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The Effect of Variable Dietary Energy and Protein with Holding the Calorie Protein Ratio, on Growing Chicks

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A number of 190 White Plymouth Rock (WPR) and 221 White Plymouth Rock X Fayoumi (WPR) X F) were involved. Four rations were used having similar calorie-protein (C/P) ratio of about, 120, and a stepwise increase of metabolizable energy (ME) (2172, 2308, 2502 and 2717 Kcal ME/Kg) and crude protein (CP) (17.54, 18.78, 20.96 and 22.87%).

Increasing both ME and CP ap to 2502 Kcal ME and 20.96 % CP with keeping constant C/P ratio, increased livewiehgt gain, rate of growth, feed efficiency for both breeds at 14 weeks old. The highest ME level (2717 Kcal) and CP (22·87%) did not improve gain but slightly improved feed efficiency. Practically the same ME and CP efficiency were found for all treatments and both breeds.

The best net return per bird was recorded with dietary energy and protein levels of 2502 kcal ME 20.96% CP.

There was no marked effect of the treatment on the dressing percentages and the nutritive analysis of differents parts (front and hind parts) for both WPR and WPR X F.

Numerous investigations related the energy requirement to the protein level and suggested that the calorie protein ratio may be used to describe and maintain the proper balance between energy and protein in poultry feeds. Combs and Romoser (1955), suggested an optimum calorie protein ratio of 42 : 1 (Kcal Productive energy "PE" per 1b per 1% crude protein "CP") for starting chicks and 47: 1 in finishing diets. Sunde, (1956) proved that it seemed likely to use a calorie proetein ratio of 45: 1(Kcal PE/1b) with the level of 20% dietary crude protein to obtain optimum feed conversion. The data of Richardson *et al.*, (1956), indicated that, for a protein level of 21.5-23.5% the optimum calorie protein ratio was between 41 and 43 (Kcal PE/1b/1% CP). Vondell and Ringrose (1958), reported that body weight increased as calorie protein ratio increased until a ratio of approximately 45 : 1 was attained. Similar results were obtained by Mraz *et al.*, (1958).

Recent studies proved the relationship between protein level and energy expressed as Kcal metabolizable energy (ME) or productive energy (PE) per kg or lb diet per one percent dietary crude protein. Douglas and Harms (1960) reported that raising the levels of protein and energy, resulted in satisfactory growth and feed efficiency. O'Neil *et al.*, (1962) also found an improvement in growth and feed efficiency for chicks fed higher levels of energy a protein levels of 24 and 28% as compared with 20% protein when 23 levels of PE (1650, 1870 and 2090 Kcal /kg) were used for each level of protein. Optimum results were also obtained by Brggemann *et al.* (1962) with 23.8 % crude protein and 2000 Kcal PE/kg when compared with 17% crude protein and 1600 Kcal/kg with a calorie protein ratio of about 90 : 1. Essary *et al.*, (1964) also found that weekly liveweight and feed conversion during the starting and finshing periods were in favour of birds fed the higher levels of protein and eneergy, having 22% protein and 987 Kcal PE/1b with 44.8 C/P ratio, Essery *et al.*, (1965) also obtained better gowth with 889 Kcal PE/lb (1970 Kcal PE/kg) and 20.77% protein than lower levels of protein and energy having the same ratio.

Little information are available on the influence of diet on dressing percentage and carcass composition at marketing age. Kondra *et al.*, (1960) reported that edible meat percent of eviscerated weight was not affected significantly by the level of energy or protein in the diet indicating, that diet did not alter the bone to meat ratio. Essary *et al.*, (1964) also showed that dressing percentage was in favour of birds fed the higher levels of protein and energy, the meat yield being 1 to 2% higher. The amount of fat deposited in the abdominal region was also about 1% greater for birds of higher levels of protein and energy. Essary *et al* (1965) found that the different levels of added fat and protein to broiler rations from 1 day to 10 weeks of age did not appreciably influence dressing percentage. However, the results of Leong *et al.* (1955) and (1959) reported that as the energy level of the diet was increased, a significant increase in percentage eviscerated yield was obtained.

