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Trade, Contact, and Female Health in Northeast Nebraska

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Most scholars are understandably preoccupied with the impact of Europeans on native peoples who were passive, unwilling, or resistant participants in that contact. We present in this chapter a different case. The Missouri River tribes, including the Omaha and Ponca, willingly engaged in relations with Euramericans, especially in the fur trade that dominated interaction in this region.

The time frame for this study is 1780–1820, a period when interaction between individual traders and Native Americans was replaced by the dominance of the American Fur Company in organized exploitation of the Missouri River lands and peoples. This involvement later contributed to the well-documented environmental destruction of Plains river systems with dire consequence to Native American subsistence in the late 1800s. The years between 1780 and 1820 saw commerce contribute to the emergence of the Omaha tribe as a major political, economic, military, and cultural force in the area of modern Nebraska. It is thought that

lifestyles changed during these dealings with Euramericans to the simultaneous benefit and peril of tribal members. Omaha population decreased during the late 1700s and early 1800s. Epidemics (Trimble, 1989) and trade in toxic lead (Reinhard and Ghazi, 1992) contributed to this decline. Beyond these factors, female health and reproductive success must have played a role in the decline and eventual recovery of the Omaha population. It appears that several factors related to the fur trade resulted in changes in ways of life that adversely affected female health. Trade exposed the Omaha to Euramericans and their diseases. The need to produce furs resulted in greater physical demands on an already heavily taxed population. We suspect that the vitality of Omaha women was compromised, resulting in a decrease in life expectancy and reproductive success.

If extrapolations from ethnographic and historical writings are correct, these alterations in life experience should have left recognizable signatures on the skeletons. The comparison of pre-

contact skeletons with contact period skeletons should illustrate the general impact of contact. The comparison of contact male and contact female skeletons should indicate how the change in life experience affected the sexes. Our view of the contact period comes from the excavation of two Omaha cemeteries and one Ponca cemetery. The Omaha cemeteries (sites 25DK10 and 25DK2) are associated with the village of Tonwatonga (site 25DK5). These cemeteries yielded 92 individuals, including 37 adults (16 females, 15 males, two possible females, and four possible males). The village site was mentioned by Lewis and Clark, so it was occupied at the beginning of the nineteenth century. It may have been established as early as 1780, and it was probably abandoned by 1833. It is not mentioned by Maximilian in his Missouri River narrative (Thomas and Ronnefeldt, 1982).

We estimate that of 10,000 grave objects, listed under 1,300 catalogue numbers, 95% were of European or Euramerican manufacture. The artifacts suggest that the Omaha cemeteries were not used synchronously. Firearms and gun parts were more common in 25DK2, and they included powder horns, gun flints, gun parts, and a complete flintlock pistol. In contrast, two burials from 25DK10 contained only four musket balls. If firearm abundance increased over time, then the presence of more firearms at 25DK2 indicates a later use of the cemetery. We have also initiated a study of a cemetery from Ponca Fort (25KX1). The Ponca tribe is related to the Omaha tribe, from which it split in the eighteenth century. Sixty skeletons were encountered, including 31 adults (26 women and seven men). In comparison with the Omaha, few trade goods were found. Ponca Fort was used contemporaneously with the Omaha sites.

Ethnographic Background

Dorsey (1884) and Fletcher and LaFlesche (1911) described tasks performed by Omaha

males and females. Primary among the female activities were duties associated with horticulture, maintenance of households, and hide preparation. Garden plots of one-half to three acres of land were devoted to maize, beans, squash, and tobacco. Simple horticultural tools were used, including bone hoes, rakes, and digging sticks. Metal tools were introduced later through trade. Food provided by efforts of the women contributed substantially to the tribe's diet and provided a surplus for trade to outside groups.

In addition to horticulture, most tasks related to sustaining households belonged to women, except for the provision of meat and the protection of the family. The construction and maintenance of the home were a woman's responsibility. They made and set up the tents that provided shelter during the hunting season and also often were used in villages. When enough resources were acquired for an earth lodge, both males and females participated in the construction of this more permanent dwelling (Fletcher and LaFlesche, 1911).

Both within and outside her home, an Omaha woman did the rest of the household chores. She tended to children, prepared food and clothing, gathered firewood, collected wild foods, and was practiced in quill and bead artwork. During the bison hunt, these tasks were accentuated by the frequent movement of the camp and the labor involved in its dismantling and establishment. Products from the hunt also required the labor and immediate attention of women. Meat was cut and jerky prepared before it spoiled, and hides needed to be dressed and tanned. The preparation of the hides of bison and other animals was a major female responsibility. This was true prior to Euramerican trade, and it increased during the contact period.

The barter in animal skins with the Euramerican traders promoted hunting for wealth in addition to subsistence. Work escalated for both sexes. When males increased their hunt-

ing time, females processed more pelts, a time-consuming and labor-intensive endeavor. Specifically, Fletcher and LaFlesche state that "in the old time one woman could scarcely give proper attention to all the skins secured by a good hunter; still less could she do the additional work occasioned by the pressure of trade" (1911:615).

