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Effect of Compensatory Growth on the Performance and Carcass Characteristics of the Broiler Chicks

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Abstract: An experiment was conducted to examine the effect of compensatory growth on the performance and carcass characteristics of broiler chicks. The chicks were divided into three experimental groups (A, B and C). Group A of chicks was offered the control diet which was formulated to meet the nutrient requirement of the broiler chicks for 45 days. Group B was subjected to physical feed restriction in the term (8-21 days), these chicks were offered 35% of their nutrient requirement in this period then they were refed with the control diet to the end of the experiment. While group C was restricted by given a low protein and high fibre diet in the term (8-21 days), then they were refed with the control diet to the end of the experiment. Results revealed that there was no significant difference in feed intake, weight gain, carcass weight, liver weight, abdominal fat weight and gizzard weight. Also results revealed that there was significant difference ($p < 0.05$) in feed conversion ratio and alimentary tract weight. Dressing percentage was 74.13%, 74.93% and 75.72% for group A, B and C respectively.

Key words: Compensatory growth, performance, carcass characteristics and broiler chicks

Introduction

Compensatory growth has been shown to occur in most farm animals, even the broiler chicken, which has a very short grow-out cycle. This catch-up growth follows a period of feed nutrient restriction imposed usually by either physical feed restriction or the feeding of diets very low in nutrient density. To be of economic interest, such animals must achieve normal weight-for-age prior to market and/or show improved efficiency of growth and/or exhibit superior carcass characteristics.

Both the beef cow and the Turkey have feeding periods extending into months, as compared to the chicken broiler which has only a relatively short growing period. Therefore, it would be expected that broilers on a compensatory growth program might have problems achieving similar weights at market age as compared to birds reared on a regular feeding program. Several metabolic disorders such as various leg problems, sudden death syndrome and ascites, were thought to be enhanced by the rapid early growth of the modern day broiler. Thus, studies were done to look at the possibility of slowing down growth at an early age, to see what effect this would have on these problems. A number of studies were reported from several areas around the world, all indicating that slowing weight gain of broilers down during the second week of life often resulted in a significant reduction in mortality from the above mentioned conditions. However, in most but not all cases, a slight reduction in body weight and enhanced fat deposition was noted at market age.

So the objective of this study is to examine the effect of compensatory growth on the performance and carcass characteristics of broiler chicks.

Materials and Methods

An experiment was conducted in the premises of Poultry Research Unit in the Faculty of Animal Production, University of Khartoum, at Khartoum North (Shambat). Seventy tow unsexed day old broiler chicks (Ross) were used in this experiment to examine the effect of compensatory growth on the performance and carcass characteristics of broiler chicks. Tow experimental diets were prepared which were approximately isocaloric, but they contained different levels of protein and crude fibre. The first diet was prepared according to the nutrient content of the broiler chicks as outlined by NRC (1984) (Table 1) .

Seventy-two chicks were selected and allocated randomly in nine experimental pens, of eight chicks each (three pens per treatment). The initial body weights of chicks in each pen were adjusted to be approximately the same. Group A was given the control diet throughout the experimental period, feed and water were provided *ad libitum* and 24 hours light was maintained. Group B was subjected to feed restriction in the term (8-21 days) of age, these chicks were offered 35% of their nutrient requirement in this period then they are refed with the control diet to the end of the experiment. While group C was restricted by given a low protein and high fibre diet in the same term (8-21 days) of age, then they are refed with the control diet to the end of the experiment.

Table 1: Nutrient Composition of the experimental diets

Ingredient	A*	B
Sorghum	58.00	61.0
Groundnut meal	19.00	0.0
Super concentrate**	5.00	5.0
Wheat bran	15.00	31.0
Oyster shell	2.70	2.7
Salt	0.30	0.3
Total	100.00	100.0
ME (Kcal/ Kg)	3057.00	2939.9
Crude protein	21.20	15.8

*Chicks of the second group (B) were given restricted amounts of this feed (35% of their nutrient requirement) in the term (8-21 days). **Super concentrate composition: protein 45%, fibre 3%, calcium 12%, phosphorus 6%, methionine + cystine 4.75%, lysine 11%, NaCl 2.8-3% and M.E. KCl/Kg 2000.

Feed intake, body weight and weight gain were recorded weekly for the individual replicates of each treatment and mortality was recorded. At the end of the experiment (at day 45), birds were starved overnight and one bird from each replicate was randomly selected, wing banded and individually weighed. Then, it was slaughtered by jugular severing. The bird thereafter was feathered and the carcass was weighed. The alimentary tract, abdominal fat, gizzard and liver were weighed. The layout of the experiment was statistically analyzed according to the analysis of variance applicable to complete randomized design as described by Snedecor and Cochran (1980).