Increasing the level of protein and energy with holding constant C/P ratio was also studied by some investigators. Leong *et ak*, (1959) reported that ether extract of the carcass for birds fed on rations with constant C/P ratio of 55, Kcal ME/1b per 1% CP (121.3 kcal ME/kg) was influenced by the source and amount of energy rather than C/P ratio. On the other hand, Pre's and Fritz, 1964, found that increasing the levels of protein and energy with a constant ratio hardly affected carcass composition.

The aim of the present investigation was to study graded levels of dietary protein and energy with holding a calorie protein ratio of 120 : 1 (120 Kcal ME/kg diet per one percent dietary crude protein) for growing white Plymouth Rock (WPR) and White Plymouth Rock × Fayoumi (WPR × F) chicks.

Material and Methods

A number of 190 White Plymouth Rock (WPR) ad 221 White Plymouth Rock × Fayoumi (WPR ×F) chicks were involved. They were fed for the first week of age a commercial ration (containing 20% CP) to minimize the influence of the protein in the yolk of the newly hatched chicks. The chicks for each breed were divided into similar numbers (from 46 to 49 chicks for WPR and from 54 to 56 for WPR × F) for four treatments. Each treatment contained two replicates of similar chick numbers. The four treatments using four rations were shown in Table 1 (treatments and rations had the same serial number) having approximately the same C/P ratio but having stepwise increase in both energy and protein levels. The dietary crude protein (CP) levels were

TABLE 1. **percentage composition and proximate analyses of experimental rations**

Ingrediente	Treatment and ration No.			
	1	2	3	4
	%	%	%	%
Yellow corn	25	34.5	45.5	49
Rice bran (extracted)	32	20	8	3
Wheat bran	20	14	8	3
Corn gluten feed	5	5	4	4
Decorticated cotton seed meal	8	13	20	26
sesame seed meal	3	5	5	4
Fish meal	2.5	3	3.5	4.5
Blood meal	1	2	2.5	3
Bone meal	1	1	1	1
Lime stone	1.5	1.5	1.5	1.5
Sodium chloride	0.5	0.5	0.5	0.5
Mineral mix	0.5	0.5	0.5	0.5
Supplements				
Vitamin +	+	+	+	+
Manganese sulphate, p.p.m.	150	150	150	150
Corn oil, kg/100 kg	—	—	—	—
Cost/kg (mils)	23.9	28.4	32.5	37.5
Proximate analyses				
Moisture	9.49	9.49	8.88	8.54
Ash	10.54	9.83	8.34	7.57
Crude fiber	6.85	5.99	5.66	5.01
Ether extract	3.43	4.31	4.16	7.21
N-Free extract	52.15	51.60	52.00	48.80
crude protein	17.54	18.78	20.96	22.87
Kcal ME/kg	2172	2308	2502	2717
C/P ration	123.8	123.0	119.3	118.8

+One kg of vit. A+D_3 per ton of feed (each gram contains 5000 I.U. of vit. A and 1000 I.U. of Vit. D_3).

One kg of Vit. B mix. per ton of feed (each kg contains 8.8 g riboflavin 8.11 g pantothenic acid, 52.9 g niacin and 229.3 g choline chloride).

17.54, 18.78, 20.96 and 22.87% for Rations 1, 2, 3 and 4 respectively. The metabolizable energy (ME) values were 2172, 2308, 2502 and 2717 Kcal/Kg ressectively. They were determined by adiabatic bomb calorimeter and were described in details as recorded by Abou-Raya *et al.*, (1971) and Selim (1971).

The one week old chicks were distributed in two commercial type electric batteries starting from the heavier to lighter birds until similar average liveweights for replicates were obtained. They were brooded in the batteries until 7 weeks old, then moved to floor brooders up to 14 weeks old. The experimental period started in March and finished in June (1966). Feed and water supplied ad libitum. Individual chick weight and feed consumption were recorded weekly during the first 8 weeks of age and biweekly until the end of the experiment. Males and females were distinguished at the fourth week onwards. Eye drops and intramuscle newcastle vaccine were used at hatching and 6 weeks of age respectively. The mortality was recorded whenever it happened.

Slaughter test and meat analyses

At 14 weeks of age a slaughter test for carcass percentages and meat analyses were carried out on 16 cockerels for each breed. Four cockerels were taken as an average for each treatment.