Because of the workload demanded of both sexes, children were assigned tasks at early ages. This was especially true for young Omaha girls, who while young were trained in the preparation of skins, the making of tent covers, the sewing of garments, and all other household duties.

Thus, duties were assigned early in a woman's life and incorporated virtually all aspects of village society and family maintenance. The central position of women in the construction and maintenance of the household provided the foundation for the entire tribe's welfare. A weakening of this female infrastructure, either by social or biological disruption, would have had a pronounced effect on the survival of the Omaha. At least biological disruption is indicated in the ethnohistoric literature. Several epidemics in the late 1700s and early 1800s probably negatively impacted the Omaha village 25DK5 (see Trimble [1989] for a history of epidemics). These included three smallpox episodes (1778-1783, 1800-1803, 1836-1840) and whooping cough and cholera (1832-1834).

The ethnobotany of the Omaha has been studied in detail (Gilmore, 1913, 1977; Yanovsky, 1986; Kindscher, 1987). Table 1 illustrates a diversity of gathered and cultivated plant foods in the Omaha diet. Among the cultivated plants, the Omaha reportedly had 15 varieties of beans, eight varieties of squash, and many kinds of maize. They also cultivated watermelon, which was introduced directly to the Omaha with the fur trade in 1795 (Nasatir, 1990:492). There was also a diversity of wild plant foods reported to have been the dietary mainstay when cultivation was not possi-

ble. Tubers from *Glycine apios*, *Psoralea esculenta*, and *Sagittaria arifolia* were most important.

Skeletal Analyses

To provide background for the increase of osseous pathology among the Omaha, especially women, a pathological study of historic and prehistoric skeletons was completed. The historic sample consisted of the Omaha and Ponca skeletons described above. The prehistoric skeletal sample consisted of 40 individuals from two prehistoric cemeteries near the Omaha cemeteries, including sites 25DK9 and 25DK13.

With regard to the vertebral column, several different types of pathological involvement were scored. Osteophytosis, also called vertebral lipping, refers to the degeneration of the centrum in response to age and activity. Osteoarthritis refers to the degeneration of the posterior synovial joints of the spine. Schmorl's nodes are depressions in the centrum resulting from the herniation of the intervertebral disks.

Vertebral Pathology

The goals of the vertebral analysis were to assess whether or not contact populations exhibited a higher prevalence of spinal pathology, and if so, whether this was attributable to an increased workload for women.

The study of vertebral pathology was limited to skeletons that had reconstructible vertebral columns. A comparison of the spines of 21 Omaha and Ponca with 18 prehistoric individuals was made with regard to prevalence and severity of two degenerative conditions related to activity, osteophytosis and osteoarthritis. A second comparison of vertebral pathology showed that trauma and mechanical stress were more characteristic of the contact period (Sandness and Reinhard, 1992).

A greater prevalence of osteoarthritis is evident in the precontact sample (17 of 18 indi-

Table 1. Common and Scientific Names of Plants and Fungus Eaten by the Omaha*

Common name	Scientific name	Part eaten
Corn smut	<i>Ustilago maydis</i> (DC.) Cda.	Spores
Morel mushrooms	<i>Morchella esculenta</i> (L.) Pers.	Fruiting body
Arrowleaf	<i>Sagittaria latifolia</i> Willd.	Tuber
Wild rice	<i>Zizania aquatica</i> L.	Caryopses
Maize	<i>Zea mays</i> L.	Kernels
Wild onion	<i>Allium canadense</i> L.	Bulb
Black walnut	<i>Juglans nigra</i> L.	Nut
Hickory nut	<i>Carya ovata</i> (Mill.) K. Koch	Nut
Hazelnut	<i>Corylus americana</i> Walt.	Nut
Hackberry	<i>Celtis occidentalis</i> L.	Nut
Yellow lotus	<i>Nelumbo lutea</i> (Willd.) Pers.	Tuber, seed
Wild gooseberry	<i>Ribes missouriensis</i> Nutt.	Fruit
Wild strawberry	<i>Fragaria vesca</i> L. var. <i>americana</i> Porter and <i>F. virginiana</i> Duchn.	Fruit
Wild raspberry	<i>Rubus occidentalis</i> L.	Fruit
Wild rose	<i>Rosa arkansana</i> Porter	Fruit (famine food)
Crab apple	<i>Pyrus ioensis</i> (Wood) Carruth	Fruit
Red haw	<i>Crataegus rotundifolia</i> Moench	Fruit
Juneberry	<i>Amelachier alnifolia</i> Nutt.	Fruit
Wild plum	<i>Prunus americana</i> Marsh.	Fruit
Chokecherry	<i>Prunus virginiana</i> L.	Fruit
Prairie turnip	<i>Psoralea esculenta</i> Pursh	Root
Indian potato	<i>Apios americana</i> Medic.	Tuber
Ground bean	<i>Amphicarpaea bracteata</i> (L.) Fern.	Bean
Garden bean	<i>Phaseolus vulgaris</i> L.	Bean
Soft maple	<i>Acer saccharinum</i> L.	Sugar
Elderberry	<i>Sambucus canadensis</i> L.	Fruit
Box elder	<i>Acer negundo</i> L.	Sugar
Milkweed	<i>Asclepias syriaca</i> L.	Greens
Ground cherry	<i>Physalis heterophylla</i> Nees	Fruit
Pumpkin, squash	<i>Cucurbita pepo</i> L.	Pulp, seed
Jerusalem artichoke	<i>Helianthus tuberosus</i> L.	Tuber
Watermelon	<i>Citrullus lanatus</i> (Thunb.) Mansf.	Melon
Buffalo berry	<i>Shepherdia argentea</i> Nutt.	Fruit

