Vitamin B12 Study on Desert Tortoise Behavior

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Abstract

Since 1990, Desert Tortoises have been categorized as a threatened species by the U.S. Fish and Wildlife Service, and obesity is a cause for concern within the species. When fat deposits form around the front and back legs, this can hinder the limbs of the tortoise from being retracted into the shell. In turn, the buildup of internal and systemic issues, injuries, infections, and immense strain on the body can lead to death. Since Desert Tortoises are not regularly active creatures, the main treatment for obesity is through dietary management and additional exercise. Therefore, vitamin B12 can help prevent fatigue caused by extra weight. In this study, I analyzed the usage of multivitamins and feed containing vitamin B12 in the diets of Desert Tortoises to determine if there is a behavior change resulting in increased activity levels. Data was collected on a survey from 16 organizations and private owners about their Desert Tortoise's diet and activity. From there, I determined that there were 6 organizations and private owners that integrated multivitamin supplements that contained vitamin B12. This led to the analysis of nine different tortoises, their diets, and their activity levels. After analysis, it was determined that there was found no change/unknown change in behavior.

Introduction

- Desert Tortoise (*Gopherusagassizii*) known as California's state reptile
- Has been added to threatened species by U.S Fish & Wildlife Services → can be due to obesity within captivity
- Consequences of Obesity: infected sores, internal injuries, low activity levels, prospective death
- Current Remedies: cycle of veterinary appointments, diet changes, adjusted feeding schedules, and added exercise
- Vitamin B_{12} (Cobalamin) Functions: nerve cell activity, erythrocyte production, DNA synthesis, energy/endurance enhancer
- Can be found in multivitamin supplements within Desert Tortoise diets

Acknowledgments

We would like to thank our mentor, Dr. Hyungchul Han, for supporting us throughout this project. Without his help and ideas, we would have not been able to adapt our research from an in-person study to a computational one. We would also like to thank all of the organizations that participated in this study despite the restrictions of the COVID-19 pandemic. It was only with their cooperation that we succeeded in completing our research.

Materials & Methods

- Emails and follow-up emails were sent on a weekly basis to 63 organizations for about 4-5 months
- Google Form was created to outline the specific details needed for this project (e.g. breeds, diet composition percentage of diet, etc.)
- Created designated categories (e.g. multivitamin information, supplement ingredients, diet ingredients, etc,) on Excel for analyzation
- Recorded and analyzed multivitamin supplement ingredients based on protein binding, strength, volume of distribution, and metabolism
- Behavior ethogram was formed containing food-related activity, solitary activity, and social activities
- Average frequencies of each activity were graphed based on what happened throughout the week in hours for both types of tortoises
- Calculations for behavioral differences in activity levels between the two groups of tortoises based on the information from the survey

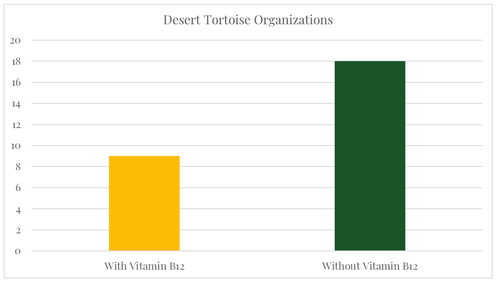

Figure 1: Desert Tortoise Organizations Separated by Vitamin B12

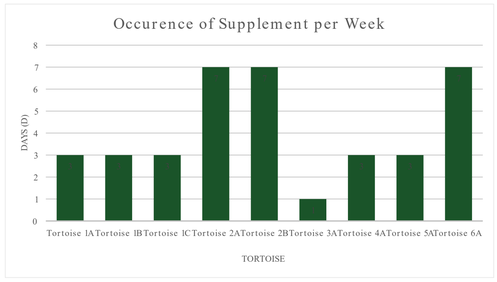

Figure 2: Occurrence of Supplements with Vitamin B_{12} given per week

Type of Behavior	Behavior	Code	Tortoise Ethogram Behavior Description
Food Related	Eat	E	Tortoise consumes food within its environment
Solitary	Travel	T	Tortoise is conducting physical activity
	Rest	R	Tortoise stays in one place but may be roused easily by environmental changes
Social	Examination	EX	Tortoise is being examined by a veterinarian
	Monitoring	M	Tortoise is being monitored by the workers of the organization
	Public Interaction	PI	Tortoise is having interaction with the public (i.e. not with workers)