Feed troughs were removed at 5 p.m. until next morning to start slaughtering at 8 a.m. The birds were individually weighed to the nearest gram, slaughtered by cutting the neck and the jugular vien with a sharp knife near the first cervical vertibrum. When complete bleeding was achieved the slaughtered weight was recorded followed by plucking the feather. After the removal of the head, viscera, shanks, spleen, gizzard, liver, heart and reproductive organs, the rest of the body was weighed to determine the dressed weight. The dressed weight included the front part, neck, wings and hind part. The total edible parts included the dressed weight and giblets (heart, empty gizzard, liver) that usually offered for table consumption. While the none edible parts and offals included the head, viscera, shanks, spleen, testicles, and the losses of blood and feathers which were obtained by difference.

The flesh for the front part (chest and neck) as well as hind part (thigh) was separated from bones and weighed out. The boneless meat was minced and well mixed. The left fluids were re-mixed with the minced meat. After taking the fresh samples to determine the moisture, the rest was fried in an aluminium dish (20 $\times$ 10 $\times$ 3 cm) at 70°C overnight in an ordinary electric oven, then samples were taken to determine ash, crude protein and ether-extract. The analysis for feed and dried boneless meat was done according to the methods of the Association of Official Agriculture Chemists (A.O.A.C. 1965).

The physiological fuel value for meat was calculated considering the values in human feeds, 1 g, protein or carbohydrates equal 4 kcal and 1 g fat equals 9 kcal.

Statistical analysis was carried out according to Snedecor (1959) using the appropriate analysis of variance and Duncan Multiple Range Test (D.M.R.T).

Result and Discussion

Growth performance with White Plymouth Rock (WPR) and its cross with Fayoumi (WPR × F)

It could be seen from Table 2, that the initial liveweight of chicks for each breed at one week old was very much similar for all treatments (Tr.) The average final liveweight (T) for WPR at 14 weeks old was 1060.8 ± 18.8, 1126.3 ± 20.7, 1249.4 ± 26.3 and 1240.2 ± 25.5 g for Tr. 1,2,3 and 4 respectively. The corresponding values for WPR × F chicks were 1047.2 ± 21.8, 1042.0 ± 20.8, 1190.2 ± 27.9 and 1173.7 ± 24.3 grams.

An analysis of variance was carried out on liveweight data for both breeds at 4, 8 and 12 weeks old for treatments, breeds, sexes, replicates and their interactions. It was shown that differences between treatments, breeds and sexes were highly significant. No significant differences were observed between replicates at 4 and 8 weeks old. Although a significant difference was shown at 12 weeks old, the "F" value was not so high when compared with other tests. The „F" value calculated (7.62) was approaching that for the significance at 1% level (6.70) . The interaction between treatments and either breeds or sexes was not significant. This indicated that the breed and sex did not respond differently to dietary changes. The interaction between breed and sex was also insignificant, indicating that males and females did not respond differently to breed change.

Duncan Multiple Range Test of analysis (Table 2) was also carried out for the liveweights between treatments at 4, 8 and 12 weeks old. At 4 weeks old, with WPR the difference between Tr. 1 and Tr. 2 was significant and was insignificant between Tr. 3 and Tr. 4. The opposite case was found with WPRxF. A significant difference was found among Tr. 1, Tr. 2, Tr. 3 and also between Tr. 1 and Tr. 4. at the three stages. However, no significant difference was shown for liveweight between Tr. 3 and Tr. 4. Notably, the difference between Tr. 2 and Tr. 4 was insignificant at 8 weeks old, but was significant at 12 weeks.

Fig. 1 and 2 show the relationship between liveweight, ($\hat{Y}$) against age in weeks (T). A linear relationship was obtained and the regression equations were calculated by the method of least squares and data were as follows :

Breed	Regression equation	Standard deviation of regression coeff.	(t) calc.
WPR	$\hat{Y}_1 = 78.85\ T - 64.63$	2.14	36.76
	$\hat{Y}_2 = 85.68\ T - 72.42$	2.21	38.48
	$\hat{Y}_3 = 93.47\ T - 85.51$	2.20	42.42
	$\hat{Y}_4 = 93.97\ T - 96.45$	2.26	41.60

TABLE 2. Average liveweight (g) + S.E. from 1 to 14 weeks of age together with variability and mortality for the WPR and WPR × F chicks

