CALORIE-PROTEIN RATIO IN THE FEEDING OF BROILERS

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By

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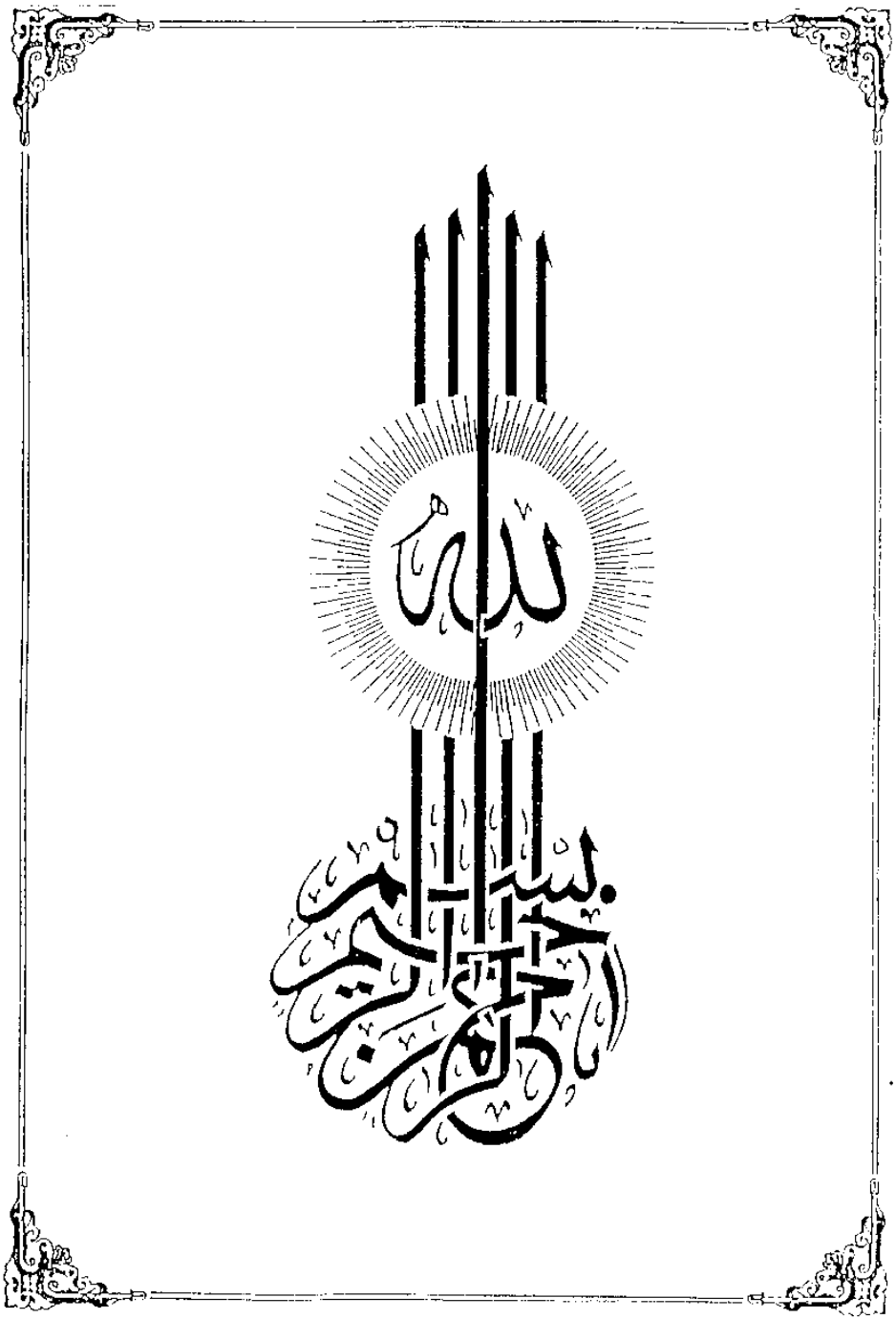

C O N T E N T S

INTRODUCTION

High efficiency rations are used in the feeding and finishing of broilers for the achievement of maximum growth response. This is always true when the ingredients are readily available and with reasonable prices under certain conditions, however this is not always the case.

When economical efficiency is taken into consideration the highest levels of nutrients might not be the most economical for the reason that the extra responsee of such high effeciency rations may not cover the high feeding costs.

This study was carried out in this respect and was meant to be a comparative economical illustration to show the most profitable nutritional levels to be used in the feeding of broilers irrespective of maximum weight gain.

