Investigation of the Effects of Diet, Sex, and Age on Dental Health Among Ancient Asian Samples from China and Mongolia

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Introduction
The transition from hunting and gathering to agriculture and its effect on human health has been widely investigated. Based on these studies, it has been shown that different modes of subsistence result in different effects on the skeletal remains. As populations increased their consumption of carbohydrates, their oral disease rates, in the form of carious lesions, antemortem tooth loss (AMTL), and abscesses among others, also increased. It has also been noted that females experienced greater frequencies of oral pathology than males, and this has been attributed to behavioral differences and physiological aspects. Increased frequency of oral pathology with age has also been established, with the exception of carious lesions, which can decrease in frequency when left untreated and result in other forms of oral pathology, such as AMTL. Focus has centered on agricultural and hunting and gathering populations but oral disease rates and the effect of sex and age among pastoral and agropastoral populations has been relatively neglected. This study addresses this gap by exploring dental health among ancient Asian samples with different modes of subsistence to examine the effect of diet, sex, and age.

Materials and Methods
This study examines samples from multiple sites that represent three different modes of subsistence. (Table 1, Figures 1-2)

- Agricultural sample from Henan, China
- Agropastoral sample from the Manchuria region of China
- Pastoral samples from Mongolia

Oral disease in the forms of carious lesions, AMTL, and abscesses were examined. Carious lesions form when the enamel is eroded by acid, a by-product of carbohydrate fermentation. AMTL is defined as alveolar bone resorption after the loss of a tooth, and abscesses are defined as the presence of cloacae and inflammatory bone reaction. Observations of oral pathology were made on site (primarily by Eng, also Myagmar for Mongol period) and later cross-checked with pictures and field notes (by Gomez). Significance, at the p=0.05 level, was tested using independent t-tests.

Table 1: Population Numbers

<table>
<thead>
<tr>
<th>Mode of Subsistence</th>
<th>Population</th>
<th>Chenjiagou Site</th>
<th>Lamadong Site</th>
<th>Mengol 1 (Enq)</th>
<th>Mengol 2 (Myagmar)</th>
<th>Xiongnu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females (N = 142)</td>
<td>26</td>
<td>56</td>
<td>21</td>
<td>17</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Males (N = 163)</td>
<td>33</td>
<td>56</td>
<td>14</td>
<td>28</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Female (YA) 20-35</td>
<td>5</td>
<td>20</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Female (MA) 35-50</td>
<td>15</td>
<td>25</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Female (OA) 50+</td>
<td>6</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Male (YA) 20-35</td>
<td>10</td>
<td>20</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Male (MA) 35-50</td>
<td>18</td>
<td>25</td>
<td>7</td>
<td>11</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Male (OA) 50+</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>14</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Total (N = 305)</td>
<td>59</td>
<td>111</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>

Materials and Methods continued...

The sample with the worse overall dental health was the agropastoral sample, especially in carious lesions (Figures 3-4). They significantly suffered from more carious lesions than either the pastoral sample (p=0.005) or the agricultural sample (p=0.006). It was expected that the agricultural sample would have the highest rates of dental disease due to their diet rich in carbohydrates but this was not the case and they had relatively low rates of all forms of oral pathology. Additionally, the pastoral sample has significantly higher rates of AMTL (p=0.017 vs agricultural; see Figure 3). While all samples suffered from oral disease, the agropastoral sample had the worse overall dental health.

The Effect of Diet

The Effect of Age

Conclusions
Several general conclusions can be drawn from this examination of oral pathology among different subsistence patterns:

1. The Effect of Diet: The agropastoral sample had the highest overall rates of dental disease among these three modes of subsistence especially in the rates of carious lesions. This could be the result of diet/cultural differences and high consumption rates of cariogenic foods. The pastoralists had significantly higher rates of AMTL, which could be the result of high numbers of OA (%44 of sample compared to 15% in the agricultural sample and 18% in the agropastoral sample) or cultural factors, such as trade that allowed them to supplement their diet with carbohydrates. The agricultural sample had lower rates of oral pathology and this could be the result of low sample size.

2. The Effect of Sex: Both males and females experienced high rates of oral pathology and there was no significant difference. This is surprising considering that sexual division of labor has been seen in both agricultural and pastoral samples, and these behavioral differences have been linked to different rates of oral pathology. Physiological aspects could also result in females having worse dental health than males. However, this trend is not significantly seen in these samples. This could be the result of having more old adult males than females (48 M vs 35 F) or the various cultural factors that influence diet in these samples.

3. The Effect of Age: As individuals aged, their dental health decreased significantly in the forms of AMTL and abcesses but not carious lesions. This correlates with known information about how untreated carious lesions can lead to AMTL and abscesses.

Suggestions for future work: Increase sample sizes to be proportional in age and sex categories; examine location of carious lesions; include periodontal disease and root exposure; add other reference samples.

References


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