Feed Intake Effects on Egg Quality of Nonstressed and Heat Stressed Layers

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Story in Brief

The effects of feed intake and environment on 5 egg quality parameters were estimated by force feeding layers housed under thermoneutral (24 C) and heat stressed (35 C) environments. Feed intake levels evaluated included 70, 85, 100 and 115% of thermoneutral ad libitum consumption. Heat stress depressed egg weight (3.2%), shell weight (7.4%), shell thickness (9.3%), specific gravity (1%) and albumin height (11.2%). Increasing feed consumption of heat stressed layers by force feeding increased egg weight (2.6%), shell weight (.4%), shell thickness (.7%), specific gravity (.2%) and albumin height (8.7%). However, layer mortality increased linearly with intake. Layers housed in a thermoneutral environment force fed at the 70% ad libitum consumption level had reduced egg weight (5.0%) and albumin height (13%) while other parameters remained nearly constant. Increasing feed intake of thermoneutral layers to 115% ad libitum was without effect. Data indicate that increasing feed consumption of heat stressed layers enables partial recovery of egg quality.

(Key Words: Layers, Heat Stress, Egg Quality, Feed Intake.)

Introduction

Environmental factors are well known to influence egg shell quality. Heat stress and feed intake have been of particular interest in the past decades. Shell quality and feed consumption decline when ambient temperature is increased above the zone of thermoneutrality. This decline is in part due to a decline in feed consumption and to the physiological changes that the birds undergo during heat stress.

The present study was initiated to investigate the effects of four different levels of feed intake at two environmental temperatures on egg quality parameters.

Materials and Methods

In this study, 151 72-wk old shaver layers were obtained from a commercial producer and placed in individual metabolism cages in two environmental chambers. Birds in each chamber were divided in five different groups. Birds were assigned to each treatment in a completely randomized design. Birds were allowed to adapt to the chambers for a period of 8 days, and fed a basal diet during which test values were obtained for all the egg quality parameters. During this period one chamber was maintained at a constant 24 C with 55% relative humidity (RH), while the ambient temperature of the other chamber was increased daily until it reached 36 C with 55% RH. Both chambers were kept under 16 hour timed lighting. A different dietary level was then force fed to

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Table 1. Composition of basal diet.

Ingredient	% of diet
Ground corn	59.5
Soybean meal	21.0
Calcium carbonate	8.4
Alfalfa	2.5
Dicalcium phosphate	2.6
Salt	.5
Vitamin Pre-mix	.35
D-L-methionine	.10
Trace minerals	.05
Fat	5.0

each group in both chambers for a period of 10 days. Control groups were fed basal diet (Table 1) ad libitum, while the other groups were force fed at 70, 85, 100 and 115% of what the ad libitum feed consumption was for the control group at thermoneutral conditions. Force feeding was accomplished by inserting a tygon tube into the bird's crop, and delivering the required amount of feed. This amount was determined by weighing the force feeding gun before and after delivery of the feed (Teeter et al., 1984). Birds were force fed three times daily during the trial.

Feed consumption, body weight, egg weight, specific gravity, albumin height, shell weight, shell thickness and mortality data were recorded during the experimental period.

Results and Discussion

The effects of environment on the parameters studies on birds fed ad libitum are summarized in Table 2. In this study, birds fed ad libitum and exposed to heat stress reduced feed intake by approximately

Table 2. Egg quality on birds fed ad libitum.

	24 C	35 C
Feed intake (% body wt)	7.800[a]	5.470[b]
Body wt change (g)	38.300[a]	-42.100[b]
Egg weight (g)	65.423[a]	62.598[b]
Shell weight (g)	8.338[a]	7.765[b]
Specific gravity	1.079[a]	1.065[b]
Albumin height (mm)	5.650[a]	4.553[b]
Shell thickness (mm)	0.014[a]	0.012[b]

[a,b]Means within a row with unlike superscripts significantly differ ($P<.05$).

30% (P<.05). As a result layers under thermoneutral environment gained weight as compared with layers under heat stress who lost weight significantly. Equalizing feed intake across the 2 environmental temperatures resulted in the layers within the heat stress environment gaining significantly more body weight (Figure 1). Equalizing feed intake at 5.5% resulted in depressed egg weight at both environmental temperatures. Increasing feed intake to thermoneutral ad libitum consumption level significantly (P<.05) enhanced egg weight. This enhancement was maintained through 115% of ad libitum consumption within the thermoneutral environment. However, increasing feed consumption to the 115% level in the birds under heat stress significantly (P<.05) depressed egg weight (Figure 2). Increasing feed intake within both environments did not

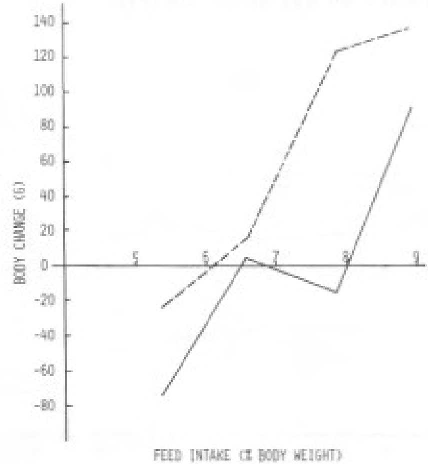

Figure 1. Body change.