Results and Discussion

Performance data

Feed intake and body weight gain: There was no significant difference in feed intake and weight gain between the experimental groups (Table 2). Group B and C ate more feed than group A in the compensating period, this could be due to the fact that group B ate more to compensate for the previous hunger while group C ate more for their protein needs. In the 80's Israeli workers, (Plavnik and Hurwitz 1985, 1988) investigated the possibility of utilizing a compensatory growth program to improve the feed utilization of market weight broilers. While the program did achieve enhanced feed utilization, in some cases, body weight of the compensatory birds did not equal to that of the control group at market age.

Auckland *et al.* (1969) and Auckland and Morris (1971a, b), showed that reduced body weight of turkeys up to 6 weeks of age, from the feeding of low protein diets resulted in weight gain equal to the controls at market age, but with a significant improvement in feed: Gain ratio and an overall reduction in protein intake. Lesson and Summers (1978), with investigating compensatory growth, also looked at diet self selection for turkeys. They found that birds given the choice to select a high energy low protein diet, or a high protein low energy diet, had similar body weights to that of control birds at market age. Plavnik and Hurwitz (1991) looked at restricting feed with turkeys, starting at 7 days of age for a 10 day period. At 20 weeks of age they noted better body weight, feed utilization and meat yield for the early feed restricted birds as compared to the controls.

Table 2: Performance of broiler chicks subjected to compensatory growth

	Chick groups				
Item	A	B	C	L.S	S.E
Number of birds	24	24	24	-	-
Number of days	45	45	45	-	-
Initial body weight (g)	64	64	64	N.S	-
Final body weight gain (g)	1430	1210	1400	N.S	0.60
Body weight gain (g)	1366	1146	1336	N.S	0.18
Feed intake (g/ bird)	4090	3160	3830	N.S	0.75
Feed conversion ratio	3.0	2.8	2.9	*	1.28

In this and subsequent table values are means of 3 replicates of 8 birds each. L.S = Least significant. N.S. = Not significant. * = P < 0.05. S.E = Standard error.

Feed conversion ratio: There was significant difference ($P < 0.05$) in the feed conversion ratio. Group (B) and (C) has better feed conversion ratio than the control group (A). Many works in poultry and turkey support this fact. In the early 90's Dr. Lesson's lab at Guelph, also began looking at the possibility of improving feed: Gain ratio of broilers by restricting nutrient intake at an early age, so that the growth curve of the bird was more concave in nature rather than linear. As pointed out by Zubair and Lesson (1994), the improvement in feed efficiency noted with compensatory growth was due to the smaller body mass of the bird up to the point of growth compensation. Thus a lower nutrient requirement for maintenance. Also the results stated herein were in line with those of Lesson and Summers (1978).

Carcass data

Carcass weight: As seen in Table 3 there was no significant difference in the carcass weight between the tested groups. Carcass weight is the reflection of the body weight, so these results were in line with those of Auckland *et al.* (1969) and Auckland and Morris (1971a, b). Leeson and Summers (1978), with investigating compensatory growth, also looked at diet self selection for turkeys. They found that birds given the choice to select a high energy low protein diet, or a high protein low energy diet, had similar body weights to that of control birds at market age but with an improved feed: Gain ratio and more carcass protein. Also Zubair and Leeson (1994) observed little or no difference was noted in carcass characteristics for the compensatory versus birds grown on a normal feeding program.

Alimentary tract weight: There was significant difference ($P < 0.05$) in the weight of the Alimentary tract (Table 3). Group C which was fed a high fibrous diet (Table 1) has the heaviest Alimentary tract weight

Table 3: Carcass characteristics of broiler chicks subjected to compensatory growth

	Chick groups				
Item	A	B	C	L.S	S.E
Live wt (g/bird)	1430	1210	1400	N.S	0.6000
Carcass wt (g/bird)	1070	840	1060	N.S	2.7500
Abdominal fat wt (g)	30	10	30	N.S	0.0010
Alimentary Tract wt (g)	10	60	70	*	6.9000
Gizzard wt (g)	30	20	20	N.S	0.0030
Liver wt (g)	20	21	20	N.S	0.0003
Dressing Percentage	74.13%	74.93%	75.72%	N.S	0.0320

followed by group B which was subjected to period of feed restriction, so it ate more to compensate for the past hunger. Group A which was finished in a control diet has the light Alimentary tract weight.

Liver weight: As seen in Table 3 there was no significant difference in the liver weight between the tested groups and this may be due to the compensatory activity of the liver when birds of group B and C were refed with the control diet.

Gizzard weight: Gizzard is an early maturing organ and according to its muscular nature slight or no change in its volume and weight will be expected by the progress of the age of the bird, so this may explain the insignificant difference in the gizzard weight between the tested groups (Table 3).

Abdominal fat weight: Compensatory growth had no significant effect on the abdominal fat weight (Table 3) this may be due to scientific fact that fat is the last forming tissue. In broilers major fat deposition occurs at the last tow weeks and upon this time the three experimental groups were fed the same diet.

Dressing Percentage: Dressing out percentage is the proportion of the carcass weight from the slaughter weight as seen in Table 3, there was no significant difference in the dressing percentage of the experimental groups.

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