RESPONSE OF LAYING HENS TO GRADED LEVELS OF DIETARY NUTRAFOS 3 IN A HUMID TROPICAL ENVIRONMENT

A MONSI and A.O. AMAKIRI

Department of Animal Science/Food Science and Technology, Rivers State University of Science & Technology P.M.B. 5080, Nkpolu, Port Harcourt.

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ABSTRACT

Four groups of 48 laying hens *(Gallus domesticus)*, midway in their laying cycle were fed diets containing graded levels (0.00%, 1.5%, 2.5% and 3.5%) of dietary Nutrafos 3 for 56 days. The completely randomized experimental arrangement was designed to evaluate the responses of the caged layers to the inclusion levels of the additive under humid tropical conditions.

The dietary additive produced statistically significant ($P < 0.01$) improvements in the rate of egg production of the hens. Significant increases ($P < 0.01$) in feed consumption and improvements in feed efficiency ($P < 0.01$) were also observed.

Haugh unit was significantly ($P < 0.05$) depressed by dietary Nutrafos 3, especially at the highest level of inclusion. There was no treatment effect on egg size as well as some major anatomical characteristics.

The best overall performance was achieved at the 3.5% level of dietary inclusion in contrast to the proprietory recommendation of 2.5%.

Key Words: Nutrafos 3, dietary supplement, laying hens

INTRODUCTION

The value of various feed additives expressed in terms of performance factors such as egg production, rate of gain, growth rate, feed conversion efficiency and decreased morbidity and mortality has been studied and reported, (Beeson and Perry, 1969, Hays, 1969, Foster, 1972 and Zucker, 1979).

Encouraged by these advantages, manufacturers of feed additives have continued to flood market channels with several new products for which various economic benefits for animal production have been claimed. In the Nigerian Livestock Industry, Nutrafos 3 is one of such proprietory products recently introduced and indicated to stimulate growth and enhanced egg production in poultry. Its use has assumed increasing popularity especially amongst commercial feed manufacturers who include it at the proprietor's recommended rate of 2.5% of layers diets.

Nutrafos 3 is an imported product which was probably evaluated under temperate climatic conditions. There has been no study so far to validate the recommended level of dietary administration of the additive under the ecological conditions prevalent in Nigeria, which is essentially a tropical environment. Biological responses to dietary additives in animals are known to vary ac-

cording to factors such as stress, environment and conditions of the animal (Cravens and Holck, 1969).

Additionally, Foster (1978) submitted that there is no guarantee that any benefits derivable from a feed additive will persist indefinitely, since the mode of action of the products are not known precisely. He therefore stressed the need for the continued evaluation of their composition as well as assessment of the effectiveness.

Early and rapid declines in egg production following peaking in a flock especially during the pullet year is particularly undesirable as it is unfavourable to profit potentials of the enterprise. This is a very serious problem in the Nigerian Poultry industry where sharp down turns in egg production are commonly noticeable shortly after the peak period and often occasion unacceptably low total annual egg output in a laying flock.

The results presented in this report were obtained from a study designed to examine the effects of graded levels of Nutrafos 3 on the performance of laying birds midway in the first year of the egg production cycle.

The purpose was to verify the validity of the manufacturer's claims and recommended inclusion rates in layers diet under the conditions of a humid tropical environment.

MATERIALS AND METHODS

Nutrafos 3 was obtained from the distributing agent (Hoechst Nigerian Limited) Port Harcourt, Rivers State and used for the 56 days observation period. A total of 192 (forty-eight week old) Babcock hens that have been in lay for 24 weeks were selected from a flock maintained at the Teaching and Research Farm of the Rivers State University of Science and Technology, Port Harcourt for the experiment. Their production rate at the commencement of the study was about 50%. The birds were randomly assigned to 64 cells in a California type battery cage system at 3 hens per cell. The cage units were later divided into 16 groups of 4 cells per group. Nutrafos 3 was added to a standard layers diet in use at the Teaching Farm (Table 1), to provide four experimental diets containing 0.0%, 1.5%, 2.5% and 3.5% (w/w) of the product. The experimental arrangement was a completely randomized design with each of the four dietary treatments allocated to 4 groups of 48 hens.

