Energetics of the green iguana (Iguana iguana) in a semi-arid environment

van Marken Lichtenbelt, Wouter David

SUMMARY

Energy budgets in the herbivorous green iguana (*Iguana iguana*) were studied from April 1985-October 1988 in a strongly seasonal environment on the semi-arid island Curaçao (Netherlands Antilles) under the auspices of the CARMABI Foundation in cooperation with the State University of Groningen (The Netherlands).

Adaptations to this climatic regime and the associated annual pulse of fresh leafy material were identified by comparison with the extensive published studies on this species in the humid tropics (Barro Colorado Island, Panama).

Constraints relevant to dietary choice concerning extraction of energy, water and protein, were studied in captive iguanas during balance trials with natural foods. Study of the temperature dependence of digestive efficiency revealed that body temperature affected transit time of food through the digestive tract rather than dry matter digestibility.

Thermoregulation was studied in free living iguanas by temperature telemetry with a sensor inserted in the abdomal cavity, and through the use of taxidermic mounts. A model was developed to estimate field body temperatures in the course of the day by combining measurements on the taxidermic mount and detailed positional behavioral protocols.

Reconstruction of digestive function combining field data on body temperature throughout the 24 hour period with the balance trials under known temperatures in the laboratory revealed different optimum body temperatures depending on the nutritional state.

Daily energy expenditure (DEE) was measured in free living iguanas using the doubly labeled water technique. Validation studies in the laboratory under high humidity levels and temperatures as met on Curaçao reveal an average deviation of 2.1% compared to repirometry and balance methods. Mean DEE in the field (68.9 $kJ.kg^{-0.8}.d^{-1}$) conform to the allometric relationship between DEE and body mass in iguanidae published by Nagy and co-workers. Measurements on DEE in the field were complemented by continuous detailed behavioral observations, allowing a subsequent estimation of the magnitude of the various components in the energy budget. A compilation of energy allocation, including standard and resting metabolic rate, costs of locomotion and postural adjustments permits the conclusion that on an annual basis the total energy expenditure of the two sexes is roughly equal. Egg production comprises 13% of the female energy budget, whereas the male faces increased costs of locomotion and postural adjustments.

Food selection was studied in all phases of the annual cycle combining direct observations on food intake, plant biomass availability and nutrient analyses of the various food items. A linear programming model was used to identify the optimality criteria, indicating that the water maximization criterion was met during the dry period and that after the early rains diets conform to the protein maximization criterion. The reproductive cycle in the green iguana is attuned to the annual precipitation cycle such that hatching coincides with

the period when lush foliage is available. Oviposition takes place three months earlier, during the dry season, when intake is below maintenance levels. The results indicate a relatively short period of positive protein balance in females resulting in a 8-10 months gap between the acquisition of the main portion of the proteins required for egg synthesis and the act of laying. Despite large differences in climate, green iguanas show a similar reproductive pattern in Panama, where lush foliage is also restricted to a relatively short period. This congruence suggests that the cycle as reported for Curaçao is more generally tenable, and reinforces the growing realization that the humid tropics themselves show marked annual rhythms.