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Influence of Feed Withdrawal for Different Durations on the Performance of Broilers in Summer

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ABSTRACT

One hundred twenty broiler chicks (two weeks old) were employed as experimental birds. These birds were randomly divided into twelve replicates of ten chicks each and the replicates were further randomly allotted to four treatment groups (A, B, C & D). Group A served as control and was fed *ad libitum*. Whereas, group B, C and D were kept off feed from 9:00 a.m. to 3:00 p.m., 9:00 a.m. to 5:00 p.m. and 9:00 a.m. to 7:00 p.m., respectively, for four weeks (2 - 6 weeks of age). The data on initial body weight, feed consumption, weight gain rectal temperature and mortality (if any) were recorded. The birds kept off feed from 9:00 a.m. to 7:00 p.m. gained significantly ($P < 0.05$) more weight (1275 gm) and utilized their feed more efficiently (2.07) than those of control group, fed *ad libitum*. However, the feed consumption was found to be significantly lower (2433 g) in the birds kept off feed from 9:00 a.m. to 3:00 p.m. The rectal temperature did not differ among the birds of various groups; however, the temperature of the birds fed *ad libitum* (control) apparently remained slightly higher than those of the feed restricted groups. Mortality occurred (2 birds), only in the control groups.

Key Words: Feed; Performance; Broilers

INTRODUCTION

The subtropical zone of the Northern Hemisphere of the world contains Pakistan with pretty vital geographic locality in respect of climatic factors. In this zone, temperature always remains well beyond the higher side of the thermoneutral zone for most part of the year. Sometimes temperature of this zone rises up to 52°C during summer, which adversely affects the poultry production (Anjum, 2000).

Broilers are more susceptible to heat during the last 3 weeks of their growing period (3 to 6 weeks of age) and the male are affected more than the female (Xin *et al.*, 1994). Therefore, economic losses attributable to heat prostration are especially large because these usually occur shortly before the broilers are marketable.

Various studies have shown that the effect of heat stress can be appeased by certain practices like use of cooling devices, immersion of birds in water, mist spray, and head wetting (Ali *et al.*, 1995). These treatments may help in increasing the feed intake, consequently resulting into improved performance of the birds (Njoku & Nwazota, 1989). But these cooling practices also raise the cost of production. Therefore, poultry farmers have to bear all risks because they cannot afford expensive and pocket snatching cooling practices. However, in countries like Pakistan if they do so, it will be at cards because their production cost will increase and they will have to face economic losses.

To alleviate the effects of the heat stress, special management methods, involving feed restriction (Francis *et al.*, 1991; MacLeod *et al.*, 1993) or short term feed withdrawal during the hottest hours of the day (Smith & Teeter, 1988) may also be used. Moreover, feeding management of broilers to deprive off feed during the hottest hours of the day in the summer months, may help resist heat stress possibly because of much easier regulation against the expected rise in their body temperature due to discontinuation of further heat production during that critical period.

In subtropical zone area time limit feeding during cool hours is a common practice for combating heat stress. Yousaf (1985) recommended that birds should not be fed during afternoon when there is potential for heat prostration. As an inference of this study, time limit feeding during the cold hours of the day may reduce the chances of heat prostration in the birds. Therefore, feed withdrawal during hot hours of the day may be a choice to reduce the effect of broiling temperature during summer and to prevent the extra cost for the installation of cooling devices in the poultry houses. Keeping in view the information above, a project was planned to study the effect of feed withdrawal during hot hours of the day, on the growth performance, rectal temperature and livability of broilers.

MATERIALS AND METHODS

The study was executed at the Poultry Research Centre, University of Agriculture, Faisalabad. One hundred and eighty, 1-day old broiler (Hubbard) chicks were purchased from a local hatchery and were reared in a group for two weeks (acclimatization period). The start of 3rd week at day fifteen, all the chicks were weighed and one hundred twenty chicks of middle weight range were selected. These chicks were randomly divided into twelve experimental

units (replicates), having ten chicks each. These experimental units were further allotted to four treatment/groups (three replicates/treatment) A, B, C and D. Group A served as control and was fed *ad libitum*. Whereas group B, C and D were, kept off feed from 9:00 a.m. to 3:00 p.m., 9:00 a.m. to 5:00 p.m. and 9:00 a.m. to 7:00 p.m., respectively.