Since protein concentrates specially those of animal origin are generally, the most expensive ingredients of poultry rations, three levels were used in this study to contribute different calorie : protein ratios maintained between gross protein value units and productive energy content per Kg. ration. The rations formulated, the prices of ingredients and the weight gain of chicks were recorded in the hope of finding the least cost weight unit produced.

Numerous investigations related the energy requirements to protein level and suggested that calorie protein ratio may be used to describe and maintain the proper balance between energy and protein in poultry diets, (Zivkovic et al., 1963 and Hizikuro & Morimoto, 1963).

Since the calorie : protein ratio was found to vary according to the fittness of the amino acid pattern to fulfil all the birds requirements in the physiological phenomenon of growth (D'Mello & Lewis 1971) it was necessary therefore, to maintain this ratio between a protein qualititative rather than quantitative value. Productive energy values, despite the criticism of Hill & Androson (1957) may still be considered the best measure of the true value of poultry rations (Baldini, 1951).

Accordingly, the standardisation of poultry diets by the calorie : protein ratio maintained between G.P.V.Us and P.E. content/Kg. ration seemed to be the most practical method as shown by Anwar (1970-a).

1- Total Protein and Energy Intake.

The influence of dietary energy on the growth response of chicken was studied by Frank et al., (1958).

These authors reported that the efficiency of energy utilization was greatest with diets that provided the highest level of protein for the same energy intake. On the other hand, the work of Lane and Bisely as summarised by Swift (1955), showed that protein supplemented with certain amino acids permitted a wider and nearly constant calorie:protein ratio than a poorer unsupplemented protein.

These findings were observed with the energy content of the diets presented as metabolizable calories. The same trend was observed when the energy contents were presented in terms of productive calories (Anwar, 1957-b).

2- Levels of calorie:protein ratio for growth.

The work of Scott et al. (1955) concerning the calorie:protein relationship of rations used for newly hatched chicks suggested the ratio per Kg. ration to be 88.2 Cal. of productive energy for each 1 per cent total protein while Leong et al. (1959) reported the ratio to be 121.5 : 1 % for the two values in view. These authors pointed out that the better the amino acid balance is, the higher the number of productive

calories needed [illegible] protein. On the other hand maximum growth [illegible] low energy diets [illegible] (Hill & Dansky, 19[illegible]4). [illegible] capable of balancing for its [illegible] for its protein requirements [illegible] (19[illegible]0).

All the [illegible] pointed out the variability in [illegible] obtained between metabolizable [illegible] total protein.

C- Gross Protein Value Units_G.P.V.U.

The G.P.V. [illegible] was reported [illegible] (1947-b) and was explained by the author to [illegible] amount of supplementary protein that would stimulate as much growth as 3 % (g.) casein protein assigned the G.P.V. of 100.

In an attempt to maintain C/P ratio between P.E. content and a protein quality value in chickens ration, three protein levels were used but contributing the same number of G.P.V.U. (30 units/1 Kg.) in isocaloric rations containing 1800 K.cal. PE/Kg. Since no significant differences in chick growth were recorded up to 8 weeks of age, it was concluded that a more

constant calorie:protein ratio could be achieved when it was maintained between productive energy and G.P.V.Us per Kg of feed irrespective of the total protein in the diets of growing Fayoumi chicks.

The same results were achieved in semi practical isocaloric rations (Anwar et al., 1971) containing Rape seed meals with different quality when they were adjusted to the same number of G.P.V.Us /Kg. using purified ingredients such as casein, tallow and fibres.

The application of calorie:protein ratio maintained between P.E. content and G.P.V.Us made it possible to measure the aggregated quality of protein mixtures and the incorporations of low quality protein concentrates with levels which would not depress growth (Anwar, 1970-a). The observations of this author illustrated the possibility of using the two above mentioned values in computing for least-cost practical poultry rations. Incorporation of G.P.V.Us instead of total protein content in computing for least-cost rations involved a new precautionary measure for the formulation of more efficient rations.

On mathematical basis, observation in view was found practical to use for turkey diets as well.

MATERIALS AND METHODS

A- MATERIALS

1- Experimental chicks.

Day-old chicks vaccinated against Newcastle disease were used in the study. Three strains : Dokki 4, Fayoumi and Fayoumi GG. (Heat strain) chicks, supplied by the Ministry of Agriculture were compared with a standard broiler strain (Nichols) for economical efficiency of meat production. The first strain came from Inshass Farm while the other two came from Fayoum Farm.

2- Experimental Rations

High efficiency rations containing 2000 productive calorie/Kg. but having a different number of G.P.V.Us for each (tables 1,2, and 3) were tested. The three levels of G.P.V.Us tried out were 30, 35 and 40 units/Kg. ration ± 0.25 unit at the most (App. 1). The energy sources were mainly the same with minimum changes (App. 2) while the protein concentrates incorporated were adjusted to give the required number of units.

