

APPENDIX 4

Calcium & Bone Fractures

Calcium is an essential mineral required for the healthy growth and development of bones. Mineralisation of marsupial joey bones relies on available calcium levels, balanced with other nutrients such as phosphorus and vitamin D₃.

Calcium concentrations in marsupial milk tend to increase from around 1.5g/litre in early lactation to over 4g/litre in late lactation (compared to only 1.1g/litre in unfortified cow's milk). These increases occur in line with increasing energy content of the milk, so its useful to standardise calcium concentrations as weight per unit of milk energy (ie mg/MJ):

Species	Calcium (mg/MJ)	Reference
Red Kangaroo	500-700	Lemon & Barker 1967, Poole et al 1982
Grey Kangaroo	400-800	Poole et al 1982
Tammar Wallaby	375-550	Green et al 1980, Green & Renfree 1982, Green 1984
Red-necked Wallaby	400-700	Green 1984, Merchant et al 1987

In all cases the reported quantity of calcium in macropod milk is greater than 375 mg/MJ. In addition, Walker & Vickery (1988) boosted their calcium levels to 486 mg/MJ after experiencing fractures at 307 mg/MJ. At all stages Wombaroo formulae contain greater than 500 mg/MJ calcium, balanced with phosphorus and Vitamin D₃ levels. It is noteworthy that some other commonly used milk replacers have deficient levels of calcium compared to those naturally present in marsupial milk.

Incidence of Bone Fractures

Bone mineralisation progresses when the joey leaves the pouch and load bearing occurs. Joeys need to gradually increase the level of load bearing to strengthen bones. Even if calcium levels in the milk are sufficient, pouch bound joeys are prone to fractures due to their low level of bone mineralisation. Problems are exacerbated if husbandry practices induce premature load bearing e.g. over-activity of young, excess movement in the artificial pouch or falls from an unsecured pouch opening. In the wild the mother tightly controls movement and level of activity in the pouch-bound young and captive husbandry needs to mimic this as closely as possible to minimise the incidence of fractures.

Reference

Walker, DM & K Vickery (1988). Tolerance of pouch young kangaroos (Macropodidae) for cow's milk and milk replacers containing different amounts of glucose and lactose. *Aust. Mammal.* 11: 125-133.
