THE INFLUENCE OF JUVENILE BODY WEIGHT AND TWO FEEDING REGIMES DURING THE GROWING PHASE ON GROWTH PERFORMANCE AND EARLY LAY CHARACTERISTICS OF PULLETS.

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ABSTRACT

TWO experiments were conducted using 500

Black Olympian pullets to determine the effects of Juvenile body weight (Trial 1) and feeding regime (Trial 2) on growth and early lay performances. Results in trial 1 indicated significantly ($P < 0.05$) higher body weight at first egg (1489.9 vs 1383.8g) and 32 weeks of age (1783.3 vs 1655.2g) in heavybody weight (HBW) than LightBodyweight (LBW) groups but not on other parameters. Feeding the birds *ad libitum* also resulted in significantly ($P < 0.05$) higher feed intake during the first 18 weeks of age (9036.4 vs 6803.7g), 18 - 32 weeks of age (14,065.9 vs 11,420.9g), weight of first egg (47.43 vs. 43.16g), hen-housed average (53.9 vs 38.7%), egg mass (2,880.39 vs. 2110.38g), feed/ dozen eggs (2285.3 vs. 1768.1g), grain feed /egg (190.4 vs. 147.3g) and body weight at 32 weeks of age (1808.1 vs 1716.6g). The results indicated earlier age at sexual maturity, lower mortality and higher body weights in HBW and *ad lib feed* (AF) groups but better production efficiency (feed/dozen eggs, cost/dozen eggs) in LBW and restricted feed (RF) groups.

Key Words: Juvenile Body Weight, Feed Regime, Growth, Egg Production.

INTRODUCTION

Variation in body weight within a flock can be attributed to genetic variations and environmental factors that impinge on individuals. This includes exposure to the specific social group in which a bird lives and its own status and competitive ability (Okpokho, *et al.* 1987). Consequently, different techniques have been introduced to manage birds in order to obtain improved productivity in the entire flock. One of such has been the housing of pullets in individual cages according to their body weights (Harms

et al., 1982; Goodling *et al.*, 1984; Bish *et al.*; 1985.; Ayorinde *et al.*, 1988). While most of the results showed no significant advantage from such a practise, the reports of Costa *et al* (1980) and Leeson and Summers (1985) indicated that differences existed in the number of eggs laid especially in the first four months.

In most of the studies reported, the birds were housed on the basis of body weight differences at about the point of lay. It has been observed that right from hatching, variations exist in weights of the chicks and it is possible that birds of smaller sizes at hatch may suffer throughout the rearing period when raised among bigger birds. Such disadvantage could probably have been removed if the birds have been raised according to the body weight right from an early age.

Feed restriction is commonly applied to broiler pullets to minimise mortality rates and ensure maximum production of settable eggs (Fuller *et al*, 1973) but it is rarely practised for egg types, as its commercial benefits are doubtful (Balnave, 1973; Lee, 1987). It has been observed that application of feed intake principles and information have resulted in improved nutrition, management and care of poultry although many problems persist and more knowledge is needed for optimum adjustment of feed and nutrient intake accordingly.

The present study was designed to examine the impact that rearing pullets according to body weight grouping and two levels of feeding would have on the growth and early lay characteristics of a commercial egg strain.

MATERIALS AND METHODS

Birds and management:

Two experiments were conducted to

determine the influence of initial body size and rearing under *ad libitum* and restricted feeding regimes on growth performance and early lay characteristics of Black Olympian Pullets.

Trial 1.

500 day old Black Olympian pullets purchased from a commercial hatchery were raised on the deep litter in two groups to two weeks of age. At this age, the birds were weighed individually, wing banded and 150 chicks weighing less than 80g were separated as light (LBW) and 150 weighing more than 110g were separated as heavy (HBW). The birds were divided into three replicates of 50 birds each and raised on the deep litter till 18 weeks when they were moved into laying cages measuring 45x40x35cm, two birds per cage. Water and feed were given *ad libitum* throughout the rearing period.

Trial 2.

