Cataracts and kangaroos:
Nutrition of orphan hand-reared macropod marsupials.

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Abstract

Sporadic cataract development in orphan hand-reared macropod marsupials is an on-going health and welfare issue. Original research supported the hypothesis that cataracts result from the inability of kangaroos to metabolise galactose. Current and on-going research findings have corroborated the findings of the original research.

Keywords.
Kangaroos, orphan, cataracts, nutrition, joeys.

Introduction

Cataracts are sporadically seen in hand-reared orphan joeys. My original research published in Nature [1] and elsewhere [2, 3] determined that kangaroos are galactosaemic and the cataracts are most likely the result of the inability to metabolise galactose. Whilst veterinary ophthalmology texts reference this work correctly, other research led to some controversy over the findings [4, 5].

As I also hypothesised that joeys are lactose intolerant, I recommended that orphan joeys be fed a low lactose milk [6].

Over the last few years I have repeated the original research together with surveys on the incidence of cataracts in hand-reared joeys. The results support the original research [7].

Furthermore, I suggest that other research that was used to cast doubt on my research could be flawed and false assumptions may have been made.

Materials and Methods

The original research was carried out at the Children's Medical Research Foundation where kangaroos were used as animal models for galactosaemia. Blood was collected from macropod joeys and other marsupials and tested for two enzymes of galactose metabolism. Galactose tolerance testing was undertaken.

The current and ongoing research tested blood from 24 suckling joeys, this time using human new-born screening papers to test the levels of galactose metabolising enzymes. In addition, a small survey was carried out to determine the incidence of cataracts in hand-reared joeys and any relationship to diet [7].

Results from the original research

Species	Galactokinase (μmol galatose phosphorylated h^{-1} ml^{-1} RBC)		Galactose-1-phosphate uridyl transferase (Ug^{-1} haemoglobin)	
	No.	Mean ± s.d.	No.	Mean ± s.d.
Grey kangaroo	22	0.039 ± 0.013	19	2.2 ± 1.7
Red kangaroo	21	0.033 ± 0.009	20	10.6 ± 3.5
Tammar wallaby	3	0.084 ± 0.019	3	8.1 ± 2.5
Parma wallaby	4	0.024 ± 0.006	4	7.6 ± 0.8
Wallaroo	5	0.077 ± 0.021	5	3.9 ± 2.4
Human	200	0.213 ± 0.028(7)	61	21.4 ± 3.2
Statistically, galactokinase and transferase values from both species of kangaroos were scientifically different ($P < 0.001$ in all comparisons) from human values. Galactokinase was not significantly different between two species of kangaroos, but transferase levels were higher in reds.				

Current research: 24 juvenile suckling joeys

- Galactose-1-phosphate (galactokinase) Range 0.01-0.03 mmol/L WB. Low levels.
- Small but detectable level of galactose-1-phosphate uridyl transferase activity and galactose levels below the lowest standard of 0.1mmol/L
- Low but detectable levels of aldose-1-epimerase

Current research: small survey of incidence of cataracts.

CATARACTS				
Number	Species	Milk	Age acquired	Fate
2	E. grey: *acropus giganteus*	*Biolac*	hairless	1 – unsuccessful cataract operation 1 – awaiting surgery
1	Whiptail: *Macropus parryi*	*Biolac*	hairless	unknown
1	Red: *Macropus rufus*	*Biolac*	hairless	Cataracts cleared when taken off Biolac
7	Swamp: *Wallabia bicolor*	*Biolac*	hairless	1 – awaiting surgery 2 – had surgery 3 – euthanased 1 – cataracts cleared when taken off Biolac
1	Pademelon: *Thylogale stigmatica*	*Biolac*	hairless	died

Discussion.

Despite the feeding of low lactose milk replacers, cataract development in hand-reared macropod joeys continues to be an ongoing concern.

The findings of this current and ongoing study on galactose metabolism in kangaroos strongly corroborates data from my original research supporting the hypothesis that joeys are unable to metabolise galactose and this is why they may develop cataracts when fed milks containing lactose and/or galactose. Furthermore, the results of a small survey show an association between cataract formation and the feeding of a high galactose milk replacer, particularly if the joey is reared from a hairless state [7]. This milk was developed based on the assumption that kangaroos are not galactosaemic [8].

Based on other research on kangaroo milk and liver and gut enzymes [4, 5] my original work was deemed to be 'untenable' [8] and other theories were suggested for cataract development such as UV light and dehydration. However, none of these have ever been tested and based on a better understanding of milk and galactose metabolism, it is likely that false assumptions were made. For instance, there was an assumption that because kangaroo milk was found to be high in galacto-oligosaccharides then these would be broken down to glucose and galactose. However, the function of these in kangaroo milk is unknown and in humans it has been found that these pass through the gut undigested to act as prebiotics.

The research on liver and gut enzymes [5] may be flawed as this was carried out on old homogenates which do not always reflect enzyme activity of living cells. Additionally, in mammals, liver galactose metabolising enzyme levels may be high even with no galactose in the milk and rats with high liver enzymes can develop cataracts if fed yoghurt which is high in galactose.

Conclusion

The current research supports the original research that kangaroos are galactosaemic and this is the most likely cause of cataracts in orphan hand-reared joeys fed milks containing lactose and/or galactose. Although the feeding of low lactose milk replacers should have led to a reduction in the incidence of cataracts, the development, based on some false assumptions, of a milk replacer high in galactose, has most likely led to the ongoing occurrence.

There are ethical and welfare issues associated with hand rearing orphan macropods. Consistent guidelines should be developed. For example, should hairless joeys be reared at all? Low lactose milks developed should be scientifically analysed for suitability. More should be done to prevent these animals coming into care in the first place such as preventing land clearing and more research should be undertaken on the fate of released hand-reared joeys.

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