

## The Reaction of Turkeys to Hot Weather

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Bronze and Beltsville turkey males were exposed to direct sun rays and compared with control shaded groups of both breeds. The exposed birds recorded higher values for all items. The respiration rate recorded the highest rise due to solar radiation followed by the temperatures of caruncles, back feather, back skin, abdomen skin and body temperature respectively and the variation occurred was highly significant for all items. The Bronze showed more percentage of increase than Beltsville in all items except that of respiration which gave reverse results. This gives evidence that Beltsville is more tolerable to heat stress than Bronze.

Bronze and Beltsville males were sprinkled by water at noon during the hot dry summer months (June and July) and compared with control group of both breeds. Sprinkling lowered the values of all items and the least reduction occurred in body temperature, while the greatest one was in respiration rate. The variation due to treatment was significant in both breeds. The reduction due to sprinkling was greater in Bronze than Beltsville.

### *Effect of exposure to solar radiation*

The intensity of solar radiation denoted by the temperature on the back feathers of Broad Breasted Bronze turkey males seems to be the major factor responsible for raising the body temperature of birds when exposed to air temperature above 30°C (Kosin and Mitchell, 1955).

### *Standing in water and bathing*

Standing in water is more efficient than air in cooling birds by conduction and convection. On the other hand, the tendency of birds for bathing during hot atmospheres is commonly observed. Bathing is of great importance as it aids evaporative heat loss although it is limited with the percentage of relative humidity on ambient air. The loss of heat increase in hot-dry air and becomes less in hot humid one (King and Farner, 1964).

### *Shading*

Shading is an important managerial method affecting body temperature of turkeys especially when air temperature exceeds 32.2°C, but the significant effect is at 40°C as the body temperature is remarkably affected (Wilson and Woodard, 1955).

## Material and Methods

### *Effect of direct solar radiation on body reactions*

This experiment was designed to study the effect of exposure to direct sun rays (insolation) and shading during hot summer months on the reactions of birds. Two groups, each of 10 tons one from White Beltsville and the other from Bronze breeds were exposed for 20 min to direct sun rays while the same number of each breed was kept in shade as controls. The investigations were carried out only at noon for five successive weeks during June and July.

### *Effect of sprinkling*

This study was carried out to show the effect of sprinkling on the body reactions during summer months. Ten Bronze males and ten White Beltsville males were sprinkled with water and equal number of each breed were used as controls. The birds were sprayed with tap water for one min using a hand-pump sprayer just to moisten the bird within dripping. Tests were carried out weekly at noon for five successive weeks during July and the beginning of August.

All the birds were fed balanced ration. Body temperature was measured by clinical mercury thermometers in the cloaca to depth of 4 cm and left 2 min. Skin temperatures were measured by a surface thermistor thermometer apparatus. The probe was applied to surface for one min before recording the temperature. Skin temperature was recorded on three body regions, back, abdomen and caruncles. The same technique was also used to measure feather temperature for the back feather region. Respiration rate was measured by counting the movements of the abdomen, stopwatch and a counter were used to count the rate per min.

Analysis of variance was done to test the differences between treatments. Differences were considered significant at 5% level of probability and highly significant at 1% level of probability.

## Results and Discussion

### *Effect of direct solar radiation on body reactions of turkeys*

The exposure of Bronze and Beltsville turkey males to direct sunrays for 20 min at noon 52 - 55°C, while the air temperature in shade ranged from 37 60 40°C, caused a marked increase in the values of the body reactions of all the exposed birds compared to the shaded ones. The percentage of variation was the highest in respiration rate followed by temperatures of caruncles, back feather, bak skin, abdomen skin and body temperature respectively (Table 1 and 2). The percentage of increase was greater in Bronze than Belts-

ville in all items except that of respiration rate. The breed differences which were slight in the shaded groups became wider in the exposed ones. The variation in the reactions due to the exposure was highly significant for all items. Concerning the breed difference it was significant only in the temperatures of feather, abdomen skin and caruncles, while it was not significant in the other items (Table 3).