* Compiled from Gilmore (1913,1977). Kindscher (1987). and Yanovsky (1986).

viduals). The severity of osteoarthritis is as follows: eight minor involvement (44.4%), five moderate involvement (27.8%), and four severe involvement (22.2%). Thirteen of 18 precontact individuals show evidence of osteophytosis. With regard to severity, seven of the 18 (38.8%) show minor osteophyte development, two (11.1%) show moderate development, and four (22.2%) show severe osteophytosis.

Fifteen of the 21 Omaha/Ponca individuals display osteoarthritis with the following severity: eight (38.1 %) minor involvement, six

(28.6%) moderate involvement, and one (4.8%) severe involvement. Osteophytosis is evident in 11 of 21 historic people. Severity is as follows: minor in two (9.5%), moderate in five (23.8%), and severe in four (19%) individuals.

The greater prehistoric prevalence in osteoarthritis is largely due to longer average life (by about 15 years) in prehistory in comparison to the Omaha and Ponca (Sandness and Reinhard. 1992). The severity of osteoarthritis is greater and is also related to higher age at death for precontact individuals. Prevalence of

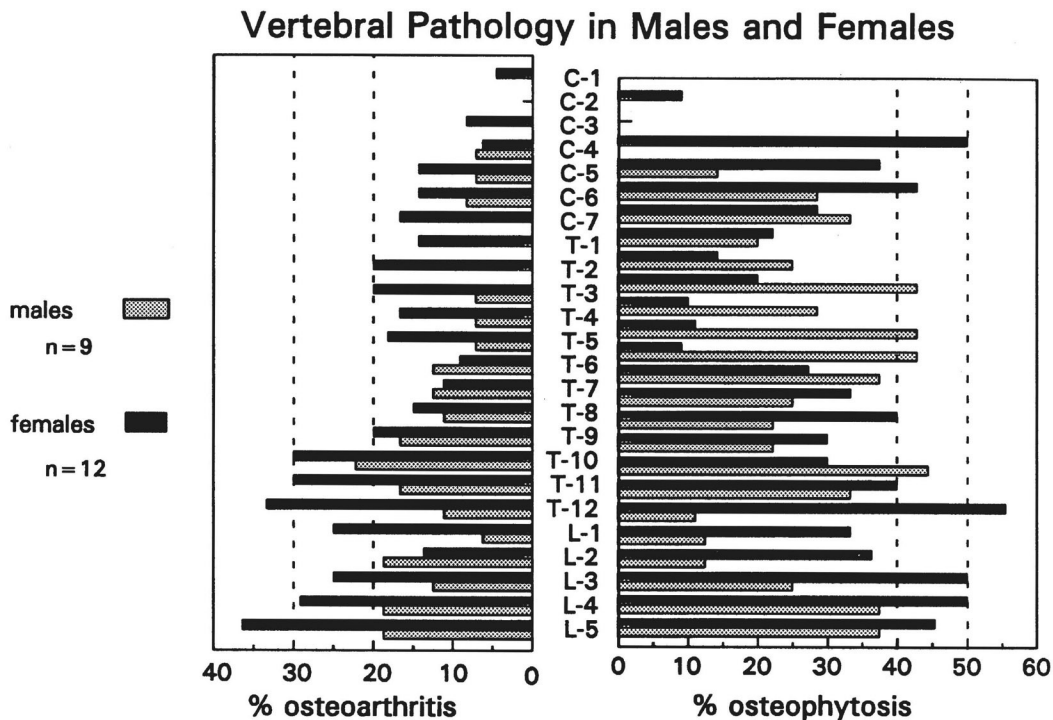


Figure 1. Distribution of degenerative disease in male and female vertebral columns.

osteophytosis is greater among the pre contact sample, but severity is greater among the Omaha and Ponca. Osteophytosis is a more sensitive indicator of activity-induced stress (Sandness and Reinhard, 1992), and therefore the increased severity indicates that the spines of the historic people were under greater activity-related stress.

