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Health Risks Among the Elite

An Ecological-Political Approach To Life in Ancient Pompeii

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This investigation challenges the assumption that reduced health is attributed to lower class individuals only. Skeletal indicators of illness and disease found on the osteological remains at ancient Pompeii are associated with an elite diet. The chronic conditions include dental caries, brucellosis, dental abrasion, dental abscesses, fluorosis, Forestier's Disease (DISH), Hyperostosis Frontalis Interna (HFI), spina bifida occulta, and tuberculosis. The volcanic eruption in 79 CE provided exceptional preservation of the remains of flora, fauna, artwork, and architecture, which are used to recreate the diet and lifestyle of members of Pompeian society. Past analyses of the osteological remains include the disarticulated skeletal elements in the bath complexes and the burial of a large family within a dwelling at Pompeii. These remains are representative of a sample of the living population and contain paleopathological markers that are attributed to the consumption of food items specific to an elite diet. This case study demonstrates another avenue of research within the ecological-political model in archaeological context and illustrates many health risks associated with the lifestyle of members of higher socioeconomic status.

Introduction

Socioeconomic status, related access to adequate nutrition, and associated health consequences are important research topics within modern and ancient contexts, and studies looking into these areas have dramatically increased over the past thirty years (Adler & Ostrove, 1999; Pelto, 1987; Trigg, 2004). Modern analyses focus on limiting disease spread, or aiding in illness treatment (e.g., DeWalt, 1998), whereas investigations of ancient peoples attempt to understand past lifeways in contexts devoid of complete written or oral records (e.g., Prowse, Saunders, Fitzgerald, Bondioli, & Macchiarelli, 2010). In ancient contexts, diet and health are analyzed according to food remains (e.g., Katzenberg, 2012), paleopathological indicators on skeletal materials (e.g., Brickley & Ives, 2008), and ancient literature (e.g., Kron, 2005). Social status is more difficult to determine for past peoples, and researchers have relied on evidence of grave goods or poor health to attribute an upper or lower class association to human remains (e.g., Atalay & Hastorf, 2006). A common focus in studies of both modern (e.g., Crooks, 1998) and ancient contexts (e.g., Kron, 2005) has been that individuals of lower socioeconomic status are at an increased risk for experiencing ill health. Recent investigations at the archaeological site of Pompeii (e.g., Henneberg, Hennenberg, & Ciarallo, 1996; Henneberg & Henneberg, 2006; Lazer, 2009) have, however, revealed that poor health is not restricted to individuals of lower socioeconomic status. Food artefacts at this site establish status-based nutritional accessibility and illustrate causal links between diet and certain diseases found in the human osteological material. Examining the health of a population requires

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multiple lines of evidence; ill-health can no longer be regarded as a straightforward response to being poor.

Access to essential vitamins and nutrients can be limited by events such as natural disasters (e.g., storms that destroy primary crops) and socio-political unrest (e.g., states that remove necessary public food subsidies), but the quality and quantity of foods available to individuals are also impacted by socioeconomic status. Socioeconomic status is a categorical term describing individuals according to their relative wealth-based class in a hierarchical system (Adler & Ostrove, 1999). Initial studies of socioeconomic-related health focused on how poverty decreased life expectancy within populations (e.g., Feinstein, 1993), followed by studies developed to explore the mechanisms by which socioeconomic status influenced illness throughout the life history (e.g., Adler & Ostrove, 1999). These methods were applied to the archaeological record and skeletal remains at cemeteries were analyzed for similar markers of health (Roberts & Manchester, 2005). Rates of disease, infection, and stature have been analyzed in buried remains using macroscopic analysis, such as Geber and Murphy's (2012) investigation of macroscopic lesions on human cranial fragments and long bones to study the rates of scurvy in ancient human remains. In addition, Prowse et al. (2010) utilize biochemical examinations such as stable isotope analysis to investigate diet and related stature among children in a Roman skeletal assemblage. Buried populations, such as those found in cemeteries, represent unhealthy individuals who died across a broad timeframe and are insufficient for examining the overall health of a living cohort or a specific population (Wood, Milner, Harpending, & Weiss, 1992). Additionally, the socioeconomic status of ancient peoples as illustrated by the grave goods buried with their associated skeletal remains is subjective. Many cemeteries do not contain burial goods, therefore in order to examine socioeconomic status and relations to health, it is necessary to explore past lifeways using different means.

Ancient Pompeii provides a unique context for analyzing many material remains due to the excellent preservation caused by the volcanic eruption of 79 CE (Panetta, 2004). Artwork, architecture, flora, fauna, and human remains provide information related to ancient human lifestyle (Laurence, 2007). Drains below the buildings specifically provide access to deposits of remains that were directly used by individual Pompeians (Ciaraldi, 2007). This investigation will serve to challenge the assumption that reduced health is attributed to lower class individuals only. The skeletal remains from the eruption site of Pompeii demonstrate evidence of many health issues, including pathogen-causing maladies (e.g., brucellosis), and metabolic conditions (e.g., fluorosis) (Henneberg & Henneberg, 1999, 2006; Lazer, 2009). Based on well-preserved food remains and ancient documentation of diet of the elite class, I will argue that members of higher socioeconomic status in ancient Pompeii were at an increased risk of developing specific illnesses and diseases because of their associated diet.

Theoretical Approaches to Diet and Health

The human body requires 13 essential vitamins and 17 dietary minerals in varying quantities to maintain strength and stability within its living systems (Combs, 2008; WHO, 2004). An imbalance of the body's homeostatic processes results in damage, ill health, and in some instances, death (Allen, de Benoist, Dary, & Hurrell, 2006). Food consumption patterns in humans have changed throughout our history due to trade, animal and plant domestication, subsistence shifts to agriculture, cooking practices, and cultural food restrictions despite human nutritional requirements remaining constant (Brothwell & Brothwell, 1969). If there are certain nutrients that are necessary to maintain human health, access to local food resources remains an issue.

Health and nutrition are defined by the ecological and economic constraints imposed on a living group (Krondl & Boxen, 1975; Messer, 1984; Mol, 2011). These conditions have varied globally and throughout time, and accessible nutrition is often imbedded into cultural practices and societal identity. Kuhlken (1999) argues that subsistence shifts to intensive agriculture and marine resource exploitation in Fiji were the result of social conflict and warfare impacting how resources from the land were utilized. Alternatively, Reitz (1999) illustrated that Native

Americans living in Spanish colonial Florida relied more on animal husbandry and maize crops for sources of nutrition, with many non-local Spanish spices being introduced. The cuisines specific to both of these areas and the dietary resources that were exploited by their people developed based on political and ecological influences. Studies in nutritional anthropology have not only focused on eating practices, but also on patterns related to insufficient diet and malnutrition (Mintz & Dubois, 2002). Pellett (1987, p. 165) outlines the four broad causes of malnutrition as:

> (1) Insufficient supply of the foods necessary for a balanced diet, often due to production failure, poor soils, climate, farming techniques, or overpopulation; (2) uneven distribution of the food (both between and within families); (3) Lack of knowledge about nutritional health; and, (4) poor health and sanitation, including infectious disease that are synergistic to malnutrition.

According to this definition, malnutrition can relate to any major health condition attributed to diet, including starvation, obesity, and metabolic diseases.

