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**An investigation of vitamin D metabolism in kiwi
(*Apteryx mantelli*), tuatara (*Sphenodon punctatus*) and
New Zealand sea lion (*Phocarctos hookeri*) and the
relationship of vitamin D metabolism with their life
history characteristics.**

A thesis presented in partial fulfilment of the requirements for
the degree of
Master of Veterinary Studies
At Massey University, Turitea, Palmerston North, New Zealand

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2016

Abstract

Vitamin D, a fat-soluble vitamin, has a wide range of functions in vertebrates. The aim of the study was to determine if the evolutionary history of different animal species affects their predominant route of vitamin D metabolism. The species chosen in this study were Brown kiwi (*Apteryx mantelli*) for their nocturnalism, tuatara (*Sphenodon punctatus*) for their diurnal sun basking nature and New Zealand sea lion (*Phocarctos hookeri*), as a marine mammal species.

A survey of plasma or serum concentrations of 25-hydroxyvitamin D₂ (25(OH)D₂) and 25-hydroxyvitamin D₃ (25(OH)D₃) in kiwi, tuatara and New Zealand sea lion and analysed the ability of skin to produce vitamin D₃ in response to UV exposure from post mortem samples of these three species. Assessment of morepork (*Ninox novaseelandiae*) skin was also carried out as an additional example of a nocturnal species.

Wild kiwi had lower plasma 25(OH)D₃ concentrations than captive kiwi and this variation was most likely of dietary origin. The low concentrations of plasma 25(OH)D₃ in wild kiwi in their natural habitat, suggest that these minimal levels are sufficient to fulfill their vitamin D requirements in the body or they utilise calcium independent of vitamin D. Captive diets for kiwi may be over-supplemented with vitamin D. In contrast to this finding, the skin of both kiwi and morepork was able to produce small but measureable amounts of vitamin D₃ in response to UV exposure. This result was unexpected, considering their nocturnal nature and the overall pattern of vitamin D metabolism in the kiwi is still unclear.

Vitamin D metabolism in tuatara suggests that both dietary and dermal pathways are important. The survey of plasma 25(OH)D₃ concentrations in captive tuatara showed variation between the five zoological institutions, which was correlated to the variation in the dietary vitamin D provided between captive institutions.

However, analysis of tuatara skin showed that tuatara had a strong ability to synthesise vitamin D dermally, indicating that it is an important route of vitamin D metabolism in tuatara.

New Zealand sea lion showed overall higher serum 25(OH)D₃ concentrations than kiwi and tuatara, which might be attributed to the high UV-B radiation exposure they receive in their natural habitat. New Zealand sea lion skin also had comparatively higher vitamin D concentrations both prior to and in response to UV exposure, which shows that dermal route of vitamin D is an important route of metabolism in these marine mammals.

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Acknowledgements

I would like to take this opportunity to express my heartfelt gratitude to everyone involved in helping me put together this thesis. Within only one year of my master's thesis, I have learnt so much more than I imagined. Firstly, I would like to thank my supervisors, Brett Gartrell, Keren Dittmer and Wendi Roe, for their endless support and guidance, and of course patience, without which this project would not have been possible. I am so thankful to each one of them for teaching me to write scientifically. I am very grateful to Dr Brett, for giving me an opportunity to work with him. I was lucky to have gotten an opportunity to learn so much from this immensely knowledgeable and wonderful person. A special thanks to Keren, who guided me through all my queries about vitamin D and the laboratory work with utmost patience, in spite of my shortcomings and I shall never forget what she has taught me. A big thank you to Wendi, an amazing teacher and person, for sharing her vast knowledge about marine mammals, which I would have never known had it not been for her and this project.

I would like to convey my genuine regards to the captive institutions that took part in this study, including Pukaha Mount Bruce Wildlife Centre, Nga Manu Nature Reserve, Wellington Zoo, and Victoria University of Wellington. With regards to sampling wild kiwi, I would especially like to thank Melody McLoughlin at Rimutaka Forest park for giving her support to this project and taking us along on her weekly kiwi monitoring and allowing us to sample wild kiwi.

In addition to sampling at the zoological institutions, I also received blood samples from patients at Wildbase hospital adjunctive to veterinary diagnostic investigations. I want to convey my sincere gratitude to the entire Wildbase team for helping me out by always keeping aside blood samples for my project. A very special thank you to Wildbase resident, Rebecca Webster, for being so helpful and assisting me for all my sample collections at the captive institutions. I sincerely appreciate both Rebecca

and Megan from Wildbase for accompanying me to Rimutaka Forest Park for sampling wild kiwi. I am aware that it was extremely exhausting to track wild kiwi and sample them and I genuinely want to thank them for their assistance. I would never had completed my project in time had it not been for your help. I would also like to thank Stuart Hunter for always remembering to save skin samples from his post mortem investigations for my project. I would like to extend my gratitude to the Department of Conservation, Hamilton and the respected Iwi for giving me the necessary permissions for carrying out my research project.

The two years I spent in New Zealand gave me innumerable memorable experiences and I would like to thank my colleagues and friends in New Zealand for the memories, which I will never forget. I am truly blessed to have such a loving and supportive family. I can't thank my parents enough for always supporting and encouraging me in my career and providing me with opportunities and exposure I needed for my career growth.

Last, but not the least, I would like to thank my partner, Varun, for always encouraging me and for being so patient and surviving two long years of long distance relationship.

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