Age in weeks	WPR Treatment No.				WPR × F Treatment No.			
	1	2	3	4	1	2	3	4
1	59.6 ±1.03	59.6 ±0.99	59.9 ±0.93	60.0 ±0.98	50.4 ±0.76	50.5 ±0.70	50.5 ±0.67	50.8 ±0.68
2	93.4	96.6	101.1	102.7	86.4	87.9	89.9	94.3
3	149.7	159.1	173.7	170.9	145.6	148.5	162.6	159.1
4	222.5[c+]	239.8[b]	262.9[a]	251.9[ab]	209.8[b]	218.8[b]	246.3[a]	224.5[b]
5	317.1	333.3	360.4	342.3	286.6	302.7	325.5	310.8
6	398.4	424.8	459.2	436.6	372.7	392.4	421.0	398.7
7	483.3	519.5	569.4	544.5	439.1	463.3	520.7	505.6
8	613.0[c]	663.1[b]	702.9[a]	672.8[ab]	548.2[c]	604.1[b]	645.8[a]	631.0[ab]
10	696.4	759.3	827.8	841.1	696.7	700.9	784.6	762.7
12	871.6[c]	947.3[b]	1022.0[a]	1039.5[a]	855.2[c]	902.6[b]	996.1[a]	995.2[a]
14	1060.8 ±18.8	1126.3 ±20.7	1249.4 ±26.3	1240.2 ±25.5	1047.2 ±21.8	1042.0 ±20.8	1190.2 ±27.9	1173.7 ±24.3
Variability %								
Initial . . .	12.1	11.5	19.7	11.1	11.3	10.4	9.9	9.7
Final . . .	12.1	12.7	14.3	13.8	15.0	15.0	16.7	15.2
No. of chicks								
Initial . . .	49	48	47	46	56	56	55	54
Final . . .	47	48	46	45	52	56	51	54
Mortality %	4.1	0.0	2.1	2.2	7.1	0.0	7.3	0.0

+ Subscribts are statistically significant ($P < 0.05$) according to Duncan Multiple Range Test (D.M.R.T.).

Breed	Regression equation	Standard deviaion of regression coeff.	't' calc.
WPR × F	$\hat{Y}_1$ 78.20 T — 81.14	2.00	39.16
	$\hat{Y}_2$ 79.66 T — 74.65	2.05	38.77
	$\hat{Y}_3$ 90.14 T — 96.05	2.10	42.86
	$\hat{Y}_4$ 89.27 T — 101.86	2.60	34.37

The 't' test was carried out on the differences among the regression coefficients (weekly rate of growth) for the four treatments.

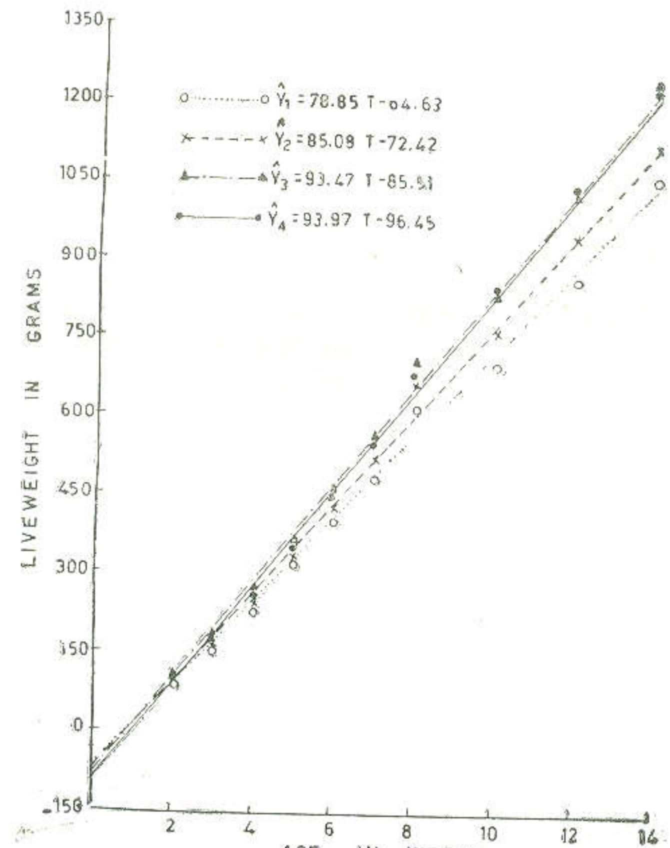

Fig.1-Relationship between liveweight and age of growing WPR chicks fed different ME and CP levels with holding C/P ratio level