Analyses of malnutrition have either focused on the role of certain food items or on particular culturally-defined groups. Mintz (1979) analyzed the role of sugar on global health as it shifted from a worldwide luxury to an everyday food item. The production and consumption of sugar changed food preferences and tastes on a broad scale. Conditions like diabetes and obesity were strongly associated with increased taste preferences for sweet foods, and became more prevalent with global trends in increased sugar consumption (Mintz, 1979). Alternatively, Bourdieu (1979) examined the taste and food ideals of individuals of various socioeconomic classes. Many of Bourdieu's (1979) gender-biased explanations of food preferences are no longer accurate, but his distinctions of class-based tastes are readily documented in historic and ancient populations (e.g., Brothwell & Brothwell, 1969). According to Bourdieu (1979), the inherent social class of an individual predisposes food preferences and tastes. Upper-class food dishes in his study included rich butter, exotic meats, and spices. Similar preferences for spices and exotic meats have been reported in ancient Roman recipes, wherein Roman elites were supposedly responsible for the overuse and extinction of a spice called Silphium (Beer, 2010; Cooley & Cooley, 2004; D'Arms, 2004). Analyzing the desired taste or texture of food is considerably subjective, especially in regards to past populations (Poppendieck, 2000). To limit subjectivity, food preferences will be explained in terms of what food is accessible.

According to Krondl and Boxen (1975), studies of nutritional behaviour are based on available food resources, energy, and cultural values in each society. In contemporary Mexico, Pelto (1987) recognized a sharp contrast between the diets of poor families and those of the upper and middle class. As a result, members of poor households were more likely to experience malnutrition than those of the other two classes. Her study highlights social differences and illustrates a direct causal link to malnutrition. Figure 1 outlines a very basic causal pathway between socioeconomic status (SES) and health and illness. Many factors that contribute to malnutrition are influenced by social class (Pelto, 1987). Similarly, Dettwyler (1993) examines the diet and health of children in Mali and attributes low socioeconomic status with poor nourishment in children. In this example, malnutrition was the main factor causing children to have more difficulty recovering from illnesses such as measles, malaria, upper respiratory infections, and diarrhea (Dettwyler, 1993). Individuals in this study were directly impacted by their social class and subsequent access to sufficient infant formula, which is in accordance with the initial examination of nutritional behaviour by Krondl and Boxen (1975). This behaviour can also be examined within different levels of modern and ancient society, both at the level of the individual and the population.

Demographic Implications of Poor Health

At the population level, comparing socioeconomic status and overall access to food is a popular trend when examining mortality rates within demography; studies of health and poverty in contemporary societies have drastically increased since the late 1970s (Figure 2).

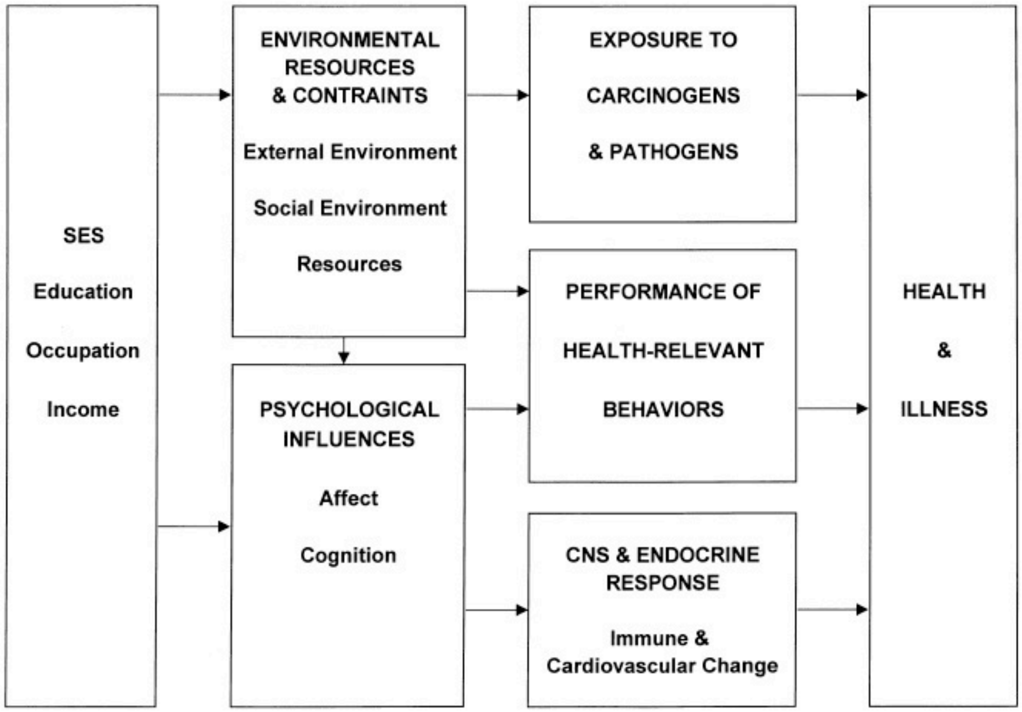

Figure 1 Model of the pathways by which socioeconomic status influences health. (Adapted from Adler and Ostrove, 1999, p. 12)

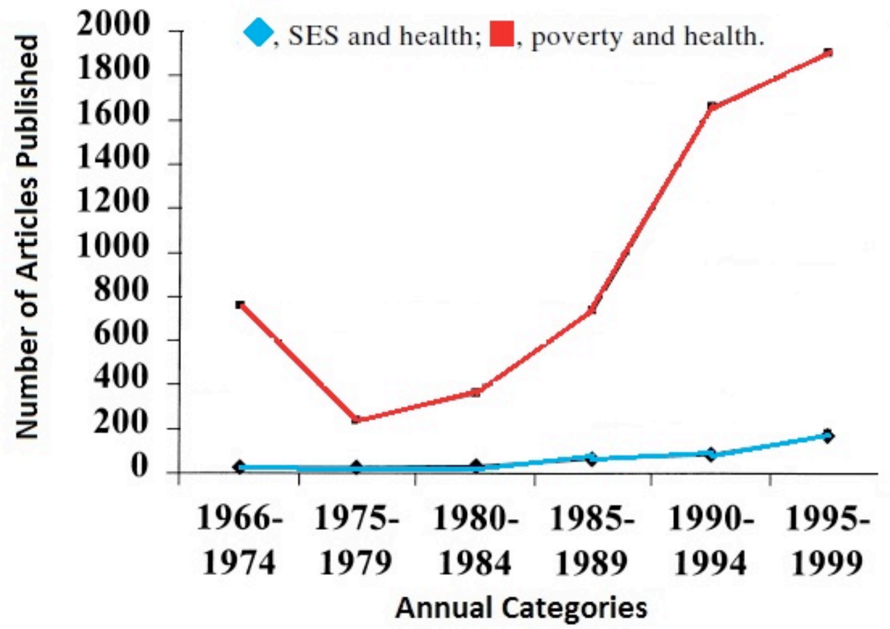

Figure 2 Number of articles published on MEDLINE according to socioeconomic status (SES) and health, compared to poverty and health based on year categories. (Adapted from Adler and Ostrove, 1999, p. 6)

Feinstein (1993) examined poverty areas in the United States and the United Kingdom over the last few decades. Within these focus areas it was shown that individuals of lower socioeconomic status had shorter life spans. Adler and Ostrove (1999) documented similar trends in their investigation of the United States, where they identified a relationship between the prevalence of many chronic diseases (e.g., tuberculosis, gastrointestinal disease) and decreased social status.

