

Bringer of Death: Explaining the Severity of the Black Death in Medieval England

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ABSTRACT

What caused the Black Death in the 14th century to be more severe than any other plague outbreak? This article argues that the Bovine Pestilence, and the consequent protein malnutrition, has contributed to an inadequate immune system for the English population. As a result, the mortality rates during the plague outbreak were high. By using contemporary insights on the *Y. Pestis* bacterium and immunodeficiencies, and combining that with historical data on the Black Death in the 14th century, this article uses an interdisciplinary approach to come to a broader understanding of the severity of the 14th century pandemic.

Keywords

Plague, Black Death, England, *Yersinia Pestis*, protein deficiency, immunodeficiency

INTRODUCTION

Death, despair and destruction: perhaps the three words that best capture the 14th century in England. In the early 14th century, England experienced one of the most devastating famines in history superseded by a high cattle mortality. These disasters were followed by the plague of 1348. The question of how this outbreak cost the lives of so many people has yet to be answered.

Previous studies have found that the malnutrition caused by the famine and cattle mortality in the early 14th century increased susceptibility of the people to the Plague (1). However, two important questions regarding the severity of the Plague remain unanswered. Firstly, it has been suggested that protein malnutrition caused by the Bovine Pestilence acted as the catalyzer of the Plague's intensity. Yet, this hypothesis has never been extensively tested. Secondly, a more detailed comparison across groups and regions is needed for a more comprehensive understanding of the Plague's severity. This research aims to fill both lacunae by combining findings from the fields of immunology and history.

METHODOLOGY

Examining the causal factors that explain the severity of the 1348 plague is best done by combining immunology and history. Without immunological explanations on the disease itself and the immune system, its impact can never be truly understood, nor can its severity be explained.

14th century England is the most suitable territory for this research, for two reasons. Firstly, there are extensive sources about medieval England in the form of manorial records, scrolls, letters and chronicles providing the required material (2). Secondly, there is existing research conducted in England, which suggests the connection between the Great Famine, Bovine Pestilence and Black Death (1). Other countries in Europe do not have this advantage, meaning this article would not be able to build on an existing hypothesis and would have to start over.

IMMUNOLOGY AND *YERSINIA PESTIS*

The immune system can be divided into the innate and adaptive immune system. The innate system is the first line of defense and is comprised of phagocytic cells amongst

others, such as neutrophils and macrophages. (3) Especially for the plague, these are important.

An immunodeficiency can increase the mortality rate during a pandemic. As such, it is important to consider secondary immunodeficiencies (acquired during a lifetime). This can give clues as to what historical events are important.

Firstly, protein is required by the innate and the adaptive immune system to synthesize a variety of different molecules and cells. When someone is infected, more immune cells need to be synthesized, increasing the metabolic rate. However, in case of a protein deficiency, this cannot happen. Secondly, there can be a more permanent consequence to protein deficiency if a child is exposed to it. During childhood all systems are still in development. Consequently, a protein deficiency might lead to incomplete thymic development, which negatively affects immunity in children by a reduction of the lymphocyte count or even atrophy of the thymus and ill-developed lymphoid organs such as the spleen. Thereupon, immature T-cells appear, there is an increase in the number of undifferentiated lymphocytes and a decrease in serum complement activity. As a result, patients are more susceptible to infections, while their immune system cannot give an adequate response to a pathogen. (4)

Leptin, primarily associated with adipose tissue, satiety and obesity, is also an important factor in the immune response. Leptin deficiency is partially responsible for the insufficient immune response in malnourished patients. CD11b, one of the receptors on the neutrophils, is involved in localizing the inflammatory sites and the stimulation of phagocytosis of particular particles. A leptin deficiency has a negative effect on the neutrophils by influencing that receptor. (5)

Another aspect that can diminish the immune response is chronic stress. The body responds to an invading pathogen by releasing stress hormones, such as epinephrine. In a non-chronically stressed person, these hormones allow for an improved immune response. When a person has been subjected to chronic stress, on the other hand, it decreases their immune response by reducing chemotaxis (the recruitment of cells) and downregulating the number of natural killer cells amongst others. Thus, the immune response is inadequate. Chronic stress also influences Immunoglobulin A, an important factor in the epithelial surfaces. Therewith, people are also more susceptible to pathogens when subjected to chronic stress (6).

