

# A History of Rickets in the Netherlands

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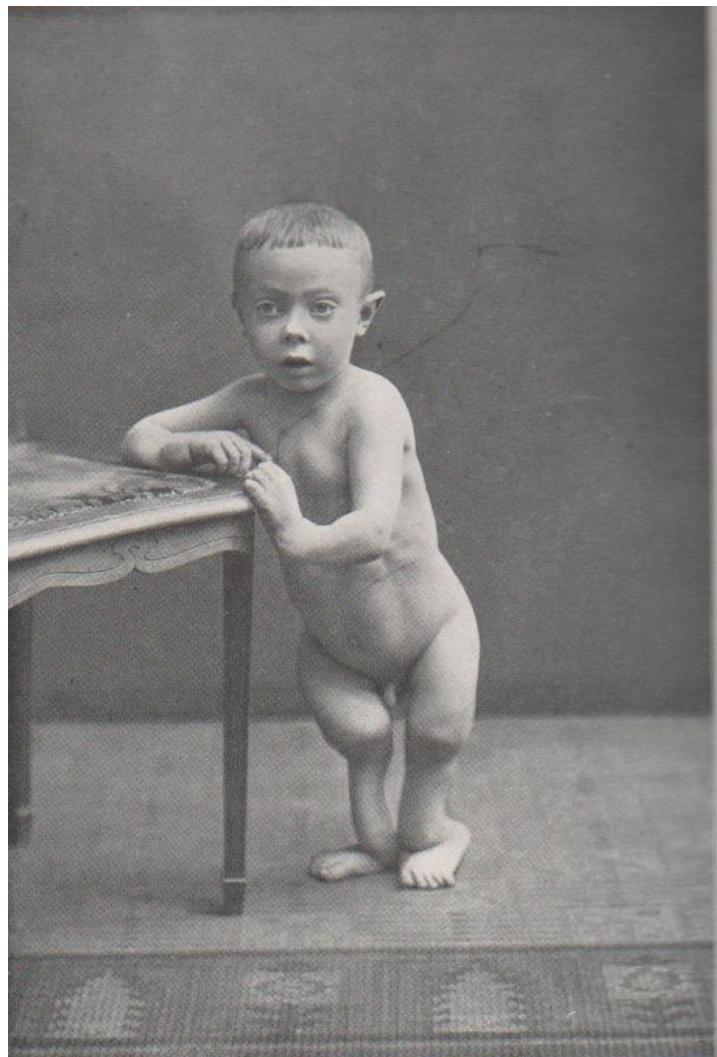
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Front page: a six-year-old boy from Amsterdam with severe rickets.  
(copied from Zeehandelaar (6))

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## **Abstract**

Rickets is a paediatric disease leading to bowing of the bones and malformation of the thorax and pelvis. It is usually caused by a deficiency of vitamin D, which is present in some food such as oily fish or synthesized after sunlight exposure of the skin. Rickets was highly prevalent in the industrializing European countries from the eighteenth century until well into the twentieth century, and is usually associated with the industrial revolution. In the Netherlands, industrialization started much later than in the surrounding countries and it is therefore likely that the prevalence and severity of rickets in the Netherlands differs from the situation in other European countries, but this has never been studied.

The aim of this study is to determine the prevalence and severity of rickets in the Netherlands and to investigate, if at all possible, whether industrialization or insufficient intake of vitamin D from food caused its prevalence. Historical texts, archaeological sources and anatomical collections were gathered and studied. For some periods, data were scarce, but it can be concluded that rickets was present in the Netherlands from the seventeenth century on. The prevalence probably started increasing between 1800 and 1860, later than in other European countries, but more research is needed to determine the exact moment of the rise. It is clear that after 1890, rickets was highly prevalent in the Netherlands. After the discovery of vitamin D, rickets had disappeared almost totally by the middle of the 20<sup>th</sup> century, although in immigrants and little children vitamin D deficiency is still a problem.



## **Introduction**

Rickets is an infancy related disease caused mainly by a disturbance in vitamin D or calcium metabolism, leading to insufficient mineralization of the bone resulting in amongst others bowing of bones and malformation of the thorax and pelvis.

Vitamin D is actually a prohormone which can be obtained by the body through synthesis in the skin, which is considered the main source of vitamin D for most people, or through dietary intake. (1-3) During exposure to sunlight, the skin absorbs ultraviolet radiation, resulting in the transformation of 7-dehydrocholesterol into vitamin D<sup>3</sup>. Vitamin D<sup>3</sup> is then hydroxylated in the liver into 25-OH-vitamin D and subsequently in the kidneys into calcitriol (1,25-OH-vitamin D), the active form of vitamin D.

The most important dietary source of vitamin D is oily fish, such as mackerel, herring, salmon and cod, the last one being the source of cod liver oil. Vitamin D is present in other foods as well, such as milk (and thus butter and cheese), eggs and meat, but the amount of vitamin D in these foods is considerably lower than in fatty fish.

For young children breast milk and sun exposure alone is an insufficient source of vitamin D, so the use of supplements is needed. (1)

Inadequate intake of vitamin D can lead to rickets because vitamin D is important for the absorption of calcium from the intestine. When enough vitamin D is present, 30% of the calcium is absorbed, in a vitamin D deficient state this is only 10 to 15%. A low calcium level in the blood leads to a low phosphorus level and to decreased bone mineralization, a low phosphorus level causes disorganization of the growth plates. Moreover, a low calcium blood level results in increased secretion of parathyroid hormone, causing osteoclasts to break down bone tissue in order to restore the lowered calcium levels in the blood. (1,4)

Rickets is usually associated with the bowing of extremities, but has more clinical features, such as a large head, short stature, kyphosis and scoliosis, the typical rachitic rosary at the rib-ends, muscle weakness and musculoskeletal pain. (5)

The disease always occurs during infancy, usually between four and eighteen months. (3)

Vitamin D deficiency leading to bone deformities in adults is called osteomalacia.

Important to mention here is that rickets is often not a primary cause of death. (6a) Besides the disabilities caused by the disease, serious complications can occur in persons who suffer or have suffered from rickets: there is a higher risk of pneumonia due to the malformed thorax (5,6b) and malformation of the pelvis can cause complications during delivery in females. (7)



## Research Question

It was pointed out in 1911 already that no-one had ever written a history of rickets in the Netherlands, and this still is true today. (6d) There are many assumptions about the history of rickets. Often, statements about the disease are based on stories rather than on scientific research. A good example is the reference made more than once to a study reporting that 80% of children suffered from rickets in Leiden, the Netherlands, by the turn of the 20<sup>th</sup> century. (3,4,8) When the original article is read, it becomes clear that this study was not performed in Leiden, not even in the Netherlands, but in Dresden, Germany. (9)

As it has been sufficiently proved that the rise in the prevalence of rickets in countries such as the United Kingdom, France and Germany was linked to the industrial revolution, it is often assumed that this is true for the Netherlands as well.

However, it was not until 1860 that something worth the name industrial revolution started in the Netherlands, one hundred years later than in the UK.

Since the history of industrialization, generally considered the main cause of rickets, is so different in our country, it does not seem unlikely that the history of rickets is different too. Therefore, the aim of this study is to identify the prevalence and severity of rickets in the Netherlands and, if possible, to determine what was the main cause of the disease in the Netherlands. First of all the most likely causes of rickets, nutrition and industrialisation, are discussed. Then, the history of rickets in other countries is mentioned and finally the situation in the Netherlands is discussed.

## Materials & Methods

Since the research question of this study is a historical one, the materials and methods are mainly the gathering and studying of sources. As a start, books about diseases, health care and life in the 19<sup>th</sup> century were read to create a context in which to interpret the results found. (10-17)

All possible sources, such as online databases (Pubmed, PiCarta, UvA library catalogue), journals, books, archives, collections and archaeological studies were searched for data about the prevalence and severity of rickets in children and about deliveries complicated by the presence of a narrow pelvis of the mother.