TABLE 1. The effect of exposure to direct solar radiation on heat regulating reactions of Bronze and Beltsville turkey males.

Items	Range of air temperature							
	Non exposed (37-40°C)				Exposed (52-55°C)			
	Bronze		Beltsville		Bronze		Beltsville	
		±		±		±		±
Body temp. °C . . . . .	41.2	0.141	41.2	0.092	42.3	0.129	42.2	0.226
Back skin temp. °C . . . . .	39.0	0.168	38.9	0.149	40.9	0.426	40.3	0.262
Abdomen skin temp. °C . . . . .	39.6	0.130	39.4	0.159	41.2	0.169	40.7	0.205
Back feather temp. °C . . . . .	37.7	0.180	37.5	0.197	39.9	0.231	38.7	0.141
Caruncles temp. °C . . . . .	38.2	0.138	38.2	0.150	40.5	0.285	39.7	0.200
Respiration rate per min . . . . .	191	9.1	154	13.0	245	9.6	216	11.1

TABLE 2. Percentage of increase in the body reactions of Bronze and Beltsville turkey males, compared with Fayoumi cocks when exposed to direct sunrays.

Items	Breed		
	Bronze	Beltsville	Fayoumi*
Body temperature °C . . . . .	2.7	2.4	3.1
Back skin temperature °C . . . . .	4.8	3.6	4.1
Back feather temperature °C . . . . .	5.8	3.2	3.0
Abdomen skin temperature °C . . . . .	4.0	3.3	4.1
Caruncles or comb temperature °C . . . . .	6.0	3.9	5.7
Respiration rate/minute . . . . .	28	40	200

\* From Kamar and Khalifa (1964)



TABLE 3. Analysis of variance of exposure to direct sun rays and its influence on heat regulating reactions in bronze and Beltsville turkeys

Items	F Value		
	Breed	Treatment	Air Class
Body temperature °C . . . . .	0.0039	41.393**	2.414
Back skin temperature °C. . . . .	2.731	54.671**	58.877***
Back feather temperature °C . . . .	130.817**	950.297**	113.031**
Abdomen skin temperature °C . . . .	4.233*	69.108**	89.958**
Caruncles temperature °C . . . . .	4.578*	117.226**	64.713**
Respiration rate/min . . . . .	0.116	50.243**	332.246**

\* Significant.

\*\* Highly significant.

These results are in agreement with that of Kosin and Mitchell, (1955) as they demonstrated that the major factor involved in the rise of body temperature of Broad Breasted Bronze was the intensity of solar radiation measured on the back feather. In the present study, the increase in body temperature occurred simultaneously with the increase in feather and skin temperatures. In this case the birds became unable to dissipate much heat via the physical channels, radiation and convection, however, the unfeathered portions still have some value in the action as they have intensive blood supply. The panting showed by the birds emphasized that the two breeds depended upon increased respiratory activity to get more relief as evaporative cooling is the only efficient way of heat dissipation from the body under such conditions. The study also showed that the Bronze was more susceptible to heat stress and recorded more rise in temperatures than Beltsville. Nevertheless, of the initial value, the percentage value of increase in respiration rate of Beltsville was higher than Bronze. This may give evidence for the efficiency of evaporative cooling in Beltsville and could be considered as one of the factors which enabled to withstand heat stress than Bronze.

The results obtained by Kamar and Khalifa (1964) on chickens by exposing Fayoumi cocks to direct sun rays, using the safe method during summer and in the same location showed that the treatment caused increase in the values of all items. The both breeds of turkey showed lower increase in their body temperature and respiration rate than the Fayoumi cocks. This proves higher efficiency in heat regulation in turkey than in chickens. In spite of

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the enormous increase in the respirations rate in Fayoumi, it was less capable of maintaining its body temperature in comparison to turkey breeds (Table 2). The percentage of increase in temperatures of back skin, back feather and caruncles was higher in Bronze than in Fayoumi cocks and this may be due to plumage colour or the thickness of feather coat or heavier body weight of Bronze.