A total of 288 two weeks old Black Olympian pullets were used for this experiment. The birds were divided into two groups of 144 birds of similar body weights and each group divided into three replicates of 48 birds each. The first group was fed *ad libitum* while the second was fed quantities of feed daily, in accordance with NRC recommendation for birds raised in the tropics (Oluyemi and Roberts, 1979) till 18 weeks of age.

Diets

The birds were fed commercial rations during the three phases. Chick mash containing 19% crude protein and 2500kcal/kg ME was fed during the first 8 weeks. A grower diet containing 14.5% crude protein and 2300kcal/kg ME was fed between 8 and 18 weeks of age and layer's diet containing 16.5% crude protein and 2400 kcal/kg ME was fed thereafter.

Data Collection and Statistical Analyses

Body weight and feed intake were measured fortnightly throughout the experimental period. Age and body weight at first egg were taken for each group and age, when 50% rate of lay was first attained was

used as an estimate of age at sexual maturity. Weekly, hen housed and average hen day rates of lay were determined from the egg production records of each group. Egg weights were taken on all eggs laid in the first three days of each week. The average egg mass was calculated by multiplying the weekly egg weight by the hen housed average.

Feed conversion ratio for the prelaying period was taken as grams feed intake divided by grams gains in body weight while for the laying period it was defined as grams of feed intake divided by grams of egg mass. The cost of raising the pullets to point of lay was obtained by adding the cost of the day old pullets, medications, feed intake and compensating for mortality. The economy of egg production was taken as cost of feed required to produce a dozen egg. Data collected were subjected to one way analysis of variance using the computerised Statistical Analysis System, SAS (Barr *et al.*, 1976).

RESULTS AND DISCUSSION

The body weight of the birds in the two experiments up to 32 weeks of age are presented in Figure 1. Body weight was significantly ($P < 0.05$) lower in Low Body Weight (LBW) group than High Body Weight (HBW) group and in Restricted feed (RF) than *ad libitum* (AF) group throughout the experimental period. Greater differences in body weight were obtained between 20 and 22 weeks, a period when the HBW and AF came into lay and consequently had increased weight. Body weight gain (Table 1) was similar in HBW and LBW and between AF and RF up to 18 weeks of age. However, while body weight gain was higher in HBW than LBW and in AF than RF during the prelaying period, the reverse was the case during the laying period. Although the HBW pullets consumed more feed (Table 1) than LBW group, the difference was not significant. This shows that feed intake per bird is similar irrespective of body weight (Duplessis and Erasmus, 1972). In all, the HBW group consumed 72, 265 and 32g more feed than the LBW group during the brooding, rearing and

TABLE 1: EFFECT OF PRELAYING TREATMENT ON WEIGHT GAIN, FEED INTAKE, FEED EFFICIENCY AND MORTALITY.

Period (WKS)	Trial	Group	Wt. gain (g)	Feed intake(g)	Feed Conversion	Mortality (%)
2-8	1	HBW	340.93 ^a	1892.50 ^a	5.55 ^a	0.00 ^a
		LBW	296.91 ^a	1818.94 ^a	6.13 ^a	1.43 ^a
	2	AF	312.20 ^a	1872.22 ^a	6.00 ^a	0.80 ^a
		RF	265.37 ^a	1507.04 ^b	5.68 ^a	0.00 ^a
8-18	1	HBW	787.43 ^b	7390.51 ^a	9.39 ^a	2.78 ^a
		LBW	705.49 ^b	6767.30 ^a	9.59 ^a	10.14 ^a
	2	AF	751.02 ^b	7164.18 ^a	9.54 ^a	6.49 ^a
		RF	706.93 ^b	5296.67 ^b	7.49 ^a	11.27 ^a
18-32	1	HBW	530.21 ^c	14203.57 ^a	26.80 ^a	5.80 ^a
		LBW	580.60 ^c	14171.72 ^a	24.41 ^a	9.52 ^a
	2	AF	618.42 ^c	14065.85 ^a	22.74 ^a	7.11 ^a
		RF	624.50 ^c	11420.92 ^b	18.29 ^a	6.67 ^a

HBW - High body weight, LBW - Low body weight, AF - *ad libitum* feeding, RF - Restricted feeding.

Means for each parameter within each trial followed by different letter superscripts differ significantly ($P < 0.05$).

18-32 weeks of age period respectively.