Table 1: Behavior Ethogram for Desert Tortoises

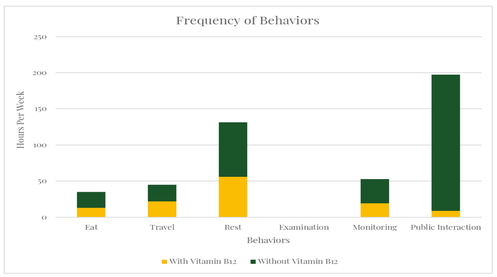

Figure 3: Frequency of Behaviors for Desert Tortoises

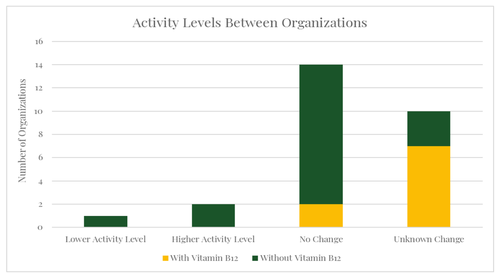

Figure 4: Activity Levels Between the Organizations

Individual Tortoises	Amount of Supplement Given	Noticed Behavioral Changes
Tortoise 1A	1/2 tablespoon	Unknown
Tortoise 1B	1/2 tablespoon	Unknown
Tortoise 1C	1/2 tablespoon	Unknown
Tortoise 2A	Dusted onto Food	Unknown
Tortoise 2B	Dusted onto Food	Unknown
Tortoise 3A	1/8-1/2 teaspoon	Unknown
Tortoise 4A	Dusted onto Food	No Change
Tortoise 5A	1/4 tablespoon	No Change
Tortoise 6A	1/4 tablespoon	No Change

Table 2: Amount of Vitamin B12 Supplement Given to Individual Tortoises and Their Resulting Behavioral Changes

Results

- Had a total of 16 organizations with 9 vitamin B12 tortoises and 18 non-vitamin B12 tortoises (Figure 1)
- Within the 9 Desert Tortoises, there was an average of 4 times per week they were given the supplement (Figure 2)
- More frequency in the major behaviors was seen in the Desert Tortoises not taking vitamin B12 rather than the ones taking vitamin B12 (Figure 3)
- Non-vitamin B12 tortoises: 5.56% had lower activity levels, 11.11% had higher activity levels, 66.67% reported no change, 16.67% reported unknown change (Figure 4)
- Vitamin B12 tortoises: 0% had lower/higher activity levels, 22.22% reported no change, 77.78% reported unknown change (Figure 4)

Discussion

- Due to time constraints and the SARS-CoV-2 social distance guidelines, my co-researcher and I had to modify our original experiment of using live Desert Tortoises to a virtual and computational study of effects of vitamin B12 on Desert Tortoises.
- Over the course of 5-month period of collecting data, I have concluded that there is no correlation between the vitamin B12 supplement and behavioral changes, meaning that activity level was neither heightened or lowered with the use of this supplement.
- Unfortunately, there is no comparable research that I can compare to in order to draw more conclusions.
- When calculating the different behaviors of each Desert Tortoise, it was difficult to accurately estimate how frequently each behavior was done in a span of a 24-hour period for 7 days a week. This was due to not being able to personally observe them over a 24-hour period.
- Data given by the organizations and private owners was not as detailed as I wanted which restricted me from being able to accurately analyze their Desert Tortoise's day.
- If this research were to be conducted again in the future, I would like to adopt the addition of live, obese Desert Tortoises where my colleague(s) and I can feed and supplement them with exact and consistent diets.
- With that potentially more accurate data, the results may be beneficial to tortoise owners, veterinarians, and other animal caretakers who can implement these same techniques to help reduce obesity in Desert tortoises much quicker than a simple diet change.
- Overall, I reject my original hypothesis and accept my null hypothesis that vitamin B12 has no impact on tortoise behavior.

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