During the adaptation period the birds were fed a commercial broiler starter mash *ad libitum*. After this the birds were given a ration containing 20.25% crude protein and 3125 Kcal ME/ kg feed (Table I), up to the age of six weeks (28 days, experimental period). The bids were kept under the same management conditions like space, light, temperature, ventilation and relative humidity. Fresh and clean water was available *ad libitum*. Cost of production of the birds in each group was calculated on per bird basis to see the economics of production of the birds for each group.

The data on initial body weight, weekly feed consumption, body weight gain and mortality (if any) were recorded up to six week of age and then used to calculate feed conversion ratio of the broilers. Rectal temperature of the birds (two bird/replicate) was recorded three times (at 9:00 a.m., 2:00 p.m. & 7:00 p.m.) daily.

Statistical analysis. The data thus collected were analyzed by the analysis of variance technique in completely randomized design. The differences in the means were compared by the Least Significance Difference (Steel *et al.*, 1996) test.

RESULTS AND DISCUSSION

Feed consumption. The average feed consumption of the birds during the experimental period for treatment A, B, C and D was 2612, 2433, 2538 and 2643 g, respectively (Table II). The birds kept off feed from 9:00 a.m. to 3:00 p.m. consumed significantly ($P < 0.05$) less feed than those of the other groups. However, there was no difference in feed consumption among the control and the other two feed restricted groups (C & D).

Reduced feed consumption due to feed restriction has also been observed by Smith and Teeter (1988), who fasted the broilers by feed deprivation. However, in the present study in the groups where the birds were fasted from 9:00 a.m. to 7:00 p.m. and from 9:00 a.m. to 5:00 p.m., the feed consumption of the birds was same to those of the control group. Similar findings have been observed by Wilson *et al.* (1989) who found that in afternoon feeding when feeding time and body temperature interaction was studied, the rate of the feed consumption was normal. The results of the present study coincided with the findings of Lepkovsky and Furuta (1960) who reported that feed restriction resulted in depressed feed consumption initially but with the increase in time of restriction the feed consumption also increased.

Equal amount of feed intake during longer period of restriction like those of *ad libitum* fed (control) birds may probably be due to the ability of the birds to adapt themselves during longer period of restriction so that the actual feed intake remained normal.

Table I. Chemical Composition of the Broiler Rations

Nutrients	Starter	Experimental ration
Crude protein (%)	22.05	20.25
Metabolizable energy (K. cal/kg)	3035	3125
Crude fiber (%)	3.53	4.21
Moisture (%)	7.85	7.65
Total ash (%)	7.30	7.79
Ether extract (%)	3.95	4.50
Sodium (%)	0.21	0.30
Potassium (%)	0.35	0.30
Calcium (%) available	0.96	0.94
Phosphorus (%)	0.42	0.45

Table II. The average initial body weight, feed consumption, final body weight, weight gain and feed conversion ratio of broilers from 2-6 weeks of age

Description	Groups			
	A	B	C	D
Initial body weight (g)	312.76	313.2	313.26	313.06
Feed consumption (g)	2612^{a}	2433^{b}	2538^{ab}	2643^{a}
Final body weight (g)	1478	1443	1527	1588
Weight gain (g)	1165^{b}	1130^{b}	1214^{ab}	1275^{a}
Feed conversion ration (g feed consumed/ g weight gain)	2.24^{a}	2.15^{a}	2.09^{ab}	2.07^{a}

Value within same row with different superscript are significantly different ($P<0.05$)

Weight gain. The average weight gain of broiler chicks in group A, B, C and D was 1165, 1136, 1214, and 1275 g, respectively during the 28 days of experimental period. The statistical analysis of the data revealed that the birds of group kept off feed from 9:00 a.m. to 7:00 p.m. gained significantly ($P < 0.05$) higher weight than those of the other groups; whereas, the lowest gain was observed in those kept off feed from 9:00 a.m. to 3:00 p.m. and those of control group.

