Introduction

• Spongiform encephalopathies are prion diseases known to result in neurodegeneration caused by cellular prion proteins folding into alternate conformations, or PrPSc.
• Prion diseases occur in three different mechanisms: familial, sporadic, and transmissible.
• Many forms of transmissible prion diseases have been discovered: scrapie in sheep and goats, bovine spongiform encephalopathy (BSE or Mad Cow Disease), Creutzfeldt-Jakob disease and Kuru in humans, Chronic wasting disease in cervids, and more recently Camel prion disease in dromedaries.

Hypothesis

This study examines the PRNP gene of C. dromedarius to determine if there is a link between the PRNP gene sequence and susceptibility to the development of CPD.

Objectives

To examine the PRNP gene of Ethiopian camels
• Compare PRNP sequence identities to Algerian camels shown to be symptomatic with CPD
• Explore the implications of camel susceptibility to CPD by examining the PRNP sequence

Methods

• Obtain tissue samples of Ethiopian camels, which were placed in the Natural Science Research Laboratory, through international collaborations
• Supplement PRNP samples with both dromedary and Bactrian camel PRNP sequences from NCBI GenBank
• Perform DNA extraction procedures on samples, amplify, and sequence.
• Examine entire PRNP genome and note any nucleotide substitutions between Ethiopian, Algerian, and Bactrian camels.
• Perform a phylogenetic analysis on all selected samples (including those from GenBank and selected outgroups).

Results

• PRNP sequences for C. dromedarius and C. bactrianus were obtained from GenBank for comparison purposes.
• No nucleotide changes were found within the PRNP gene of C. dromedarius from both Ethiopia and Algeria.
• Potentially significant single nucleotide substitutions were found at positions 231, 243, and 246 between C. dromedarius and C. bactrianus.
• These substitutions did not have any effect on the amino acid sequences after visual analysis on MEGA.

Table 1: Nucleotide and amino acid substitutions between C. dromedarius and C. bactrianus. The asterisk indicates phylogenetically informative characters.

<table>
<thead>
<tr>
<th>PRNP Nucleotide Position</th>
<th>Nucleotide change</th>
<th>Amino Acid</th>
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<tbody>
<tr>
<td>231*</td>
<td>T to a C</td>
<td>G77S</td>
</tr>
<tr>
<td>243*</td>
<td>A to a T</td>
<td>G81G</td>
</tr>
<tr>
<td>246*</td>
<td>C to a A</td>
<td>G83G</td>
</tr>
<tr>
<td>231*</td>
<td>T to a C</td>
<td>H88H</td>
</tr>
<tr>
<td>264</td>
<td>A to a T</td>
<td>G255G</td>
</tr>
<tr>
<td>765</td>
<td>A to a T</td>
<td>G255G</td>
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</tbody>
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Figure 1: Haplotype network depicting genetic relationships between the 8 breeds of dromedaries used in this study.

Figure 2: Map depicting the collection locations of C. dromedarius in Ethiopia.

Figure 3: Bayesian tree displaying differences in Cytochrome-b sequences between C. dromedarius individuals with probability values of .95 or higher.

Figure 4: DFA results from physical measurement of Ethiopian camels demonstrating size differences between the Afar breed and others.

Figure 5: Phylogenetic tree generated from PRNP sequences.

Table 2: MEGA PRNP gene sequences with arrows displaying nucleotide differences between C. dromedarius and C. bactrianus.

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Figure 4: DFA results from physical measurement of Ethiopian camels demonstrating size differences between the Afar breed and others.

Implications

• As a novel prion disease, CPD’s capabilities surrounding interspecies transmissibility is currently unknown.
• Examining the PRNP gene could give clues as to how susceptible Camelus individuals are to contracting CPD.
• With the rise in chronic wasting disease (CWD) cases in the United States, researching how to prevent more camels from developing CPD is paramount. Since camel meat is widely consumed in Africa, the Middle and Near East, as well as in parts of the Western world, controlling the spread and discovering more about CPD could help keep a new prion disease from entering the human population as well as keep dromedaries in these localities healthy.

Conclusions

Initial study of the PRNP gene in Ethiopian camels demonstrate similarities to the Algerian camels, which were documented to naturally possess CPD.

Further study is required to determine if nucleotide (but not amino acid) changes at sites 231, 243, and 246 in the Camelus PRNP gene are relevant in terms of susceptibility to CPD.

Acknowledgments

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Characterization of the Prion Protein Gene in Eight Breeds of Ethiopian Camels

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