Feed intake was significantly ($P < 0.05$) higher in AF than RF group during the three phases. Even when feed restriction was removed after 18 weeks of age, the RF group still consumed 2645g less than the AF group. This is probably on account of the higher body weight and laying rate of the latter which calls for greater feed requirement to maintain both body weight and egg production. This agrees with the assertions of Nordskog and Briggs (1968) that smaller bodied birds have lower nutrient requirement for maintenance and hence consumes lesser amount of feed. Feed efficiency was not significantly different ($P > 0.05$) within each trial. During the rearing process (2-18 weeks of age), efficiency of feed utilization was better in HBW than LBW. However, the smaller sized birds of the LBW group were more efficient in utilizing the feed during the laying period. Birds on feed restriction, RF, were more efficient feed utilizers than those fed *ad libitum* throughout the experimental period.

Mortality was not significantly ($P > 0.05$) different within each trial. The trend in experiment 1 agree with the findings of Fowler and Quinsenberg (1970) that livability is positively correlated with initial body weight. The same advantage was observed for the AF group during the rearing period (Table 1).

However, during the early laying phase, pullets feed restricted in the rearing period had slightly lower mortality.

The performance of the birds during the rearing and laying periods are shown in Table 2. Age at first egg was delayed by both body weight and feed restriction as the HBW group came into lay 10 days earlier than LBW and the AF group 12 days earlier than the RF group. The delay in onset of egg production by the LBW group agrees with the report of Cunningham (1980) and Okpokho (1983). The delay in laying by RF group also agrees with the reports of Gous and Stielav (1976), Robinson and Sheridan (1982), Mbugua and Cunningham (1983) and Lee (1987) that feed restriction to 20 weeks delayed onset of egg production by about 10 days. This delay, according to Hurwitz (1965), could result from direct interference with the maturation process especially the rapid development of the ovary, uterus and secondary sex organs which usually start about 3 weeks before egg production. Although feed restriction was terminated 6 weeks before onset of egg production, it still caused a delay in egg production probably due to the reduction caused a delay in egg production probably due to the reduction caused on body weight which then prevented the birds from attaining a minimum body weight required for onset of egg production (Dunnington and Siegel, 1984; Soller *et al.*,

TABLE 2: PRODUCTION PERFORMANCE OF PULLETS AND HENS BASED ON TREATMENT

Parameter	HBW	Trial 1 LBW	AF	Trial 2 RF
Pullet				
Age at first egg (days)	151	161	156	168
Wt. at first egg (g)	1489.9 ^a	1383.8 ^b	1436.9 ^a	1396.7 ^a
Total feed to first egg (g)	13,131.6 ^a	13,390.4 ^a	13,341.4 ^a	11,610.4 ^b
Feed conversion to first egg	9.62 ^a	10.21 ^a	10.18 ^a	9.09 ^a
Wt. of first egg (g)	43.15 ^a	44.03 ^a	47.43 ^a	43.16 ^b
Prelaying mortality (%)	2.78	11.57	7.29	11.27
Overall cost to 18 wks (N)	124.63	119.82	123.12	104.03
Layer (21 - 32 weeks)				
Hen housed average	55.2 ^a	51.7 ^a	53.9 ^a	38.7 ^b
Age at sexual maturity (wks)	25 ^a	26 ^a	26 ^a	29 ^a
Feed intake (g)	10,837.4 ^a	9710.9 ^a	10,274.2 ^a	5699.2 ^b
Mean egg wt. (g)	53.23 ^a	53.55 ^a	53.39 ^a	54.56 ^a
Egg mass (g)	2965.98 ^a	2769.61 ^a	2880.39 ^a	2110.38 ^b
Feed/dozen eggs (g)	2333.9 ^a	2253.1 ^a	2285.3 ^a	1768.1 ^b
Cost/dozen eggs (N)	29.87 ^a	27.04 ^a	29.25 ^a	22.63 ^a
Feed conversion (g feed/egg)	194.5 ^a	187.8 ^a	190.4 ^a	147.3 ^b
Body wt. at 32 wks.	1783.3 ^a	1655.2 ^b	1808.1 ^a	1716.6 ^b
Laying mortality (%)	4.41	8.06	6.15	4.76

Means for each parameter within each trial followed by different letter superscripts (a,b) differed significantly ($P < 0.05$).

