface exposed to the sun. Chemical analysis of this sample was as follows : 9.54% moisture, 84.84% CP, 0.98% EE, 0.78% CF; 0.83% NFE, 3.03% ash, 0.70% silica, 0.02% Ca and 0.31% P. As the range of CP in studied samples was 61.34 — 79.66%, it is clear that producing good quality blood meal is possible on both the laboratory and industrial levels.

Meat Meal :

The standards of this product are : CP $\geq$ 55.0%, EE $\leq$ 10.0% and ash $\leq$ 0.6%. From Table 1 it can be seen that the average CP was lower than the standards while the EE and ash values were higher. Higher CP value of meat meal were reported as 72.20%, — and 61.95% by Kellner (1926), — and the .UA.R. Ministry of Agric. (1968), respectively. Lower ash values were also reported by the same authors.

TABLE 1.—CHEMICAL COMPOSITION OF SOME ANIMAL PROTEIN SOURCES (AIR-DRIED BASIS)

Item	Moisture	CP	EE	CF	NFE	Ash	Silica	Ca	P
	%	%	%	%	%	%	%	%	%
Blood Meal (13 *samples*) :									
Average	13.10	70.02	1.34	4.56	0.75	10.03	5.01	0.70	0.59
S_x . . .	0.85	1.60	0.03	0.48	0.13	0.47	0.23	0.02	0.06
Meat Meal (13 *samples*) :									
Average	8.30	45.67	12.49	4.74	2.45	25.35	3.15	7.43	3.62
S_x . . .	0.71	0.96	2.30	0.62	0.55	1.03	0.33	0.22	0.14
Fish Meal (6 *samples*) :									
Average	7.90	56.17	8.59	1.75	1.40	24.18	2.84	6.57	3.14
S_x . . .	0.60	1.80	0.73	0.30	0.73	1.90	0.39	1.38	0.27
Sardine Meal (6 *samples*) :									
Average	7.95	62.56	5.72	1.27	0.40	22.10	1.01	7.83	3.27
S_x . . .	0.33	1.60	0.40	0.17	0.05	1.85	0.51	1.07	0.22
Shrimp Meal (6 samples):									
Average	9.59	54.89	4.05	2.31	5.19	24.05	1.23	6.31	2.70
S_x . . .	0.65	5.42	0.63	0.72	2.25	3.09	0.42	0.87	0.10
Crab Meal (2 *samples*) :									
Average	9.00	41.74	2.21	8.88	2.66	35.51	0.62	10.06	2.15

Calcium and P values were within the reported ranges (Ewing, 1951). The C% was also high with CP, indicating high variation in the product. However, the CP ranged between 41.96 and 55.56% indicating that certain samples had quality as good as those of the standard. This is also true for the EE.

The low CP and high ash percentages suggest that these samples are "meat and bone meals" rather than meat meals (Schneider, 1947).

Fish meal :

The average CP was slightly lower than the standard ($\geq$ 60.0) while CF were slightly higher ($\leq$ 1.0), being much higher with ash content ($\leq$ 15%). Some nutrients in the studied samples were up to the standard. Kellner (1926) reported lower CP value (52.50%) and higher ash percentage (32.60%) than averages obtained here. Calcium and P value are within the reported values (Day and Hill, (1959).

It was also noted that C% was high in all determniations (except the CP) ranging between 18.73 and 51.76.

Sardine Meal :

Results shows that sardine meal is very close in composition to fish meal. Sardine meal had relatively higher CP, lower EE and CF. U.A.R. Ministry of Agric. (1968) reported sardine meal to contain 50.56% CP and 23.28% ash. Higher CU and lower ash values were also reported (Ewing, 1951). Since the official standard do not include the sardine meal, it may be considered to belong to belong to the fish-meal. The product meets the fish-meal standards except having higher ash percentage. However the ash ranged between 12.94 and 24.83% indicating the possibility of producing sardine meal that satisfies the standards (ash : 15%).

