Health Issues In Zoo Animals Related To Habitat And Diet Conditions

Zoo-housed animals are exposed to increased levels of stress and reduced dietary nutrition. These sudden changes in environmental conditions has shown to impact the health of certain organisms. These changes have shown to increase the prevalence of diabetes, proteinuria and reduction in salivary amylase production. Therefore, an experiment was conducted on three different organisms suspected to have health-related issues. A rhinoceros with concerns for proteinuria, a chimpanzee thought to have issues with salivary amylase production and an orangutan suspected to have diabetes were examined. Each examination was repeated three times, and the results were observed and recorded. The results tested positive for the respective health issues of the Rhino and the Chimpanzee. However, the Orangutan tested negatively for diabetes. Although the test was negative, the initial concern for the possibility of these issues shows that they are potential problems.

Introduction

Research surrounding the health of zoo animals has become increasingly active. Understanding their wild environments plays an important role on the health of the animals. Especially in zoo-housing environments, where animals live under conditions dictated by humans, usually detached from the conditions of their natural environment (Berger, A. 2010).

Some species individuals have become more susceptible to health issues such as proteinuria, diabetes and reduced salivary amylase production.

Conditions of zoo-housed animals are never identical to those in the wild. Common factors such as diet and stress are the main elements that affect species when moving from a wild to an enclosed environment.

The initial step for reducing these factors lies in understanding the feeding ecology of the species. An inappropriate diet can lead to a variety of conditions; diabetes, obesity and gastrointestinal diseases. (Cabana, F., et al., 2017). Animals in a zoo are fed produce bought from local markets, which is assumed to be comparable with the food found in the wild. However, the nutrient composition varies greatly. The diets are high in water soluble carbohydrates and low in fibre. The fruit purchased from markets have been bred to have increased sweetness, which has resulted in fruits with a higher sugar and energy content, compromising the fibre and mineral content (Cabana, F., et al., 2017).

An organism’s activities are heavily influenced by environmental rhythms typical to their habitat. Changing these conditions alters the activity patterns of animals directly (Berger, A. 2010). An organism’s health can be affected if they suddenly change. External stressors (sudden environmental changes, hunting or social stress) act as disturbances, and alter the harmonic frequencies of the organism’s regulatory systems, leading to health problems (such as increased blood pressure caused by stress).

Some significant risk factors of developing diabetes include a high calorie diet and reduced exercise (Kuhar, C., et al 2012). When comparing zoo environments to the wild, the zoo primates have a high calorie diet as well as reduced exercise. They no longer spend a great deal of time seeking out and processing their food (Hosey, G., et al, 2013). A survey conducted on AZA (association of Zoos and Aquariums) facilities, on the prevalence of diabetes in zoo-housed primates, showed that from the 30% of responding institutions, each one housed at least one diabetic primate.

Although nutrition is known to play an important role in the maintenance of good health, trying to replicate the species' natural, wild diet in a zoo environment has shown to be difficult. Instead of trying to replicate the wild diet, the aim should be to provide the animals with the level of nutrients they require (Hosey, G., et al. 2013). Lack of exercise and increase in obesity can result in pancreatitis which can affect salivary amylase production. Saliva contains amylase, which is the first step in digestion, where starch molecules are hydrolysed into maltose. Without this enzyme, starch and sugars would not be able to be digested.

Zoo-housed animals feed on a high starch, high sugar diet (fruits mostly) and will suffer from lack of salivary amylase. As a result, the importance of analysing the nutritional requirements and enclosure facilities of zoo-housed animals has increased as the abundance of health-related issues is rising.

Methods

Each case study had three samples from three different times of the day (A, B and C). Each case study was tested for the presence of a specific molecule.

The urine from the Rhino thought to have proteinuria, was subject to Bradford's Test, which tested concentration of protein. The urine from the Orangutan suspected to have diabetes underwent Benedict's test for reducing sugars. The saliva from the chimpanzee thought to have issues with amylase production was exposed to an Iodine test for the presence of starch molecules.

Quantitative Testing

Rhinoceros Urine

A rhino that was suspected to have proteinuria underwent a Bradford's Test for protein concentration.

This experiment uses a spectrophotometer; thus, cuvettes were prepared. A blank cuvette was prepared with de-ionised water set a zero reading for absorption. Following that, three cuvettes of each sample (A, B and C) were prepared, resulting in a total of 10 cuvettes.

To prepare the cuvettes, a p-1000 micropipette was used to transfer 1000µl of Bradford's reagent into each cuvette. The p-1000 micropipette was then set at 500µl and was used to transfer 500µl of each unknown sample (A, B and C) into each of the 9 appropriately labelled cuvettes - excluding the blank sample, into which 500µl of de-ionised water was transferred.