1984). Infact, throughout the 32 week period, the RF birds did not catch up in body weight with the AF group despite access to free quantity of feed between 18 and 32 weeks of age.

Body Weight at first egg was significantly ($P < 0.05$) lower in LBW than HBW but was similar in AF and RF. The lower body weight of the RF group, due to feed restriction during the prelaying period, however agrees with the findings of Philips (1970). Weight of first egg was slightly heavier in LBW than HBW probably on account of delayed onset of lay. However, the much higher body weight of the AF group lead to significantly heavier first eggs. This agrees with the findings of Ayorinde *et al* (1988) that body weight and egg weight are positively correlated.

The LBW pullets consumed slightly more feed (+59g) than HBW pullets to commencement of egg production since laying

started 10 days later than in the HBW group. However in experiment 2, despite the 12 days lateness in commencement of egg production, the RF group still had lower feed intake on account of the inferior body weight. The overall prelaying mortality was much reduced by the advantageous bigger size of HBW and AF pullets.

Egg production was similar in the LBW and HBW groups (Table 2). However, the RF group laid significantly ($P < 0.05$) fewer eggs than the AF group to same age. Although onset of egg production was delayed by both lower body weight and feed restriction, a more rapid increase in egg production (Figure 2) brought all treatments to a peak, 80.50% (HBW), 80.55% (LBW), 79.70% (AF) and 78.81% (RF), at 28, 30, 30 and 31 weeks of age respectively. However, egg production was slightly lower in LBW than HBW and RF than AF during each week of production. Age at

Fig. 1 Effect of Treatment on Mean Body Weight of Birds.

Fig. 2 Effect of Treatment on Egg Production Rate.

Fig. 3 Effect of Treatment on Egg Weight.

sexual maturity was similar in both HBW (25 weeks) and LBW (26 weeks) groups due to a more rapid increase in production rate of the LBW group. Thus, sexual maturity was reached five weeks after laying commenced in the HBW group whereas, it took only four weeks for the LBW to reach maturity. However in experiment 2, the AF group attained sexual maturity (50% laying rate) in the 26th week of age but this was not attained till the 29th week in the RF group. These ages however corresponded to the 6th week after egg laying started in both groups.

Feed intake and feed conversion were similar for HBW and LBW groups (Table 2) but the RF group had significantly ($P < 0.05$) lower feed intake and feed efficiency than the AF group. Based on feed requirement it was cheaper to raise the LBW than HBW group and to feed restrict the birds during the prelaying period. The small bodied hens, LBW group, were slightly better in feed efficiency and consumed less than the large bodied hens. The better efficiency of egg production for smaller sized hens agree with the results of Render and McDaniel (1984) and Ayorinde *et al* (1988). The result on feed intake is however contrary to the findings of Duplessis and Erasmus (1972) that feed intake per bird is the same irrespective of body weight. It however agrees with the assertion of Nordskog and Briggs (1968) that smaller bodied birds have lower nutrient requirement for maintenance and hence consume lesser amount of feed. The results on feed restriction during the prelaying period indicated better feed efficiency and a more efficient egg production as the feed restricted birds required lower quantity of feed for both body maintenance and egg production.

The overall economy of production revealed that the LBW group, in terms of cost, out performed the HBW group in that it costs N4.81 more to produce each HBW pullet at point of lay. It was also N2.83 cheaper to produce a dozen egg from the LBW group compared with HBW. Similarly a pullet raised on restricted feeding required N9.09 lesser to produce and egg production N6.62 lower for a

dozen eggs than pullets raised on *ad libitum* feeding. Probably on account of age (figure 3) egg weight was higher in LBW than HBW and RF than AF although the differences were not significant ($P > 0.05$). On account of egg number, egg mass to 32 weeks of age was greater in HBW than LBW and AF than RF. Laying mortality was not significantly ($P > 0.05$) different within each experiment although it was higher in LBW than HBW and AF than RF. The results indicated that feed restriction during the prelaying period and rearing of pullets according to weight group is advantageous and could be practised.

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