HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

SEASONAL DYNAMICS OF PHYSIOLOGICAL STATUS IN AFRICAN OSTRICHES OF VARIOUS AGE GROUPS ACCLIMATIZED TO THE CLIMATE OF UZBEKISTAN

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Abstract. This paper evaluates the seasonal fluctuations of baseline physiological markers-namely core body temperature, heart rate (HR), and respiratory rate (RR)-in African ostriches (Struthio camelus) as a function of age, sex, and lineage under the conditions of a sharply continental arid climate in Uzbekistan. The experimental cohorts comprised juvenile birds (aged 3–6 months), as well as mature 5-6-year-old males and breeding females (parent stock) representing both Iranian and Russian selection lineages. The findings indicate that the extreme heat of the summer season ("chillya", ambient temperature exceeding +40 ^{0}C) triggers a significant compensatory response in the thermoregulatory systems of all evaluated cohorts, characterized by an elevation in body temperature and the onset of hyperventilation (polypnea). While the young stock exhibits a high metabolic rate and vegetative tone, adult birds of Iranian selection demonstrate superior evolutionary thermotolerance compared to their Russian counterparts under extreme heat loads.

Keywords: African ostrich, adaptation, climatic conditions of Uzbekistan, body temperature, heart rate (HR), respiratory rate (RR), heat stress, ontogenetic dimorphism.

INTRODUCTION The establishment and expansion of African ostrich (Struthio camelus) farming in Uzbekistan represents a highly promising and economically viable sector of modern animal husbandry. However, the sustainable development of this industry is fundamentally constrained by the capacity of imported breeding stock to adapt to the region's harsh, arid, and sharply continental climate, which is characterized by extreme summer heatwaves (the local "chillya" period, where temperatures frequently exceed +42 ^{0}C) coupled with critically low relative humidity [1, 2].

Basic clinical parameters, specifically rectal core body temperature (T ^{0}C), heart rate (HR), and respiratory rate (RR), serve as highly sensitive biological markers of an animal's physiological state, environmental stress levels, and homeostatic integrity. Investigating these vital parameters across different age groups and seasonal cycles provides an objective scientific framework to assess the depth of acclimatization in various ostrich genotypes [3, 4].

The primary objective of this study was to investigate the seasonal variations in physiological vital signs (T, HR, RR) among African ostriches across diverse age categories (juvenile stock, mature males, and breeding females of the parent flock) representing both Iranian and Russian selection lineages under the climatic pressures of Uzbekistan.

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MATERIALS AND METHODS The scientific and field trials have been conducted since 2020 at the "Chinobad Khaitbaev Saidulla" farm, located in the Kibray district of the Tashkent region. For the experiment, two age-matched groups were formed using the peer-group (analogue) method:

The first group comprised descendants of African ostriches of Iranian origin;
The second group comprised descendants of African ostriches of Russian origin.

To study the seasonal dynamics of clinical parameters in African ostriches of various age groups, we investigated:

1. Young stock offspring (3–6 months of age, n=10): co-housed on deep litter.
2. Adult breeding males (5-6 years of age, n=10 per genotype): of Iranian and Russian selection lines.
3. Adult breeding females of the parent stock (5-6 years of age, n=20 per genotype): of Iranian and Russian selection lines.

The monitoring of physiological status was consistently performed in the morning hours (prior to the daily feeding regime) during three distinct seasonal intervals:

Spring (March): characterized by ambient temperatures of +18-22 ^{0}C (representing the thermal comfort zone).

Summer (July): characterized by extreme heat of +40-42 ^{0}C (representing the heat stress "chillya" period).

Autumn (October): characterized by ambient temperatures of +16-20 ^{0}C (representing the physiological recovery phase).

Rectal body temperature was recorded using a calibrated digital thermometer. HR was assessed via direct cardiac auscultation in the projection area of the heart, and RR was quantified visually by tracking the excursion of the ribs and abdominal wall over a 1-minute interval. The gathered quantitative data were subjected to biometrical analysis, and statistical significance was determined using Student's t -test.

RESULTS AND DISCUSSION

1. Physiological Status of Juvenile Ostriches

The rapidly growing organism of young ostriches is characterized by an elevated basal metabolic rate, which is directly reflected in their vegetative tone and basic clinical constants (Table 1).

Table 1. Seasonal variations of physiological vital signs in juvenile ostriches (M ± m , n = 10)

Monitoring Period	Age (months)	Body Temperature (^{0}C)	Heart Rate (bpm)	Respiratory Rate (breaths/min)
Spring (March)	3	39,42 ± 0,05	118,5 ± 1,25	14,20 ± 0,31
Summer (July)	6	40.25 ± 0.06 ***	145.2 ± 1.82 ***	38,40 ± 0.95 ***
Autumn (October)	9	39,11 ± 0,04	95,40 ± 1,10 ***	0,50 ± 0,28 ***

Note * - p < 0.001 in comparison with the spring baseline values (for females) and the summer baseline values (for males).

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In the spring, the physiological parameters of the 3-month-old chicks reflect high metabolic and growth activity: HR is recorded at 118,5 bpm, and RR is stabilized at 14,2 breaths/min. Under the extreme summer heat load in July (at 6 months of age), the young birds develop pronounced hyperthermia, with core body temperature rising to 40.25 ^{0}C ($p < 0.001$). Simultaneously, their RR increases by 2,7 - fold, reaching 38,4 breaths/min, which indicates the active engagement of evaporative cooling mechanisms. By autumn (at 9 months of age), corresponding with cooler ambient temperatures and natural age-related stabilization, the HR decreases to 95,4 bpm, while the respiratory rate calms down to 10,5 breaths/min.