The ingredients used in the formulation of the experimental rations used were purchased from the common

market representin. local products readily available at all times. The vitamins & minerals and antibiotics mixtures were provided by Pfizer Co. Cairo and were mixed to give the recommended levels (App. 3).

The analytical data needed were carried out according to the Official Methods of Analysis (1955) and are given in App. (3).

3- Prices

The prices of the ingredients used were in general those given by the governmental price-list for poultry feeds except in few cases where it was necessary to buy some ingredients from the free market. The prices are given in App. (4).

B- METHODS

1- Biological Evaluation of Protein Concentrates

Gross Protein Value

The method described below (Carpenter, Ellinger and Shrimapton, 1955) is a modification of the original (Heiman, Carver and Cook, 1939) but adapted to feeding-stuffs readily available in the market and elastic enough

to be used for [illegible] widely in fibre [illegible], 1957-a).

Two hundred day-old Dokki 4 cockerels were brought from Inshass Poultry Farm, Ministry of Agriculture, and housed in batteries placed in an electrically heated room. The temperature in the room was adjusted manually to give the required degree.

a- Depletion period :- The chicks were fed the depletion diet (App. 5) which contained 8 % protein contributed from common energy sources only, up till 14 days of age.

b- Randomisation :- When the chicks were 14 days of age they were individually weighed to the nearest gram discarding the extremes (heaviest and lightest) to leave a range of 5 gm. difference. The birds were then distributed at random into groups of 10 each, with a final weight difference of not more than 2 g.

c- Experimental period :- The chicks were fed the test diets for another 14 days. The control and casein diets were included for comparison. The test diets for meat and fish meals were constructed as given in App. 5

to contain 11 % total protein of which 8 % were contributed from the depletion diet and the rest by the concentrate.

Four groups were fed on each test diet for the whole experimental period when the chicks were weighed and averages of both weight and feed consumption were recorded.

d- Calculations :- The calculations were carried out as in the new method of Anwar (1960) but with the control and casein diets included for comparison as mentioned in the simplified technique of G.P.V. (Anwar, 1961).

1- Mean weight gain g.

2- Protein consumed g.

3- Supplementary protein consumed g.

4- Gain/g of protein consumed "Control".

5- Gain/g of test protein consumed.

6- Gain/g of casein protein consumed.

7- Gross protein value = $\frac{(5-4)}{(6-4)} \times 100$

2- Feeding Experiments

Three feeding experiments were designed to test three strains of chicks : Dokki 4 , Fayoumi and Fayoumi GG with the aim of achieving the best economical efficiency when three levels of G.P.V.Us were fed.

Exp. 1.

300 day-old chicks, 10[illegible] of [illegible] strain were randomized into groups of 25 chicks each ± 3 g. The groups were distributed into wire batteries for 3 weeks when they were transferred to floor pens till the end of the experimental period (8 weeks).

1 : 1 cracked corn and wheat was given for the first two days then Ration 1 which contained 30 G.P.V.Us and 2000 Kcal. P.E./Kg. up till 8 weeks of age.

The chicks were weighed and feed consumption was recorded weekly. The feed efficiency was calculated as the amount of feed in grams needed for the production of one gram growth. The economical efficiency was also calculated, but as the feeding price/unit produced since all the other items of costs were essentially the same under these experimental conditions.

Exp. 2

The same number of chicks and the three strains in view were tested in the same manner as in Expt. 1 except for feeding level, where Ration 2 which contained 35 G.P.V.Us and 2000 K.cal. P.E./Kg was fed.

Expt. 3

In this experiment ration 3 containing 40 G.P.V.Us and 2000 K.cal. M.E./Kg was only fed to Dokki 4 since its both feed and economical efficiencies were still the best (lowest).

Calculation of the Gross Protein Value Units

a- In Kg supplementary protein concentrate .

1. Total protein content in Kg. concentrate (g.)
2. Gross protein value (G.P.V.) of concentrate.
3. G.P.V.Us /Kg = (1) x (2) -÷- 3 x 100

where the unit is equal to 3 g. casein protein assigned the gross protein value of 100.

b- In Kg. diet :

1. G.P.V.Us /Kg protein concentrate
2. Amount of concentrate in Kg diet (g.)
3. G.P.V.Us contributed by concentrate = (1) x (2) -÷- 1000.
4. G.P.V.Us in Kg. diet = aggregate of (3) for all the supplementary protein concentrates used.