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THE INFLUENCE OF DIFFERENT REGIMENS OF EARLY NUTRIENT RESTRICTION ON PERFORMANCE AND ABDOMINAL FAT OF BROILERS

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ABSTRACT

This study was carried out to examine the influence of different regimens of early nutrient restriction on the performance and abdominal fat of broilers. A total of 126 day old Ross broiler chicks were randomly assigned to six dietary treatments, each with three replicates of seven birds. All birds were fed *ad libitum* to seven days of age on the control starter diet (ME 3,081.20 Kcal/kg) and (23.00%) crude protein (diet 1). During the starter phase, birds in treatments 2 to 6 were fed a low energy (ME 2,800.00 Kcal/kg) and low protein (18.40%) diet, that is diet 2 for 16 days in varying regimens, all starting at 7 days of age, alternated by feeding the standard starter diet, (diet 1). All birds were then offered a standard finisher diet, diet 3 from day 35 to the end of the experiment (day 63). Feed intake and body weight of birds were measured weekly. Feed conversion ratio (FCR) and body weight gain were also determined. At the end of the experiment three chickens from each replicate were randomly selected, weighed, slaughtered and used to determine the abdominal fat weight and carcass weight. The completely randomized design was used in analysing all data. Varying the regimens of early nutrient restriction did not significantly influence all the performance parameters measured and the abdominal fat of broilers. It was, therefore, concluded that a mild form of feed restriction can be embarked upon as early as 7 days of age without detrimental effect on broilers.

Key words: Performance, abdominal fat, early nutrient restriction, broilers, compensatory growth

INTRODUCTION

The ability of animals to compensate in growth during realimentation following a period of under-nutrition has been demonstrated in poultry (Plavnik and Hurwitz, 1991). Researchers have also reported improved feed conversion during realimentation by broilers subjected to early nutrient restriction (Plavnik and Hurwitz, 1985). Novel *et al.*, 2009 reported that 75% *ad libitum* restriction feeding during the starter phase of broilers from 14 to 21 days of age may offer some economic benefits over *ad libitum* feeding regimen, majorly by enhancing feed utilization. These researchers further suggested that feed restriction may be a good nutritional strategy to reduce the cost of commercial starter grain-based diets (Novel *et al.*, 2009).

The study of compensatory growth in broilers has generated much interest over many years. It is been documented to be a means of enhancing weight gain. Feed restriction has been described as one of the ways of solving the problems of skeletal disorder, excessive body fat deposition and metabolic diseases of broilers (Saleh *et al.*, 2005; Rezaei *et al.*, 2006; Ozkan *et al.*, 2006; Azamik *et al.*, 2010; David and Subalini, 2015). Feed efficiency can be improved by embarking on feed restriction in the early phase of life of birds (Zubair and Leeson, 1994).

Feed restriction could either be quantitative or qualitative. Quantitative feed restriction can be achieved by reducing the quantity of feed made available to the birds while qualitative feed restriction can be carried out by lowering the level of one or more essential nutrient in the diet. In either case, feed restriction not only reduces production cost but, it is also a means of achieving compensatory growth, improving the utilization of ingested food and production of a leaner meat (Szepesi, 1980).

Over-feeding at the early stage of life enhanced maturation and increase fat cell number (Hausberger, 1981). Hence, over-feeding early in life is probably the main cause of obesity in later life. The relative deposition of fat at market age in broilers is influenced by what and how the chicks are fed at the early phase of their life. Thus, embarking on early nutrient restriction may be used as a method of reducing fatness in broilers. The present study was carried out to investigate the effect of different regimens of early nutrient restriction on the performance and abdominal fat of broiler chickens.

MATERIALS AND METHODS

A total of 126 Ross broiler day old chicks were raised in an electrically heated battery brooder. All birds were fed *ad libitum* to 7 days of age on the control starter diet (diet 1) (Table 1). There were six dietary treatments replicated three times and chicks were randomly allotted to each treatment, in a completely randomised design. Birds in the control, that is treatment 1, were fed diet 1 *ad libitum* throughout the starter phase. During the starter period, broilers in treatments 2 to 6 were fed a low energy (ME 2,800.00 Kcal/kg) and low protein (18.40%) diet (diet 2) (Table 1), for 16 days in different regimens, all starting at 7 days of age, alternated by feeding the diet 1.

