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THE EFFECTS OF DIFFERENT SEASONS ON BODY TEMPERATURE IN JAPANESE QUAILS *(COTURNIX COTURNIX JAPONICA)* FROM DIFFERENT LINES

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ABSTRACT: In this research, the aim was to investigate the effects of different seasons on body temperatures in Japanese quails (*Coturnix coturnix japonica*) selected from different lines for 11 generations. The research was based on four lines, namely high body weight line (HL), low body weight line (LL), and a random bred control line (C) of 5-week body weight and layer line (L) of egg production for 120 days. The seasons, measurement time and lines had a significant effect on body temperatures (P<0.01). In the afternoon hours, inside temperatures and humidity values were determined as 17.88±0.360^{0}C - 55.49±1.93% in winter; 22.87±0.414^{0}C - 58.91±1.85% in spring and 32.33±0.315^{0}C - 54.21±2.34% in summer seasons. Average body temperatures were measured as 40.93 ± 0.011^{0}C and 41.28 ± 0.011^{0}C for morning and afternoon hours, respectively. At the same time, the difference (0.35^{0}C) between the morning and afternoon hours for body temperatures was found significant (P<0.01).
Key words: Japanese quail, Body temperature, Season, Temperature-Humidity

FARKLI HATLARDAKİ JAPON BILDIRCINLARINDA *(COTURNIX COTURNIX JAPONICA)* FARKLI MEVSİMLERİN VÜCUT SICAKLIĞINA ETKİLERİ

ÖZET: Bu çalışmada, farklı mevsimlerin 11 generasyon seleksiyon uygulanmış Japon bıldırcınlarında vücut sıcaklıklarına olan etkilerinin belirlenmesi amaçlanmıştır. Materyal olarak yüksek canlı ağırlık, düşük canlı ağırlık ve yumurta verimi yönünde seleksiyon uygulanan hatlar ile kontrol hattı kullanılmıştır. Mevsimin, ölçüm zamanının ve hatların vücut sıcaklığına etkileri önemli bulunmuştur (P<0,01). Öğle saatlerinde sıcaklık ve nem değerleri kış, ilkbahar ve yaz mevsimlerinde sırasıyla 17,88±0,360^{0}C - %55,49±1,93; 22,87±0,414^{0}C - %58,91±1,85; 32,33±0,315^{0}C - %54,21±2,34 olarak belirlenmiştir. Ortalama vücut sıcaklıkları sabah saatlerinde 40,93 ± 0,011^{0}C ve öğle saatlerinde ise 41,28 ± 0,011^{0}C olarak ölçülmüştür. Aynı zamanda, sabah ve öğle saatlerinde ölçülen vücut sıcaklıkları arasındaki fark (0.35^{0}C) önemli bulunmuştur (P<0,01).
Anahtar Sözcükler: Japon bıldırcını, Vücut sıcaklığı, Mevsim, Sıcaklık-Nem

1. INTRODUCTION

Chickens, which are homeothermic animals, are able to maintain constant deep body temperature (DBT) within a thermo neutral zone, which lies in the range of ambient temperatures (AT) within minimum energy expenditure (Lin, 1995). Van Kampen et. al. (1979) defined this range as 32.2-37.7 ^{0}C in the light, and as 27.5 – 37.7 ^{0}C in the dark, whereas other researchers identified 24 ^{0}C as being thermo neutral (Teeter et al., 1992; Fulton et al., 1993; Smith, 1993).

The DBT of unstressed chickens normally varies between 40.6 and 41.7 ^{0}C (Şenköylü, 2001). All classes of poultry experience heat distress as the combination of relative humidity and ambient temperature rises above the comfort zone. Chief among the factors influencing the bird's responses to heat distress are age, body size, previous exposure to heat distress and genetic make up. An acceptable brooding ambient temperature at hatching is 35 ^{0}C, while at just 4 weeks posthatcing 35 ^{0}C can elicit a significant heat distress response. The comfort zone for poultry declines from 35 ^{0}C at hatching to approximately 24 ^{0}C at 4 weeks of age. Therefore, poultry producers rarely worry about heat distress with poultry less than 4 weeks of age. Heavier and / or faster growing poultry breeds generally have a greater problem with heat distress as they mature. This occurs because bird's surface area, required for heat dissipation by conduction and convection, increases only three fourths as fast as body weight. Just as important as age and body size in the bird's susceptibility to heat distress is the environmental history of the bird (Teeter and Belay, 1996). Cahaner and Leenstra (1992), Washburn et al. (1992) and Yunis and Cahaner (1999) concluded that the effect of heat stress was more pronounced in commercial broiler stocks and in broilers with high growth potential than in slower-growing chickens. Since fast-growing broilers produce more heat, they have greater difficulty in dissipating heat in hot temperatures (Cahaner and Leenstra, 1992; Eberhart and Washburn, 1993; Yalçın et al., 1997), which leads to higher body temperatures (Cahaner et al., 1993) and reduced performance. As pointed out by Etches et al. (1995), the physiological responses to high temperature are effected complicatedly by many factors including relative humidity, strain, age of bird, feed energy level, light intensity, previous exposure to high ambient temperature and so on.