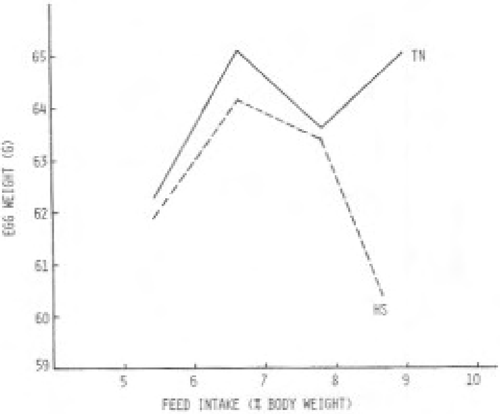

Figure 2. Egg weight.

have an effect on shell thickness (Figure 3) or shell weight (Figure 4). Specific gravity, on the other hand, was significantly ($P<.05$) elevated when birds under heat stress environment were fed at 115% level (Figure 5). Albumin height (Figure 6) was highly and positively correlated with different levels of feed intake in both thermoneutral and heat stressed environments.

These results indicate that increasing feed intake above ad libitum tends to increase egg quality on layers housed under heat stressed environments. At thermoneutral environment, reducing feed intake by 15% did not have any adverse results on egg quality, suggesting that limiting feed intake of birds housed under thermoneutral environment might be of value. However, long term studies would be necessary to determine the influence of feed intake on overall egg production, and the effect of egg production responses on egg shell quality.

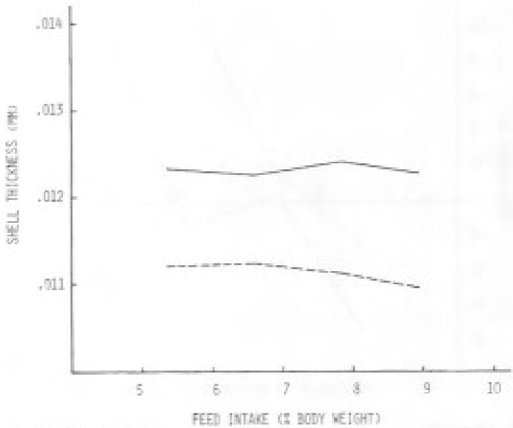

Figure 3. Shell thickness.

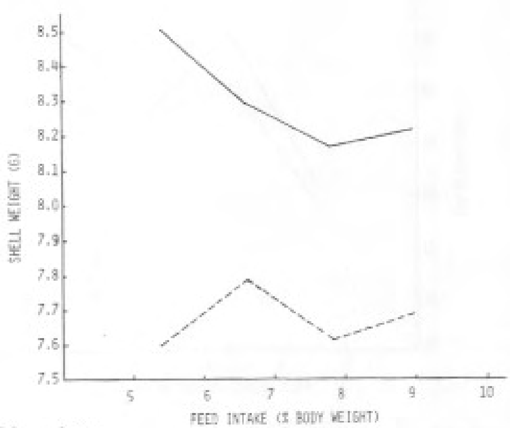

Figure 4. Shell weight.

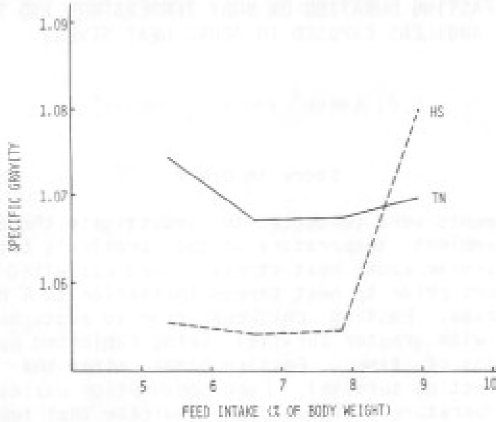

Figure 5. Specific gravity.

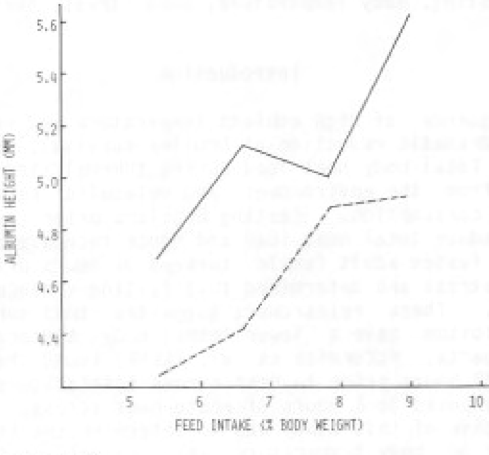

Figure 6. Albumin height.

Literature Cited

Teeter, R.G. et al. 1984. Force feeding methodology and equipment for poultry. Poultry Sci. 63:573.