The following journals were studied:

- Nederlands Tijdschrift voor Geneeskunde, 1857-2009
- Het Nederlands Tijdschrift voor Verloskunde en Gynaecologie, 1889-1900
- Nederlandsch Lancet 1838-1856
- Nederlandsch Weekblad voor Geneeskundigen 1851-1856
- Practisch Tijdschrift voor de Geneeskunde 1822-1856
- Het Repertorium 1847-1856
- Tijdschrift der NMG (Nederlandsche Maatschappij ter bevordering der Geneeskunst) 1850-1856
- Tijdschrift Boerhaave 1839-1848
- Kliniek: Tijdschrift voor Wetenschappelijke Geneeskunde 1844-1849

In all journals that were scrutinized covering the period 1822 to 1856, 24 articles about rickets, translated from foreign journals (mostly from Great Britain, France and Germany) and 27 articles about rickets in the Netherlands were found.

In the Nederlands Tijdschrift voor Geneeskunde only ten articles concerning rickets were published in the period 1857-1900.

The City Archive of Amsterdam was searched for texts concerning rickets or diseases in general. More specifically the writings from the guild of surgeons were searched and studied, among them the monthly notebook of deaths, which was kept between 1774 and 1805.

In the Archive data from the Amsterdam Bureau for Statistics were found. Apart from annual reports on deaths and causes of death, once in a while special reports about epidemic diseases, like cholera and typhoid fever were made. Unfortunately, there was no special report available on rickets. From 1854 till 1860 there was an annual report of all deaths and causes of death in the whole city of Amsterdam. Unfortunately, between 1860 and 1893 no annual overview was made anymore. From then on all deaths, an average of 8000 a year, were listed individually with the probable cause of death. From a practical point of view, it was impossible to work through all the deaths and to score the prevalence of rickets. For the period 1893-1915 more reports of deaths and causes of death were found.

The Bureau for Monuments and Archeology in Amsterdam and the Faculty of Archaeology of the University of Amsterdam provided reports of three osteo-archaeological studies. The excavation in the Nieuwezijds Chapel was performed in Amsterdam, the other two studies were done in Zwolle and Alkmaar.

In the Vrolik museum in the Academic Medical Centre the collections of pathological bones by Hovius and Vrolik were studied. (see also the appendix on Hovius and Vrolik)

## Nutrition in the Netherlands

As described in the introduction, by far the most important food containing vitamin D is oily fish. The small amounts present in, for example, milk and eggs usually can not compensate for a lack of fish or sunlight. (1) Therefore, this section will focus mainly on the consumption of fish.

In the 18th century meat was no longer an available food for the lower and middle class in the Netherlands. This was due to the fact that the meat production could not keep pace with the increase in population, and due to epidemics of cattle-plague. (10a)

As a result, fish became the most eaten animal product in these classes. Herring for example was eaten from the lowest to the highest classes, and stockfish and salmon were poor mans food pre-eminently. Salmon was so cheap and common that it was forbidden in cities like Kampen and Dordrecht to serve salmon to ones servants more than three times a week. (10b)

At the end of the 18<sup>th</sup> century fish became scarce, probably because of overfishing and pollution of the rivers caused by the rapid industrialization in the countries surrounding the Netherlands. This scarcity is illustrated by the fact that, contrary to the situation before, at the beginning of the 19<sup>th</sup> century it had become difficult to find a market stall selling salmon.(10b) The only places where fish still was a major ingredient of the daily meal were fishing-villages.

In the 19<sup>th</sup> century the potato replaced wheat and peas as the most important staple food for the working class. (10c) In fact, in many families the potato was almost the only food they could afford, and there was never enough to feed all members of the family. (11a)

Meat, fish and dairy products were almost never eaten by the working class. It was estimated in 1854 that 100000 adults in Amsterdam never ate meat or fish, on a total population of around 250000. (11b)

Due to the development of a more effective agriculture and new conservation methods the diversity in food consumed per capita slowly rose after 1850.(10d) Although there was a slow but steady rise in the consumption of meat, dairy products and fruit, the main staple food in 1886 was still the potato, now accompanied by mostly low quality bread. (11b)

But even when meat, fruit and dairy products became available for everyone at the beginning of the 20<sup>th</sup> century, fish was still considered something to be eaten occasionally. This was especially true at the countryside, since fish had to be bought, while most farmers preferred to eat what they grew or raised themselves. (10b,10e)

When we look at the situation today, we see that fish never resumed a superior position in our daily meal: in the Netherlands, it is eaten five times less than meat and it is still considered something to be eaten now and then. (10e)

## **Industrial Revolution and its effects in the Netherlands**

By the midst of the 19<sup>th</sup> century, neighbouring countries had industrialized on a large scale, but for a long time the Netherlands stayed behind. For example, in 1837 only 72 steam engines could be found in the whole country, compared to 1049 in 1838 in Belgium. (12a)

This difference in industrialisation had several causes. Historically the Netherlands had always been focused on trade instead of production. (12b)

Furthermore, several factors caused production costs to be higher in the Netherlands than in other countries. First of all, the quality of the infrastructure was insufficient for large scale industries: due to the swampy grounds, the costs for railway construction were high. Besides, the Netherlands had an effective network of canals and rivers, which had always been suitable for the transport of end-products, but were too slow and small for the transport of large amounts of raw materials. (13a)

Secondly, because there were no ore mines or coal mines in the Netherlands, raw materials were very expensive. The coal mines in Limburg, the southern part of the Netherlands, produced only for local use. (13b) Due to the regional focus of production and the difficulties in obtaining raw materials, the use of old techniques (wind and water energy) remained more profitable for a long time than the use of steam energy. (13c)

In the Netherlands it was also more difficult to find enough labourers willing to work hard for low rewards. Historically the Netherlands and especially Amsterdam had higher wages than neighbouring countries. This was due to the fact that the country had always depended on foreign workers and because the living costs were relatively high. (13d)

The politics played an important role too: King Willem I had the idea to divide the country in a commercial part (the Netherlands) and an industrial part (Belgium). After the independence of Belgium in 1830 there was hardly any industry left in the country. (14a)

The apparent lack of industrialization did not mean that the Dutch economy failed to grow. As early as 1830, there was economical growth, but it was oriented mostly towards agriculture and services. (13a,13e) For example, in 1849 60% of the population worked in the agriculture. (13f)

It was not until 1860 that a real industrialization started in the Netherlands, resulting in large scale migration from the countryside to the cities.

Most of the migrants coming to the city ended up living in small houses in narrow streets, where hardly any daylight entered the house. This was the case in all large cities in the Netherlands as well as in the surrounding countries. (11c)

The following phrase from a report from 1853 about the housing of labourers is clear enough: “Limited in space, often badly lit, insufficiently protected from the influences of the weather, in humid places and in corridors and alleys..”

A health commission in Amsterdam investigated in 1874 almost five thousand so called basement apartments, the worst possible accommodation, of which 73% was considered uninhabitable. In almost one thousand of these houses it was impossible for a ray of sunlight to enter the house. As late as 1909, there were still more than 2700 basement apartments in Amsterdam. (11d)

## Foreign History

The first time rickets was described was a long time ago. Soranus of Ephesus described the characteristic deformities of legs and spine in young children as early as the second century A.D. Galenus was the first to exactly describe the typical knock-knee, bowed legs and pigeon breast and the same features were reported from China. (18)

However, the first publications in which the disease was clearly described are those written by Daniel Whistler and Francis Glisson in the first half of the 17<sup>th</sup> century.