HISTORICAL ANALYSIS OF THE GREAT FAMINE

Earning the reputation of one of the worst famines in the European history, the Great Famine was a Pan-European disaster that lasted from 1315 to 1318, covering about 400.000 square miles and affecting around 30 million people(7). Malnutrition is an important factor in immunodeficiencies. Therefore, it is important to evaluate the Great Famine's consequences.

One can deduct from primary sources how bad the famine actually was and how suddenly it struck. Robert of Reading laid out the following in his *Flores Historiarum*, written around 1325:

“...a cruel famine and a detestable mortality, which, unexpectedly and quite suddenly slew an uncountable great number of people, such that the weariness of burying and the fear of looking (at the dead) brought the living together in a terrible admiration.” (8)

So, the circumstances were dreadful, but not everyone was affected equally. The authors of the Brut Chronicle, one of the most important pieces of English medieval literature affirm that the poor suffered the most. The authors even accused the poor people of cannibalism and the stealing of children for food (9). Unlikely as that might have been, it illustrates the despair of especially the poor people well. The rich would have had more money to cope with the rising prices therefore being affected less. Moreover, they also relied more heavily on animal products than the poor did, therewith being able to evade the harshest consequences of the Great Famine. (10)

HISTORICAL ANALYSIS OF THE BOVINE PESTILENCE

The Bovine Pestilence, raging in England from 1319-1320, was a panzootic disease that killed around 62% of the English cattle, thereby drastically decreasing the availability of meat and dairy products and thus reducing protein intake for human consumption. (11) Protein malnutrition may lead to immunodeficiencies, therewith increasing the severity of the Plague in the 14th century. As such, assessing how much protein different people consumed is imperative in order to evaluate the impact on their immune system.

The poorest people consumed little to no meat and dairy products even in times of excess: only 2% of their diets consisted of these produces. It being close to zero, the Bovine Pestilence would not have had a large effect on their protein intake. (10) The people who lived in towns had more access to meat, as is illustrated by the amount of carcasses found in medieval towns and the presence of butchers on markets. Importantly, only the middle class would have had money to buy the meat. (10) During the Bovine Pestilence, when prices rose, they would not have been able to afford the meat and dairy products anymore. The aristocracy had protein-rich diets, eating a lot of meat and cheese. Even though dairy products were important, their main source of protein was meat. Nobles ate a lot of different kinds of meat, such as beef, pork and mutton. Wild animals, such as deer and wild birds, were mostly seen as a status symbol. (12) Thus, only the richest had access to this source of meat. The higher nobility and the royals, would probably have suffered less from the Bovine Pestilence than the middle class and lower nobility, as they could cope the best with rising prices of domestic meat and could fall back on hunted meat.

Importantly, the consequences of the Bovine Pestilence were felt for far longer than the actual presence of the pestilence. Even the children born after the Bovine Pestilence might have been impacted by the protein malnutrition that affected their parents. The production of milk, for example, would only start to increase again in 1332. (2) Pre-pestilence levels of cattle would in some regions never be reached again. (1) Thus, the generations born after the Bovine Pestilence had officially ended, would also have been subjected to a protein deficiency, increasing the chances of immunodeficiencies for a large percentage of the population, mainly belonging to the middle class and lower nobility.

THE DISSEMINATION OF THE BLACK DEATH

The Plague outbreak in Europe lasted from 1347-1353 and

struck first in Italy, only to quickly disseminate over the rest of Europe. In June 1348 it hit England in Weymouth (Dorset), brought there by the trading routes. (13)

The majority of the English people, the peasants, were badly off. The poorer were worse off than the richer peasants, as becomes clear from different secondary sources. (14) This can also be confirmed in primary sources, such as the Polychronicon, written by Ralph Higden, a monk in St Werburgh. His piece implies that the mortality rate in England had a class aspect, with poorer people being more likely to die.

“Indeed it raged so strongly that scarcely a tenth of mankind was left alive. (...) and so much misery ensued that the world will hardly be able to regain its previous conditions. Few, virtually none, of the lords and great men died in this pestilence.” (15)

Towns also suffered severely. Many had to consecrate new burial grounds, such as Newark, Worcester and York, as becomes clear from primary sources. (15)