The battery cages were accommodated in an open-sided building constructed of half-walled cement blocks with the other half covered with chicken wire, a popular housing type in Rivers State. one week prior to the dietary treatments, all groups were fed the standard basal layers diet containing 16% protein. Pre-treatment information on egg production, body weight, feed intake and some egg quality factors were obtained during this period. The birds were thereafter placed on the treatment diet and fed *ad libitum*. Weekly records were maintained on similar performance traits as in the pre-treatment week for the rest of the study period. During the 8th week of the experiment and immediately following the collection of the terminal data, four hens were randomly selected from each treatment group and sacrificed. Their individual carcass, kidney, gizzard, liver heart, lung and abdominal fat weights were measured. The oviduct lengths were also determined.

Statistical analysis was performed by analysis of variance, using the General Linear Model procedure, type III SS (SAS institute Inc, 1985). Differences between means were detected at 1% level of significance by the multiple range test of Duncan (1955).

Table 1
Composition of Control Diet

Ingredients	%
Corn	50.00
Palm Kernel Meal	4.50
Soyabean Meal	4.00
Groundnut Cake	9.00
Fish Meal	3.00
Wheatbran	3.60
Brewers Dried Grain	12.40
Brewers Dried Yeast	4.00
Vitamin/Mineral mix[1]	0.25
Limestone	5.40
Bone Meal	3.35
DL Methionine	0.10
Salt	0.40
Total	100.00
Calculated Analysis	
Crude Protein (%)	17.59
Metabolizable Energy (MJ/KG)	11.74
Crude Fat (%)	5.5
Lysine (%)	0.83
Methionine (%)	0.42
Calcium (%)	3.56
Phosphorus (%)	0.67

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1 Vitamin-mineral premix supplied the following in a cereal carrier per kg of diet; retinol 2.4mg, cholecalciferol 74mg, tocopherol 30mg, menadione sodium bisulphate 2mg, riboflavin 3mg, niacin 10mg, calcium pantothenate 3mg, cabolamin 8mg, choline chloride 150mg.

RESULTS

The performance of laying hens receiving the various dietary inclusion levels of Nutrafos 3 and the statistical significances of their differences are presented in Table 2. There were significant ($P < 0.01$) differences between the treatments in respect of hen-day egg production, feed consumption, feed efficiency, body weight, and Haugh unit. The addition of Nutrafos 3 to the diet of laying hens at any of the levels investigated did not significantly ($P < 0.01$) affect egg size or any of the anatomical characteristics observed.

Egg production

To facilitate treatment comparison of the rate of egg production, the egg production data was adjusted to discount mortality. The result demonstrated overall improvement in egg production attributable to all levels of added Nutrafos 3 with the 3.5% treatment (63.9%) being significantly higher ($P < 0.01$) than both the 2.5% and 1.5% groups (59.4% and 57.7%) respectively which did not differ significantly ($P > 0.01$) among themselves. Egg production in the control group was 45.2%. The trend differences over the 56 days experimental period are shown in Fig.1. Although treatment differences were not consistently significant ($P > 0.01$) over every week of the investigation (being significant ($P < 0.01$) only during weeks, 3, 7 and 8 birds treated with Nutrafos 3 consistently produced more eggs than the control throughout the study.

Feed Consumption:

Mean feed intake over the experimental period differed significantly ($P < .01$) between dietary treatments being significantly ($P < .01$) higher in the group of hens on 2.5% and 3.5% Nutrafos 3 inclusions (106.71g/bird/day and 105.86g/bird/day respectively). The lowest consumption of 96.16g/bird/day was recorded in the control which differed significantly ($P < .01$) from the 1.5% treatment group which consumed 102.77/bird/day. The weekly feed intake/hen/day is shown in Fig.1. There were no significant ($P > 0.01$) pre-treatment feed consumption differences among the groups. Statistical analysis of the data during the experimental period showed that with the exception of weeks 5 and 6, there were consistent significant ($P < .01$) differences among treatments for all the weeks of the investigation. The type III SS (General Linear Model Procedure) analysis further revealed that the linear component of the response surface was positive while the quadratic was negative. both components were however, statistically significant. ($P < 0.01$).