Shrimp Meal :

Comparing the average chemical composition of shrimp meal with that of fish meal reveals that the two products are alike but only differed in the EE being 4.05% in shrimp meal and 8.59% in fish meal. The C% was very high in all determinations (except the P) being from 16.47 up to 76.62. This indicates the inconsistency of the product which appeared to contain variable proportion of the different parts in the starting meterials. It was noted that the average Ca, P and CF here were lower than reportal by Ewing, 1951.

Crab Meal :

Comparing the average of the two samples with that reported by Ewing, 1951, shows that they contain higher CP and P but lower ash and Ca being in favour of protein contents in the local product. More studies are required particularly. if the product could be produced on a large scale.

It may be generally concluded that for all the mealsanalyzed there was high variability in composition of nutrients except with CP. This reflected the inconsistency of the product and calls for more strict censorship and control during their manufacture. It was also noted that fish meals and sardine meals were closer in meeting the standards than other products. This appears to be in favour of fish and sardine meals as promising animal protein sources for poultry nutrition.

Comparative feeding studies with blood, meat and fish meals : Growth and feed efficiency :

From figure 1, it may be seen that the growth response from 2-12 weeks due to the presence of 2% fish meal in the ration was evident and higher than that of other products. Then at 16 weeks of age to the end of the experiment, the growth response due to the 1.3% blood meal was nearly equal to that of 2% fish meal; both of them were better in promoting growth then the other treatments. The final average body weight of the four groups was; 689.0 $\pm$ 47.49, 876.0 $\pm$ 38.06, 725.4 $\pm$ 47.21 and 835.3 $\pm$ 43.14 g. for the control, blood, meat and fish meal groups respectively (Table 2).

TABLE 2.—AVERAGE BODY WEIGHT, SE CONSUMED AND GROWTH MEASURE OF LOCAL CHICKS

Item	Group			
	Control	Blood Meal	Meat Meal	Fish Meal
Initial Average body Wt. . .	46.5	49.5	46.9	44.8
$S\bar{x}$	1.38	1.44	1.46	1.21
Final Average body Weight	689.0	867.0	725.4	835.3
$S\bar{x}$	47.49	38.06	47.21	43.14
SV consumed/chicks, kg. . . .	2.200	2.434	2.270	2.608
Growth measure, kg.	3.598	2.950	3.696	3.302

This showed that at the end of experiment, chicks fed the blood and fish meals were 25..93 and 21.19% heavier ($P < .05$) than the control group. Hawever, the meat meal group had similar final body weight to the control. Similar results were found by Stewart (1959) with fish and meat meal, the