*Effect of sprinkling on body reactions in turkeys*

The value of sprinkling Bronze and White Beltsville turkey males as a method of cooling during the severe noons of July was obvious. It lowered the temperatures of body, back skin, abdomen skin, feathers and caruncles respiration rate. The lowest value for that reduction was of the body temperature and the greatest was that of respiration rate followed by feather temperature (Table 4). The reduction was greater at the higher air temperature than the lower one. The analysis of variance showed that the change in body reactions due to the treatment and air temperature range was highly significant (Table 5). The reduction was greater in Bronze than in Beltsville in all items except of caruncles. The breed difference was more pronounced in respiration rate since the Bronze recorded the greatest reduction in the number of breathes per min. The analysis of variance for the effect of sprinkling showed that the breed differences due to the treatment was highly significant in caruncles and feather temperatures and respiration rate but only significant in body and abdomen temperatures.

TABLE 4. The mean values of reactions of nonsprinkled and sprinkled Bronze and Beltsville turkey at two ranges of air temperature.

Items	Air temperature range 34.0 — 37.0°C							
	Bronze				Beltsville			
	N. Sp.		Sp.		N. Sp.		Sp.	
		±		±		±		±
Body temperature °C . . . .	41.2	0.144	41.0	0.074	41.1	0.087	41.0	0.068
Back skin temperature °C . .	38.7	0.221	37.9	0.353	38.3	0.209	37.6	0.176
Abdomen skin temperature °C	39.0	0.183	38.1	0.134	39.1	0.136	38.1	0.220
Back feather temperature °C .	37.4	0.190	35.4	0.200	36.9	0.248	34.4	0.231
Caruncles temperature °C . . .	38.2	0.187	37.3	0.160	38.0	0.183	36.7	0.150
Respiration rate per min . . .	158	12.3	98	8.9	121	9.8	75	8.7

TABLE 4. (Cont.) The mean values of reactions of nonsprinkled and sprinkled Bronze and Beltsville turkey at two ranges of air temperature.

Items	Air temperature range 37.5 — 40.0°C							
	Bronze				Beltsville			
	N. Sp.		Sp.		N. Sp.		Sp.	
Body temperature °C . . . .	41.4	± 0.095	41.1	± 0.094	41.3	± 0.076	41.1	± 0.056
Back skin temperature °C . .	39.5	0.153	38.2	0.184	39.3	0.153	38.0	0.206
Abdomen skin temperature °C	39.3	0.141	38.7	0.184	39.5	0.151	38.5	0.206
Back feather temperature °C	38.6	0.185	35.8	0.266	38.0	0.151	35.9	0.311
Caruncles temperature °C . .	39.0	0.178	38.0	0.172	38.9	0.169	37.7	0.210
Respiration rate per min . .	217	8.9	133	13.5	167	13.7	107	15.7

TABLE 5. Test of significance (F values) for the effect of sprinkling and air temperature on the body reactions of Bronze and Beltsville.

Items	F. Value		
	Breed	Treatment	Air temp. range
Cloacal temperature °C . . . . .	0.308*	7.231**	6.923**
Back skin temperature °C . . . . .	2.498	34.171**	16.330**
Abdomen temperature °C . . . . .	0.532*	71.259**	22.930**
Caruncles temperature °C . . . . .	8.838**	84.141**	48.116**
Back feather temperature °C . . . . .	9.272**	208.477**	43.707**
Respiration rate/min . . . . .	17.352**	62.202**	31.692**

\* Significant

\*\* Highly significant

In chickens, the findings of Kamar and Khalifa (1964), showed that sprinkling Fayoumi cocks under the same environmental conditions and using the same method had no effect on reducing body and abdomen skin temperatures. On the other hand, it reduced greatly respiration rate and comb temperature followed by back feather and back skin of cocks respectively (Table 6). The comparison between the present result on turkeys and that obtained by Kamar and Kalifa, (1964) spotted light on the relationship between body temperature and respiration rate since the Fayoumi cocks which exhibited no reduction in body temperature have showed the lower reduction in respiration rate. Also the reduction in skin temperature was related to that of feather. The comparison also gave evidence that sprinkling is a method of cooling was more effective in turkeys than in chicken when they were raised is not atmosphere.