Feed Efficiency:

The mean feed efficiency (kg feed/dozen eggs) for the experimental period were 3.81, 2.21 and 2.00 for the 0.0%, 1.5%, 2.5% and 3.5% levels of Nutrafoes 3 respectively. These value differed significantly ($P < 0.01$). Although there were no statistical ($P > 0.01$) differences between the diets incorporating the feed additive (i.e. 1.5%, 2.5% and 3.5%) the highest level sustained the lowest feed efficiency value. The three Nutrafos diets were, however, consistently superior to the control in feed efficiency from the third week of the study till the end of the observations.

Body Weight:

The addition of Nutrafos 3 in the diet of laying hens significantly ($P < 0.01$) affected body weight over the duration of the study shows no significant ($P > 0.01$) differences between 3.5% Nutrafos treatment group (1928.13 g/bird) and the control (1923.75 g/bird). However, in the 1.5% and 2.5% treatment groups, (1893.75 g/bird and 1908.13 g/bird respectively) body weight was significantly depressed ($P < 0.01$). The weekly trend in body weight changes are il-

Table 2
Performance of Laying Hens fed graded levels of Nutrafos 3 for 56 days

	Performance Characteristics											
Levels of Dietary Nutrafos 3	Hen day Production Mean	SEM	Feed Consumtpion Mean	SEM	Feed Efficiency Mean	SEM	Body Weight Mean	SEM	Egg Weight Mean	SEM	Haug Mean	Unit SEM
%		%		(g)	(g)		(g)		(g)			
0.0	45.20^{c}	3.35	96.16^{c}	1.55	3.81^{a}	0.73	1923.75^{a}	14.61	52.94	1.45	84.78^{a}	0.81
1.5	57.70^{b}	2.04	102.77^{b}	1.53	2.20^{b}	0.07	1893.75^{c}	14.45	52.12	0.40	83.23^{ab}	0.63
2.5	59.40^{b}	1.79	106.71^{a}	1.12	0.05	1908.13^{b}	9.40	54.87	0.64	83.31^{ab}	0.70	
3.5	63.90^{a}	1.34	105.86^{a}	1.32	2.00^{b}	0.04	1928.13^{a}	10.10	53.84	0.61	82.49^{b}	0.70
Statistical Significance	49.69**		41.53		9.65**		52.60**		1.98NS		3.47*	

* $P < 0.05$
** $P < 0.01$
NS Not Significant

^{abc} Means within each column that bear different superscripts differ significantly.