Each cuvette was then covered with parafilm and gently mixed by inverting. The wavelength was set to 550nm, and after 5 minutes, the samples were placed into the spectrophotometer one at a time and absorption readings recorded into an excel spreadsheet.

A linear graph was produced from the average absorptions. Calculations were made for protein concentration using the linear equation, and a standard curve was formulated.

Qualitative Testing

Orangutan Urine

Benedict's reagent for reducing sugars was used to test for the presence of glucose. Using a p-1000 micropipette, 2000µl of Benedict's reagent was measured into 9 test tubes. The p-1000 micropipette was then used to pipette 1000µl of each sample into the appropriately labelled test tube, repeating each sample three times. Each test tube was mixed by gently swirling.

The test tubes were then placed into a hot water bath, set at 35ºC for 10 minutes. The colour change was recorded into a table, where blue was negative, and reddish-orange was positive for the presence of glucose.

Chimpanzee Saliva

Tested for the presence of starch with Iodine solution. This experiment was conducted using a 12 well-plate. Three drops of each sample were placed into the appropriately labelled wells, repeating three wells for each sample, followed by two drops of iodine solution. As an instant test, an immediate colour change appeared. A black colour showed positive, and a yellowish-brown showed negative for presence of starch. The visual observations were recorded in a table.

Results

The concentration of protein in the urine of a zoo-housed Rhinoceros was measured due to the concern of proteinuria. The average absorbance of each sample was plotted against the calculated protein concentration, shown in Figure 1.

The presence of protein indicates proteinuria, showing issues with kidney function. The standard curve shows that the Rhino had proteinuria as the concentration of protein found in the urine recorded up to 3.684g in Sample C. Samples A (3.509g) and sample B (2.193g) also showed positive indications of proteinuria.

Figure 1. A standard curve of the average absorbance against the calculated protein concentration in each sample.

[image:][image:][image:]The qualitative test results from the Orangutan Urine are recorded in table 1. The results confirm a negative result for the presence of glucose as the solution did not change colour post-incubation. The observed blue colour shows there was no glucose present. Concluding that the Orangutan did not have diabetes. A presence of glucose would change the colour to a reddish-orange. Samples A, B and C for Benedict's Test on Orangutan Urine for

presence of glucose

Table 1. Colour change observed when Benedict’s reagent was added to three samples of Orangutan Urine and heated to 35ºC for 10 minutes.

Sample

Start Colour

End Colour

A

Blue

Blue

B

Blue

Blue

C

Blue

Blue

The test conducted on Chimpanzee Saliva for the presence of starch molecules is recorded in Table 2. The immediate colour change from clear to black, indicates a very strong result for the presence of starch. The black colour indicates a presence of starch in the saliva, concluding that the Chimpanzee had issues with producing salivary amylase. If the chimpanzee produced amylase normally, then starch would be broken down into smaller monosaccharides of glucose, and the the presence of starch would be negative (yellowish-brown colour).

[image:]Table 2. Presence or absence of starch observed by colour change when Iodine solution was added to three samples of Chimpanzee saliva.Iodine Test Results for presence of Starch in Chimpanzee Saliva

Sample

Start Colour

End Colour

A

Clear

Black

B

Clear

Black

C

Clear

Black

Discussion

There are growing concerns towards the health of zoo-housed animals. Due to sudden changes in environmental conditions, the alterations in diet composition and the reduced amount of exercise, the number of zoo-housed animals suffering from health-related illness is increasing. Stress levels arise from sudden environmental changes, as well as loud zoo visitors (Clarke, F, E., et al., 2011). High levels of stress not typically experienced in the wild can cause sudden increases in blood pressure, which result in issues such related to kidney function. Due to the results of the test on the Rhino urine, the importance of maintaining the health of zoo-housed animals is detrimental.

The nutritional requirement of wild species varies greatly from what is received in a zoo environment. The free roaming counterparts have access to a much more nutritional diet. The assumptions made (Cabana, F., et al., 2017) that food bought from local markets and food found in the wild have equal nutritional value have proven to be unfavourable regarding the organism's health. The lack of exercise, due to the decreased necessity of hunting food, alongside the reduced nutrition in the diet, has resulted in unfortunate health related issues (Smith, B, K., et al. 2014). These include diabetes and reduced salivary amylase production. The chimpanzee saliva tested positive for starch, indicating reduced amylase production. Even though the orangutan tested negative for suspected diabetes, the initial concern of diabetes shows that health-related issues are present, and not unexpected for species in zoo-housed environments.

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