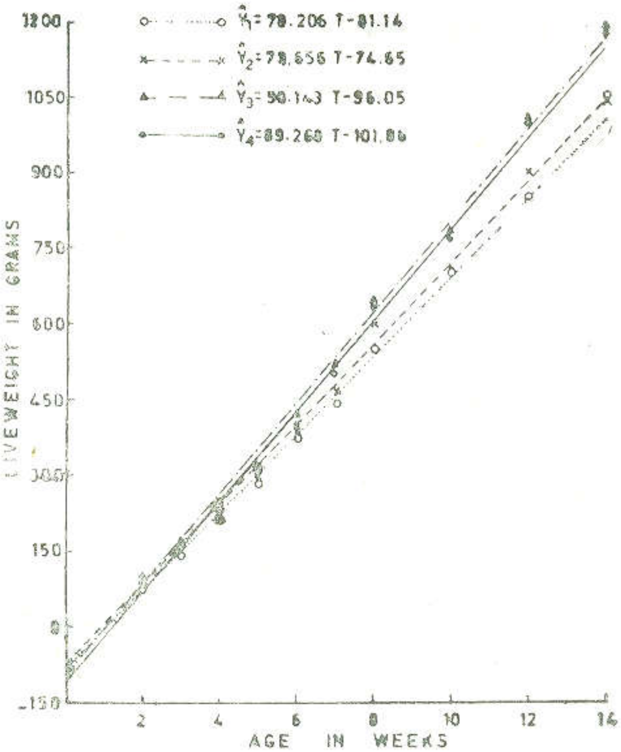

Fig. 2. Relationship between liveweight and age of growing WPR × F chicks fed different ME and CP levels with holding C/P ratio level

Results were concurrent with those obtained when comparing differences in liveweight, using Duncan Multiple Range Test at 12 weeks old as indicated before. Investigation of differences among treatments appeared to be more reliable when using regression coefficients, including the whole growth data, rather than using the liveweight figures at certain ages.

As indicated from the growth data of WPR and WPR × F chicks, liveweight increased with the increase of protein level from 17.54 to 20.96 and metabolizable energy leves from 2172 to 2502 Kcal per kg diet. However, the higher level of 22.87% CP and 2717 Kcal ME for Tr. 4, produced slighlty less liveweight than the lower levels of 20.96% CP and 2502 Kcal ME for Tr. 3. These rations had a constant calorie protein ratio of about 120 (Kcal ME/kg per 1% CP). Within these limits the consistent trend in improvement of liveweight was observed for those chicks being fed increasing levels of protein and energy. The results were in good agreement with those obtained by Hill and Dansky, (1954), Biely and March (1954) Combs and Romoser (1955) Leong *et al.*, (1955) Matterson *et al.*, (1955) and Sunde (1956). The reports of Vondell and Ringrose (1958) Mras *et al.*, (1958) O'Neil *et al.*,

(1962) and Essary *et al.*, (1954) proved that increasing protein and energy levels improved growth. These workers also showed that optimum growth was obtained at a C/P ratio ranging from 40 to 45 (Kcal PE/1b per 1% CP). Assuming 70% utilization from ME/kg (Fraps 1946), this ratio would range from 126 — 141 (Kcal ME/kg per 1%) CP. The lower limit was approaching the ratio used in Rations 3 and 4.

It could concluded from the growth study that with the C/P ratio level of about 120 (Kcal ME/kg diet per 1% CP), two levels of energy and CP could be used to produce best results. The two levels are 20.96% CP along with 2502 Kcal ME/kg feed (Tr. 3) and 22.87% CP along with 2717 Kcal ME/kg feed (Tr. 4). It was obvious that raising the protein level above 17.54% (Tr. 1) to 20.96 and 22.87% (Tr. 3 and 4) resulted a significant improvement in livewieght. These results were in good agreement with those reported by Zivkovic *et al.*, 1962 Wisman and Siegel (1963) and Summers *et al.*, (1965) who found retardation in gain by seducing the protein level than 19% CP.