Evidence of trauma or mechanical stress in the Nebraska vertebrae increases after contact. Schmorl's nodes are found in three of 18 pre-historic people (16.7%) in contrast to nine historic people (42.8%). Spondylolysis is present in five historic adults (23.8%), but there is no evidence of the condition in prehistoric people.

Vertebral Pathology of Males and Females

Spondylolysis and Schmorl's nodes were used as indicators of mechanical stress and trauma-induced activities. Twelve female

spines and nine male spines from the Omaha and Ponca were complete enough for study (Sandness and Reinhard, 1992).

Apparently, females were engaged in different activities than males (Figure 1). Osteoarthritic vertebral degeneration is more frequent in females (75%) than in males (66.6%), and females exhibit higher frequencies of moderate (33.3%) and severe (8.3%) stages. In contrast, males are more commonly affected with osteophytosis (66.6%) than females (50%). The women exhibiting osteophytosis are moderately or severely affected in comparison to men who show primarily minor involvement. Both conditions affect males primarily in the lower thoracic and lumbar regions, especially at the tenth thoracic vertebra. Females exhibit higher frequencies in the upper thoracic and lower lumbar vertebrae. Overall, women also have a greater pathological involvement throughout the spine than men.

The distribution of osteophytic vertebrae is different between men and women. Female spines exhibit frequencies of 40% or more in the upper and mid-cervical (C-3 and C-5), middle and lower thoracic (T-8, T-11, and T-12), and lower lumbar vertebrae (L-3 to L-5). In contrast, male spines display frequencies of 40% or more in the upper and middle thoracic vertebrae (T-2, T-4, T-5, and T-10).

Schmorl's nodes are present in three women, but six of nine males have the condition. Of these, five males have more than one vertebra with a Schmorl's node, whereas only one woman has multiple Schmorl's nodes. Thus, it is possible that herniation of the intervertebral disks was more of a problem for men than women.

Among the Omaha, trauma is evidenced by four examples of spondylolysis (three affecting L-5). In every instance, there is complete bilateral separation in the region of the pars interarticularis. Three cases are women, all of whom were less than 25 years old at death (25% of females). The only male with the condition died at about 40 years of age (11% of males). It is noteworthy that one female with spondylolysis also has bilateral stress fractures of the first rib. In clinical settings, such fractures usually occur in people who habitually lift and carry heavy loads (Phoebe Kaplan, University of Nebraska Medical Center, personal communication).

In general, it seems that women were more profoundly affected by degenerative disease of the spine than men. This observation is consistent with ethnographic data (Fletcher and LaFlesche, 1911). Spondylolysis in women may have resulted from the stooped-over posture during hide scraping as depicted by Fletcher and LaFlesche (1911:Figure71).

Role of Horse Riding, Trauma, and Degenerative Disease

Skeletal samples from the Omaha (25DK2 and 25DK10) and Ponca (25KX1, 25KX5, and

25KX9) sites were examined for indications of horseback riding (Miller, 1992). Habitual riding is indicated by the presence of superior elongation of the acetabulum, extension of the articular surface of the femoral head onto the femoral neck, and enlarged muscle attachments for the gluteus medius and gluteus minimis, the adductor magnus and brevis, the vastus lateralis, and the medial head of the gastrocnemius muscles. Osteoarthritis of the first metatarsal, possibly from the use of toe stirrups (a thong through which the first toe was thrust), was also considered.

For sex comparison, the samples were divided into two activity groups, including those with (riders) and those without (nonriders) the osteological characteristics of horseback riding. The rider sex distribution is five females and 13 males, and the nonrider distribution is eight females and six males. Distribution by age groups, including adolescents (14-19), young adults (20-29), middle adults (30-39), and old adults (40+), show that individuals classified as both riders and nonriders are represented in all age groups for both sexes (Table 2).

Of 14 nonriders, there are four cases of vertebral mechanical stress, all of which are examples of spondylolysis in females. This spondylolysis in females may not be associated with horseback riding, but with hide scraping, as noted above. Schmorl's nodes are associated with one nonrider. In addition, there are three cases of trauma, including one fractured ulna, one dislocated clavicle, and one example of blunt trauma to the lower leg. Only one of these individuals exhibits vertebral degenerative changes. This individual is an old female, and degenerative conditions were expected regardless of riding status.