Francis Glisson is usually credited for giving the first description of rickets in his book “*De Rachitide sive Morbo Puerili qui vulgo The Rickets dicitur Tractatus*” in 1650. This book was the result of a large study in London by Glisson and seven other members of the London Medical Union. Although Glisson is often considered the first to report on rickets, Daniel Whistler already published his thesis “*de Morbo puerili Anglorum, quem patrio idiomate indigenae vocant The Rickets*” in Leiden in 1645, although it has been said by some that Whistler never observed a case of rickets when he wrote his dissertation, but took it as the subject of his study after having heard about the large study in London. The Dutchman Arnoldus Boot published his book “*Observationes medicae de affectibus omissis*” (Medical observations about omitted affections) in 1649, describing a disease very similar to rickets, but calling it *Tabes Pectora*. (19a)

Rickets may even have been described as early as 1582, by Bartholomeus Reusner from Basel, who wrote the “*Dissertatio de tabe infantum*”, describing a disease very prevalent in Switzerland and Holland, in which “the bones bent and the flesh withers”. (19b)

No copy of this dissertation is left, but it seems likely anyway that rickets has been described earlier than 1645, since the word rickets was already used in the London Bill of Mortality report of 1634. (18)

At the beginning of the seventeenth century, rickets probably was a disease of the rich instead of the poor. The rich preferred to keep their children inside the house and feed them with meat and bread only, which made them very vulnerable to vitamin D deficiency. (19c,20) It is argued though that in these days rickets was not caused by vitamin D deficiency, but by a lack of calcium. (21)

Much has been written about the sudden increase in prevalence of rickets and the causes of this rise. One of the factors in seventeenth and eighteenth century Britain is the large amount



of coal used, causing the large cities to be covered in smog, sunlight being unable to penetrate the cloud. (22) With the onset of the industrial revolution in the eighteenth century and the migration of farmers to the cities, where they lived in crowded and dark houses in narrow alleys, rickets became a disease highly prevalent in the large cities. As early as 1773, it was said that 20000 children in London were affected by rickets. (6c,18,20,22,23a,24) Probably somewhere in the eighteenth century, rickets turned from a disease of the rich into a disease of the poor, but the exact moment of this change is unclear.

In 1826 it was mentioned in a German article that rickets is a disease that is “among the most occurring and most difficult to cure”. (25) In 1838, in an article describing cases in the obstetrical clinic in Berlin, it was written that: “Disorders in labour, caused by narrowing of the pelvis, occur pretty abundant”. (26)

An article in 1839 about a clinic in Paris stated the following: “Here you can meet a crowd of misshapen daily at certain hours, mostly children though, who as a result of rickets or scrophulosis suffer from bending of the spine or the limbs” (27) In 1843 it was written about the inhabitants of the city of Neuhoff, close to Strasbourg, that: “The people there are generally small, with goitre and rachitic” (28)

An article by dr. Hauner of the children’s hospital in Munich showed that, out of the 1853 children treated in the hospital in 1851/1852, 122 visited the hospital because of rickets.(29) In the same year it was stated that “In London they finally proved in numbers, what we suspected for so long, that in the dirty, narrow and dark houses three diseases were the most prevalent, namely the typhus, cholera and measles. (..) What is left, is decimated by chronic diseases, rickets, scurvy, scrophulae, tubercles and chlorosis.” The author described the houses to be the worst in London, Liverpool, Manchester, Lyon, Paris “and other cities.” (30) In 1856 Dr. Kuttner from Dresden wrote about rickets, “because of her extraordinary high prevalence in the children’s hospital in Dresden.” He proved this by giving the following numbers: out of the 7700 children treated in the hospital, 1654 suffered from rickets, more than 20%. (31)

In 1867 33% of all children in a hospital in London were found to be rachitic and in 1884 every child examined in a hospital in Clydeside was suffering from rickets.(23a) The situation in other European countries was hardly any better. Around 1900, approximately 90% of all children in Vienna, Dresden, Berlin, Bergen, Oslo, Glasgow, Dublin, Belfast, Edinburgh, Paris, Florence and Moscow showed clinical signs of rickets. (18)

The first known description of cod liver oil as a cure for rickets dates from 1824, but it took far into the 20<sup>th</sup> century before the downfall of rickets started. (19d)

In 1909 the discovery that rachitic children excreted more calcium than they took in had a large impact. This meant that the primary problem was not a lack of calcium in the food, but the incapability to use it for bone formation. Moreover, osteomalacia, until then often considered a totally different disease, appeared to be related to rickets. (19e)

In 1914 Casimir Funk published his book “die Vitamine”, describing the essential elements required for the prevention of beriberi and scurvy. Funk was the first to add rickets to the group of deficiency diseases.

In 1918 Edward and May Mellanby pointed out that young dogs needed the intake of the “fat-soluble vitamin A”, present in meat, fish and dairy products to grow healthy bones and teeth. The Mellanbys concluded that the cause of rickets is a diminished intake of either vitamin A or an anti-rachitic factor closely related to vitamin A. (19f)

An American research group (Elmer McCollum, Edward Park and Paul Shipley) found out that, although the rats in their study took in enough vitamin A, they still developed rickets, unless they were also given cod liver oil. The only possible conclusion was that the anti-rachitic factor was not vitamin A, but a new vitamin later to be named vitamin D.

However, many studies in the years before attributed rickets to a lack of fresh air and sunlight, so many scientists were unhappy with the conclusion that rickets was merely a dietary problem. In 1924 the Americans Steenbock and Hess solved the dispute by proving that, when pieces of dead human skin were rayed with an ultraviolet lamp and then fed to rats, they could cure rickets. (19g,32)

Between 1927 and 1932 scientists succeeded in isolating vitamin D and its pro-vitamin and the whole pathway of vitamin D and its precursors was discovered.

In most Western countries, vitamin D was added to certain foods, such as milk (USA) or margarine (Netherlands). In the Netherlands it was also advised to give extra vitamin D to children under the age of four. These measures caused the rapid decline in the prevalence of rickets after World War II.

## History of rickets in the Netherlands

The first Dutchman to write about rickets was Arnoldus Boot, who was born in the Netherlands and earned his doctoral degree in Leiden, but moved later to live in England, Ireland and Paris. In 1649 he published his book “Observationes medicae de affectibus omissis” (Medical observations about omitted affections), in which he describes rickets under the name of *Tabes Pectorae*. His description was restricted to the situation in England and Ireland. The first person to describe the situation in the Netherlands is probably Herman Boerhaave, professor at the university of Leiden, in his book “Aphorismi de Cognoscendis et Curandis Morbis” (Aphorisms on the recognizing and healing of diseases) in 1709. He described rickets to be highly frequent in Europe in the 17<sup>th</sup> century, but agreed with Glisson that it was a disease of the rich, those who “are of a weak and frail body condition, idle, soft, use rich meals, fat and sweet foods, few bread, sweet wine and lots of warm water; are exhausted by chronic diseases, venus, and by their age, though especially subjected to the “*tabes venerea*” (syphilis) and repeated gonorrhoea.” (19h)

After the works of Boerhaave and his student van Swieten, nothing has been written about rickets in the Netherlands for some time. J.F. Ackermann writes in his “Geneeskundige verhandeling over de Engelsche Ziekte” (Medical treatise on the English Disease) (1794) that: “In the miserable dens of the poor, we find no child, that is free of the English disease.” (19i)

The “Maandelijksch Notitieboek der Gestorvenen” (monthly notebook of deaths) by the guild of surgeons showed that in the period 1774-1805 only a few deaths per year were caused by rickets, the disease even disappeared from the notes during some periods. Though this is an indication of the impact rickets had, the conclusion cannot be drawn that rickets was very rare, since the primary cause of death in people suffering from severe rickets was usually pulmonary infection or females dying during labour due to a deformed pelvis. (33)

The first notion of rickets in the Netherlands in an article was published in the *Practisch Tijdschrift voor de Geneeskunde* in 1822. (34) In a large article about all causes of “beentering” (bone tuberculosis), the author noted rickets (rhachitis) to be one of the causes. It is not until 1834 that the next article about the Dutch situation was written.(35) Moll wrote about the use of cod liver oil against rickets in children, “a therapy whose value is beyond all doubt”. However, he did not mention the prevalence of the disease.

In 1832 the dissertation of Petrus Ens from Franeker is published: “de oleo jecoris aselli, atque ipsius usu imprimis in rachitide; exposita simul hujus morbi natura”. (36)

Ens had a very clear opinion about the prevalence of rickets in the Netherlands; in his introduction he wrote: “The disease rickets is endemic in our country, or at least is very prevalent” and about cod liver oil: “It is used almost daily in our Academy against this disease.” (36a)

About the causes of rickets he wrote: “Furthermore, the living at wet and humid places, through which the disease is frequent in our fatherland and in England, while on the other hand it is seldom seen in warm regions, Italy, Spain, Portugal, etc.” (36b)

In his conclusion he again mentioned the severity of the disease: “It is a fact, so it appeared to me, when I worked at the Leiden medical study, that I saw very many children with rickets, who were brought to the academical hospital almost daily by their mothers, who asked for help for their poor offspring.” (36c)

In 1840 an article was published in the section Orthopaedics of the *Nederlandsch Lancet*. (37) This article was mostly concerned with some sort of splint designed to cure bent spines. There were of course many causes of spine deformities and the author referred not to rickets as such, but in the introduction the author mentions that “since a few years, we have been giving more attention to the infirmities in the form of the bones, so long forgotten.”