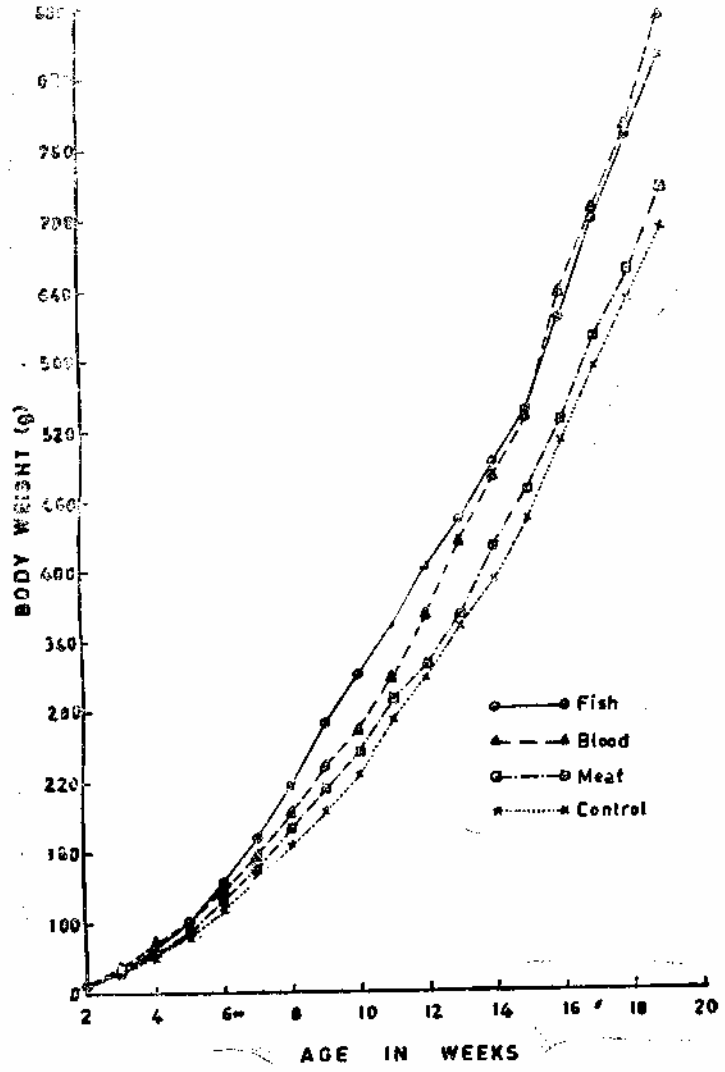

FIG. 1.—Growth of local chicks fed on different animal protein sources.

former being superior The superiority of blood meal here may be attributed to its high lysine content as indicated by Squibl and Braham (1955). But Aboul-Seoud and Ismail (963) found that both blood and meat meal were equal in growth promotion to chicks.

When the regression of live weight (Y grams) on age (× in weeks) was calculated in the four groups, it was found to be highly singnificant, ('t' over, 37). The following linear regressions were obtained and used to differentiate the rates of growth of the control and tested groups :

Groups	Regression	Standard deviation of regression
Control	$\hat{Y} = 37.91 \times -106.49$	0.89
Blood Meal	$\hat{Y} = 47.44 \times -145.29$	1.26
Meat Meal	$\hat{Y} = 39.51 \times -107.68$	0.90
Fish Meal	$\hat{Y} = 46.56 \times -126.61$	0.85

The only significant difference ($P < .05$) was found between the control and the fish meal group being in favour of the fish meal.

Regarding feed consumption as starch value, it was found to be comparable among the control and meat meal group, but higher with blood meal and further higher with fish meal. Compraing the feed efficiency among the group during the growth period, shows that the feed consumption per kilogram growth (growth measure) was 3.598, 2.950, 3.696, 3.302 kg for the control, blood, meat and fish meal groups respectively (Table 2).

This indicates that the blood meal group was the most efficient in converting feed into body gain followed by the fish meal group. The meat meal group was inferior to the control group in this respect.

These results indicated that the used meat meal appeared to be of inferior quality, feed consumption being low associated with poor frowth and least efficiency of feed utilization.,This was confirmed by the 'in vitro' determined digestibility of protein being 82.41 in the meat meal against 94.57 and 89.22% in blood and fish meals respectively It was found to be 76.66% for the protein of the basal ration.

Carcass Composition and chemical analysis :

The percentage of 'the main body' (the live weight excluding blood, feather, viscera and internal organs) varied between narrow limits (16.11 and 65.65%. Table 3), being comparable with the results of El-Kotoury (1959). Therefore the addition of animal protein sources in this study seems to have no appreciable effect on the carcass composition.

TABLE 3.—CARCASS COMPOSITION AND CHEMICAL ANALYSIS CARACASS

	Control			Blood Meal			Meat Meal			Fish Meal		
	Males	Females	Average	Males	Females	Average	Males	Females	Average	Males	Females	Average
Average live body weight,g.	754.0	749.0	751.0	975.0	779.0	877.0	731.0	627.5	679.0	951.5	825.5	888.5
Main body %	65.58	65.62	65.60	61.17	62.45	61.81	61.69	61.11	61.40	65.31	65.65	65.48
Moisture %	73.11	72.32	72.72	71.97	70.87	71.41	71.32	71.69	71.51	69.11	69.26	69.18
Ash %	4.13	4.20	4.17	3.89	4.10	3.99	3.89	3.89	3.89	4.15	4.14	4.14
Crude Protein %	17.16	17.63	17.39	18.41	19.06	18.74	18.14	17.83	17.98	19.81	19.66	19.74
Ether Extract %	5.60	5.85	5.72	5.73	5.97	5.85	6.56	6.59	6.62	6.93	6.94	6.94

Regarding chemical composition of the carcass, the moisture and ash% showed no change due to sex or treatment, the former ranged from 69.11 to 73.11% while the latter from 3.89 to 4.20% (Table 3).

