ULST Timisoara
Multidisciplinary Conference on Sustainable Development
21-22 May 2026

THERMOREGULATORY STRATEGIES IN REPTILES: PHYSIOLOGICAL MECHANISMS AND FUNCTIONAL IMPLICATIONS

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Abstract:*Reptiles, as ectothermic organisms, rely fundamentally on external heat sources to maintain optimal body temperature, which profoundly influences their physiological processes. Thermoregulation represents a central mechanism in the adaptation of these species to their environment, playing a key role in metabolic rate, digestion, cardiovascular function, and reproduction. The aim of this review is to synthesize current knowledge on the physiological mechanisms underlying thermoregulation in reptiles and to highlight the impact of temperature on vital functions. Furthermore, the implications of thermal variation on digestive processes, cardiovascular performance, and reproductive function are discussed. Finally, this review emphasizes the relevance of these mechanisms in veterinary practice and in the management of captive reptiles, where environmental control is essential for maintaining homeostasis and preventing associated pathologies. This paper provides an integrated perspective on the fundamental role of temperature in reptilian physiology.*
***Keywords**: reptiles, thermoregulation, homeostasis, basking*

• Introduction

Reptiles, as ectothermic vertebrates, depend on environmental conditions to regulate body temperature. Unlike endotherms, they achieve thermal balance through behavioral and physiological mechanisms that allow adaptation to fluctuating environments. Thermoregulation is essential for maintaining homeostasis and directly influences key functions such as digestion, locomotion, reproduction, and immune responses. It involves an interaction between environmental factors (solar radiation, substrate temperature, air movement) and internal mechanisms. Common behaviors include basking, shade seeking, burrowing, and postural adjustments. Physiological adaptations such as cardiovascular shunting, chromatophore-mediated color change, and hormonal regulation further support efficient thermoregulation.

• Material and method

This review is based on a comprehensive analysis of scientific literature addressing the physiological aspects of thermoregulatory strategies in reptiles. Relevant information was gathered using major academic databases, including Scopus, Elsevier, and PubMed, to ensure a broad and reliable coverage of the subject. The literature search focused on key terms such as "reptiles," and "thermoregulation," "homeostasis", allowing the identification of studies directly related to the topic.

• Results and discussions

Behavioral thermoregulation in reptiles involves several adaptive behaviors that help maintain optimal body temperature: basking in the sun to absorb heat, seeking shade or burrows to avoid overheating, and adjusting body posture to control heat absorption. Reptiles use physiological mechanisms such as cardiovascular shunting to regulate internal heat distribution by adjusting blood flow between body regions, a process especially important in semi-aquatic species.

Skin color change, mediated by chromatophores, allows modulation of heat absorption, with darker tones increasing and lighter tones reducing thermal gain.

Additionally, hormonal factors, particularly thyroid hormones and corticosteroids, influence thermal sensitivity, metabolic activity, and thermoregulatory responses, as demonstrated in species like Pogona vitticeps (Narayanan, P. 2025).

Reptiles' thermoregulation strategy is well known and is affected by their digestive system.

In contrast, they choose warmer Tpref. to increase the digestion efficiency process by increasing the metabolic rate known as a thermophilic postprandial phenomenon

Fig 1. An example of colour change in the same individual bearded dragon lizard

.On the other hand, under digestive state, reptiles tend to alter microhabitat selection that supports the higher thermal environment and change thermoregulatory post–feeding behavior to stay within their T*pref.* and have a shorter time for the digestion process (Seebacher, F. & Franklin, C.E. 2005).

Several studies have been well known explained that reptile has a significantly higher T*pref.* after post–feeding effect, higher oxygen consumption, higher heart rate and higher blood flow rate to the digestion system that may be implicated to prioritize digestion process, especially under low temperature ambient. Temperature plays a crucial role in reptile reproduction, influencing reproductive cycles, mating behavior, and embryonic development. n many species, temperature also affects sex determination, particularly in reptiles with temperature-dependent sex determination (TSD). Additionally, inadequate thermal conditions can impair reproductive success by disrupting hormonal regulation and developmental processes (Oktariansyah, Y. 2025).

• Conclusions

- ❑ The significant correlation between thermoregulatory behavior and internal physiology supports the integration of both elements in future ecological modeling.
- ❑ Given the escalating impacts of global climate change, these insights are not only academically valuable but also crucial for informing conservation efforts.
- ❑ Protecting thermally diverse habitats and understanding species-specific thermal tolerances will be vital to preserving reptile biodiversity in the decades ahead.

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