From 1850 on, the number of articles on rickets multiplies. This does not necessarily mean that the prevalence of rickets increased, as the number of medical journals multiplied too. Two articles with a reference to rickets were written in 1850. The first was a long article about child death in Amsterdam. The only reference to rickets made here was the description of 33 child autopsies in the Amsterdam Binnengasthuis Hospital, of which one child died of “rhachitis cum atelektasi pulmonum” (rickets with pulmonary atelectasis). (38)

The next article was a “Bijdrage tot de statistiek der doodgeborenen” (contribution to the statistics of still-born). The author described the main causes of still-births in Zeeland to be “syphilis and poverty and rickets, etc.”(39)

In 1851, Leopold Lehmann discussed in the *Nederlandsch Weekblad voor Geneeskundigen* the influence of rickets and osteomalacia on the pelvis, causing a variety of deformities.(40)

In the same year, a report of the meeting of the surgical and obstetrical division of the NMG\* was published. (41) Baart de la Faille from Groningen emphasized the occurrence of osteomalacia, which he said to be more prevalent in the past few years. He saw seven cases in six years, while he never saw it before and could not find any osteomalacic skeletons in the anatomical collections in Groningen. It was discussed at the meeting that the observations of Professor Simon Thomas from Leiden seemed to confirm this. He owned two osteomalacic skeletons, while “in this region the disease had never before been observed”. The issue seemed important enough to ask the following question to all departments: “Because it seems to be, that the osteomalacia has increased in some regions of our country, it is wished to know whether this happens in general? And if this is the case, to what causes can this be attributed?”

In 1854 Swaagman wrote a large article “Over de veranderingen van het beenweefsel bij osteomalacie” (on the changes in bone tissue in osteomalacia). (42) He acknowledged the insufficient knowledge of osteomalacia and described two osteomalacic skeletons he acquired: one of the skeletons he obtained five years ago, the other one, from the museum of professor Ens from Franeker, is probably older.

In 1855 four articles about rickets in the Netherlands were published. In de Tijdschrift der NMG a review was published on Dutch literature concerning the osseous system, with also a few references to rickets. (43)

In the report of a meeting (44) it was mentioned that Tilanus showed the corpse of a three year old child, of which all bones were heavily deformed due to rickets.

In the *Nederlandsch Lancet* a gynaecologic article mentioned a 26-year old female having problematic labour and suffering of rickets in her youth. (45)

In the same journal there was a description by Swaagman of the rachitic deformed thorax of a 20-months old child. (46)

In 1856 a case report concerning rhachitis adultorum (adult rickets) was published. (47)

Furthermore there was a summary of a “Verslag omtrent de ziekten welke in het jaar 1855 binnen Amsterdam geheerscht hebben” (report on the diseases that were about in Amsterdam in the year 1855), in which rickets was not mentioned at all. (48)

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\* Nederlandsche Maatschappij tot bevordering der Geneeskunst (Dutch Society for the promotion of Medicine)

The dissertation “De ossium mutationibus, quales in rhachitide observantur” (On the changes in bones, which are observed in rickets), written by Stephanus Cartier van Dissel in 1854, contains no useful data about the prevalence of rickets. (49) Neither do two other dissertations, “Verhandeling over de verkrommingen der beenderen en de daardoor te weeg gebrachte misvormingen bij rachitis” (Treatise about the bowing of the bones in rickets and the deformities caused by this), written by J.S. Wichers in 1858 and “Verhandeling over de Rachitis” (Treatise on Rickets) by Theunis Haakma Tresling in 1860. (50,51)

It is confirmed in 1911 that no more dissertations on rickets were written in our country after 1860. (6e)

Special types of article were the annual reports of the Leiden obstetrical clinic that professor Simon Thomas started publishing in 1849. In those reports, he summarized all births in the clinic and polyclinic and all complications that occurred. In one of his reports (52) he stated that in the clinic “the women are mostly unmarried and from the poorest classes of the population. On the contrary, in the polyclinic most women are married, and, although coming from the needy classes, live in their own house and whose way of living is far better than that of those, who come to the clinic.” Although this might not be a representative population, Professor Simon Thomas did see women from different classes and therefore it can probably be concluded, that if rickets occurred in Leiden, he should have seen it.

In the section “disorders of labour” the amount of complicated births due to a narrowed pelvis of the mother was described. However, Simon Thomas did not report how many of the deformities were because of rickets, although sometimes he mentioned it or highlighted a case in which rickets was the cause. From these reports, the following table could be made. (Table 1) (52-58) From the table it becomes clear that less than 1% of the deliveries was definitely complicated by rickets. In the unlikely case that all narrowed pelvises were caused by rickets, an average of 8% of the deliveries was complicated by the disease.

It is important to remember that when a woman’s pelvis is narrowed due to rickets, this means she suffered from rickets during her childhood. During the study it was found by the author that most women gave birth for the first time in their twenties, so these data indicate that the prevalence of rickets in Leiden in the 1820’s and 1830’s was lower than in neighbouring countries.

From the reports of the Amsterdam Bureau for Statistics it became clear that in the period 1854 till 1860, an average of two people a year died because of “rachitic deformity of the thorax”. (59)

Between 1860 and 1880, very few articles on rickets were published, partly due to the decrease in the number of journals. In the *Nederlands Tijdschrift voor Geneeskunde*, the article by J.J. Bos about the possible causes was the only article in which rickets was the main subject. (60)

In a dissertation from 1893, females with a narrowed pelvis by whom an intervention was needed were described. Out of 13 serious interventions (use of the forceps, Caesarean section and provoked premature deliveries), 8 were needed because of a rachitic narrowed pelvis. (61)

The “Vereeniging tot verleenen van Buitengewone Verloskundige Hulp voor den kleinen burgerstand te 's Gravenhage” (Association for Extraordinary Obstetrical Assistance for the lower middle-class in The Hague) gave obstetrical assistance for a small price and collected data on the number of deliveries and complications in its group of patients. It becomes clear from the table that was made out of these data that between 1890 and 1896 less than 1% of the deliveries assisted by the Vereeniging was complicated by a narrowed pelvis. (Table 2) (62-68)

In his dissertation of 1891, about the obstetrical clinic of the University of Amsterdam, HJ Hart described the prevalence of narrowed pelvises to be 4%, but he supposed only the heaviest cases to be described. Milder cases were presumably not recognized. (69)

Publications with data from 1896 and 1897 also showed a higher prevalence than in the Hague: for example, in the City Clinic in Amsterdam, 6% out of 529 women giving birth needed an intervention because of a severely narrowed pelvis, of which about two third was caused by rickets. (70)

Professor Treub described in the same year that 63 women, i.e. 12% of all women in the Amsterdam Academical clinic, suffered from a narrowed pelvis, of which 30 were caused by rickets. (71)

However, the next year the number of patients in the Amsterdam City Clinic tripled to 1600, but the number of women suffering from a narrowed pelvis only doubled to 67 (4.2%), of which only 15 women, less than 1%, suffered from rickets. (72)

In the review “Baring bij bekkenvernaauwing.” (Deliveries with a narrowed pelvis.) from 1900 professor G.C. Nijhoff described women with narrowed pelvises and the course of their deliveries. (73) Out of one hundred women giving birth, 33 suffered from a narrowed pelvis, of which 21 were classified as rachitic. He compares this to data from other clinics: 5% in Rostock, 18% in Dresden, 14% in Marburg (all in Germany) and 12-14% in Amsterdam (the Netherlands).

Nijhoff explained the high number in Groningen by the fact that only women who were expected to or already had problems during labour, were brought to the University clinic. It is unclear whether this is a good explanation, because it is not known what population came to University clinics in other cities. Nijhoff also described the difficulties doctors have in determining whether a narrowed pelvis is due to rickets, because sometimes the diagnosis seemed clear but the family of the patient denied that the patient had ever suffered from rickets. The other way round a patient sometimes reported she suffered from the disease, but did not have other rickets-related signs. He concluded: “In these circumstances the classification of a pelvis as either or not rachitic always depends on subjective views and it does not surprise, that with respect to many doubtful cases, the judgment of one person will be different from that of another person.”