The nobility will be discussed next. Geoffrey the Baker, a contemporary, wrote that not many nobles had died. (16) However, mainly from the images surrounding the ‘Danse Macabre’, which accompanied the Black Death, we can assume that nobles and kings must have been affected badly. In these images, kings stand beside commoners as Death comes to collect them. Especially in the 14th century, this theme of the Dance of Death was very popular in England. (17) John Lydgate, a monk from Bury St. Edmunds in England transcribed and translated these verses of the Danse Macabre from French into English around 1430. This is illustrative of its popularity and the Dance of Death having hit fertile ground in England. John Lydgate also emphasizes the all-encompassing element of death in his poem: all were equal in death. (18) Importantly, this is a long-term cultural change of the Black Death. Therefore, it might be a more unbiased representation of the events that occurred. In Piers Plowman, a poem and one of the most often studied literary texts from the English late Middle Ages, written by William Langland in the late 14th century (around 1379), a reference to death affecting everyone can also be found:

*“Death came driving after and all to dust bashed
Kings and knights, kaisers and popes.
Learned nor lewed, he left no man stand
That he hit even, that ever stirred after.
Many a lovely lady and their leman knights
Swooned and swelled for sorrow of Death’s dints.”* (19)

Alas, this reference in Piers Plowman, as well as the images of the Dance of Death, can tell us something the groups of people that died. Even the knights, the nobles and the high clergy were affected. Robert of Avesbury, a clerk based in London, also emphasizes that only a very few of the wealthy escaped the pestilence. Avesbury died in 1359 (15). Him being a contemporary, makes his account extremely valuable.

Regional differences can also be taken into account in order to evaluate whether the Bovine Pestilence and Great Famine affected the severity. If a region was struck harshly by the Bovine Pestilence and Great Famine, given that malnutrition affects the severity, the Black Death mortality should also be higher. In Oxfordshire, for example, the Bovine Pestilence wiped out about 70-80% of the cattle. (1) This is substantial compared to other regions. The Black Death also killed many of the rural tenants (around 60-70%). (14) In

1290 the total population of Oxfordshire counted 90,759 people, decreasing to 49,424 in 1377. (11) Especially when compensating for a possible growth of the population after the Black Death, there must have been a very high mortality rate.

One of the most interesting regions is Hampshire. Not only are there a lot of sources about this county, but it also has the highest Black Death mortality compared to the other regions. (14) In the county of Hampshire around 70-80% died of the Black Death and 70-80% of the cattle died during the Bovine Pestilence. (1) Again, this shows that the severity of the Bovine Pestilence is seemingly linked with the mortality rate of the Black Death.

For the region of Yorkshire, there was a high cattle mortality (around 60-70%). (1) There were (continuous) consecrations of new burial grounds to accommodate for the large mortality during the Plague. The rapid concession of these letters as well as the number of new burial grounds established, gives a clear impression of the graveness of the situation. (15) Indeed, many people must have died if so many burial grounds had to be established. A high mortality rate in Yorkshire can be confirmed by two other sources. Firstly, relief was given to villagers living in this region. (15) Secondly, the population in North Yorkshire, the region that is covered most extensively in the sources, the population decreased from 163,634 to 73,099. (10) This implies a mortality rate of almost 60% among the general population. Again, there is a combination of a high cattle mortality and a high mortality of the Black Death.

Some of the regions, such as Berkshire, do not fit within the hypothesis. This region had a very high cattle mortality (80-90%), (1) while the Black Death killed only around 40-50% of the people. (14) A possible explanation could be that the Bovine Pestilence and Great Famine had been so severe in this region, that many people did not live to see the Black Death outbreak. As such, there is a possibility that only the strongest people survived, who stood a better chance against the Plague. Consequently, the Black Death mortality rates might be low, where one expects them to be high. More research will need to be done in order to understand this apparent mismatch with the rest of the information, however.

DISCUSSION OF THE RESULTS

During the years of the Great Famine, the poor were struck the hardest. The nobility could more easily compensate for the high prices and also ate a lot of other produces, such as butter, milk and meat. Peasants, even in non-famine years, would consume around 1500-2000 calories per day, which is insufficient. (10) For the years of the famine, this decreased to around 1300. (11) This lack of calories can be especially detrimental for the immune system during pre-natal and child development. This has been confirmed by recent research on individuals born during the Hunger Winter (1944/1945) in the Netherlands. This famine, caused by the Germans cutting off the food supply to the northern provinces of the Netherlands, decreased the daily consumed calories to around 700 per person. One study on the Hunger Winter found that pre-natal exposure to famine could cause lower methylation of the insulin-like growth factor 2 (IGF2), which is related to the immune response, in individuals compared to siblings that were not exposed to famine. (20) Hence, it might explain why the Black Death mortality among those who were born during the Great Famine was higher.