The group of riders (18 individuals) shows a much different picture of skeletal trauma and degeneration. There are 10 cases of degenerative disease excluding the metatarsal, 10 cases of trauma, and 12 cases of first metatarsal arthritis in this sample (Table 2). Spondylolysis

Table 2. Vertebral Mechanical Stress, Skeletal Trauma, and Osteoarthritis of First Metatarsal Among Riders (5 Women, 13 Men) and Nonriders (8 Women, 6 Men)

	Adolescent		Young adult		Middle adult		Old adult	
	Male	Female	Male	Female	Male	Female	Male	Female
Nonriders								
Mechanical stress	0	2	0	1	0	0	0	1
Trauma	0	0	1	0	1	0	0	1
Osteoarthritis	0	0	0	0	0	0	0	1
Riders								
Mechanical stress	0	1	3	1	2	0	2	1
Trauma	0	0	3	1	2	1	2	1
Osteoarthritis	1	0	3	1	3	1	2	1

is present among two male riders (one of these had an incomplete spine and therefore was not noted in the vertebral analysis). Other forms of degenerative disease and mechanical stress include fusion of vertebrae and long bones, “kissing” lumbar spines, which indicate hyperflexion of the lumbar spine, Schmorl’s nodes, and atrophy of a shoulder following a fracture of the humerus. Trauma is represented in seven individuals as fractures, in one individual as blunt trauma, and in one person as a knife wound to the forehead (this skeleton also has a dislocated shoulder). The occurrence of joint degeneration is also high among horseback riders of all age groups and both sexes. Twelve individuals exhibited degenerative changes in the joints, primarily the vertebrae, knees, hips, feet, and elbows.

Female trauma was not related to horseback riding. There are no significant differences between female riders and nonriders (χ^2 , $p > 0.05$). Female riders show a younger age of onset for all conditions. Significant differences are present, however, between male riders and nonriders in mechanical stress frequency (χ^2 , $p > 0.25$) and osteoarthritis (χ^2 , $p > 0.05$), but not in the frequency of trauma (χ^2 , $p > 0.05$). These findings indicate that the degenerative disease and trauma present in men was related to a primary male activity: horseback riding. Such

conditions in females were related to a rigorous lifestyle, unrelated to riding, that would have included strenuous labor while planting crops, foraging, burden carrying, and preparing hides.

Diet

Dietary reconstruction was completed through stable nitrogen and carbon isotope analysis in order to determine whether dietary differences existed between Omaha men and women, and whether such differences, if found, could be implicated in women’s health (see Schwarcz and Schoeninger, 1991). Plants gathered by the Omaha have a C_3 metabolic pathway. Maize was the dominant C_4 plant that was consumed.

The carbon stable isotope data for the Omaha and Ponca are plotted in Figure 2. The carbon to nitrogen ratios of all values falls between 3.0 and 3.1, which indicates that preservation of collagen is good. When the values are examined by cemetery, there seems to be a difference between male and female diets at 25DK2, but not at 25DK10. Perhaps women at 25DK2 consumed more maize than males. This suggests that dietary habits changed between the use of the cemeteries. Among the Ponca, there is no difference between male and fe-

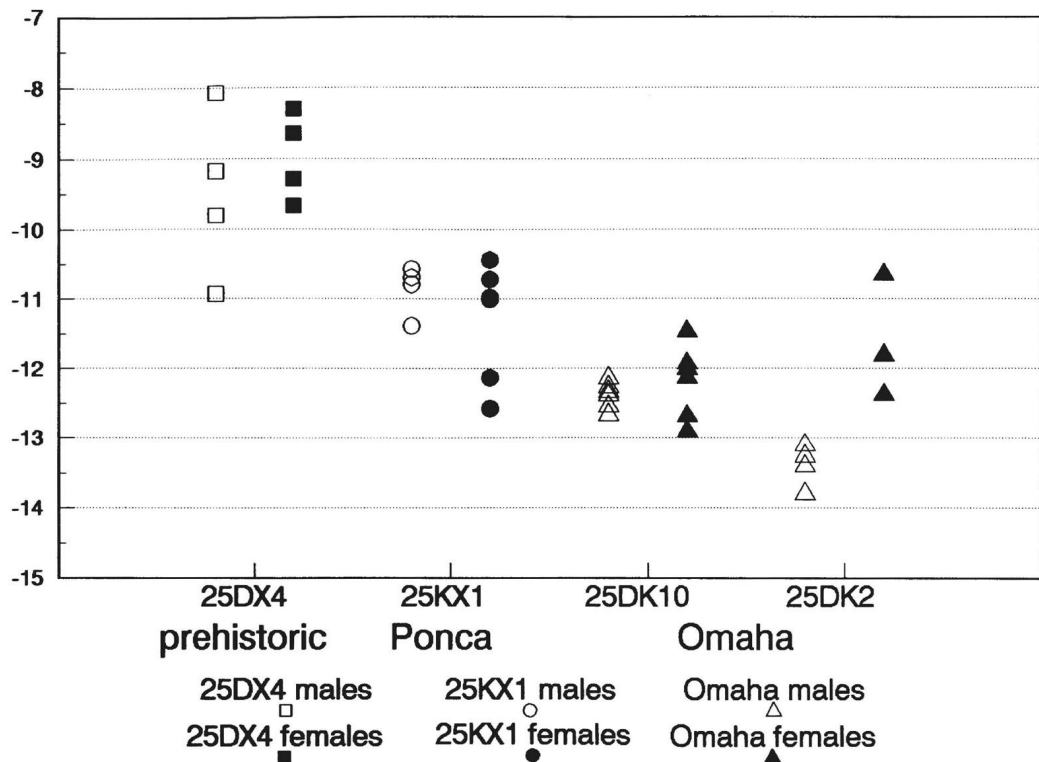


Figure 2. Delta carbon values for Omaha and Ponca skeletons.

males values (Figure 2). For all three sites, the males exhibit less variation than females, reflecting less dietary variability in males than females.