TABLE 6. Percentage of reduction in the values of body reactions of turkey due to sprinkling

Items	Air Temp. range				
	34—37°C		37.5—40°C		32—36°C
	Breed				
	Bronze	Belts	Bronze	Belts	Fayoumi cocks
Body temperature °C . . . . .	0.5	0.24	0.72	0.48	—0.47
Back skin temperature °C . . . .	2.1	1.8	3.3	3.3	1.2
Abdomen temperature °C . . . . .	2.3	2.5	3.0	2.5	Zero
Back feather temperature °C . . .	5.3	6.7	7.3	5.5	4.0
Caruncle or Comb temp. °C . . . .	2.3	3.4	2.6	3.1	8.0
Respiration rate/min . . . . .	38	38	38	36	8.7

\* From Kamar and Khalifa (1964)

The prevailing climatic conditions of Egypt are those particular to subtropical countries in general, with spells of severe hot weather during the summer season where birds had to be under the direct effect of such ambient atmosphere. It is of prime importance to both the breeder and husbandry man to study the physiological reactions of their characters to such common conditions. Therefore, the principles of environmental amelioration could be arrived at whether in housing, feeding or management. Turkeys are by nature and practice kept in direct contact to such factors and their sensitivity to abnormal heat effect are known to be rather fatal.

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To prevent such male effects, abundant shade should be provided in the yards and plenty of ventilation in the roosting quarters should be provided. In such limited range of rearing the fenced yards may be beneficial if they are larger enough to provide green feed as well as comfortable exercise area. The area of land will vary according to the size of the flock and the nature of vegetation.

Under favourable condition adult turkeys may be kept through summer on free range with scattered trees and bushes or other economic plants in the place of raising to give comfortable microclimate. The free range needs constant attention of the herder to prevent theft or the free range may be carried out in places with boundaries of water streams as confinement, and for turkeys to drink. This procedure, although needs sacrifice of land it sounds to be practical.

Sprinkling with water during summer noons give the birds relief and comfort which increases their productivity and reproductivity. Therefore, keeping the birds at noon and applying mist spraying or fogging when it could be available will be useful to overcome the dry atmosphere in June and July.

It may also be advised that birds may be fed and also be free in the early morning and late afternoon, since, in these periods of the day the difference between the temperature of body surface in ambient temperature records the greatest value. Also, the reduction in body temperature which may reach optimal value at these period of the day facilitate the tolerance of birds to the heat produced after taking food and by locomotor activity.

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## تأثير التعريض لأشعة الشمس المباشرة وكذا تأثير الرش على ظواهر التحمل الحرارى فى الرومى

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عرضت ذكور الرومى من كل من البرونز والبلتسفيل لأشعة الشمس المباشرة وقورنت بمجموعات مظلة، وقد سجلت الطيور المعرضة لأشعة الشمس قيما أعلى لجميع الظواهر وكانت سرعة التنفس أعلاها وتلتها حرارة العرف فريش الظهر فجلد البطن ثم حرارة الجسم على التوالى . ولقد أظهر البرونز نسبة مئوية للزيادة فى جميع الظواهر أعلا من البلتسفيل فيما عدا سرعة التنفس التى أعطت نتيجة عكسية وهذا يوضح أن البلتسفيل أكثر مقاومة للضغط الحرارى من البرونز .

لدراسة تأثير الرش بالماء تم رش ذكور من كل من البرونز والبلتسفيل بالماء عند الظهر وذلك خلال شهر يوليو وهو من أشهر الصيف الحارة الجافة وقورنت هذه بمجموعة أخرى مكونة من كلا النوعين وقد أثر الرش بالماء كثيرا على الظواهر وخاصة سرعة التنفس وكان الأثر أكبر فى البرونز عن البلتسفيل .