Energetics and geometry of huddling in small mammals

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Huddling in small mammals appears as an efficient response to low ambient temperatures with important consequences in thermoregulatory energy savings. These energy savings have been ascribed to a decrease in the exposed area in relation to the animal's volume. It has been proposed that during huddling reductions in the exposed area and in the metabolic rate are equal functions of the number of grouped individuals with a common exponent of -1/3. However, reported data shows a great variability of this exponent. In this paper we present a geometrical and energetic analysis on several huddling efficiencies in small mammals and in geometric bodies. Our theoretical analysis shows a variability in the efficiency of huddling, depending on the morphological characteristics of the geometric bodies. At the same time original and literature information show an analagous interspecific variability in small mammals. Finally, a general mathematical expression is proposed which represents and explains