This study was carried out to determine the effects of different seasons on body temperatures in Japanese quails (*Coturnix coturnix Japonica*) selected from different lines for 11 generations.

2. MATERIALS AND METHODS

The material used in this research was selected from high (HL) or low (LL) body weight Japanese quail lines according to 5-week body weights and their random bred control line (C) and layer line (L) for 120 days egg production. These lines were raised in the Akdeniz University, Faculty of Agriculture in Turkey.

Birds were housed in individual cages in quail houses with windows at both sides and exposed to 16 hours of light and 8 hours of darkness. During the experiment, the quails were fed with a diet consisting of 11.7 MJ/kg metabolic energy and 210g crude protein/kg as *ad libitium* and unlimited water was supplied during the experiment.

The temperature and humidity of inside air were measured in summer, spring and winter seasons using thermohigrograph. Rectal temperature, as a measure of body temperature, was obtained using digital thermometer (±0.1^{0}C) by insertion approximately 3 cm into the cloak; the temperature was allowed to stabilize before the reading was obtained. The temperature was considered to be stable if it does not increase more than 0.06^{0}C in 5s.

Table 1. Inside temperatures and relative humidity values for seasons

	Winter	Spring	Summer
Temperature			
Morning (04-06)	7.72±0.294^{Aa}	12.97±0.347^{Ab}	22.19±0.269^{Ac}
Afternoon (14-16)	17.88±0.360^{Ba}	22.87±0.414^{Bb}	32.33±0.315^{Bc}
Relative humidity			
Morning (04-06)	87.78±1.85^{X}	94.42±0.772^{X}	94.50±0.886^{X}
Afternoon (14-16)	55.49±1.93^{Y}	58.91±1.85^{Y}	54.21±2.34^{Y}

a, b Means in a row with no common superscript differ significantly (P<0.01)
A, B and X, Y: Means in a column with no common superscript differ significantly (P<0.01)

The temperatures of most of the birds were stable within 10s, but occasionally as long as 30 s were required to reach a stable body temperature. The sexes were not identified because no differences between sexes were observed in the studies of Katanbaf et al. (1988) using 20 day-old chicks or Dunnington and Siegel (1984) using younger chicks.

In this study, the rectal temperatures of birds were measured in the afternoon (14-16 p.m.) and in the morning (04-06 a.m.) hours in all seasons. Data were analyzed by using the General Linear Model Procedure of SAS (Anonymous, 2002).

3. RESULTS

Means and standard errors for temperature and humidity in all seasons were given in Table 1, where it can easily be seen that there were significant differences between all seasons in terms of morning (04-06 a.m.) and afternoon (14-16 p.m.) temperatures. There were differences of 10.16 ^{0}C, 9.9 ^{0}C and 10.14 ^{0}C between the morning and afternoon temperatures in winter, spring and summer seasons, respectively. But, there were no significant differences between all seasons for relative humidity in the morning (04-06 a.m.) or in the afternoon (14-16 p.m.) hours. Also, there were determined differences of 32.29%, 35.51% and 40.29% between morning and afternoon hours for relative humidity in winter, spring and summer seasons, respectively. These differences between morning and afternoon hours in terms of relative humidity were found significant for all seasons.

Means and standard errors for body temperatures in terms of seasons, measurement times and lines were given in Table 2. As it was presented, there were found significant differences between seasons, measurement time and lines for the body temperatures. The highest and lowest body temperatures were determined in summer (41.36 ± 0.013^{0}C) and in winter (40.88 ± 0.013^{0}C) seasons, respectively. Also, the difference (0.35^{0}C) for body temperatures between the morning (40.93 ± 0.011^{0}C) and afternoon (41.28 ± 0.011^{0}C) hours was found significant (P<0.01).