Malnutrition also decreases stature and impacts size and weight at the individual level (Pellett, 1987). During growth and development essential nutrients are required for adequate skeletal growth and must be consumed from diet (Brickley & Ives, 2008). As an example, scurvy is a metabolic bone disease that results from insufficient dietary intake of ascorbic acid (vitamin C). The case study by Geber and Murphy (2012) concerns the analysis of skeletal remains of children who lived in Ireland during the mid-19th century potato famine. For poor individuals in Ireland during this time, a typical diet consisted of only potatoes and dairy products. While this diet was sufficient in ascorbic acid, the destruction of potato crops removed most nutrients from an already minimalistic Irish diet (Geber & Murphy, 2012). As a result most children developed the characteristic joint and dental problems that left lasting markers on their skeletons. Roughly one million people were killed during this famine, and those children that survived had modified growth during essential stages of development (Geber & Murphy, 2012). This example illustrates a case of malnutrition influenced by socioeconomic status and natural disaster.

DeWalt (1998) examined other types of malnutrition in southern Honduras by focusing on individuals specific to the local communities. She identified many "diseases of poverty" including hunger, malnutrition, infant mortality, and very high birth rates (DeWalt, 1998, p. 306). These diseases would create a population with a large number of children that rarely survive past adolescence. Those that did survive would be likely to experience health issues and continued malnutrition throughout life. Decreased socioeconomic status and increased rates of malnutrition were reported in studies of other living populations (e.g., Poppendieck, 2000; Scott & Duncan, 2002), and have led to the common belief that poverty automatically relates to lower nutritional health. The available ecological resources, and those controlled by socio-political aspects of society, influence the health of members within that society (Crooks, 1998; Katzenberg, 2012; Kuhlken, 1999). This ecological-political approach will be utilized in my analysis of ancient Pompeii in order to demonstrate that lower nutritional health has not been restricted to those living in poverty.

Accessing Health and Status in the Past

In investigations of the past, analyses are limited to the material remains from both the individual and overall population. Macroscopic analyses of skeletal remains have been used to indicate prevalent diseases (as outlined in the standard palaeopathology volumes of Brickley & Ives (2008) and Roberts & Manchester (2005)) and stable isotope methodology illustrates trends in available diet (e.g., Prowse et al., 2010). Katzenberg (2012) examined subsistence shifts to maize agriculture in ancient Mexico from the remains of flora, fauna, and human skeletons. Biochemical testing of tissues from these organisms reflects consumed diet and demonstrates the foods accessible to humans. Pathological indicators on human remains demonstrate the health effects of a dietary shift to maize agriculture (Katzenberg, 2012). Dental pathologies, such as carious lesions, result from an increase in sticky starch-based foods in diet (Powell, 1985). Harris lines in bones result from periods of nutritional stress, and are a health risk associated with food shortages such as crop failures (Katzenberg, 2012).

Similar to studies of modern populations, children in the past were also susceptible to malnutrition based on access to food resources. Prowse et al. (2010) examined childhood growth and development in Roman-period Italy (100 BCE – 700 CE) and observed patterns of modified growth, illness, and death. Similar to the study of Dettwyler (1993), Prowse et al. (2010) examined the interactions between nutrition and infection through physical evidence in the skeletal material such as Wilson bands and reduced stature. Wilson bands, or enamel hypoplasia, are formed during periods of nutritional stress and appear as lines in the enamel of teeth, illustrating actual stoppages in sufficient growth (Lai, Kim Seow, Tudhope, & Rogers, 1997; Roberts & Manchester, 2005). Reduced stature is also attributed to malnutrition and illness because the body is unable to maintain proper growth due to external stresses. Prowse et al. (2010) attributed many of these features to periods of breastfeeding and weaning. In Roman Italy, it was typical for individuals to be breastfed, and therefore experience stressful weaning periods (Brothwell & Brothwell, 1969). Breast milk contains all essential vitamins and nutrients and a shift to basic foods (e.g., porridge) that do not contain these same nutrients places stress on the body. Individuals who do not have access to well-balanced weaning foods would experience even greater stress on their bodies during adolescence (Prowse et al., 2010).

The body can recover from the stresses of weaning if there is sufficient nutritional intake. Brickley & Ives (2008) document an assortment of metabolic bone diseases evident in archaeological remains that occur if these needs are not met. Geber and Murphy (2012) examined the incidence of scurvy in the Irish Potato famine in skeletons of children and adults. Many members of society were impacted by the mid-19th century famine and those of lower socioeconomic status endured the most suffering. Potatoes provided the major source of vitamin C and those who were unable to pay for alternatives were at an increased risk of developing scurvy (Geber & Murphy, 2012).

Famines and other occurrences of civil unrest may cause malnutrition associated with social class, and are largely documented in historic records (e.g., Kuhlken, 1999; Messer, 1984). Archaeological contexts that are devoid of written records rely on material remains to illustrate notions of status. Many archaeological assessments of past health focus on human stature and growth (i.e., anthropometry), to estimate the nutritional and biological standards of living within ancient populations (e.g., Henneberg & Henneberg, 2006; Prowse et al., 2010). Kron (2005) outlines a number of these investigations and examines skeletal stature recorded from graves across ancient Greece and Rome. Relative heights of human skeletons from archaeological assemblages were then contrasted to 'average' height values of humans living in modern North America. In his study, regions that contain skeletons with stature that is lower than 'normal' represent geographic areas that have malnutrition (Kron, 2005).

There are many issues with this assumption: (1) it is unknown what 'average' should entail as we do not know what the truly healthy average individual height is; (2) it is difficult to accurately determine the height of an individual from their skeletal remains; and (3) there is no way to assemble a truly random and representative sample of a population (Kron, 2005, p. 70). The final limitation relates to the osteological paradox, which places serious limitations on osteological analyses. According to Wood et al. (1992) the majority of osteological specimens within a sample represent individuals that died of non-natural causes and, therefore, the sample does not accurately represent an entire demography. The studies summarized in Roberts and Manchester (2005) also illustrate that many health concerns increase with age and skeletons of older individuals have the potential to contain many pathological lesions as a result. Skeletal remains found in cemeteries do not represent the living population and cannot be used to solely analyze stature-based health for an entire population.

Challenging the Norm

To overcome issues related to the osteological paradox it is essential to use multiple lines of evidence to examine past lifestyle and health. Atalay and Hastorf (2006) examined the remains of flora, fauna, lithics, ceramics, clay, and architectural evidence to illustrate aspects of diet and health in the ancient Çatalhöyük community in Turkey. The skeletal sample contained human remains buried under the homes of the living population and represent a selection of individuals who died of natural and non-natural causes. Apart from minimal dental pathologies there were no apparent health issues. Dental pathologies were attributed to eating maize and gritty foods, which were consistent with the diet that had been reconstructed. Researchers were unable to identify the socioeconomic status associated with individual skeletal remains in the community. This either suggests that there were no differences in food accessibility, or that individuals of lower socioeconomic status did not experience nutritional deficiencies (Atalay & Hastorf, 2006).

In 1890s Europe, children of the middle class experienced better nutritional health compared to those of lower and upper socioeconomic statuses (Apple, 1987). Basic formula was fed to upper class children as an alternative for breastfeeding. It was unknown at time that breast milk provided vitamin C, and as a result this essential nutrient was omitted from popular formula. Elite children that were formula-fed developed scurvy and other issues related to malnutrition. Comparably, children of lower socioeconomic status were still at risk for being malnourished because of inadequate dietary resources from their mother, but children were still able to consume necessary vitamins from breast milk. Alternatively, children of the middle class were the healthiest. These individuals could not afford formula but received sufficient nutrition from their mother's breast milk (Apple, 1987).