Among the treatment there was no difference between crude protein content of males and females. Therefore C.P. was 17.39 (control) 18.74 (blood meal), 17.98 (meat meal) and 19.74%. (fish meal). It may be seen that the inclusion of fish and blood meal in chick ration up to 19 weeks of age caused an appreciable increase in the crude protein percentage in the chick carcass, over that of control. The percentage increase over the control was 13.51 and 7.76% for the fish meal and blood meal respectively.

But addition of meat meal did not show any improvement in protein content of the carcass.

Regarding the net protein in the carcass related to the average live weight of the tested groups, it was found to be 78.6, 100.4, 80.1 and 108.0 g from control, blood, meat and fish meal groups respectively. Therefore, the over all result was the superiority of fish meal producing the highest net protein gain.

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« تقييم الاضافات الغذائية من البروتين الحيوانى المحضرة محليا بدراسة تحليلها وتجربتها بالتغذية المقارنة مع الكتاكيت النامية »

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الملخص

أجرى تحليل غذائى كامل مع تقدير الكالسيوم والفوسفور والمواد انسليكية فى عينات من البروتين الحيوانى المجهزة محليا تشمل ١٣ عينة من مسحوق الدم ، ١٣ من مسحوق اللحم ، ١٣ من مسحوق السمك ، ٦ من مسحوق البروتين ، ٦ من مسحوق الجمبرى و ٢ من مسحوق الكالوريا .

وقد وجد أن معامل الاختلاف كبير فى كل المركبات الغذائية ما عدا البروتين مما أظهر تباينا كبيرا فى التركيب الكيماوى لهذه المواد مما يدعو لضرورة مراقبة تجهيزها وتمل مواصفات قياسية لخطوات تجهيزها ، وكان مسحوق السمك والسردين يتقاربان فى تركيبها من المواصفات القياسية لهما عن نظيرها من المواد الأخرى .

واجريت تجربة تغذية مقارنة لدراسة القيمة الغذائية واستجابة كل من مسحوق الدم والسمك واللحم عند التغذية للكتاكيت المحلية النامية ، قسمت ٧٢ كتكوتا من عمر اسبوعين الى أربع مجاميع متساوية غذيت كل على عليقة اساسية فقط مع مجموعة المقارنة وعلى عليقة اساسية مع ٣ر١٪ مسحوق دم أو ٢٪ مسحوق لحم أو ٢٪ مسحوق سمك فى المجموعة الثانية والثالثة والرابعة على الترتيب .

ووجد من الدراسة أن مجموعتى مسحوق الدم والسمك كانت كتاكيتها اعلى فى وزنها الحى عند نهاية التجربة فى عمر ١٩ اسبوعا من مجموعتى المقارنة ومسحوق اللحم ، وكانت أعلى كفاءة غذائية مع كتاكيت الدم المجفف حيث كان مقياس النمو لها (معادل النشا اللازم لانتاج كيلو جرام نمو) اقل منه فى المجاميع الأخرى ، كما أن اضافة مسحوق الدم والسمك سببت زيادة فى النسبة المئوية للبروتين فى الذبيحة عنها فى تجربة المقارنة ، وبلغت هذه الزيادة النسبية ٥١ر١٣ ، ٧٦ر٧٪ فى مسحوق السمك والدم على الترتيب ، وكان مقدار البروتين الصافى فى الذبيحة هو ٦ر٧٨ ، ٤ر١٠٠ ، ١ر٨٠ ، ١٠٨ر٠ جم فى كل من مجموعة المقارنة ومسحوق الدم ومسحوق اللحم ومسحوق السمك على الترتيب مبينة تفوق مسحوق السمك على المواد الأخرى ، واظهرت الدراسة أن مسحوق اللحم المجهز محليا غير صالح للاستعمال كبروتين حيوانى لتغذية الكتاكيت وذلك لرداءة طريقة تجهيزه .

* قسم الانتاج الحيوانى « فرع تغذية الحيوان » بكلية الزراعة ـ جامعة القاهرة ـ بالجيزة