Concerning the energy, the present results indicated that the optimum range of ME for growth was 2502-2717 Kcal ME kg, being within the range of 800-850 Kcal PE/lb (or calculated 2514-2766 Kcal ME/kg) recorded by Robertson *et al.*, (1948) Panda and Combs (1950) and Essary *et al.*, 1965). These workers used a CP level of about 20%. Therefore, the present study indicated the importance of the relationship that exists between dietary protein and energy levels and their effect on the growth and liveweight the experimental chicks. However, further work is needed to find out any probable managerial as well as other nutritional factors are affecting growth of chicks.

Variability for initial and final liveweights

As indicated in Table 2, the variability was slgihtly lower with each breed at the initial weight than at the final weight. The results indicated generally that no marked effect on variability was observed among treatments. This would be in agreement with those of Mraz *et al.*, (1958). Their data showed that varying the levels of protein from 7.5 to 30% and productive energy from 992 to 1943 Kcal per kg diet, did not affect the variability

Mortality among treatments

The data in Table 2, showed that mortality rate ranged between 0 0 and 7.3% among treatments for both breeds. The rate was low being satisfactory and indicating no treatment effect on mortality.

Efficiency of feed utilization for WPR and WPR × F chicks

Feed consumption (Table 3) for both breeds was almost similar, except for Ration 4 with WPRxF, the feed consumption was impaired at the highest energy and protein level. The average (daily feed intake per chick per day during the whole period was higher (ranging from 6.4 to 11.3%) with Tr. 1, 2 and 3 than with Tr. 4. Seemingly, the average feed consumption per chick per day was similar to chicks fed on rations 1,2 and 3 having from 2172 Kcal ME/kg and 17.54% CP to 2502 Kcal ME and 20.96% CP. Increasing the dietary energy and crude protein to 2717 Kcal ME/kg and 22.87% CP tended to reduce feed consumption. These findings were in agreement with those reported by Hill and Dansky (1954), Griminger *et al.*, (1957) and Vermeersh and Vanschoubrock (1968).

There was a stepwise increase in feed efficiency (Table 3). from Tr. 1 to Tr. 4 for both breeds. This increase was higher (ranging from 3% to 26%) for Tr. 2, 3 and 4 than for Tr. 1. with both breeds. These results were in full agreement with those obtained by Leong *et al.*, (1959). Douglas and Harms (1960) Essary *et al.*, (1964) Marion and Woodroof (1965) Vermeersch and Vanschoubrock (1968) who indicated that the efficiency of feed utilization increased with the increase of energy or both energy and protein levels in the diet. Marz *et al.*, (1958) using a C/P ratio of 45 (PE/lb per 1% CP or 141 Kcal ME/kg per 1% cP) and three levels of cP (10, 15 and 20%) found an increase in efficiency as CP and energy levels increased, being 0.20, 0.25 and

TABLE 3. **Daily feed ME and CP consumption and their utilization during the whole experimental period (1-14 weeks old).**

Treatment No.	WPR.				WPR × F			
	1	2	3	4	1	2	3	4
Feed intake, g	53.5	54.2	53.3	50.1	52.5	50.6	51.3	46.9
Feed efficiency								
Gain in kg/kg feed .	0.204	0.216	0.244	0.258	0.209	0.215	0.243	0.263
kg feed/kg gain . . .	4.902	4.630	4.098	3.876	4.785	4.651	4.115	3.802
Energy intake, kcal. . .	116.3	125.2	133.4	136.0	113.3	116.8	128.4	127.3
Protein intake, g . .	9.39	10.19	11.18	11.45	9.15	9.51	10.75	10.72
Efficiency of ME, kg gain/Mcal. kg . . .	0.094	0.094	0.098	0.095	0.096	0.093	0.097	0.097
Efficiency of CP, kg gain/kg CP	1.165	1.151	1.165	1.128	1.194	1.147	1.160	1.151
Selling cost of gain/ bird, mils	375.6	400.0	446.1	443.6	373.8	371.8	427.4	421.1
Feed cost of gain bird, mills.	117.2	140.4	158.2	170.8	113.9	131.1	152.3	159.3
Return/bird, mills . .	258.3	259.6	287.9	271.8	259.9	240.7	275.1	261.8

0.36 kg gain/kg feed respectively. It seemed that chicks fed Ration 4 (Tr.4) reduced their feed consumption to balance their energy and protein intakes. Generally, birds had a high containing ME and CP diet should have chance for getting their needs of these nutrients (Hill and Dansky 1954).

