

## VITAMIN D STATUS IN PRIMATES IN CAPTIVITY

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### **Abstract**

Vitamin D is a liposoluble vitamin available in two forms: D2 (ergocalciferol) and D3 (cholecalciferol). It plays an important role in calcium absorption and homeostasis. Human as well as non-human primates from Old World (OW) can metabolize both vitamin D2 and D3, whereas New World (NW) primates cannot metabolize D2 well. Serum concentrations of 25-hydroxy-vitamin D3 (25-OH-D3) are regulated through dietary vitamin D intake as well as endogenous synthesis from UV-light. The latter may be compromised under low exposure to sunlight, which is affected by skin pigmentation depending of the UV index available in the region. Vitamin D deficiency may occur due to several factors. The main reason is low exposure to UV-light, but it may also be influenced by other aspects such as geographic location, fur cover and skin pigmentation. Apart from calcium regulation, several diseases are also associated with the lack of this vitamin, such as alterations of dopamine metabolism, neoplasm, risk of diabetes and decrease of immune response. In zoos located in countries with low UV exposure or behind glass, the dermal synthesis of vitamin D may be compromised, and dietary supplementation is utilized to overcome such deficiency, especially during winter. From 17 species of captive primates, 157 serum 25-OH-D3 values were collected. Values were collected from 8 zoos and rescue centers from Europe and 4 African sanctuaries (only chimpanzees). From each individual, information regarding skin color (1=light, 2=intermediate, 3=dark), season of sampling, geographical location, and vitamin D supplementation was collected. Data analysis was performed using ANOVA, evaluating the effect of the variables on vitamin D concentrations from primates within Europe and comparing the chimpanzees' populations from Europe and Africa. Statistical significance was accepted at  $P < 0.05$ . The 25-OH-D3 concentrations varied depending on skin color ( $P = 0.0001$ ), with higher values from animals with lighter skin ( $109 \pm 60$  nmol/l) and lower in animals with darker skin ( $39 \pm 42$  nmol/l). Likewise, and independent of skin color, season showed a marked effect on the vitamin levels ( $P = 0.005$ ), being lower during winter ( $33 \pm 29$  nmol/l). There were also differences between OW and NW primates ( $P = 0.02$ ); the latter presented higher values of 25-OH-D3 ( $78 \pm 64$  nmol/l) compared to OW animals ( $54 \pm 33$  nmol/l). Surprisingly, there were low vitamin D levels in animals receiving supplementation ( $P = 0.002$ ). When chimpanzees from both locations (European zoos and African sanctuaries) were compared, animals from European zoos had lower 25-OH-D3 titers ( $65 \pm 29$  nmol/l) than those from Africa ( $118 \pm 47$  nmol/l). These results suggest that, in general, skin color appeared to be determinant for vitamin D status, and the fact that even supplemented animals showed low levels, suggests that additional UV-light may be necessary, especially during winter. Compared data from chimpanzees indicates that animals from European zoos may be deficient, and values from animals living in their original area could be used as preliminary reference values. Given the importance of vitamin D in general health and well-being

of primates living in captivity, further research is needed in order to improve the utilization of this nutrient in countries in temperate regions.