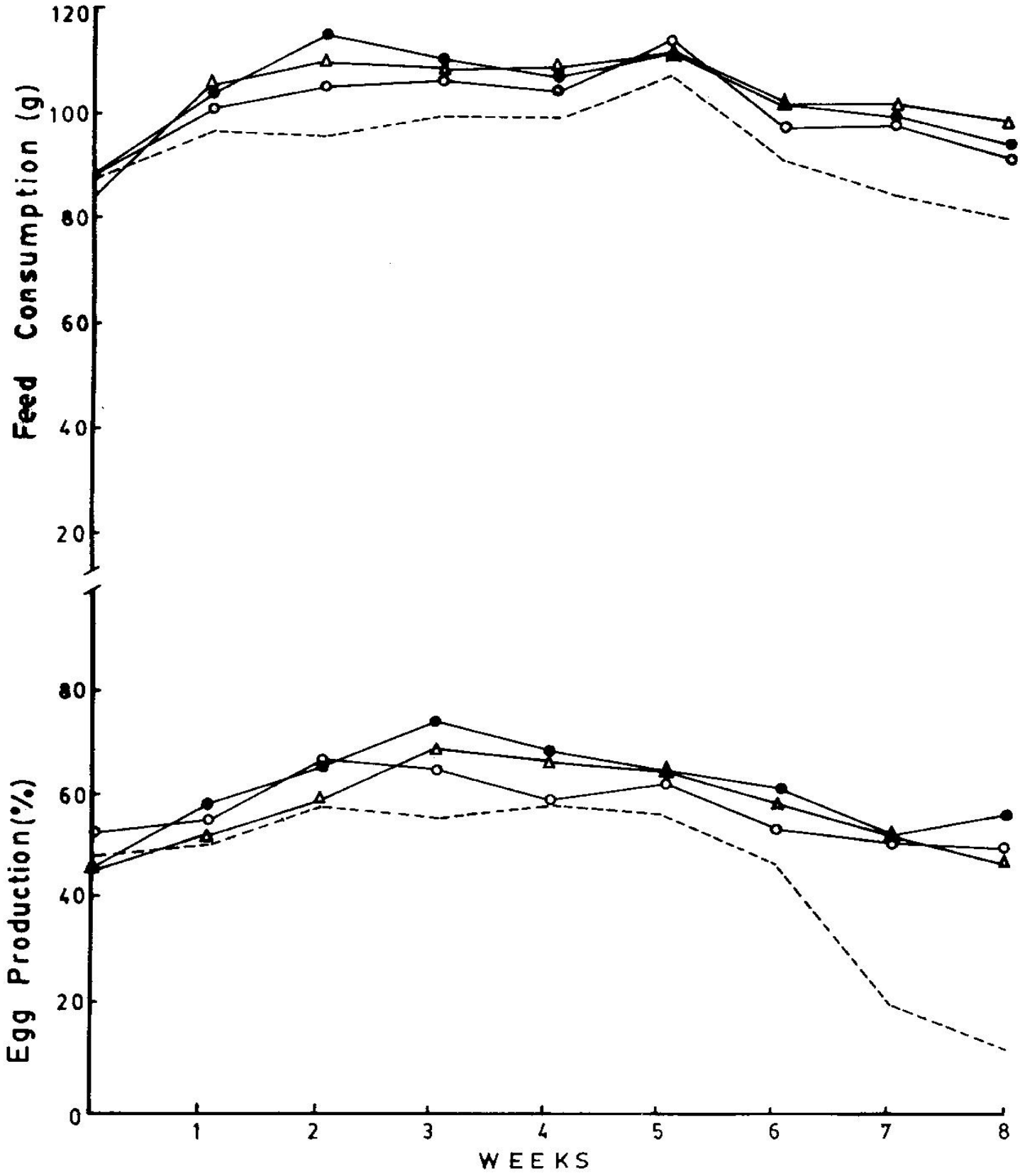

Fig 1 Mean feed consumption ($g \cdot bird^{-1} \cdot d^{-1}$) (top panel) and egg production (%) (bottom panel) of laying hen fed graded levels of dietary Nutrafos 3 for 8 weeks.

lustrated in Fig.2.

Egg Weight:

Mean egg weight showed no significant ($P > 0.01$) differences among treatments. However, a trend towards heavier eggs with Nutrafos 3 addition to the diet especially at the higher concentrations of 2.5% and 3.5% was evident.

Haugh Unit:

The observations indicated that the ingestion of feeds containing the tested levels of the feed additive significantly ($P < 0.05$) depressed Haugh Unit values. There was a significant ($P < 0.05$) treatment difference between the highest level of inclusion (3.5%) and the control. The dietary treatment levels of 1.5% and 2.5% did not differ significantly ($P > 0.05$) from either the control or the 3.5% treatment group. The addition of Nutrafos at 3.5% of layers diet was associated with the lowest mean Haugh Unit (82.49) observation.

Organ Weights:

The effects of the graded levels of Nutrafos 3 in the diet of laying hens are shown in Table 3. Statistical analysis of the data shows no significant ($P > 0.01$) treatment differences on the observed anatomical characteristics. Kidney weights were observed to decrease with increasing levels of Nutrafos 3 (12.60g, 11.17g, 10.21g and 9.63g at 0%, 1.5% 2.5% and 3.5% Nutrafos additions respectively). A relatively high abdominal fat (115.66g) and a comparatively shorter oviduct length (46.99 cm) was also observed at 3.5% inclusion level of the feed additive.

DISCUSSION

The trial examined the value of Nutrafos 3, an imported feed additive that is commercially available for poultry production in Nigeria, for which outstanding improvements in egg and meat have been claimed.

The experiment focussed on the role of the dietary additive in egg production during a critical post-peak period in the laying cycle.