These examples illustrate the need to expand analyses of socioeconomic status and health to incorporate all social levels that may endure malnutrition as a result of their access to foods. The introduction of formula to industrial Europe was well documented and provided an explanation for high levels of scurvy among elite children. Most archaeological assemblages are devoid of written or oral history and other artefacts must be used to provide interpretations of the past. Ancient Pompeii provides an example of a context where written records are limited. Ancient literature recorded aspects of life in Italy during the Roman period; however, few sources specifically mention Pompeii. My analysis will utilize the physical remains found at this archaeological site to verify ancient literature and illustrate a more in-depth view on foods accessible to individuals at Pompeii. Within this area, nutritional resources were accessible according to socioeconomic status. Certain food items increased the risk of developing associated illness and disease, and were accessible only to those of elite status. Decreasing nutritional health was documented among the human osteological remains at Pompeii, and is associated with increasing societal status.

Pompeii – a Case Study

Ancient Pompeii was a small rural town in Italy that economically benefited from its location (Panetta, 2004). The close proximity to the Sarno River, Tyrrhenian Sea, and extensive forests provided exceptional access to fresh water, vegetation, and game meat (De Albentiis, 2009). Pompeii was also a trade town, which provided the availability of non-local goods and exotic foods (Cooley & Cooley, 2004). The fertile soils and lush vegetation around Pompeii resulted from the active volcano Vesuvius (Ciarallo, 2001). In 79 CE this volcano erupted and destroyed Pompeii by covering the city in metres of volcanic debris (Cooley & Cooley, 2004). As a result of the eruption, the remains of important food deposits and incidences of past lifeways are available for analyses (Laurence, 2007).

Sources of Evidence

There are many sources of evidence at Pompeii that can be investigated to analyze diet, lifestyle, and health. Ancient literature details aspects of daily life and ancient cookbooks illustrate lists of available cooking ingredients (Beer, 2010; Dalby & Grainger, 1996). Graffiti at Pompeii includes grocery lists and tavern menus and is another example of textual evidence regarding available food resources (Cooley & Cooley, 2004). Artwork illustrates scenery, some food items, and dining settings (Dunbabin, 2003). Images in markets, such as those of fish and fowl for sale provide examples of the importance and distribution of food items (D'Arms, 2004). A relief of a vegetable stall from Ostia (Figure 3) illustrates identifiable produce, including cabbage, kale, garlic, leeks, and onions (White, 1970, p. 344) which are assumed to be representations of human foods.

Public and private gardens at Pompeii provide evidence of items that were grown and have been analyzed using root cavities, seeds, and pollen from the actual gardens (Ciarallo, 2001; Jashemski, 1973). Taverns, bakeries, and markets all sold food items that were intended for human consumption and contain the remains of the serving vessels, lists of available foods, and the flora and fauna that were served (Cooley & Cooley, 2004). Investigations of the drains underneath homes of individuals have been excavated and provide a direct link between foods consumed and the socioeconomic status of the individuals who lived in the home (Ciaraldi, 2007). One measure that dictates the 'status' of those residing in a dwelling relates to the architectural size and structure, and the style and

Figure 3 Relief of a vegetable stall that is currently found at Museo Ostiense, Ostia (White, 1970, p. 344).

quantity of artwork present; Wallace-Hadrill (1988, 1994, 2008) has studied house structure, society, and associated relative socio-economic class in detail, and his theories are widely regarded as current ideology (Cooley & Cooley, 2004; De Albentiis, 2009; Laurence & Wallace-Hadrill, 1997). The structural layout of a dwelling has also been used to indicate whether a specific drain was used predominately by the servants or slaves, or by the families that owned the home (Ciaraldi, 2007). Food remains found in drains are therefore directly attributed to members of a dwelling, and the dwelling can illustrate the relative class of the family and its occupants.

To illustrate how architecture, diet and drainage refuse have been examined in conjunction with one other, the following examples from Pompeii have been provided. Three well-studied dwellings of different socioeconomic class (Fig. 3: numbers 1 through 3) have been provided, with an additional example from recent excavations (Fig. 4: number 4, outlined in red).

The House of Hercules' Wedding is located in Regio VII just east of the Forum (Figure 4) and was studied in detail by Ciaraldi (2007). There are many phases of occupation for this dwelling, which are considered to be humble based on architecture and artwork. In order to investigate the food items of individuals of low socioeconomic standing, the drains and amphorae deposits were excavated and recorded. A number of species of cheap wheat were found in the drains and were intermingled with those of human waste.

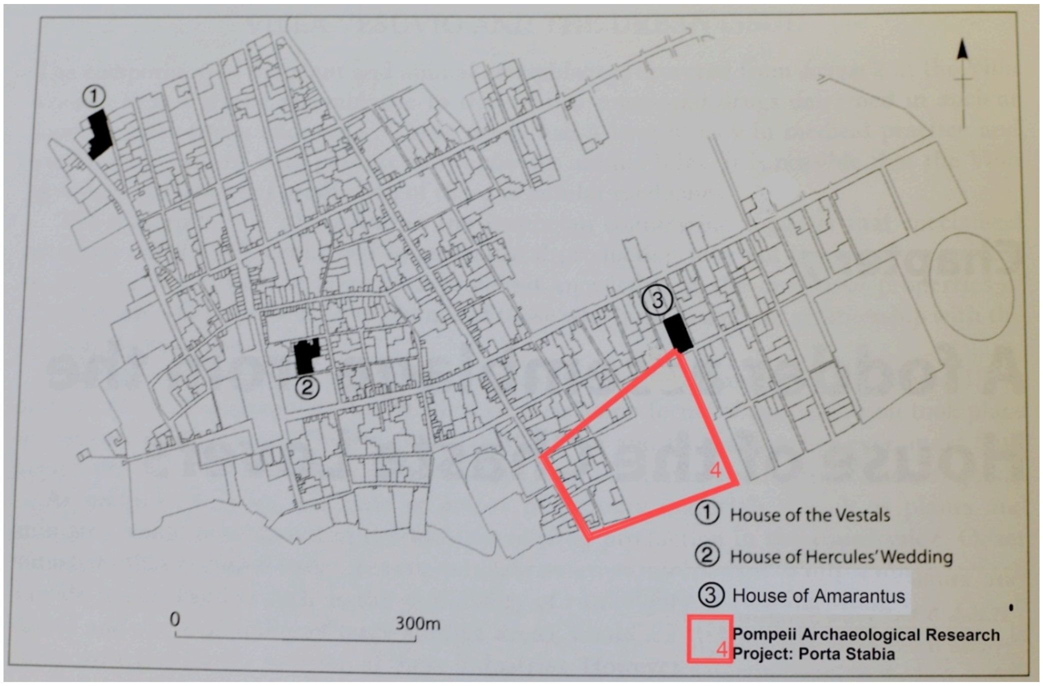

Figure 4 Map of the Pompeiian case studies discussed (Adapted from Ciaraldi, 2007, p. 76).

Millet was not considered a human food source, yet was found in this residence (White, 1970). According to White (1995), millet could be considered animal fodder; however, this dwelling did not support animal cohabitation (Ciaraldi, 2007). While grains were abundant, spices were not readily found, and the few fruits that remained were not considered exotic. Additionally, two deposits were found in the green space of this dwelling and included two large circular pits that contained burnt miniature pots and a range of food items. Pulses, many grains, an intact carbonized ring-shaped biscuit, fragments of a mineralized poppy seed cake, and some fruits and nuts were found in this deposit. The main drainage refuse is believed to be directly associated with human consumption/food processing waste, whereas the two garden deposits are believed to be ritual offerings (Ciaraldi, 2007). These remains have documented charring, and include intact food items. The presence of millet in this household, and the lack of exotic items such as spices or abundant animal remains strongly suggest that this was a poorer home.