Table 2. Body temperatures for seasons, measurement times and lines

		N	Body Temperatures
Seasons	Winter	572	40.88 ± 0.013 a
	Spring	584	41.09 ± 0.013 b
	Summer	576	41.36 ± 0.013 c
Lines	C	428	41.12 ± 0.015 b
	L	432	41.05 ± 0.015 a
	HL	428	41.21 ± 0.015 c
	LL	444	41.06 ± 0.015 a
Measurement time	Morning	866	40.93 ± 0.011 a
	Afternoon	866	41.28 ± 0.011 b

Means in a column with no common superscript differ significantly (P<0.01)

Means and standard errors for body temperatures in respect of interactions of season x line and season x measurement time were presented in Table 3. As it was seen, there was found significant interactions for season x line and season x measurement times.

Table 3. Body temperatures in terms of interactions of season x line and season x measurement time

Seasons	Lines	Body temperatures	Seasons	Measuremet time	Body temperatures
Winter	C	40.92 ± 0.026 c	Winter	Morning	40.65 ± 0.018 a
Winter	L	40.84 ± 0.026 b	Winter	Afternoon	41.12 ± 0.018 c
Winter	HL	41.01 ± 0.026 d	Spring	Morning	40.93 ± 0.018 b
Winter	LL	40.76 ± 0.026 a	Spring	Afternoon	41.25 ± 0.018 d
Spring	C	41.08 ± 0.026 d	Summer	Morning	41.23 ± 0.018 d
Spring	L	41.02 ± 0.026 d	Summer	Afternoon	41.49 ± 0.018 e
Spring	HL	41.17 ± 0.026 e			
Spring	LL	41.08 ± 0.025 d			
Summer	C	41.37 ± 0.026 f			
Summer	L	41.29 ± 0.026 f			
Summer	HL	41.45 ± 0.026 g			
Summer	LL	41.33 ± 0.026 f			

Means in a column with no common superscript differ significantly for seasonxline ($P<0.05$)
Means in a column with no common superscript differ significantly for seasonxmeasurement time ($P<0.01$)

4. DISCUSSION AND CONCLUSION

The body temperature of unstressed chickens normally varies between 40.6 and 41.7 ^{0}C (Şenköylü. 2001). Especially, the body temperature determined in winter season was lower than 41.0 ^{0}C. This was because, during low ambient temperature exposure (in winter season); heat losses (by radiation, conduction, and convection) from body surface increase, and body temperature cannot be maintained between the 40.6 and 41.7 ^{0}C. Heat loses by radiation; convection and conduction depend upon the temperature difference between the birds and their environment. In winter season, because of the high temperature differences between the birds and their environment, heat loses from body surface increased. There was found 0.35^{0}C difference between the measurement times for body temperatures (Table 2). Since, inside temperatures in the morning hours, was lower than the afternoon hours. average body temperature in the morning hours was found lower than those of the afternoon hours. That is, the measurement time had significant effect on body temperature. There were found significant differences between the body temperatures both in the morning and in the afternoon hours for all season (Table 3). The highest and lowest body temperatures were measured as 41.49 ± 0.018^{0}C and 40.65 ± 0.018^{0}C in the afternoon hours of summer and in the morning hours of winter seasons. respectively.

There were significant differences between the HL and other lines in point of the body temperatures in all seasons (Table 3). The highest body temperature was obtained in HL line in all seasons. Heavier and / or faster growing poultry breeds generally have a greater problem with heat distress as they mature. Also. Dunnington and Siegel (1984) found little correlation of body weight and body temperature among various White Rock lines and crosses. This occurs because bird surface area, required for heat dissipation by conduction and convection, increases only three fourths as fast as body weight. Also, Cahaner and Leenstra (1992). Washburn et al. (1992) and Yunis and Cahaner (1999) concluded that the effect of heat stress was more pronounced in commercial broilers stocks and in broilers with high growth potential than in slower-growing chickens. As fast-growing broilers produce more heat, they have greater difficulty in dissipating heat in hot temperatures (Cahaner and Leenstra. 1992; Eberhart and Washburn. 1993; Yalçın et al.. 1997), which lead to higher body temperatures (Cahaner et al.. 1993) and reduced performance. Since HL line grew faster than the other lines, these quails produced more heat, and they had greater difficulty in dissipating heat especially in summer season.

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