In Figure 3, the stable carbon and nitrogen isotope values for Omaha males and females are plotted against prehistoric St. Helena Phase horticulturalist skeletons from cemeteries near the Omaha cemeteries. The values for the St. Helena peoples fall within the range for maize horticulturalists. The Omaha tend to have more negative carbon values and more positive nitrogen values. Overall, it seems that Omaha diet included more animal protein or gathered plants. Presumably, then, the introduction of horses and firearms to the Omaha resulted in more successful hunting and greater access to meat as well as more effective foraging for wild plant foods.

Stress Associated with Childbearing

Among the Omaha remains, three fetal skeletons were identified. One was found in the abdominal cavity of a female aged 15.5-17.5 years, an individual who died during pregnancy. The other two fetal skeletons, presumably from miscarriages or stillbirths, were not associated with adult female remains. The presence of these remains suggests that spontaneous abortion and death during pregnancy were metabolic strains on Omaha women. It is possible that the stress of pregnancy contributed to the death of the pregnant woman noted above in combination with physical demands on young Omaha females as indicated by spinal pathology and ethnographic references.

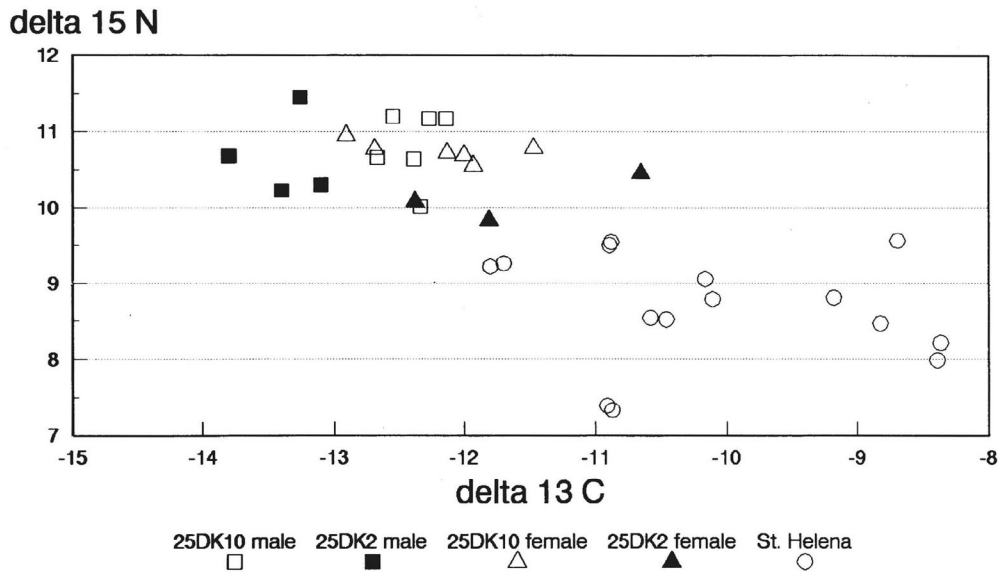


Figure 3. Carbon and nitrogen stable isotope values for Omaha and prehistoric skeletons.

Dental Wear

Barnum and Peterson (1991) have completed an analysis of dental wear for prehistoric and historic native Nebraskans. Wear on 32 prehistoric and 14 Omaha dentitions was classified on a five-point system: 0, no wear; 1, wear of enamel only; 2, initial exposure of dentin; 3, extensive exposure of large areas of dentin; and 4, dentin completely exposed (Figure 4). Omaha females show greater attrition than males, and the Omaha have more heavily worn teeth than the prehistoric inhabitants of 25DK13 and 25DK9 (Barnum and Peterson, 1991).

Forty-eight percent of all teeth exhibit level 4 wear. The greatest wear is on the anterior teeth (83% exhibit severe wear). Females have a greater percentage of severely worn teeth (61%) than males (43%), even though Omaha females generally died earlier in life than males. In contrast, only 15% of precontact teeth are severely worn. Again, severe wear is more common on the anterior teeth: 29% of the anterior teeth fall into this category, and 8% of the posterior teeth are similarly worn. With regard to sex, 21 % and 7% of the

precontact male and female teeth, respectively, are severely worn.