Alternatively, the House of Amarantus, detailed by Fulford et al. (1999), provides an examination of a dwelling of middle socioeconomic class (Figure 4). This residence included parts of a bakery and was home to individuals who could have afforded simple luxuries in moderation, illustrated by the drainage areas and the domestic refuse found in the small garden area. Some grains were found, including barley and emmer wheat. Millet was found within earlier cultural deposits however it is believed to be associated with animal refuse and not human consumption (Fulford et al., 1999). A number of faunal remains were found in this garden space, and include mostly pig, with some rooster, reptiles, and fish. An additional burnt deposit was examined and is similar to the one found at the House of Hercules' Wedding. Miniature pots found in this context were blackened, and had contained incense or oil that was burned. Additionally, a poppy seed cake and the heads and feet of mature roosters were found. These ritual offerings were similar to others found at Pompeii (Cooley & Cooley, 2004). Faunal bones were associated with the overall green space and include mostly the cranial/dental and feet elements from pig, sheep/goats, and a few cattle. A pig neonate was also found in association with the ritual deposit. All of the fauna at this dwelling are categorized as domesticated animals and are, therefore, not considered exotic species, nor do they reflect expensive cuts of meat. The ritual deposits at this house compared to the House of Hercules' Wedding include more faunal remains and less millet, which suggest it is of a higher socioeconomic standing (Ciaraldi, 2007; Fulford et al., 1999).

The House of the Vestals provides an example of an investigation into an upper class residence (Figure 4). Ciaraldi (2007) describes the dwelling as considerably larger than either of those mentioned, and it was subject to frequent and substantial construction. The food items found here were also considerably different, as attributed to the higher status and wealth associated with the home (Ciaraldi, 2007; Wallace-Hadrill, 1988). This house has an extensive drainage unit, which contained aspects of food from the latrine/drainage area in the kitchen. While no ritual deposits were found at this location, there are a number of striking aspects of the remains. The first is that there were very few aspects of grain, and definitely no millet found in the drains. The few forms of grain that were found are believed to have been from an indirect source; as animal remains were being prepared for a meal, the food that they consumed would have also gone into the drains. If there was no millet present, though it is known that millet was used as a fodder for domesticated animals, we can extrapolate the fact that wealthier individuals were game-hunters (e.g., MacKinnon, 2004; Moeller, 1976; Moses, 2012). Wild game would have consumed natural grains, and not the millet that was fed to domesticated animals. While grains were uncommon, fruits and weeds were prevalent in the drains, including a number of very rare floral species. The cucumber or melon seed that was found was not considered a local commodity (Ciaraldi, 2007). Spices were also found in abundance at this residence, including peppercorn, which would have been bought at the market for a high price (Cooley & Cooley, 2004). Additionally, the remains found at this dwelling were found in excess. It has been suggested that the elite often over-indulged on food, which would have produced a lot of waste (e.g., Ciarallo, 2001; Dunbabin, 2003). Due to the abundance of food remains, in addition to the presence of a large number of rare food items it is suggested that this was a home of higher socioeconomic standing (Ciaraldi, 2007).

All three of these examples have provided evidence of a specific 'class' of housing. Recent excavations at Regio VIII by the Pompeii Archaeological Research Project, Porta Stabia, have uncovered a house with drains in two separate areas of the home (Ellis & Devore, 2010). One of these drains is linked to the 'service' section of the dwelling (drain one), while another is linked to the 'reception' area (drain two) (Zanker, 1998). These drains allow for an analysis of food remains as they relate to the workers or slaves of the home, compared to the region that is directly connected to the triclinium area where the masters would have eaten (Ellis & Devore, 2010; Zanker, 1998). Drain one contained inexpensive and widely available foods, including grains, olives, lentils, local fish, some chicken eggs, very little shell-fish, and some pig bones. This would suggest that food items for those members of the house who were working within the insula were eating inexpensive and common food items (Ellis & Devore, 2010). Interestingly, drain two not only had more material, but it also had a number of house mice skeletons. The presence of excessive food remains would have attracted these mice, suggesting a surplus of food in this drain, similar to that found at the House of the Vestals (Ellis & Devore, 2010). Drain two contained a large variety of expensive foods including shellfish, sea urchins, dormice and game meat. The most fascinating aspect of drain two is that there was a juvenile giraffe femur present, which contained evidence of butchery, cooking, and marrow extraction (Ellis & Devore, 2010). This find represents the only giraffe remains reported to date at Pompeii, and as such may have been considered exotic and expensive. These distinct differences between drains found at the same household illustrate a dietary divide among masters and their workers (Ellis & Devore, 2010).

These case studies illustrate the different qualities and quantities of food available based on different facets of life and the associated socioeconomic standing of the individuals. Additionally, a number of studies (e.g., Ciaraldi, 2007; De Albentiis, 2009) examine aspects of ritual and illustrate that even ritual food items will vary based on the class of the individuals giving the offering. The available foods, analyzed in conjunction with the context of drains, can then be used to re-evaluate the original understandings of what socioeconomic class could entail. Instances such as those outlined by the drains at Regio VIII suggest that not only are masters and slaves eating different types and quantities of goods, but that different meals involve the consumption of distinct food types.

The examples provided illustrate specific instances of food consumption however other basic similarities have been summarized. The extensive faunal assemblages within homes and public areas of Pompeii demonstrate that meat was an important part of diet (MacKinnon, 2004). Domesticated animals were consumed very often, whereas wild and more exotic creatures were rarely eaten (MacKinnon, 2004). Ancient literature details notions of wealth in Roman society according to the success of agricultural crops and animal husbandry (Howe, 2014). According to Howe (2014, p. 151):

> The ancients held that elite status deemed from owning land and producing animals primarily because animals, especially large animals such as cattle and horses, were physically impressive and required substantial investment in terms of care and facilities.

Similarly, exotic foods were more difficult to procure and would have been available to select members of society (Brothwell & Brothwell, 1969). Displays of meat distribution (e.g., feasts at a family dwelling) that included exotic fauna would have increased the visual status of a household, becoming an important aspect of upper-class diet (Dunbabin, 2003; Howe, 2014). Domesticated fauna, such as pigs, were more commonplace and were available to all members of a society; the butchery marks documented on bone illustrated that many parts of the pig were consumed (Moses, 2012).

Sheep, goats, and oxen were not as commonly consumed for their meat, and rarely showed signs of butchery. These animals were important for their wool, milk, and strength, respectively, and were only consumed for their meat by the spiritual priests as part of a ritual (Beer, 2010; Moeller, 1976). Goat milk was commonly consumed in the form of cheese (De Albentiis, 2009). Cheese-making vessels have been found at Pompeii and illustrate the type and quality of cheeses made (Jashemski, 1973). Soft cheeses involved less filtering and would have been cheaper; harder cheeses that were flavoured with seasonings would have been more expensive, and, depending on the seasoning, very exotic.