Efficiency of energy and protein utilization

The energy and protein intakes gradually increased (Table 3) from Tr.1 to Tr.3, while their intakes were nearly similar for Tr.3 and Tr.4. for both breeds. It is worth noting that despite of the stepwise increase in feed efficiency with increasing dietary ME and CP, the efficiency values for ME and CP were moreless similar for all treatments. These results were in good agreement with those reported by Matterson *et al.*, (1955) Donaldson *et al.*, (1957) and Maraz *et al.*, (1958) who found an improvement in feed efficiency by increasing the levels of ME and CP in the rations, but they got no noticeable improvement in the efficiency of energy and protein utilization. It could-be concluded that units of ME and CP intakes in the diet appeared to produce comparatively equal gain irrespective to their in the diet.

Net return per chick for experimental treatments

The net return per chick (difference between the selling price of gain and its feed cost per bird), the results (Table 3), with both reeds indicated that Ration 3 Produced the highest return that other rations. Rations 1 and 2 produced the lowest return being about 10% lower than with Ration 3. It was clear from the study that more profit could be gained from a ration higher in energy and feeding cost.

Slaughter test

It could be seen in Table 4, that despite of different average liveweight for both breeds, the percentages of carcass parts of liveweight were practically similar to comparable parts for different treatments. Although the liveweight was lower with WPRxF than with WPR, the dressing percentages of comparable parts were generally similar for all treatments. It was clear from these results that raising dietary protein from 17.54 to 22.87% and ME from 2172 to 2717 Kcal/kg holding a constant C/P ratio of about 120 : 1 did not have any appreciable effect on the dressing percentage for different parts of liveweight. The results for both WPR and WPRxF cocks appeared to be in good agreement with those reported by Kondra *et al.*, 1960, Marion and Woodroof (1965) and Essary *et al.*, (1965) Their data proved that dressing percentages were not markedly influenced by varying the dietary protein and energy.

Results for each treatment with both WPR and WPRxF cocks for the average proximate analysis and calculated physiological fuel value are illustrated in Table 5. The analysis of variance for each breed alone for both front and hind parts indicated that majority of cases, showed no effect of the treatment on the proximate analysis and the physiological fuel value per 100g fresh boneless meat. The effect of the treatment on the average of fat and the fuel value was only significant with the boneless hind part of WPR. When

TABLE 4. **Dressed weight and dressing percentage of liveweight for WPR and WPR × F cocks**

	Treatment							
	1		2		3		4	
	g	%	g	%	g	%	g	%
	WPR							
Liveweight *	1146.3	100	1285.0	100	1421.3	100	1439.0	100
Total edible proteins	799.9	69.8	903.6	70.3	1014.0	71.3	1011.3	70.3
1. Dressed Wt.	744.5	64.9	838.9	65.3	950.8	66.9	943.8	65.6
2. Giblets	55.4	4.8	65.0	5.1	60.2	4.2	67.5	4.7
Total boneless meat	616.3	53.8	676.6	52.7	783.7	55.1	764.3	53.1
	WPR × F							
Liveweight *	1126.5	100	1120.2	100	1267.5	100	1267.2	100
Total edible proteins	785.9	69.8	795.5	71.0	891.9	70.4	890.8	70.3
1. dressed wt.	733.9	65.1	743.7	66.4	837.8	66.1	835.0	65.9
2. Giblets.	52.7	4.6	52.3	4.7	54.1	4.3	55.8	4.4
Total boneless meat.	601.0	53.5	605.1	54.0	680.9	53.7	681.5	53.8

* Average data of 4 birds having the nearest average of experimental cocks.

using Duncan multiple range test with the hind part of WPR (Table 5), the significant difference with fat was only between Tr. 3 and each of the other three treatments. The results for fuel value on dry matter basis were parallel to those for fat, but with fuel value on fresh basis, the difference was only significant between Tr. 3 and Tr. 4.