These wear patterns probably reflect the use of these teeth as tools for manipulating or holding objects. Omaha women, in particular, had pronounced anterior tooth attrition. Because tooth wear leads to pulp exposure and abscessing, increased dental wear among Omaha women likely predisposed them to dental disease. The cause of increased anterior wear in female dentitions might be related to softening hides by chewing.

Trade in Toxic Metals

A study of lead isotopes in these bones clearly demonstrates that lead from several geological sources were traded to the Omaha (Reinhard and Ghazi, 1992). Metallic lead was traded from present-day Missouri, and it was manufactured into ornaments and musket balls by the Omaha. Some Omaha skeletal lead signatures indicate absorption of lead from this source. There was, however, a more insidious source of lead—a red pigment used as a cosmetic. The isotope analysis of pigment

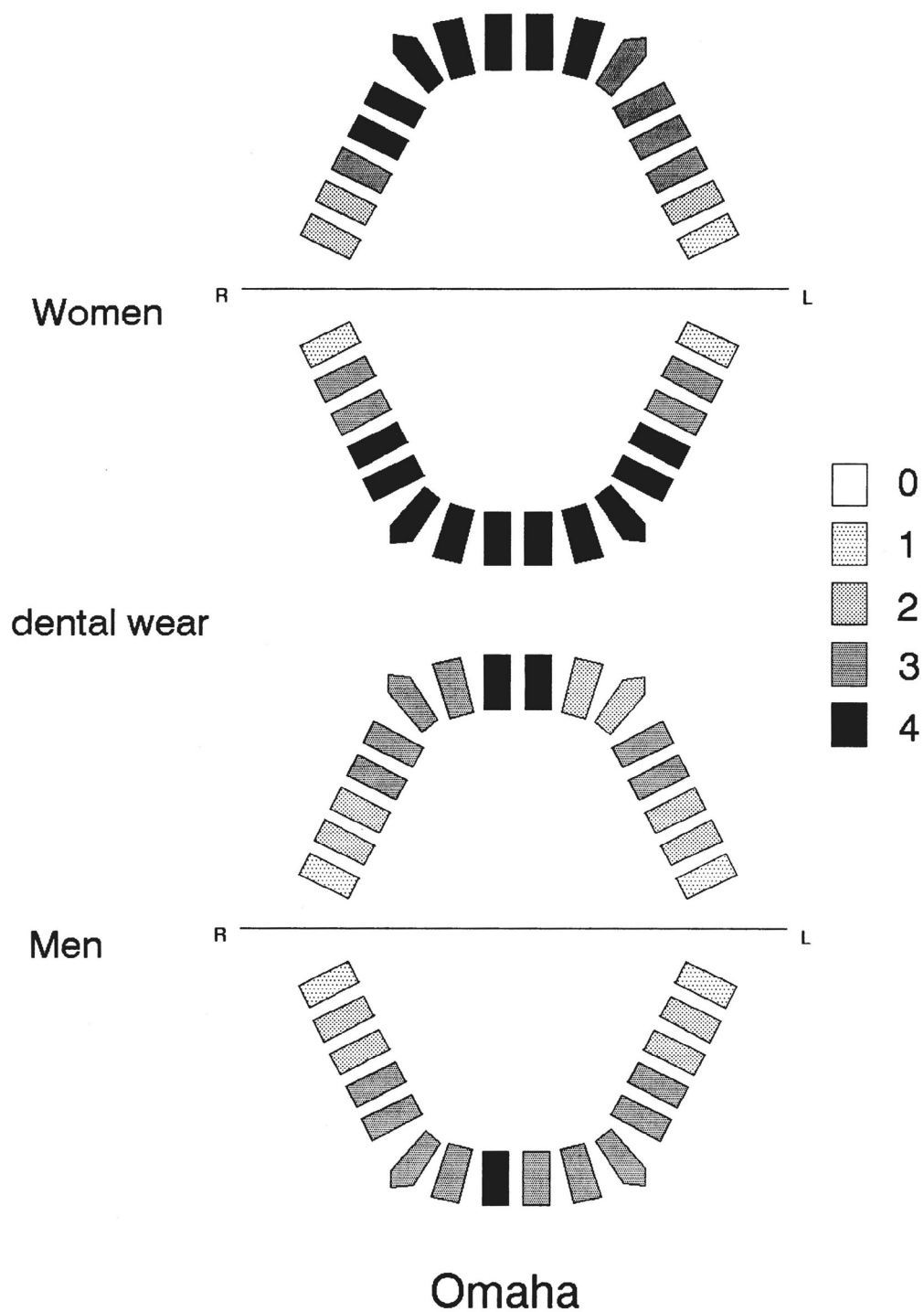


Figure 4. Distribution and severity of tooth wear for Omaha males and females. Mean score for tooth wear is presented. See text for explanation.