Fish and shellfish were accessible from local marine sources and were considered an elite food item (D'Arms, 2004). Pompeii was also well known for a fish sauce called garum, which was made from raw fish that were salted and fermented over many months (Cooley & Cooley, 2004). This condiment was more expensive and commonly incorporated into lavish dishes at elite banquets (Beer, 2010). Amphora storage vessels were characteristic for the type of sauce, oil, and wine stored in them, and provided evidence of these food items found in particular homes at Pompeii (Panetta, 2004). Both wine and olive oil were a necessary part of all Pompeian diet and the quality and quantity varied in price (De Albentiis, 2009). Honey was also a necessary aspect of Pompeian diet as a natural sweetener and in the form of a preservative (Ciaraldi, 2007). Honey could be flavoured according to the plants that bees pollinated with and such commodities would have varied in price according to flavour and quantity (Jashemski, 1973).

Due to the state of preservation of Pompeii, floral remains were found carbonized and aspects of vegetation are analyzable (Ciarallo, 2001). The accessibility of fruits, vegetables and grains in Pompeii was different according to an individual's ability to pay for them, which was in direct response to their socioeconomic status. As an example, the graffiti found at the Thermopolium in Pompeii details the cost of bread based on the status of the purchaser: slaves paid two asses (common currency of the time), members of the middle-class paid four asses, and masters paid eight asses (Cooley & Cooley, 2004). Bread has been found in abundance and as such is reported as a very important aspect of diet (Cooley & Cooley, 2004). Breads also varied in price according to the type of grain used in production (De Albentiis, 2009). Wheat was highly coveted to make bread, and the soft tips of wheat provided the softest and most expensive bread, which was likely sold to the masters. Cheaper breads were made from the rough portion of wheat grain and were often harder and denser, likely being sold to the middle-class customer (Cooley & Cooley, 2004). All breads were ground between volcanic rocks which deposited fine grit into the wheat meal (Lazer, 2009). Many pods, seeds, and pollen from fruits and vegetables have been analyzed at Pompeii demonstrating that there was a great selection available to eat (Jashemski, 1973). Many fruits were important for their medicinal purposes, and some were eaten on a regular basis (Ciarallo, 2001). Greens and other vegetables were more frequently incorporated into larger meals. Cabbage, onions, and pulses were among the most popular vegetables and could easily be grown throughout Pompeii. Less common vegetables would have also been eaten, but were more expensive and would only appear in specific dishes for those who could afford them (Ciaraldi, 2007). Numerous remains of garlic were found at Pompeii, yet the ancient literature, such as Apicius' cookbook (Brothwell & Brothwell, 1969), strongly suggests that the Romans did not favour it (D'Arms, 2004; White, 1970). The literature was written from the perspective of the elite class, which suggests that this food item was common among individuals of lower socioeconomic status (Dalby & Grainger, 1996). All food remains at Pompeii vary in accessibility and have the potential to cause serious health issues.

Skeletal Health and Nutritional Access

The osteological materials at Pompeii demonstrate physical evidence of diseases that could have been caused by the direct consumption of specific food items. During excavation, the remains of those who died during the eruption at Pompeii were rendered into plaster casts, left permanently on display at the archaeological site, or haphazardly stored in bathing complexes (Henneberg et al., 1996; Lazer, 2009). Skeletal materials are largely devoid of context and are disassociated from the original human skeleton. Basic osteological assessments have been conducted for these remains, and provide a limited overview of illness (e.g., Lazer, 2009), relative stature (e.g., Laurence, 2005), as well as age and sex estimations (e.g., Henneberg & Henneberg, 2006).

Samples from the Bath Complexes

Henneberg and Henneberg (2006) and Lazer (2009) conducted extensive analyses with the remains found in Terme del Sarno (the Sarno bath complex) and Termo Femminile del Foro (the Forum bath complex). In these locations bones were often stored in areas according to skeletal element (e.g., all femora were stored in one area), and the remains of disarticulated elements were analyzed individually. Remains of over 500 individuals were found in these areas (Table 1) and there are a number of pathological markers on the skeletal material that were analyzed on a case-by-case basis. Many of these diseases can be caused by specific food items that were only

Table 1 Skeletal elements used to calculate the minimum number of individuals (MNI) in the skeletal sample from Pompeii [1]

Skeletal Element	Stipulation	Minimum # of Individuals
Left Femur	At least entire head preserved	503
Left Humerus	At least condyle preserved	447
Glabella (skull)	Skull fragments of children younger than two years of age with an open metopic suture are not included	379
Left Os Coxae (pelvis)	Only fragments with characteristics diagnostic for age and sex were counted	289

[1] Based on analysis of Henneberg & Henneberg (2006, p. 25), from the Terme del Sarno and Terme Femminili complexes.

Table 2 Pathological Risk Associated with Aspects of Diet[2]

Disease	Cause of Disease	Dietary Risk
Dental Caries	Starchy foods that are sticky; Cariogenic factors: selenium, magnesium, lead, cadmium, silicon	Carbohydrates; Well-cooked foods; Oysters
Brucellosis	*Brucella* pathogen in infected animals	Harder cheeses
Dental Abrasion	Contact between enamel and a foreign substance	Grit in bread; harder breads
Dental Abscess	Dental caries and abrasion	Carbohydrates; Harder breads; Grit
Fluorosis	Fluoride Poisoning	High concentrations in water, Marine wildlife; Carnivorous animals
Forestier's Disease or Diffuse Idiopathic Skeletal Hyperostosis (DISH)	Increased retinoid exposure; obesity; genetics; misc.	Sweetbreads; Excess foods (overweight)
Hyperostosis frontalis interna (HFI)	Virilism, obesity, diabetes, (seen in postmenopausal women)	Excess foods (overweight)
Spina bifida occulta	Fluoride exposure; genetics; misc.	Marine wildlife; Carnivorous animals
Tuberculosis	Tuberculosis pathogen in infected animals (*Mycobacterium bovis* and *Mycobacterium tuberculosis*); human-to-human respiratory transmission	Infected boar; Infected oxen viscera

2 – The Disease and Cause of Disease categories are based upon works discussed in the text. The Dietary Risk was interpreted from analysis of these works.

accessible to members of higher socioeconomic status (Table 2). The remains found at Pompeii are unique in that they provide a sample of the living population, or a specific cohort of individuals. Whereas cemeteries illustrate individuals who died of unknown causes, the skeletal remains at Pompeii represent individuals who all died because of the volcanic eruption. Due to the circumstances surrounding the eruption (e.g., individuals were able to flee the region; not all skeletons may have been recovered), it is difficult to pinpoint the exact cohort represented by the assemblages studied. What is definitive is that every member of the sample was alive prior to 79 CE, and would have presumably been alive afterwards (Laurence, 2005). The remains found at Pompeii illustrate an excellent source for understanding the dietary health of the demographic that lived at Pompeii on the day of the eruption.

Individuals of the upper class often had bakeries installed into their private residences (e.g., House of Amarantus) as evidenced by the remains of grinders and large stone ovens used to make bread (Cooley & Cooley, 2004). Grinders were made of volcanic rock and grit from the rock would have been included within all types of wheat bread. The consumption of grit over time would wear down the teeth of bread consumers and expose each individual to dental pathologies such as abscesses (Lazer, 2009; Powell, 1985). All members of society would have been at risk for dental abrasion based on diet- and activity-based attrition, although members of the lower class consumed harder breads and would demonstrate more dental wear. Lazer (2009) documented variation in dental wear from moderate to heavy abrasion among the Pompeii skeletal remains. Dentition with moderate abrasion demonstrated more carious lesions. This suggests that members of upper socioeconomic status, who would have had moderate dental abrasion based on their preference for softer breads, were at an increased risk for developing dental caries. Within their diet, elite individuals often consumed cooked and mushy foods with many sauces that could have increased the prevalence of this disease (Dalby & Grainger, 1996). Powell (1985) also examined factors that increase rates of carious lesions, and determined that a number of elements are cariogenic (e.g., selenium). Oysters provide the highest concentration of selenium and were only consumed by members of the elite class due to their worth as an exotic item (De Albentiis, 2009).