As was argued in the immunology section, protein is one

of the basic components of our body and the cells of our immune system. Paleopathological research on a sample of bodies from a Black Death cemetery in London has shown that individuals with skeletal stress markers related to protein deficiency, such as enamel hypoplasia and a B12 deficiency, are overrepresented in the cemetery (2). This suggests that protein malnutrition is an important determinant of mortality during the Plague. Differences in mortality rate between rich and poor have not yet been considered, however.

As mentioned before, peasants barely had any access to dairy products and meat. The nobility and the people belonging to the middle class, on the other hand, consumed quite some meat, cheese and other dairy products. During the Bovine Pestilence, however, this would not have been the case. The shortage in cattle prevented all (except a few of the most wealthy) from getting their daily protein intake. Therefore, children born during this pestilence or after, considering the long-felt consequences of the cattle shortage, were more likely to develop immunodeficiencies. Consequently, the rich would, supposedly, have been more susceptible to the plague than in a 'normal' situation. As such, considering the differences in mortality rates is essential in proving (or disproving) the hypothesis.

The answer to whether the rich were more susceptible to the plague remains ambiguous in primary sources. On the one hand, most chronicles mention that the nobility escaped the great mortality. On the other hand, Avesbury in London does emphasize that most nobles, except the wealthiest, were affected. In addition, the cultural long-term consequences of the Black Death, best illustrated in the Dance of Death and Piers Plowman, tell a story of no one being able to escape death. What might explain the underreported mortality rates of the nobility in most chronicles, is that some authors were unwilling to show the equality of death, out of fear of angering the nobility. After all, this period was a time of social unrest: the peasants were demanding higher wages and more rights. In such a situation of societal division, portraying the nobility as weak, would not have sat well with the ruling class.

When comparing these more equalized mortality rates to previous outbreaks of *Y. Pestis*, the relative equality is unique. During the first outbreak of the Justinian Plague (541 AD), the first epidemic of *Y. Pestis*, the rich seemed to be less affected than during the later outbreaks. (21) Given that primary sources demonstrate that all plague forms (the more deadly pneumonic as well as the 'lesser' bubonic and septicemic plague) were likely present during both outbreaks, they cannot explain the difference in mortality. The difference can be explained, however, from the lack of protein and general malnutrition as a result of the cattle mortality and famine accompanying the plague during the first outbreak in the Byzantium Empire. Logically, this would have made the population more susceptible to disease and death. (21) In contrast, the outbreaks of the Plague after 1352 in England were less severe, while the protein intake increased during that time as a result of the decimated population (10). Thus, there seems to be a clear correlation between protein deficiency and the mortality rate of *Y. Pestis*. Importantly, the severity of the protein deficiency might explain why the mortality rates in the 14th century were generally higher than in the 6th century.

Leptin might explain why the peasants still died in larger numbers than the nobles. Without adequate leptin levels, neutrophil development may be compromised.

Consequently, neutrophils cannot do their job, which might prevent detection as well as destruction of pathogens, such as *Y. Pestis*. Peasants had less access to adequate resources than the nobility did. Consequently, their leptin levels would have been lower and therefore they would have had a less efficient immune system in general, which resulted in higher mortality rates.

A second explanation for differences in mortality as well as the severity of the Black Death is chronic stress. Chronic stress has been found to have consequences for the immune system, making the immune system less likely to detect as well as destroy pathogens. In the Middle Ages, people lived in a constant sense of fear, making stress a part of their daily life. During the 14th century in specific, people must have been particularly terrified. Earlier in that century, they were already exposed to strenuous circumstances, but when the Plague broke out, people truly believed the end of the human race was near. Some had no hope of salvation left, an example of which is Friar John Clyn, a chronicler of the time.

"(...) seeing these many evils, and the whole world lying, as it were, in the wicked one, among the dead, waiting for death till it come (...)" (22)

Chronic stress also affected fetuses. Consequently, the continuous agonizing circumstances during the Middle Ages, combined with the particularly stressful events in the 14th century, might not only have increased the mortality rate among those who lived through the famines, but also those who were conceived during that period. Peasants had more stress, as they had very little security when it came to food or life in general. As such, they would have been hit worse by the chronic stress levels, which would explain their higher mortality rate.