The time of restriction seemed to affect the weight gain of the birds in this experiment. It can be inferred from the results of the study that the birds subjected to longer time feed restriction also gained more weight than those of the other treatment groups. Similar findings have been reported by Lee and Leeson, (2001) who observed that feed restricted birds gained more weight than full fed control birds. The results of the present study also agree with the finding of Ohtani and Leeson (2000) who compared the effects of intermittent feeding with repeated cycle of one-h darkness program, with continuous lighting program on the performance of the broiler chickens. Based on the results of the study, it was concluded that feed intake and weight gain in the intermittent lighting was higher.

Higher weight gain of the birds kept off feed for longer period (from 9:00 a.m. to 7:00 p.m.) was due to more feed consumption, which may be attributed to the feeding during cool hours. Because there might have been less metabolic heat production in feed restricted birds (Zhou & Yammoto, 1997; Zulkifli *et al.*, 2000) resulting into reduced stress in the birds caused by high environmental temperature, as compared to the *ad libitum* fed (control) birds.

Another explanation for justification of the above findings may be the feeding management of the broilers,

which were deprived of feed during the hottest hours of the day in the summer months. That might have helped resist heat stress possibly because of much easier regulation against the expected rise in their body temperature due to discontinuation of further heat production during that critical period (Francis *et al*., 1991).

Contrary to the finding of the present study various scientists (Pokniak *et al*., 1985; Fontana *et al.*, 1992; Zubair & Leeson, 1994; Zhong *et al*., 1995) have observed similar weight gain and even lower weight gain (Cable & Waldroup, 1990; Summers *et al.*, 1990; Yu *et al.*, 1990; Polo *et al.*, 1995) in the feed restricted birds. Probable explanation of these contrary findings may be the difference in feed restriction schedules (early feed restriction, dilution of feed and short period restriction) used for the studies.

Feed conversion ratio. Feed conversion ratio was calculated on the basis of amount of feed consumed to produce unit live weight gain in birds used for the study. The average feed conversion ratio values were 2.24, 2.15, 2.09 and 2.07 for the groups A, B, C and D, respectively. The results of the study exhibited that the birds kept on restricted feeding plans utilized their feed more efficiently than those fed *ad libitum* (control). However, the difference in feed conversion ratio of *ad libitum* fed birds and those kept off feed from 9:00 a.m. to 3:00 p.m. was found to be non-significant.

The results of present study coincide with the finding of McDanial *et al.* (1975), Plavnik and Hurwitz (1985), Zubair and Leeson (1994), Zhong *et al.* (1995), Lee and Leeson (2001), Rincon and Leeson (2002), who observed better feed efficiency in broilers kept on restricted feeding as compared to those fed *ad libitum*.

Duration of feed restriction affected the efficiency of feed utilization of the birds in the present study. The best feed conversation ratio was observed in the birds kept off feed for longer time than those kept off feed for shorter period of time or fed *ad libitum*. The results of the present study are compatible with the findings of McCarteny and Brown (1977) who found better efficiency of feed utilization in broilers with increase in feed restriction time.

Probable explanation for the efficient feed utilization of the birds kept on restricted feeding may be the reduced heat stress during hot hours of the day. Feed restriction during hot hours of the day might have reduced the metabolic heat production (Zhou & Yamamoto, 1997) resulting into reduced stress upon the birds. Moreover, feed restriction has been found to reduce the body temperature of broilers during summer days (Anjum, 2000). Hence, better efficiency of feed utilization may be attributed to the feed restriction of the birds during hot hours of the day. Feeding management of the broilers to deprive of feed during the hottest hours of the day in the summer months, may help to resist heat stress possibly because of much easier regulation against the expected rise in their body temperature due to discontinuation of further heat production during that critical period (Francis *et al*., 1991).