The hen day egg production data in Table 2 provide some evidence in support of the claim of improved egg production due to the incorporation of Nutrafos 3 into layers diet. The improvement which is evident at all the three levels of the additive studied was in the order of 13-19% over and above egg production of the birds on the control diet. maximum efficacy was, however, achieved at the 3.5% inclusion level and this is higher than the manufacturer's recommendation of 2.5%.

This suggests that the addition of Nutrafos 3 at a level of 3.5% is more appropriate for laying hens in a humid tropical environment. The finding further indicates that the levels of added Nutrafos 3 in layers diet varies with ecological conditions, agreeing with Bowland (1956) who provided data showing variations in animal response to feed additives due to different environments. Although dietary Nutrafos 3 caused increased feed consumption, the simultaneous improvement in feed efficiency in the treated groups which was reasonably consistent throughout the experiment, justifies the increases in feed intake. besides, the significant positive linear and negative quadratic components of the response curve indicates that Nutrafos 3 increased feed intake at a rate of increase that decreased with higher levels of dietary addition. Increased, though non-significant feed consumption in broilers due to dietary additives such as Eskalin, Payzone, zinc bacitran and Flavomycin, was reported by Foster (1978). Similarly, general improvements in feed efficiency due to the inclusion of food additives in poultry diets have been reported by Lucas (1972) and Koster (1973).