In treatment 2, birds received diet 2 for 16 days followed by diet 1 to 35 days of age. In treatment 3, birds were fed diet 2 for 8 days, and then diet 1 for another 8 days, then diet 2 for a further 8 days followed by diet 1 to 35 days of age. Birds in treatment 4 received diet 2, 1 and 2 for 8, 4 and 8 days respectively then diet 1 to 35 days of age. For birds in treatment 5, diet 2 and 1 were alternated every 4 days such that birds had 16 days of diet 2 while birds in treatment 6, were fed diet 2, 1 and 2 for 4, 2 and 4 days respectively, such that birds had 16 days of diet 2. All birds were then offered a standard finisher diet, diet 3 (Table 1) from day 35 to the end of the experiment (day 63). Feed intake and body weight of birds were measured weekly. Feed conversion ratio and body weight gain were also determined.

At the end of the experiment, three birds were randomly selected from each replicate and slaughtered to determine the abdominal fat weight and carcass weight. The adipose tissue

surrounding the gizzard, intestine, extending within the ischium and surrounding the cloaca, bursa of fabricius and adjacent abdominal muscle were collected and weighed as abdominal fat.

Table 1: Percentage composition of experimental diets

Ingredients	Starter		Finisher
	Diet 1	Diet 2	Diet 3
Maize	42.03	42.00	60.00
Soy bean meal	29.81	15.47	17.47
Brewers dried grain	10.00	16.22	6.27
Maize milling waste	8.00	12.45	10.45
Blood meal	3.03	3.00	2.94
Palm oil	3.58	3.44	-
Bone meal	2.69	2.95	1.94
Oyster shell	0.26	0.15	0.33
Salt	0.25	0.25	0.25
Mineral/Vitamin			
Premix*	0.25	0.25	0.25
DL-methionine	0.10	0.10	0.10
Grit	-	3.72	-
Total	100.00	100.00	100.00
Calculated analyses			
Crude protein (%)	23.00	18.40	18.30
ME (Kcal/kg)	3,081.20	2,800.00	3,024.00
Chemical analyses			
Moisture %	5.87	4.96	6.86
Dry matter %	94.13	95.04	93.14
Crude protein %	22.51	17.49	17.30
Crude fat %	5.30	4.80	1.70
Crude fibre%	3.85	4.75	4.42

*Premix supply per kg of diet; Vitamin A (8,000 IU), Vitamin D_3 (1,200 IU), Vitamin E (3 IU), Vitamin K_3 – KSTAB (2mg), Vitamin B_2 – Riboflavin (3mg), Nicotinic acid (10mg), Pantothenic acid (150mg), Manganese (Mn) (80mg), Zinc (Zn) (50mg), Copper (Cu) (2mg), Cobalt (0.2mg), Selenium (Se) (0.1mg).

RESULTS AND DISCUSSION

Table 2 shows the effect of different regimens of early nutrient restriction on the overall performance of broilers. There was no significant difference in the daily feed intake ($P>0.05$). However, Leeson *et al.* (1991) reported that birds offered a diluted diet attempted to maintain their nutrient intake by consuming more feed. It is worth noting that the quantity of feed consumed or the rate of feed intake by birds may be dependent on some major factors such as, the length of the feed restriction, the phase of growth when the feed restriction was embarked on, the type of feed restriction and the severity of the feed restriction. In this research study where a mild type of feed restriction was carried out, feed intake of birds on the control diet was not significantly different from those on the nutrient restricted diet. Dietary treatments had no significant effect on daily weight gain of broilers ($P>0.05$). This observation is similar to the findings of some researchers like, Pinchasov and Jensen (1989); Yu *et al.* (1990); Azamik *et al.*, 2010, they found no significant difference in feed efficiency between feed restricted and full-fed broilers. In contrast to the findings of this research study, however, Hassanien (2011) reported that feed restriction systems had significant effect on body live weight, body weight gain and feed conversion ratio during the starter phase. Hassanien (2011) also mentioned that feed restriction significantly led to decrease in feed intake and at the same time improved economic efficiency of broilers. Likewise, McMurty *et al.* (1988) suggested that there was an advantage for early feed restriction in terms of improving feed efficiency with broiler chickens.