As a context to the collected data, Nijhoff writes that for this study, only women who had clear signs of rickets were classified as rachitic, so patients who had a history of rickets but no clinical signs were classified as not rachitic. He continued: “I say this for it gives me the right to point at the extraordinary high frequency of not only narrowed pelvises in common, but especially of rachitic pelvises, largely among the poorest of all inhabitants of the countryside in the heath regions of Friesland and Drenthe.”

In 1890 Theobald Palm published his famous treatise on rickets, “The geographical distribution and aetiology of rickets”, in which he gives an overview of the prevalence of rickets all over the world: “Its principal seats are Germany, England, Holland, Belgium, France, and northern Italy”. It is also written that: “in amount and severity of type it stands in a definite relation to climate, that countries with a cold and wet climate, subject to frequent changes of weather, such as Holland, many parts of England, the north German plain, the



mountainous regions of central and southern Germany, and the plains and mountainous districts of Northern Italy, if they are not the exclusive seats of rickets, are at least its headquarters. In keeping with this, we find, moreover, that there is most of the disease in the countries named wherever the nature of the soil has a good deal to do with the character of the climate, e.g. in the wet plains of Lombardy, of Alsace, of Holland, of Belgium and of northern Germany,(...)" (74)

Emilie Frey writes in her dissertation "Beitrag zur aetiology der Rachitis" (Contribution to the aetiology of rickets) (1896): "The rickets is found a lot in Germany, in the Netherlands, in England, France and North-Italy" and "With the character of an endemic disease we find it in the damp and boggy districts of Holland and Belgium, (...)" (75)

An interesting fact is that both Palm and Frey, and much earlier also Petrus Ens, described rickets to be related to the climate. It is possible that this connection was caused by the amount of sunlight, but this is not exactly what these authors described: according to them, rickets was not attributed to a lack of sunlight, but to the amount of water and rainfall in a region.

From the annual reports of the bureau for Statistics covering the years 1893-1900 it becomes clear that 78 persons died because of scrofulosis or rickets annually, on an average of 8941 deaths a year in the period 1893-1900.

From 1901 on, the statistical reporting changed and rickets was no longer listed as a cause of death. A new category was found though, about the number of stillborn children due to changes of the motherly pelvis. On the total amount of stillborns from 1901 till 1910, an average of 2.7% was caused by a deformation of the motherly pelvis and an average of 5.2% was caused by disorders in the position of the child. From 1911 till 1915, these two categories are put together in a new category. The average percentage of this combined category is 7.9%, which totals the same (2.7% + 5.2%) as in the period the two categories were apart. This makes it likely that the amount of deaths due to a deformed pelvis of the mother remained a constant 2.7% over the period 1901 till 1915. (76)

In 1911 the book "De sociale beteekenis en de bestrijding der Engelsche Ziekte" (The social meaning and the fight against the English Disease), written by Israel Zeehandelaar, was published. Zeehandelaar wrote this book to call attention to the impact of this disease: "In our

country and especially in Amsterdam, each year again unfortunate people are made, whose deformity could have been prevented; every year lots of children die, who should not have had to die; every year lots of women give birth under the most difficult circumstances, that would not have been necessary, when enough attention had been given to their English disease in their youth. Every year lots of recruits are rejected, who would have been able to fulfil their duty, had attention been given to their rickets in their youth. Everyone knows these facts; no one, who cares about it.” (6f)

To prove this, Zeehandelaar studied the prevalence of the disease in Amsterdam. He asked several heads of paediatric polyclinics for their books, to search them for the prevalence of rickets in their clinic. He did not go to the clinics for internal medicine, because he said: “it is true, as one of their heads wrote me, that almost every child, visiting the ordinary clinics in Amsterdam, suffers more or less from the English disease. Luckily, the milder cases heal by their selves, without leaving traces.” (6g)

In the four largest hospitals 71 children were nursed for rickets in 1909. According to Zeehandelaar “this data gives an incomplete view: it is far too low. Patients who were in the hospital for other disease, but also suffered from rickets, are not counted. Neither are the many patients with orthopaedic and surgical disorders originating from rickets, who are taken in for an operation. Furthermore, the children with English disease are usually not referred to a hospital, because they are not considered as real patients.” (6h)

Apart from the data from the clinics, Zeehandelaar also studied the reports of the Gemeentelijke Geneeskundige Dienst (Communal Medical Service) in the years 1907 till 1909 and a part of 1910, which contained all data of prevalences of diseases, as collected by the communal doctors. As Zeehandelaar already mentioned, this data probably gave an underestimation of the prevalence of rickets. First of all, only cases in which rickets was the primary reason for visiting and could be diagnosed were registered. Secondly, in the busy urban polyclinics, the registration of every case was not a priority and thus the data were incomplete. Finally, the large group of “ziekenfondspatienten” (patients who had a government funded health insurance) did not visit the polyclinics. Despite this, in three years 1160 cases of rickets were reported by the communal doctors. (6i)

Zeehandelaar concluded that “the English disease truly occurs very much in Amsterdam, also in the most severe degrees (...) I come to the conclusion that in Amsterdam every year at least 1000 children with severe rickets are treated.” (6h)

In a review of Zeehandelaar's book professor Cornelia de Lange supported this statement: "This is definitely not an overestimation". She also wrote about "the Amsterdam doctors, who treat children with rickets daily." (77)

Zeehandelaar also gave some data concerning the situation in other countries. Kassowitz found in Vienna that out of 1000 children, 895 no doubt suffered from rickets, of which 330 already had severe changes in their skeleton. In London, Berlin and Dresden a considerably lower frequency of rickets was found than the almost 90% in Vienna, but the studies in these cities did not count the children with mild rickets. (6k)

About the meaning of rickets for the obstetrics, Zeehandelaar wrote: "The frequency of narrowed pelvises is not minor; in Germany the reported frequency ranges between 5% and 27% (Krönig). In our country the frequency of narrowed pelvises differs locally. According to Professor Treub it is extraordinary high in Leiden, on the contrary in Amsterdam it is much smaller. Treub says: "Everything together, rachitic pelvises occur very frequently." (6j) It is not described what number Treub meant when he said "extraordinary high", but he said the number in Leiden is higher than in Amsterdam. It is known from Treub's yearly report from Amsterdam in 1896 (see page 20), that in this city 12% of all women giving birth suffer from a narrowed pelvis and half of these deformities were due to rickets, so the prevalence in Leiden must be even higher than 6%.

The data found about females suffering from a narrowed pelvis is remarkable. Numbers given vary from 1% to 21% for the period 1890-1910 and are not always in line with the data found about children suffering from rickets twenty to thirty years earlier.

The finding that the number of females diagnosed with a deformed pelvis is often much lower than the number of children suffering from rickets can be explained in many ways. First of all, the classification of narrowing of the pelvis as either rachitic or not is subjective. Secondly, a mildly narrowed pelvis does not always lead to a complicated delivery, and is therefore not always diagnosed. Then, looking at absolute numbers, it is logical that at most half of the children who suffered from rickets are diagnosed with a narrowed pelvis later in life, as men will never give birth.

Zeehandelaar also gives a possible explanation: "Of the exceptionally high amount of little sufferers from the English disease not very much is found later. There are more than enough,

who survive with remnants of the disease, as well as some survive without the disease leaving traces, but an important part has already died because of other ailments.”

The situation in the Emma’s Children’s Hospital is described in a historical article from 1990; out of a total of 930 children admitted to the hospital in 1914, the primary diagnosis was rickets in 28 cases. Most children in the hospital came from the poorer parts of Amsterdam, such as the Jordaan. (78)

By 1924 much more was known about the cause of diseases such as rickets, scurvy and beriberi. In JC Strengs dissertation, “Over rachitis als deficientie-ziekte” (about rickets as a deficiency disease), the author was very optimistic about the possibilities for curing rickets. In chapter 4, he described his own study, for which he examined one hundred children from the vicinity of Leiden in 1922 and 1923. He divided the examined children in four groups: (79)

|                          |          |
|--------------------------|----------|
| Group 1 (no rickets)     | 14 cases |
| Group 2 (mild rickets)   | 45 cases |
| Group 3 (clear rickets)  | 27 cases |
| Group 4 (severe rickets) | 14 cases |

In 1927 Hans Bergmann published his dissertation, “Die Verbreitung der Rachitis” (The distribution of Rickets), in Germany, in which he writes: “On the whole, rickets seems to be widespread in the West European countries. All news reports from the Netherlands complain about the endemical occurrence of the disease in the swampy lowlands and the larger cities. Voûte saw in Amsterdam 16% rachitic, (...). The forms of rickets are said to be especially heavy in Holland.” (80) It becomes clear from these dissertations that rickets was highly prevalent in the 1920’s. Besides that, rickets is still described to be related to the swampy nature of the Netherlands.