Therefore, the result generally, indicated that increasing energy and protein levels (keeping a C/P ratio about 120), appeared not to affect the proximate analysis and fuel value of boneless meat. These data were confirmed by those for Pres and Fritze (1964).

TABLE 5. The average percentage proximate analysis and calculated pysiological fuel value for fresh boneless meat of front and hind parts for WPR and WPR × F cocks *at 14 weeks old Expt. 1.

Treatment No.	Moisture %	CP N× 6.25%	Ether Extract %	Ash %	Calcul. fuel Fresh	Value/kcal DM
			WPR			
			A — Front part			
1	73.15	22.48	2.23	1.14	1190	4421
2	73.54	22.89	2.42	1.15	1134	4281
3	71.76	22.64	4.41	1.19	1302	4602
4	73.70	23.14	2.01	1.15	1106	4197
			B — Hind part			
1	74.53	20.62	3.76 b	1.09	1163 ab†	4561 b
2	75.18	20.43	3.27 b	1.12	1112 ab	4476 b
3	72.60	20.26	6.10a	1.04	1359 a	4949 a
4	75.42	20.80	2.67b	1.11	1072 b	4346 b
			WPR × F			
			A — Front part			
1	72.64	23.43	2.68	1.25	1179	4308
2	74.12	22.79	1.98	1.11	1089	4207
3	75.58	24.15	2.12	1.15	1156	4217
4	72.71	23.47	2.72	1.10	1183	4332
			B — Hind part			
1	74.76	20.45	3.71	1.08	1152	4563
2	75.64	20.75	2.52	1.09	1058	4335
3	73.95	22.20	2.74	1.11	1135	4352
4	74.09	21.51	3.33	1.07	1160	4469

* Average data for four cocks.
+ Treatments having different subscripts are statistically significant ($P < 0.05$).

It was clear (Table 5) that the boneless meat of the hind part contained higher fat and fuel values on dry matter basis, but lower protein than those for the front part with both breeds, such differences we e highly significant (P 0.01). These results were in good agreement with those recorded by Kotou y (1959) and Selim (1964).

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تأثير تغيير كل من طاقة بروتين الغــذاء مع تثبيت النســبة بينهما على الكتاكيت النامية

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شملت هذه التجربة على عدد ١٩٠ كتكوت بليموث ابيض ، ٢٢١ كتكوت خليط البليموث الابيض مع الفيومى قسمت الى اربعة معاملات وغذيت على اربعة علائق لها نفس النسبة بين الطاقة والبروتين $\frac{\text{الطاقة (ط)}}{\text{البروتين (ب)}}$ حوالى ١٢٠ ومتدرجة فى الزيادة لكل من الطاقة الممثلة (٢١٧٢ ، ٢٣٠٨، ٢٥٠٢ ، ٢٧١٧ كيلو كالورى / كجم) والبروتين الخام (١٧٫٥٤ ، ١٨٫٧٨ ، ٢٠٫٩٦ ، ٢٢٫٨٧٪)

وتتلخص النتائج فيما يلى : ـ

زاد الوزن الحى ـ ومعدل النمو والكفاءة التحويلية للغذاء لكلا النوعين من الطيور بزيادة كل من الطاقة الممثلة والبروتين الخام الى مستوى ٢٥٠٢ كيلو كالورى و٢٠٫٩٦٪ بروتين خام مع ثبات النسبة بين الطاقة والبروتين . ولم يظهر تحسن فى الزيادة فى الوزن بارتفاع مستوى الطاقة الى ٢٧١٧ كيلو كالورى فى حين ظهر تحسن طفيف فى الكفاءة التحويلية للغذاء وقد وجد من الناحية العمية أن كلا من الكفاءة التحويلية للطاقة والبروتين متشابها بين المعاملات المختلفة لكلا النوعين وكان أحسن عائد اقتصــادى للطيور التى تغذت على عليقة بها ٢٥٠٢ كيلو كالورى ، ٩٦ ، ٢٠٪ بروتين خام .

كما أنه لم يوجد أى تأثير ملحوظ للعلائق المختلفة على نسبة التصــافى والتحليل الغذائى لاجزاء جسم الكتكوت المختلفة (الورك والصــدر) لكلا النوعين من السلالات المختبرة .