Table 2: Effect of different regimens of early nutrient restriction on performance of broilers

Treatments	Daily feed intake (g/day)	Daily weight gain (g/day)	FCR
1	77.41	25.55	3.03
2	78.84	28.46	2.77
3	79.36	26.84	2.96
4	79.66	28.82	2.76
5	79.29	28.20	2.81
6	82.82	27.57	3.00
Significance	NS	NS	NS
SEM	± 6.2	±3.3	± 0.05

FCR= Feed conversion ratio
NS= Not significant
SEM= Standard error of mean

The effect of different regimens of early nutrient restriction on abdominal fat of broilers is presented in Table 3. As depicted in Table 3, birds in treatment 4 which were fed diet 2, 1 and 2 for 8, 4 and 8 days respectively until 16 days of feeding diet 2 was achieved, had 2.16% abdominal fat expressed as a percentage of carcass weight. While their control counterparts had 3.21% abdominal fat expressed as a percentage of carcass weight, however, this difference was not statistically significant (P>0.05). Similar observation was made by Zubair and Leeson, (1994) and this result also agrees with the research finding of Mollison *et al.* (1984), they observed that lowering the calorie-protein ratio tended to reduce abdominal fat, but not significantly. The effect of varying regimens of early nutrient restriction not being significant may be associated with the fact that the restriction embarked on was rather mild and not severe enough to produce significant reduction in the deposition of abdominal fat of broilers fed the nutrient restricted diet. However, research reports from the study carried out by Rezaei and Hajati (2010) showed that feed dilution with 20% rice hull during 16 to 20 days of age of broilers did not negatively affect performance and in addition reduced abdominal fat pad weight and carcass crude fat proportion of broilers. According to Jones and Farrell (1992) early nutrient restriction may limit adipocytes hyperplasia. The success of early life nutrient restriction in decreasing fat deposition in broiler chickens is associated to negative energy balance achieved during the period of restriction. The broiler chickens on a qualitative feed restriction produced less fat and more protein deposition in carcass, when compared with the broilers on the control diet (Longo *et al.*, 1999). Conversely, these research authors may not have embarked on a mild type of feed restriction as they reported deposition of less fat, contrary to the observation made from this study in which the nutrient restriction carried out did not produce significant decrease in the deposition of the abdominal fat of broiler chickens.

Table 3: Effect of different regimens of early nutrient restriction on abdominal fat of broilers

Treatments	Carcass weight (g)	AFW (g)	AFW as % of carcass weight
1	1,183.00	38.00	3.21
2	1,210.00	30.50	2.52
3	1,097.00	29.60	2.69
4	1,193.00	25.80	2.16
5	910.00	28.30	3.10
6	1,170.00	34.20	2.92
Significance	NS	NS	NS
SEM	± 116.83	± 6.90	± 0.17

AFW= Abdominal fat weight
NS= Not significant
SEM= Standard error of mean

CONCLUSION

The different regimens of early nutrient restriction had no negative influence or detrimental effect on the weight of birds at market age, likewise performance parameters like daily weight gain, daily feed intake and feed conversion ratio were not adversely affected. Nevertheless, the abdominal fat deposition of broiler chickens was not significantly influenced by dietary treatments, probably because the nutrient restriction was not severe enough to cause reduction in the abdominal fat deposition of birds.

REFERENCES

Azamik, A., Bojarpour, M., Eslami, M., Ghorbani M.R. and Mirzadeh K. (2010). The effect of different levels of diet protein on broilers performance in *ad libitum* and feed restriction methods. *Journal of Animal and Veterinary Advances* 9 (3): 631-634. DOI: 10.3923/javaa.2010.631.634.

David, L. S. and Subalini, E. (2015). Effects of feed restriction on the growth performance, organ size and carcass characteristics of broiler chickens. *Scholars Journal of Agriculture and Veterinary Sciences* 2(2A):108-111. Available Online: http://saspjournals.com/sjavs 108 Scholars Journal of Agriculture and Veterinary Sciences.