CONCLUSION

This article has made clear that there is an association between protein malnutrition and mortality during the Plague. The nobility and the rich middle class, who would have suffered the most from the loss of cattle, seemed to have had a more equalized mortality rate compared to other outbreaks. The richest nobility would have been able to deal with the rising prices. Therewith, they would have been less affected, which also explains the low mortality rate of royalty.

There is an association between the Plague mortality and the cattle mortality when comparing regions. Thus, malnutrition seems to be an important long-term determinant of health. As such, a historical perspective can contribute to the field of immunology, by researching data that is not available for contemporary research, due to the obvious limitations of ethics and time. This article has shown there might be an association. However, a case study on an individual or town level is necessary in order to further prove or falsify this hypothesis.

Chronic stress might have contributed to the higher death rate. Even though it is hard to determine precise levels of stress for people in the 14th century, it must have been a very stressful environment to live in, due to the constant (realistic) fear of death, as becomes clear from primary sources. Indeed, a higher mortality is found during the Black Death outbreak compared to outbreaks of *Y. Pestis* known as the Justinian Plague (541 – 800AD) or the Modern Outbreak (1860 – now).

ROLE OF THE STUDENT

Elvire Landstra was an undergraduate student working under the supervision of MD Cornelus Sanders and Dr. Anna Adamska when the research in this paper was performed. The topic and methodology were proposed by the student. The student herself went to the archives and translated medieval texts from Latin. The analysis, formulation of the results and the writing were done by the student with help from the supervisors.

REFERENCES

1. Philip Slavin, 'The Great Bovine Pestilence And Its Economic And Environmental Consequences In England And Wales, 1318-50' (2011) 65 *The Economic History Review*
2. DeWitte and Slavin, 'Between Famine And Death: England On The Eve Of The Black Death—Evidence From Paleoepidemiology And Manorial Accounts'
3. Matthew Helbert, *Immunology For Medical Students* (2nd edn, Elsevier 2016).
4. Schaible US Kaufmann, 'Malnutrition And Infection: Complex Mechanisms And Global Impacts' (2007) 4 *PLoS Medicine*
5. H. Zarkesh-Esfahani and others, 'Leptin Indirectly Activates Human Neutrophils Via Induction Of TNF-Alpha' (2004) 172 *The Journal of Immunology*
6. Dorin Dragoş and Maria Daniela Tănăsescu, 'The Effect Of Stress On The Defense Systems' (2010) 3 *Journal of Medicine and Life*.
7. William C Jordan, *The Great Famine: Northern Europe In The Early Fourteenth Century*
8. Robert de Reading, *Flores Historiarum* (1325).
9. Timothy Thornborough, Thomas Langdon and Mary Whinkop, *Brut Chronicle* (1450), pp 209-210
10. Woolgar, Serjeantson and Waldron, *Food In Medieval England*, pp 50-91.
11. Broadberry and others, *English Medieval Population: Reconciling Time Series And Cross Sectional Evidence*
12. Gundula Müldner and Michael P. Richards, 'Fast Or Feast' (2005) 32 *Journal of Archaeological Science*.
13. Blockmans WP Hoppenbrouwers, *Introduction To Medieval Europe 300-1550* (Routledge 2014)
14. De Witte SM Kowaleski, 'Black Death Bodies' (2017) 6 *Fragments*
15. Horrox, *Manchester Medieval Sources Series: The Black Death*, pp 62-64, 279-181, 296-298.
16. Le Baker and Preest, *The Chronicle Of Geoffrey Le Baker Of Swinbrook*, pp 87-88.
17. Sophie Oosterwijk, 'Of Corpses, Constables And Kings: The Danse Macabre In Late Medieval And Renaissance Culture' (2004) 157 *Journal of the British Archaeological Association*.
18. Aberth, *The Black Death: The Great Mortality Of 1348-1350 A Brief History With Documents*, p 165.
19. William Langland and Derek Pearsall, *Piers Plowman* (University of Exeter Press 2008), p 233, passus 20, lines 100-105.
20. Bastiaan T. Heijmans and others, 'Persistent Epigenetic Differences Associated With Prenatal Exposure To Famine In Humans' (2008) 105 *Proceedings of the National Academy of Science*
21. Lester K Little, *Plague And The End Of Antiquity* (Cambridge Univ Press 2009)
22. Thomas Scott Holmes, *The Register Of Ralph Of Shrewsbury, Bishop Of Bath And Wells, 1329-1363* (Ilminster: Somerset Record Society, 1896)