Fluoride is a cariostatic element: one that prevents dental caries from forming (Powell, 1985). For all individuals in Pompeii, fluoride was available in the water sources and throughout flora and fauna because of their close proximity to the volcano (Petrone, Guarino, Giustino, & Gombos, 2012). Fluoride occurs naturally in environments associated with volcanic activity due to volcanic ash and other volcanic sediments. In modern contexts fluoride is added to drinking water to provide cariostatic influences. Cariogenic factors can easily reverse the benefits of fluoride, and consuming excessive amounts of fluoride are not only ineffective, but toxic. Modern values of fluoride recorded at the city of Pompeii exceed the World Health Organization's recommendation and soil deposits from the archaeological context of 79 CE reflect similar values (Petrone et al., 2012; WHO, 2008). Fluorosis is poisoning based on overexposure to fluoride and can cause detrimental staining and damage to the teeth, and abnormal bone growth throughout the skeleton. Fluorosis is evident in both modern and ancient human skeletons from Pompeii (Lazer, 2009; Petrone et al., 2012).

If fluoride is readily accessible in the water and in the sediments, fluoride levels will steadily increase up the food chain in trophic levels. Plants contain the fluoride of the soil, and the animals that consume the leaves will incorporate fluoride from the plant and drinking water. The biomagnification of fluoride is strongest in marine fauna such as fish or shellfish (Petrone et al., 2012). Marine wildlife are not considered a lower status food, and are instead an exotic or necessary part of elite diet (D'Arms, 2004). While every individual at Pompeii would have been at risk for fluoride overexposure, the elite, who had the most access to marine wildlife, would have been at a higher risk for increased fluoride exposure. Fluoride exposure has also been attributed to increased risk of spina bifida occulta, which has been documented in the skeletal remains found at Pompeii (Henneberg & Henneberg, 1999; Lazer, 2009).

Herculaneum is another archaeological site near Pompeii that was impacted by the eruption of Vesuvius. This city was affected by the volcanic debris in a mannerthat enabled the preservation of many organic items such as breads, cheeses, and wood (Cooley & Cooley, 2004). The remains of cheese at Herculaneum were found carbonized and contained the remains of *Brucella* bacteria (Capasso, 2002). This pathogen infects animals and spreads through their excrements, including milk (Pappas & Papadimitriou, 2007). Brucellosis is an infection that impacts the spine and other areas of the skeleton, and there is evidence of this infection on the skeletal remains found at Pompeii (Lazer, 2009). Incidence of this disease is largely attributed to the consumption of an infected goat's cheese (Capasso, 2002). Individuals who consume more cheeses that require extensive processing would be at an increased risk for contracting brucellosis. Cheese is produced by milk that curdles either through natural processes, or by the addition of acid. Drier and harder cheeses are formed by draining off excess liquid in a more acidic environment (Dolby, McDowall, & McDowell, 1937). According to Pappas and Papadimitriou (2007), more acidic environments promote proliferation of *Brucella* bacteria. Therefore the harder and more processed cheeses would likely contain higher concentrations of the *Brucella* bacteria. Due to the cost of preparation, and the ability to incorporate exotic spices and flavourings, members of the elite class consumed harder cheeses more often and would have been exposed to an increased risk of brucellosis (Brothwell & Brothwell, 1969).

Brucella is a genus of a harmful type of bacteria, but Streptomyces are naturally occurring soil bacteria that excrete beneficial antibiotics (Madigan, Martinko, Dunlap, & Clark, 2008). If vegetation is grown in this soil, Streptomyces can excrete the antibiotic onto the vegetation (Madigan et al., 2008). If root vegetables were consumed raw or unwashed, Pompeians could have consumed these beneficial bacteria. There was evidence of the organism in the garden areas excavated under the volcanic lapilli at Pompeii and all members of society had access to it (Lazer, 2009). The skeletal evidence also showed many incidences of healed infection and other well-healed wounds, which would support medicinal use and suggest ingestion of Streptomyces (Lazer, 2009). Individuals of higher socioeconomic status would have had cooked vegetables and prepared foods with sauces that could inadvertently destroy the beneficial bacteria (Dalby & Grainger, 1996). Conversely, members of lower socioeconomic status, including those that worked in the kitchens, would have had more opportunities to eat raw or under-washed vegetation and inadvertently the natural antibiotic (Lazer, 2009).

The pathogen *Mycobacterium bovis* is found in infected animal viscera and can cause tuberculosis in humans (Madigan et al., 2008; Martin-Hernando et al., 2007). Human infection of tuberculosis affects many parts of the body, including the respiratory system (Madigan et al., 2008). Often the infection will leave lesions on the skeleton, including the vertebrae and ribs (Roberts & Manchester, 2005). These lesions were in few of the skeletal remains at Pompeii (Lazer, 2009). The low number of skeletal remains found with evidence of tuberculosis is not an indication of low infection rates at this site, and it is possible a larger portion of the population were living with this illness (Cooley & Cooley, 2004; Lazer, 2009).

Cows, a carrier of *M. bovis*, were not readily consumed in Pompeii unless they were part of a tribute (Lazer, 2009). In this scenario, priests would have been more prone to developing tuberculosis through *M. bovis* because of the undercooked, infected oxen viscera that was consumed as part of a ritual sacrifice (Laurence, 2005). The initial infection of *M. bovis* would have been more likely among individuals of higher socioeconomic status, with equal likelihood of transmitting the disease among all members of society. Once infected, tuberculosis can spread from human to human through inhalation of infected airborne particles (Martin-Hernando et al., 2007). Congested conditions, such as those experienced in the Roman bathing complexes, could have aided in pathogen growth and infection (Madigan et al., 2008). Certain bathing complexes were restricted to members of specific classes or ranks however it is possible that all members of society were exposed to such pathogens (Lazer, 2009).

Another medical condition that the elite would have been exposed to would be Forestiers' disease, or diffuse idiopathic skeletal hyperostosis (DISH). This arthritic health issue affects the vertebrae and was found in two of the osteological specimens at Pompeii (Lazer, 2009). Recent analyses have focused on the direct processes causing DISH, but there have been direct links made between increased retinoid exposure and an increased risk of developing DISH (Periquet et al., 1991; Roberts & Manchester, 2005). Retinols occur naturally in the form of vitamin A, are lethal at high doses, and are most common in livers of individuals positioned higher in the food chain (Allen et al., 2006; Combs, 2008). If an individual consumes non-lethal amounts of vitamin A, retinols become stored in their liver, increasing the likelihood of developing this type of arthritis (Lazer, 2009). Lavish cuts of meat and sweetbreads were a delicacy among the elite and would have contained non-lethal doses of vitamin A (Brothwell & Brothwell, 1969).

Another risk factors involved in the development of DISH is obesity (Periquet et al., 1991; Roberts & Manchester, 2005, p. 159). Excess weight on the body stresses the spine and contributes to arthritis formation at this target area (Denko & Malemud, 2006). Individuals of higher socioeconomic status often consumed excessive amounts of foods at lavish dining events that were high in fats and would increase the risk for obesity and girth (D'Arms, 2004). Statues and artwork depict members of elite society with larger figures, supporting this hypothesis (De Albentiis, 2009).