Rectal temperature. Average rectal temperature of broilers kept under various treatment groups are shown in (Table III). Feed withdrawal during the hot hours of the day had non-significant ($P < 0.05$) effect on the rectal temperature of the birds under study. However, the temperature of birds in group D, where the birds were kept off feed from 9:00 a.m. to 7:00 p.m. was found to be slightly lower than those of the other groups. Whereas, the temperature of the birds fed *ad libitum* (control) remained slightly higher than those of the restricted groups. Moreover, increase in the fasting period also resulted in comparatively lower rectal temperature of the broilers under study.

The results are in line with the findings of Francis *et al.* (1991); Smith (1992); Macleod *et al.* (1993); Teeter and Belay (1996) who reported that feed withdrawal at higher environmental temperature proved very useful in keeping the rectal temperature at lower range. The decrease in rectal temperature of the birds exposed to feed restriction may probably be due to less heat production in the body of the birds, which otherwise has been reported to increase linearly with increasing feed intake.

Mortality. The number of the birds that died during experimental period was two from the control group. It indicated that feed withdrawal helped in reducing the mortality of the birds. The findings of this study are similar with those observed by Fuller *et al.* (1973) where *ad libitum* feeding of high energy rations increased the mortality. The results are also in line with those observed by Smith (1992), Zulkifli *et al.* (2000) and Rincon and Leeson (2002). Who observed significant effect of feed restriction and acclimation on livability in heat stressed broilers. A probable explanation for no mortality in the feed restricted group may be the alleviation of heat stress due to keeping the birds off feed during hot hours of the day (Smith & Teeter, 1987, 1988). Therefore the results of the present study may be attributed to less heat stress on the birds because of restricted feeding plans.

Economics of production. The rearing cost of broilers kept under different feeding schedules in groups A, B, C and D was rupees 47.33, 45.48, 46.61 and 47.42, respectively (Table IV). As the experiment was conducted at the Poultry Research Centre, University of Agriculture, Faisalabad therefore the cost of production per broiler was calculated excluding the cost of labor. Miscellaneous cost, which summed up rupees 13.00/broiler included estimated cost of electricity, gas, litter, disinfection, vaccination and medication. The sale price of the broilers kept in groups A, B, C and D was rupees 59.08, 57.72, 61.08 and 63.52 per broiler, respectively.

The net profit per broiler in groups A, B, C and D excluding the cost of labors was rupees 11.75, 12.24, 14.67 and 15.90, respectively. The profit per broiler was apparently more from those kept off feed during the hot hours of the day. The highest profit was obtained from group D, where the birds were kept off feed for longer period i.e. from 9:00 a.m. to 7:00 p.m. followed by C, B and

Table III. Average rectal temperature (°C) of broilers kept under different feeding plans from 2-6 weeks of age

Description	Groups			
	A	B	C	D
Morning	41.7	41.6	41.6	41.7
Afternoon	42.1	42.0	41.8	41.8
Evening	41.8	41.7	41.6	41.6

Table IV. Data showing economics of broiler production kept under different treatment groups

Description	Groups			
	A	B	C	D
Cost/chick (Rs.)	15.00	15.00	15.00	15.00
Feed consumed (Kg) (1-day to 2 weeks)	0.51	0.52	0.50	0.50
Feed consumed (Kg) (3 to 6 weeks)	2.612	2.433	2.538	2.643
Total feed (Kg)	3.121	2.953	3.038	3.148
Feed cost/Kg Rs.	11.00	11.00	11.00	11.00
Feed cost (6 weeks of age)	34.33	32.48	33.41	34.62
Miscellaneous	13.00	13.00	13.00	13.00
Total cost/broiler	47.33	45.48	46.41	47.62
Average live wt. (Kg)	1.477	1.443	1.527	1.588
Sale price/Kg live wt.	40.00	40.00	40.00	40.00
Sale price/broiler	59.08	57.72	61.08	63.52
Net Profit	11.75	12.24	14.67	15.90

Note: The values were calculated on per broiler basis.

A.

In making a final assessment of the study, longer period of feed restriction during hot hours of the day seemed to be the most effective feed restriction program, because the results showed more feed intake, higher growth rate and better feed conversion ratio of the birds in this group. Moreover, less mortality and better profit margin as compared to *ad libitum* fed birds make the restricted feeding an economical pursuit during summer season.

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