Still many children suffered from rickets in 1941, as reported by consultation bureaus for children in the Netherlands. (81) Tausk also stated in his book in 1945: “We can eliminate the rickets but we still have not done it. There still is a lot of rickets in the Netherlands.” (9j) In 1964 it is concluded that rickets is not prevalent anymore. The estimated number of cases of rickets in the Netherlands is less than one hundred a year. (82)

The most troublesome forms of rickets nowadays are those that have an underlying chronic disease. Nevertheless, rickets primarily caused by vitamin-D deficiency never disappeared. In 1982 it was noticed that rickets is re-emerging, mostly in immigrant children. (83) Recently, the Dutch Health Council (Gezondheidsraad) reported that there is still a large group of people, among them children, who have an inadequate vitamin-D level in their blood, although this rarely leads to rickets. (84)

## **Osteo-archaeology**

In March 2005 part of the floor of the Nieuwezijds Chapel in Amsterdam was uncovered. (85) A number of skeletons was excavated, on which a physical anthropological examination was performed. The study in the Nieuwezijds Chapel showed that 29% of the examined individuals suffered of rickets more or less. It is questionable though, whether a conclusion about the prevalence of rickets in Amsterdam can be drawn. First of all only 20 individuals could be studied. Secondly, it was not possible to determine the exact year of burial: it happened somewhere between 1789 and 1862. Finally it did not become totally clear from which socioeconomic level the buried persons descended. They probably came from the working class and consisted of hand workers, but this is not entirely certain, so a conclusion about the prevalence in the entire population cannot be made.

Two other archaeological studies were performed in the Grote Kerk (Great Church) of Alkmaar en de Broerenkerk in Zwolle. (86)

All excavated skeletons in the Grote Kerk were buried there between 1716 and 1830, and were from predominantly prosperous people. Of the examined 250 individuals only one was found to have rickets. (85) It is important to notice that in the course of the 18th century rickets had turned from a disease of the rich people into a disease of the poor, although the exact moment and cause of this change are unclear. This fact possibly explains the low prevalence of rickets among Alkmaar's rich.

In the Broerenkerk in Zwolle people were buried from the 15<sup>th</sup> century on, till 1828. A substantial amount of the examined individuals could be identified from the registers of the church and were buried between 1819 and 1828. Signs of rickets were found in 5,3% of the examined skeletons.

The Hovius and Vrolik collections of pathological bones are discussed in the appendix. It is not clear whether the prevalence of diseases in the collection Vrolik is representative for the prevalence of diseases in the time the collection was gathered. However, the fact that pelvises affected by rickets are present in the collection, tells us that the disease did occur in the Netherlands and that it was sometimes severe enough to heavily deform females pelvises. Out of 93 malformed pelvises in the collection Vrolik, mostly gathered by Gerardus Vrolik, who

practiced as an obstetrician for over thirty years (1796-1828), 10 pelvises show signs of rickets.  
(87)

The collection Hovius contains 25 bones affected by rickets, approximately 5% of the total amount of 484 human bones.(88) Although it was not possible to determine whether the prevalence of certain diseases in the collection is representative for the prevalence of these diseases in the 18<sup>th</sup> century, it does tell that at least a certain number of people suffered from rickets in Amsterdam in the 18<sup>th</sup> century.

## Conclusion

Although some conclusions can be drawn from the results with reasonable certainty, other conclusions remain debatable.

First of all it should be concluded that, though very useful for this study and sometimes available for periods when no data on rickets was found, data on narrowed pelvises is less reliable than data about rickets itself.

About the prevalence of rickets it is clear that the disease was first recognized as such in the Netherlands around the same time as in other countries, somewhere in the 17<sup>th</sup> century. However, it is unlikely that it really was a new disease, since the disease seems to have existed before the current era. It is certain that from the 17<sup>th</sup> century on, the disease remained present in our country.

There is also enough evidence to conclude that rickets had become highly prevalent by 1890 and, looking at the amount of females with a narrowed pelvis at the end of the 19<sup>th</sup> century, probably some time earlier. In spite of the progress made in the scientific knowledge of vitamins and deficiency diseases, the situation had not improved in 1927, maybe even got worse, when compared to the situation a few decades before.

The question remains when exactly this change from an infrequent occurring disease to an endemic disease has happened.

It is possible that rickets arose as early as the end of the 18<sup>th</sup> century. The only source supporting this is Ackermann (1794). The monthly guild notebook of diseases, although not very reliable, does not point to a high frequency at the end of the 18<sup>th</sup> century, nor does the scarcity of literature about rickets in this period.

Until 1850, rickets is hardly ever mentioned in a scientific article. In 1851, it is mentioned that the prevalence of osteomalacia seemed to be rising.

The annual reports (1849-1855) from the Leiden obstetrical clinic, where the poorest females came, show that only a minor part (probably only 1%) of females had a narrowed pelvis. The Bureau for Statistics also reports only a few deaths due to rickets, though it is mentioned before that this was unreliable for determining the prevalence. These data suggest that rickets was only a minor problem these days, but opposing this is the dissertation of Petrus Ens, who wrote as early as 1832 that he saw rickets daily and called it an endemic disease. The



excavation in Zwolle found rickets in 5.3% of the people buried before 1828, a number that can not be called endemic, but is higher than might be expected from the other sources.

It is clear that no definite conclusion can be drawn yet about when the increase in the prevalence of rickets started, although it is most likely that this happened somewhere between 1800 and 1860.

It is difficult to give an answer to the last research question, about the causes of the rise in the prevalence of rickets, because it is not even sure when this rise started.

If the rise began at the start of the 19<sup>th</sup> century, the decrease in the consumption of fish might be the main cause, but it cannot be excluded that the poverty after the French occupation and the collapse of the economy was a more important factor.

In case the increase of rickets started after 1850, the industrialization with all its effects is most likely the cause.

Further research is needed to give an answer to these remaining questions.

## Discussion

One of the problems every historical study encounters is how reliable the sources really are. This is not different for this study, and it is not possible to determine the reliability of the data with a statistical test, like it is in medical studies.

It is therefore important not to base a conclusion on one single source, but to try and find more sources that confirm the findings. This was especially problematic for the first half of the 19<sup>th</sup> century. A fair amount of texts referring to rickets was found, but most of these texts express merely the view of the author. They tell mainly that rickets exists, or that it is “a problem”, but do not often provide us with objective data on the prevalence and severity of the disease. The quality of the data found for the end of the 19<sup>th</sup> century is better. There are more numerical data available on the prevalence and, also very important; most authors seem to agree about the prevalence.

The idea of this study was at first to focus mainly at the situation in Amsterdam. It became clear soon after the start of the study that 19<sup>th</sup> century data on rickets is pretty scarce for the Netherlands as a whole, let alone for Amsterdam. It was decided to describe the situation in the whole country. However, time was too limited to visit all City Archives in the Netherlands that could possibly have information on rickets, reason why this section of the results only deals with Amsterdam. It is very well possible that other archives contain more data on rickets in the Netherlands, most likely more mortality reports. However, a problem in the Amsterdam mortality reports that probably all mortality archives may have is that rickets is not very often the primary cause of death. Zeehandelaar wrote that “the children do not often die of the English Disease as such; but how many children die of spasms, internal affections, pneumonia, measles, whooping cough, and others, who would not have died, when the English Disease they suffer from as well, had not severely weakened their immune system, cannot be estimated.” (6a)

Therefore, it is likely that the numbers of deaths the mortality reports give is lower than the amount of children who really suffered from rickets.