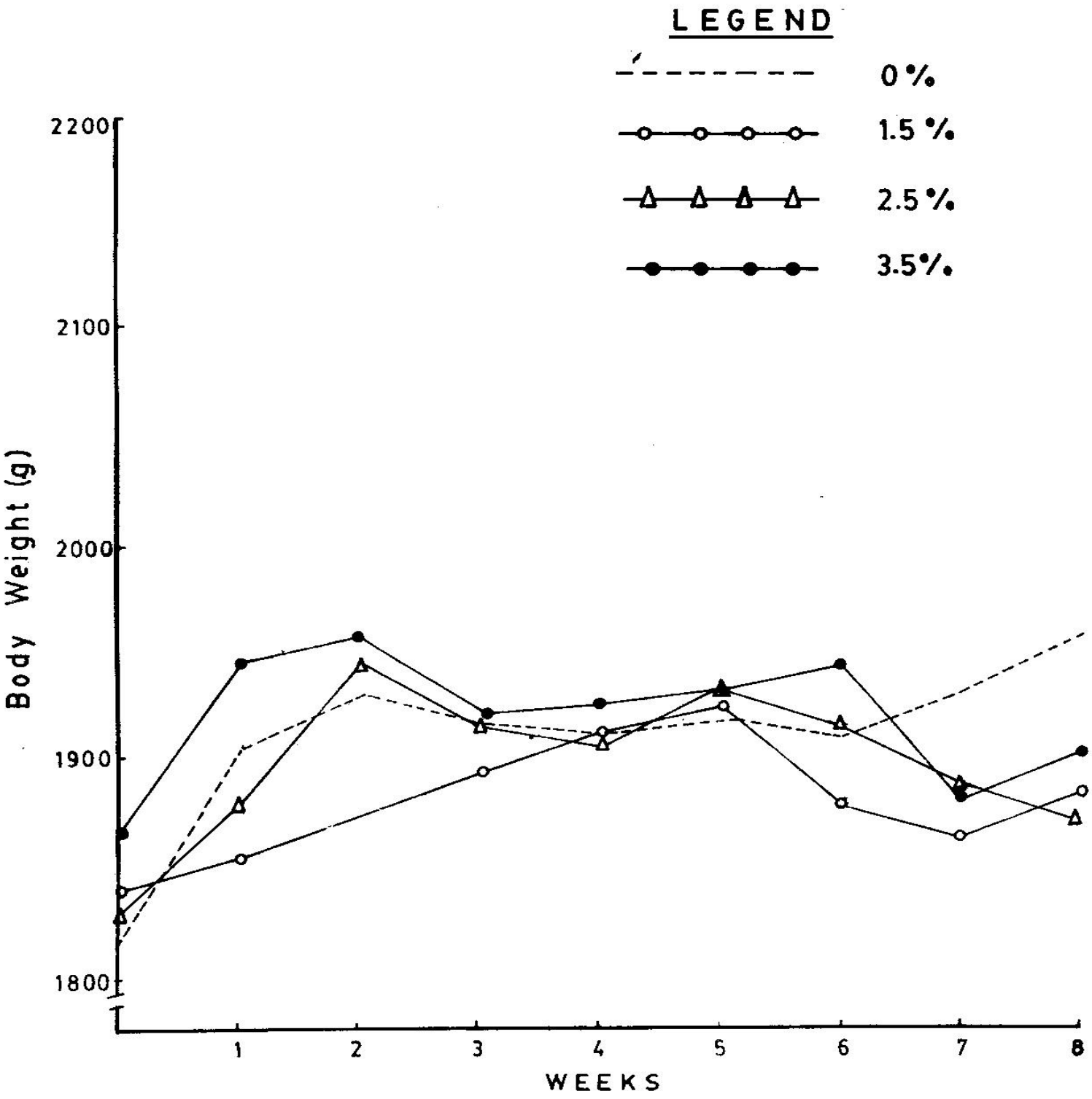

Fig 2 Mean body weight (g) of laying hen fed graded levels of dietary Nutrafos 3 for 8 weeks.

Table 3
Anatomical Characteristics of Laying Hens fed graded levels of Nutrafos 3 for 56 days

		Levels of Dietary Nutrafos 3							
		0%		1.5%		2.5%		3.5%	
Body Characteristics	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Prob.
Carcass Weight (g)	1105[2] (55.52)[3]	87.70	970 (53.44)	17.80	987 (55.23)	77.38	1115 (54.39)	77.62	0.8291
Kidney (g)	12.60 (0.64)	2.39	11.17 (0.62)	1.21	10.21 (0.57)	1.18	9.63 (0.47)	0.55	0.4116
Gizzard (g)	48.69 (2.49)	4.44	49.85 (2.74)	2.85	49.99 (2.81)	2.78	53.49 (2.66)	6.54	0.6760
Liver (g)	43.21 (2.66)	5.95	34.41 (1.91)	1.034	49.11 (2.79)	11.05	38.86 (1.89)	4.58	0.4098
Heart (g)	12.90 (0.53)	1.66	16.02 (0.54)	2.12	10.45 (0.43)	0.45	13.88 (0.43)	0.89	0.0849
Lung (g)	10.32 (0,67)	0.98	9.65 (0.89)	0.41	7.77 (0.62)	1.14	8.85 (0.69)	0.73	0.3517
Abdominal Fat (g)	73.54 (3.61)	19.66	48.82 (2.65)	11.12	54.23 (2.95)	19.92	115.66 (5.52)	50.59	0.6441
Oviduct Length (cm)	59.69	3.81	60.33	3.93	60.32	2.62	46.99	1.64	0.0927

[2] Values are means of 4 hens.
[3] Values in bracket are organ weights expressed as percentages of bodyweight.

The effects of the additive on the two egg quality indicators (Haugh Unit and egg size) examined in the experiment were not very outstanding.

In the case of the Haugh Unit, which is a measurement of internal egg quality, the highest level of Nutrafos 3 exerted an unfavourable influence. A closer investigation into the effects of the additive on all measures of egg quality may therefore be necessary.

Nutrafos 3 did not have any significant effect on the body organs examined. The organ data were analysed as percent of bodyweight to minimize variations due to the size of the selected hens sacrificed, a procedure recently reported not to be as accurate and effective as the covariance analysis (Brown *et al.*, 1985). However, the high abdominal fat and the relatively regressed oviduct length at the 3.5% dietary Nutrafos 3 treatment level need to be further investigated. Variations in oviducal length of the laying hen has been attributed to variable levels of gonadotrophic hormones from the anterior pituitory and estrogen produced by the ovary (Neisheim *et al.* 1979). The scope of the present investigation did not involve any endocrinal examinations Nutrafos 3 is indicated as a preparation fortified with minerals, trace elements, vitamins and flavomycin. laboratory analysis to validate this composition and the levels of the ingredient was not made.

However, the overall improvement of the performance of the treated hens offer some justification for the claim of such nutrient fortification.

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