2. Physiological Parameters of breeding Females (5-6 Years Old)

For the 5-6-year-old laying hens, the spring period (March) coincides with the initiation of the active laying cycle under favorable environmental conditions, whereas July represents the absolute peak of environmental thermal stress (Table 2).

Table 2. Comparative physiological vital signs of 5-year-old female ostriches of different genotypes (M ± m, n=20)

Physiological Indicator	Spring (March)	Summer (July)	Student's t - statistic
Group I (Iranian Selection)			
Body Temperature (^{0}C)	39,20 ± 0,02	39,79 ± 0.03	16,36 ***
Heart Rate (bpm)	42,50 ± 0,43	48,60 ± 0,51	9,14 ***
Respiratory Rate (breaths/min)	5,80 ± 0,15	18,40 ± 0,32	35,63 ***
Group II (Russian Selection)			
Body Temperature (^{0}C)	38,89 ± 0,02	40,09 ± 0,02	42,42 ***
Heart Rate (bpm)	36.40 ± 0,22	52,40 ± 0,31	42,08 ***
Respiratory Rate (breaths/min)	4,50 ± 0,11	24,80 ± 0,24	76,84 ***

The data in Table 2 reveal distinct, statistically significant inter-group differences. During spring, the females of the Russian selection (Group II) exhibit a highly conservative and energy-efficient vegetative state: their basal HR is 36,40 bpm (which is 14,3% lower than that of their Iranian peers, $p < 0,001$), accompanied by a tranquil respiratory rate of just 4,5 breaths/min.

However, the severe heatwave of July triggers profound thermal stress in the Russian cohort. Their core body temperature spikes by 1,20 ^{0}C (reaching 40,09 ^{0}C), while their RR escalates by 5,5 - fold, jumping to 24,8 breaths/min. This severe polypnea manifests as gular flutter-an essential mechanism to facilitate water evaporation from the mucosal linings of the upper respiratory tract to promote heat dissipation. Conversely, the Iranian hens exhibit a much more moderate response: their body temperature increases by only 0,59 ^{0}C (to 39,79 ^{0}C), and their respiratory rate rises 3,17 -fold (to 18,4 breaths/min). This demonstrates superior genetic adaptability and heat tolerance of the Iranian lineage to arid environmental pressures.

3. Physiological Parameters of adult Males (5-6 Years Old)

The monitoring of physiological responses in adult breeding males was centered on the transition from the highly demanding summer season (coinciding with the intensive mating period) to the thermo-neutral autumn phase (Table 3).

Table 3. Comparative physiological vital signs of 5-6-year-old male ostriches of different genotypes (M ± m, n=10)

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Physiological Indicator	Summer (July)	Autumn (October)	Student's t - statistic
Group I (Iranian Selection)			
Body Temperature (^{0}C)	39,50 ± 0,04	38,80 ± 0,04	12,37***
Heart Rate (bpm)	45,80 ± 0,39	38,80 ± 0,42	12,21 ***
Respiratory Rate (breaths/min)	16,20 ± 0,29	5.40 ± 0,16	32,61 ***
Group II (Russian Selection)			
Body Temperature (^{0}C)	39,91 ± 0,04	38,61 ± 0,04	23,00 ***
Heart Rate (bpm)	50,20 ± 0,49	34,60 ± 0,40	24,65 ***
Respiratory Rate (breaths/min)	22,40 ± 0,34	4.80 ± 0,13	48,24 ***

During the peak summer month (July), the males of both genetic groups experience substantial stress on their cardiorespiratory systems. The HR in the Russian selection group reaches 50,20 bpm, while the RR is recorded at 22,40 breaths/min. With the arrival of the cooler October climate, these parameters settle back to physiological baselines: core body temperature drops by 0,70 ^{0}C in the Iranian cohort and by 1,30 ^{0}C in the Russian cohort. Furthermore, the autumn RR of the Russian males slows down 4,6 -fold (to 4,8 breaths/min), and their HR drops to a highly efficient level of 34,6 bpm, indicating full systemic recovery.

CONCLUSIONS

1. Ontogenetic Dimorphism: Juvenile ostriches (aged 3–6 months) are characterized by significantly elevated baseline metabolic rates, resulting in higher basal clinical values (in spring, HR is 118,5 bpm, and RR is 14,2 breaths/min), which is dictated by intense metabolic processes during rapid physical growth.

2. Genotype-Specific Adaptation: Mature ostriches of Iranian origin demonstrate significantly higher homeostatic stability when subjected to summer hyperthermia (July core body temperature of hens is 39,79 ± 0,03 ^{0}C, RR is 18,4 breaths/min). In contrast, the Russian stock responds with acute compensatory polypnea (RR of 24,8 breaths/min) and an elevated core temperature of 40.09 ^{0}C, proving they experience a much more severe thermal stress.

3. Functional Recovery Reserves: Under optimal environmental conditions (spring for females, autumn for males), the Russian selection birds shift to an exceptionally conservative and energy-saving vegetative state (HR of males is 34,6 ± 0,40 bpm, RR is 4,8 ± 0.13 breaths/min). This points to deep metabolic and physiological reserves that are fully realized once environmental stressors are removed.

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