## **Suggestions for future research**

The author is rather confident that most of the available sources for the period after 1830 were studied. The volumes of the Dutch Journal for Obstetrics and Gynaecology that were published after 1900 were not studied. This would probably not be very useful, because the conclusion about the period after 1890 is supported by enough evidence. The same is true for the reference Zeehandelaar made to the statistics the GGD (Medical and Health Department) kept at the beginning of the 19<sup>th</sup> century. Another unused source are the annual reports from the Leiden University Obstetrical Clinic. Only the reports in the period 1849-1855 were used, because the data from these reports were available from the *Nederlandsch Lancet*. After 1855, the reports were still published every year, but as individual dissertations. They were published at least until 1900, so all reports together would give a perfect view over the decades of the amount of females who suffered from a narrowed pelvis. This would, however, represent a huge amount of work, because it might be difficult to locate all dissertations and it might not be unlikely that some got lost over the years.

The best option for further research would be to study the sources available for the period before 1830. Probably, more archaeological studies have been done in which skeletons from this period were excavated and studied for diseases. Other city archives, for example in Leiden or The Hague, might also provide more information, albeit death rates extracted from these archives may have the same shortcomings as the data obtained from the archives of Amsterdam.

Medical journals from this period that have not been studied yet include “Hippocrates”, “het Geneeskundig Magazijn” and “Arti Salutiferae”. It is very well possible that in these journals some more articles can be found that give a clue to the prevalence of rickets.

# **The pathological bone collections of Hovius and Vrolik**

## ***Introduction***

A sidestep from the main questions of investigation of this study is the research of the collections Hovius and Vrolik.

The collection of the Museum Vrolik is based on the private collection of Gerardus and his son Willem Vrolik and dates back to the beginning of the 19<sup>th</sup> century. (89)

It contains two large historical collections: the collection of father and son Vrolik, which was gathered between 1800 and 1850, and the collection of the surgeon Hovius, which was collected somewhere between 1736 and 1782. Recently an inventory of the osteopathological part of both collections was made. (87,88)

Both osteopathological collections contain an amount of bones with deformities due to rickets. One of the main questions here is whether the amount of rickets in the collection, when compared to other diseases, is representative for the actual prevalence of rickets at the moment the collection was gathered. When this is the case, the collections might also be useful for historical research for other diseases.

## ***Methods***

### **Hovius**

The collection Hovius consists of a total amount of 406 human bones, all showing deviations due to fractures, tumours and inflammatory or other diseases.

The diseases in the collection of Hovius were compared to the “monthly notebook of deaths”, made up by the guild of surgeons in the period of 1774-1805, the best available and most easily accessible source for information about diseases in Amsterdam in the 18<sup>th</sup> century.

### **Vrolik**

The collection Vrolik contains 767 human osteopathological pieces. The 101 skulls and 103 pelvises have recently been inventoried and diagnosed. The other bones, mostly bones of arms, legs and hands, were not inventoried. An attempt to make a start with the other bones learned

that this is difficult and would not be helpful for the purpose of this study. First of all, diseases like tuberculosis or syphilis usually do not leave traces in the bones of the limbs. Secondly, in the catalogue of the Vrolik collection it is described that most bones of limbs were simply put in the collection because they were fractured or otherwise damaged, rather than being affected by an identifiable disease. (90)

## ***Results***

### Hovius

In the monthly notebook of deaths, only a few diseases that can be found in bones are described. The only diseases described, and therefore comparable with the Hovius collection, are rickets, (urinary bladder-, gallbladder- and kidney-) stones, tumours and fractures. According to the notebook, rickets and stones are very rare causes of death, cancer is more prevalent and trauma is very common. In the collection a higher amount of rickets and stones is found and a lower amount of tumours. (Table 3)

### Vrolik

The collection Vrolik was more difficult to study. The collection was gathered in the decennia between 1800 and 1860. The only data on diseases available from the city archive is the data from the monthly notebook of deaths (1774-1805) and the data from the bureau for statistics (1854-1860), so there is incomplete overlap between the data and the collection. (33,59) Moreover, the only diseases that have been diagnosed on the skulls and pelvises and can be compared to the data are *ulcus noma*<sup>\*</sup> and syphilis. Other diseases diagnosed are arthritis and very rare diseases like *leontiasis ossea* and *porotic hyperostosis*. No bones with traces of tuberculosis or other common lethal diseases were found in the collection.

## ***Discussion & Conclusion***

### Hovius

It proved difficult to compare the collection with the guild notebook. First of all, the notebook kept only deaths, where most of the bones in Hovius' collection were not deviated from lethal

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<sup>\*</sup> *Ulcus Noma* is an orofacial ulcer associated with malnutrition and recurrent infection. Untreated it has a mortality of 90%. Nowadays it has almost disappeared from the Netherlands, but until the 19<sup>th</sup> century it was highly prevalent and in developing countries it still is. (91)

diseases. Injuries or stones were usually not lethal and thus not incorporated in the notebook, but were highly present in the collection. Secondly, diseases like tumours and tuberculosis were present in both the collection and the notebook, but the notebook did not specify the localization of the disease. There were large differences in the prevalence of certain diseases, including rickets, according to the monthly notebook of deaths and the collection Hovius. With respect to these difficulties in comparison, this small study could not give a clue as to how representative the collection is for the prevalence of diseases in the 18<sup>th</sup> century.

### Vrolik

Neither can a conclusion be made about the representativeness of the collection Vrolik for the prevalence of diseases in the first half of the 19<sup>th</sup> century, because the collection and the available data did not have enough diseases in common to be compared with each other.



Skeletons deformed by rickets in the collection of the museum Vrolik.

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**Table 1**

| <b>Report on the Leiden Obstetrical Clinic</b> |                   | <b>"Verslag der Leidsche Verloskundige<br/>Kliniek"</b> |                   |   |
|--|-------------------|---|-------------------|---|
| <b>Year</b>                                    | <b>Deliveries</b> | <b>Narrowed Pelvises</b>                                | <b>Percentage</b> | <b>Narrowed pelvises<br/>definitely caused by rickets</b> |
| 1849   | 72                | 7   | 10 %              | 2   |
| 1850   | 56                | ?   |                   | 1   |
| 1851   | 105               | 12  | 11 %              | 1   |
| 1852   | 138               | 7   | 5 %               | 1   |
| 1853   | 152               | 13  | 9 %               | ?   |
| 1854   | 130               | 12  | 9 %               | 1   |
| 1855   | 180               | 12  | 7 %               | 2   |
| Total  | 777               | 63  | 8,1 %             | 8,0 (=1%)   |

**Table 2****Annual report of the Association for Extraordinary Obstetrical Assistance  
for the lower middle-class in The  
Hague**

"Jaarverslag van de Vereeniging tot verleenen van Buitengewone Verloskundige  
Hulp  
voor den kleinen burgerstand te 's Gravenhage"

| <b>Year of<br/>publication</b> | <b>Concerning<br/>year</b> | <b>Deliveries total</b> | <b>help/operation/forceps</b> | <b>Narrowed pelvises</b> |                   |
|--------------------------------|----------------------------|-------------------------|-------------------------------|--------------------------|-------------------|
|                                |                            |                         |                               | <b>Total</b>             | <b>Percentage</b> |
| 1890                           | 1890                       | 2254                    | 143                           | 15                       | 0,7               |
| 1891                           | 1891                       | 2220                    | 125                           | 8                        | 0,4               |
| 1893                           | 1892                       | 2387                    | 162                           | 20                       | 0,8               |
| 1894                           | 1893                       | 2444                    | 151                           | 14                       | 0,6               |
| 1895                           | 1894                       | 2460                    | 107                           | 18                       | 0,7               |
| 1897                           | 1895                       | 2336                    | 146                           | 16                       | 0,7               |
| 1898                           | 1896                       | 2552                    | 124                           | 21                       | 0,8               |

**Table 3**

**Hovius collection versus the monthly notebook of diseases**

|                                  | 1774 | 1775 | 1776 | 1777 | 1778 | 1779 | 1780 | 1781 | 1782 | Total       |
|----------------------------------|------|------|------|------|------|------|------|------|------|-------------|
| Trauma (Fractures / Deadly fall) | 31   | 48   | 24   | 35   | 1    | 1    | 5    | 3    | 0    | <b>148</b>  |
| Accidents and Tumours            | 30   | 39   | 51   | 50   | 79   | 74   | 68   | 55   | 67   | <b>513</b>  |
| Rickets                          | 6    | 12   | 6    | 2    | 1    | 1    | 0    | 1    | 0    | <b>29</b>   |
| Stones or urinary gravel         | 10   | 11   | 6    | 4    | 4    | 9    | 4    | 5    | 6    | <b>59</b>   |
| Cancer                           | 34   | 39   | 24   | 35   | 36   | 33   | 39   | 42   | 39   | <b>321</b>  |
| Total                            |      |      |      |      |      |      |      |      |      | <b>1070</b> |