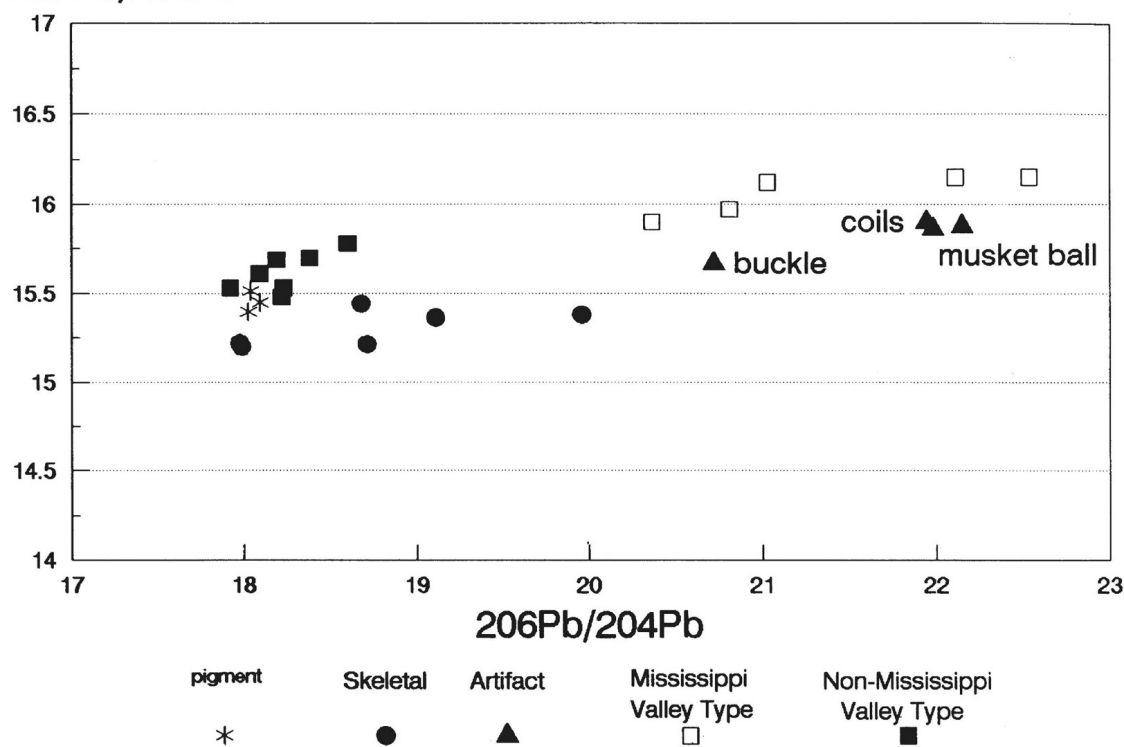
$^{207}\text{Pb}/^{204}\text{Pb}$ 

Figure 5. Lead isotope values for skeletons, artifacts, and pigments in comparison to mine values from Mississippi Valley type deposits and non-Mississippi Valley type deposits.

indicates that this lead came from a non-Mississippi type deposit, possibly from the northeastern United States. Most of the lead in the Omaha bones is derived from this source (Figure 5). Evaluation of the lead levels indicates that most of the values are due to diagenetic absorption of lead from the pigment. Those values that cannot be attributed to this source are low (below 60 mg/g). The low levels may have been debilitating but were not lethal.

Conclusion

The analysis of Omaha and Ponca skeletons indicates that there were positive and negative effects of the fur trade. The main positive impact of the trade was the introduction of fire-

arms that, when combined with horse riding, resulted in more efficient hunting practices and greater access to animal sources of protein. It also allowed efficient foraging for wild plants (Table 1) to supplant agricultural foods. Thus, in comparison to their prehistoric Nebraska counterparts, the Ponca and Omaha diet was probably more nutritionally sound.

Other analyses suggest a negative impact of the fur trade on the lives of the Omaha, in general, and particularly women. There is an earlier onset of degenerative disease among the Omaha in comparison to precontact peoples. The Omaha and Ponca male and female skeletons indicate that heavy labor associated with the fur trade combined with traditional female tasks led to more pronounced degenera-

tive disease, especially among females. Stress during early years of pregnancy is suggested by the presence of fetal skeletons and the remains of a pregnant woman in the contact period cemeteries. The fact that the pregnant woman was 15.5–17.5 years old at death suggests that early pregnancy was an aspect of female life for the Omaha. Horseback riding seems to be a primary activity for men, and one of many activities carried out by women. Thus, the general depiction of male and female activities of men and women by Fletcher and LaFlesche (1911) is supported by the skeletal analysis presented in this chapter.

Increased anterior dental wear is associated with the Omaha in comparison to precontact peoples; it is especially characteristic of Omaha women. These observations suggest that the activities resulting in tooth wear increased in historic times, probably due to processing goods (e.g., furs) for trade. Such tasks placed women at greater risk to other dental diseases and, hence, lowered the quality of their lives.

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