Obesity is also an associated factor for developing hyperostosis frontalis interna (HFI), a condition that involves the interior aspect of the frontal bone (part of the forehead), thickening across the midline (Talarico, Prather, & Hardt, 2008). While little is known about the exact etiology and clinical presentation of HFI, there are a number of causative factors that relate to this metabolic and endocrine disturbance (Flohr & Witzel, 2011; Talarico et al., 2008). Some studies suggest that postmenopausal women and individuals who are obese are at the highest risk for developing HFI due to hormonal and chemical changes throughout their bodies (Talarico et al., 2008). Lazer notes that "HFI can be diagnosed from the skull alone, which means that the disarticulated nature of the [Pompeian] sample does not have a significant effect on the confidence of diagnosis" (2009, p. 203). Forty-three out of a possible 360 skulls were identified as having HFI in the Pompeii skeletal assemblage. Other archaeological investigations (e.g., Flohr & Witzel, 2011) have similarly attributed increased social status to individuals living with HFI. In Pompeii, elite members of society were at an increased risk of obesity, and it is similarly likely that these individuals were at an increased risk of developing HFI (Lazer, 2009). Due to the disarticulated nature of the remains in the bathing complex, it is difficult to make conclusions about HFI based on the cranium alone.

Family-Based Sample

In addition to the remains analyzed from the bath complexes, articulated skeletons of a family have been examined at a household at Pompeii. Henneberg et al. (1996) conducted the investigation at the Casa del Polibio (CI Polybius) where 13 skeletons represented six adults (three males, three females), four boys, one girl, a child of unknown sex, and a fetus associated with the younger adult female. This dwelling was noted as being relatively large, with many rooms, some including beds. According to Balch's (2008) inventory, this home included at least four large paintings, a small temple, and a triclinium (formal dining area consisting of three couches in a U-shape). Based on the architecture, artwork, and presence of triclinium, this dwelling would classify the members of the home to be of middle- to upper-class (Balch, 2008; Henneberg et al., 1996; Wallace-Hadrill, 1988). While it is possible that the 13 skeletons found here were merely seeking refuge in CI Polybius, the relative size of the dwelling is in keeping with the size of the extended family (Henneberg et al., 1996)

The analysis of the skeletal remains in this home is unique to the bathing complex remains. The members of CI Polybius are not only in anatomical position, but they have an associated context. Henneberg et al. (1996, p. 249) explain that "it seems that the group is representative of a Pompeian household: many children born approximately 3 years apart, early age at marriage, good food, and relative freedom from disfiguring disease." These characteristics were not thoroughly discussed and require more attention. The mention of 'good food' is based on dental health, as 87.5% of individuals had enamel hypoplasia, all had dental calculus, 63.6% of individuals had dental caries, and individuals had moderate tooth wear (Henneberg et al., 1996, p. 258). These dental indicators suggest that the members of this family ate sticky, non-abrasive foods that were well cooked.

This family also demonstrated spina bifida occulta in the remains of an adult female and the female child (Henneberg & Henneberg, 1999). Based on the previous identification of risks associated with spina bifida occulta, this family may have been of a higher socioeconomic class. This distinction is corroborated by the architectural context of the dwelling. Spina bifida occulta is also a genetic condition (Lazer, 2009). Members of this family lineage may have at one time been of the elite class, wherein increased fluoride exposure modified their genetic predisposition. As a result, this family may have developed spina bifida occulta for genetic reasons rather than for reasons of dietary consumption (Henneberg & Henneberg, 2006). The presence of reduced dental abrasion, increased dental caries, and spina bifida occulta is consistent with the designation of middle to upper-class status.

Limitations and Future Approaches

The incidence of spina bifida occulta within the families of CI Polybius demonstrates a major limitation within this study. Many of the conditions outlined in Table 2 have multiple causes that could be attributed to more than just the diet of each individual. The attribution of health risks and the elite socioeconomic status is just that – a risk. Status is also a variable term that can change throughout an individual's life. Freedmen were slaves within a household that earned sufficient money to be able to buy their freedom (Cooley & Cooley, 2004). The food available to these individuals would have been considerably different during their growth and development stages when they were poor, compared to the later stages of their life where they were of the middle class (De Albentiis, 2009). Additionally, health has an impact on all members of a household during the life course. If the mother of an individual is poorer, and is unable to provide sufficient nutrition during vital stages of growth and development, children may be at a greater risk of developing illnesses later in life (e.g., Dettwyler, 1993; DeWalt 1998).

Recent work by Gowland and Garnsey (2010) examined health and nutritional status throughout the Roman Empire according to skeletal indicators and illustrated an additional limitation to studies of the past. Through their work with malaria they found that living in highly populated areas, such as Rome, greatly increased the risk of an individual contracting such an illness. Individuals that migrated from more rural towns would be more susceptible to these contagions due to the overcrowded living conditions in larger cities (Gowland & Garnsey, 2010). This theory would likely hold true throughout other regions in the Roman Empire, and may account for the health conditions suffered by Pompeians. Medical conditions and other indications of health cannot be assigned to a particular region because of mobility. It is essential to focus on all aspects of life's context (e.g., diet, geography, chronology) in order to have a more accurate understanding of an individual's health.

This analysis does not exhaust all health benefits or risks associated with lifestyle. I focused on particular health conditions demonstrated on the skeletal material found at Pompeii. My aim in this paper was to examine the socioeconomic status and health debate from a different context and with a different approach. Much attention has been paid to stature, size, and the life history model within the skeletal remains found at many archaeological sites (e.g., Kron, 2005; Prowse et al., 2010). Basic demographic indicators at Pompeii have been recorded but are largely based on the measurements of separate skeletal elements (e.g., Henneberg & Henneberg, 1999; Laurence, 2005; Lazer, 2009). The site at Herculaneum was also impacted by the Vesuvius eruption and has yielded the skeletal remains of articulated individuals. While the food remains at Herculaneum are not as expansive as the large site of Pompeii, any pathological indicators can be investigated in the same ways I have outlined here.

Interpretations of past lives always involve the use of subjective comparisons. Through the use of multiple and varied lines of evidence, research develops credibility and significance. Pompeii is still being excavated and will continue to provide information that can be considered in analyses similar to this one. In contexts not impacted by volcanic eruptions it is even more necessary to approach health analyses with caution. The label of malnutrition cannot be applied blindly to skeletal remains that are of smaller stature within the sample. All individuals died of something and therefore no member of a burial ground is 'healthy' (Wood et al., 1992).

Conclusions

Pompeii provides a unique opportunity to analyze the skeletal remains of a sample of a 'living' population. Finding ways of overcoming the limitations imposed by a lack of context are not only necessary to increase our breadth of knowledge for this site, but to also unlock a significant resource from the osteological remains found there. Attributing social status to specific food items can be used to illustrate the health risks associated with elite members of society. The paleopathological conditions observed on the skeletal material are devoid of burial context, but can be attributed to a causal dietary intake. This method provides an associated living context to the osteological remains.

Examining the health risks of the social elite provide a new way of studying past lifeways. Ecological-political and biocultural approaches of health and nutrition often focus too heavily on individuals of lower socioeconomic status. The danger with a one-sided approach is that we simply create a vision of health that may not in fact be an accurate representation of the past (Moore, 2013). Future approaches should continue to analyze archaeological sites holistically and from many different avenues of research. In cases where the osteological paradox does impact the sample population, numerous methods of interpreting health, diet, and status must be explored.

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