Hassanien, H.H.M. (2011). Productive performance of broiler chickens as affected by feed restriction systems. *Asian Journal of Poultry Science* 5: 21-27. DOI: 10.3923/ajpsaj.2011.21.27.

Hausberger, F.X. (1981). Effect of nutritional factors on the development of adipose tissue. In: Handbook of Nutritional Requirements in a functional context Jr. ed.1: 365-388.

Jones, G.P.D and Farrell, D.J. (1992). Early-life food restriction of broiler chickens. II. Effects of food restrictions on the development of fat tissue. *British Poultry Science* 33:589-601.

Leeson, S., Summers, J.D. and Caston, L. (1991). Diet dilution and compensatory growth in broilers. *Poultry Science* 70:867-873.

Longo, F.A., Sakomura, N.K., Benatti, M.R.B., Junqueira, O.M. and Zanella, I. (1999). Effects of early-life feed qualitative restriction on performance, characteristics of gastro-intestinal tract and carcass of broiler. 12/1998; 28(6):1310-1318. DOI: 10.1590/S1516-35981999000600019. *Revista Brasileira de Zootecnia* 28(6):1310-1318.

McMurtry J.P., Rosebrough R.W., Plavnik I. and Cartwright A.L. (1988). Influence of early plane of nutrition on enzyme systems and subsequent tissue deposition. In: Bio-mechanisms regulating growth and development. First Edition, Steffens GL, Rumsey TS editors. Dordrecht, the Netherlands. 329- 341.

Mollison B., Guenter W. and Boycott B.R. (1984). Abdominal fat deposition and sudden death syndrome in broilers: the effects of restricted intake, early life caloric (fat) restriction, and calorie: protein ratio. *Poultry Science* 63(6): 1190-1200.

Novel D.J., Ng'ambi J.W., Norris, D. and Mbajiorgu, C.A. (2009). Effect of different feed restriction regimes during the starter stage on productivity and carcass characteristics of male and female Ross 308 broiler chickens. *International Journal of Poultry Science* 8 (1): 35-39.

Ozkan, S., Plavnik, I. and Yahav, S. (2006). Effect of early feed restriction on performance and ascites development in broiler chickens subsequently raised at low ambient temperature. *Journal of Applied Poultry Research* 15:9-19.

Pinchasov, Y. and Jensen (1989). Comparison of physical and chemical means of feed restriction in broiler chicks. *Poultry Science* 68: 61-69.

Plavnik, I. and Hurwitz, S. (1985). The performance of broiler chickens during and following a severe feed dilution at an early age. *Poultry Science* 64:348-355.

Plavnik, I. and Hurwitz, S. (1991). Response of broiler chickens and turkey poults to food restriction of varied severity during early life. *British Poultry Science* 32:343-352.

Rezaei, M. and Hajati, H. (2010). Effect of diet dilution at early age on performance, carcass characteristics and blood parameters of broiler chicks. *Italian Journal of Animal Science* DOI:10.4081/ijas.2010.e19.

Rezaei, M., Teimouri, A., Pourreza, J., Syyahzadeh, H. and Waldroup, P.W. (2006). Effect of diet dilution in the starter period on performance and carcass characteristics of broiler chickens. *Journal of Central European Agriculture* 7(1):63-70.

Saleh, E.A., Watkins, S.E., Waldroup, A.L. and Waldroup, P.W. (2005). Effects of early feed restriction of live performance and carcass composition of male broilers grown for further processing. *Poultry Science* 14:87-93.

Szepesi, B. (1980). Effect of frequency of calorie deprivation on the success of growth compensation. *Nutrition Report International* 21: 479-486.

Yu, M.U., Robinson, F.E., Clandinin, M.T. and Bodnar, L. (1990). Growth and body composition of broiler chickens in response to different regimens of feed dilution. *Poultry Science* 69:2074-2081.

Zubair, A. K. and Leeson. S. (1994). Effect of varying period of early nutrient restriction on growth compensation and carcass characteristics of male broilers. *Poultry Science* 73 (1): 129-136. DOI: 10.3382/ps.0730129.