**Diseases in Hovius' cupboard**

**Monthly Notebook of Deaths**

|           | Amount | % of total | % of total |
|-----------|--------|------------|------------|
| Fractures | 131    | 67         | 14         |
| Rickets   | 25     | 13         | 3          |
| Stones    | 32     | 16         | 6          |
| Cancer    | 7      | 4          | 30         |
| Total     | 195    |            |            |

| Amount | % of total |
|--------|------------|
| 148    | 14         |
| 513    | 48         |
| 29     | 3          |
| 59     | 6          |
| 321    | 30         |
| 1070   |            |



## **Appendix 1**

There are a few differences between the final study and the original research description. It was planned to study at first the pathological bone collections of Hovius and Vrolik. However, as is described in the appendix on this study, it became clear soon that the amount of data and the possibilities for research were not very promising, reason why most of the time was spent at determining the prevalence of rickets.

Another difference is that it was planned at first to focus mostly on the situation in Amsterdam alone, but this was changed to a study of the situation in the whole Netherlands. This is because the data on Amsterdam was so limited that it seemed more promising to describe the situation in the whole country.

## **Appendix 2**

This research project was only slightly concerned with earlier anatomical and medical-historical research in the AMC. The research question was formulated by the student and the daily tutor together. The gathering, studying and interpretation of the sources were done by the student alone. The found results and interpretation were discussed with the tutor regularly.



## Appendix 3 Project Description

|                           |   |
|---------------------------|---|
| <b>Titel project</b>      | <b>Het verband tussen het voorkomen van rachitis in de verzamelingen Hovius en Vrolik en in Amsterdam 1750-1850</b> |
| <b>naam student</b>       | Thomas Boerlage   |
| <b>Senior onderzoeker</b> | Prof. dr. EMH Mathus-Vliegen  |
| <b>Begeleider</b>         | dr. L. de Rooy, Museum Vrolik, Afdeling anatomie & embryologie, t: 5664664, e: l.derooy@amc.uva.nl                  |
| <b>Werkplek:</b>          | J0-109, J0-130, Z01-226   |
| <b>Begin datum:</b>       | 02-02-2009  |
| <b>Eind datum:</b>        | 05-06-2009  |

### **Inleiding**

#### ***achtergrond & probleemstelling***

In de verzameling van museum Vrolik bevinden zich twee grote deelcollecties osteopathologie, menselijke beenderen, schedels en skeletten die door ziekten zijn aangedaan. De oudste van de twee is de verzameling van Jacob Hovius (1710-1786), inwonend geneesheer van het toenmalige buitengasthuis. De andere collectie is een onderdeel van de verzameling pathologische anatomie die hoofdzakelijk bijeengebracht is door Gerard Vrolik (1775-1859), hoogleraar botanie, verloskunde, anatomie en chirurgie aan het Atheneum Illustre.

Kort geleden zijn beide verzamelingen in de vorm van stages door studenten geneeskunde geïnventariseerd en opnieuw gediagnosticeerd.\* Een belangrijk resultaat van de stages was dat de collectie voor een groot deel bleek te bestaan uit gevallen van TBC, syfilis en rachitis. Deze stage zal een stap verder gaan en wil met de rachitische beenderen en skeletresten als uitgangspunt een beter beeld krijgen van het voorkomen van rachitis in de 18<sup>e</sup> en 19<sup>e</sup> eeuw in Nederland en vooral Amsterdam. Het gaat hierbij niet zozeer om medisch biologische kwesties, maar om medisch historische.

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\* Patricia van Velzen, herinventarisatie en rediagnostiek van de osteologische preparaten uit de Hovius collectie (2002) Ruud Man in 't Veld, herinventarisatie en rediagnostiek van de osteologische preparaten uit de Vrolik collectie (2004)

De Engelse arts en hoogleraar Francis Glisson (1597-1677) was een van de eersten die in 1650 rachitis als afzonderlijke ziekte erkende.\* Het is echter de vraag of de ziekte in die tijd heel veel voorkwam. In ieder geval steeg het aantal gevallen van de ziekte in Engeland schrikbarend vanaf het einde van de 18<sup>e</sup> eeuw. De industriële revolutie die toen in Engeland begon leidde tot een enorme trek naar de steden met als gevolg een groeiende armoede, stedelijke vervuiling, ondervoeding en kinderarbeid. Deze verloedering leidde tot een toename van allerlei ziekten. Rachitis, ‘Engelse ziekte’ was een van de belangrijkste van deze aandoeningen.

Rachitis is het gevolg van een tekort aan vitamine D en calcium. Al op jonge leeftijd raken de ledematen er door vergroeid waardoor vooral het lopen wordt bemoeilijkt en uiteindelijk vaak onmogelijk wordt. Ernstiger is het effect van de ziekte bij zwangere vrouwen. Door de vervorming van het bekken is een normale bevalling vaak onmogelijk of zeer problematisch. In het verleden had de vervorming dan ook meestal het desastreuze gevolg dat zowel moeder als kind stierven tijdens de verlossing.† Vooral de verzameling van Gerard Vrolik bevat een groot aantal vrouwenbekkens, dat door rachitis is aangedaan. Vrolik had als hoogleraar Verloskunde de leiding over een eigen kraamzaal in het Binnengasthuis en kon in die hoedanigheid veel pathologisch materiaal verzamelen.‡

Als het grote aantal rachitische beenderen in de verzamelingen van Hovius en Vrolik een maat is voor het voorkomen van de ziekte in de 18<sup>e</sup> en 19<sup>e</sup> eeuw is dat medisch historisch gezien een opvallend verschijnsel. De ziekte nam immers in Engeland vooral toe tijdens urbanisatie van de industriële revolutie, en die industrialisatie werd in Nederland pas tegen het einde van de 19<sup>e</sup> eeuw, veel later dus, in gang gezet.

### ***Vraagstelling***

De vraag is dan ook: als de hoeveelheid rachitische skeletten en skeletdelen in de collectie iets zegt over het voorkomen van rachitis in Amsterdam tussen 1750 en 1850, wat is dan bij uitblijven van industrialisatie, de oorzaak van dit veelvuldig voorkomen van rachitis? Om deze vraag goed te kunnen beantwoorden moet dus eerst bepaald worden of er überhaupt een verband bestaat tussen het voorkomen van bepaalde ziekten (w.o. rachitis) in de verzamelingen van Hovius en Vrolik en het voorkomen van deze ziekten tussen 1750 en 1850 in Amsterdam.

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\* Porter, Roy, The greatest benefit to mankind, p 222

† deze sterfte werd in de hand gewekt door de kraamvrouwenkoorts als gevolg van de ongewassen handen van de vroedvrouw of vroedmeester.

‡ De Rooy, L, Gerard Vrolik: multidisciplinair medicus en verloskundig verzamelaar, in: Ships that pass in the night, Liber Amicorum bij ht afscheid van Prof. Dr. O.P Bleker, AMC, 2006

### ***Hypothese & Doelstelling***

Als inderdaad het aantal gevallen van rachitis in de verzameling duidt op een aanzienlijk voorkomen van deze ziekte in die periode in Amsterdam, dan zou de oorzaak hiervan waarschijnlijk te maken hebben met de verloederde toestand waarin de stad verkeerde na de ‘gouden’ 17<sup>e</sup> eeuw en voor de industrialisatie van de late 19<sup>e</sup> eeuw. Niet zozeer de gevolgen van de industriële bloei, maar eerder het tegenovergestelde zou dan de oorzaak zijn voor het veelvuldig voorkomen van rachitis.

Het doel van het onderzoek is om uiteindelijk meer te weten te komen over het voorkomen van rachitis in de 18<sup>e</sup> en 19<sup>e</sup> eeuw, hoofdzakelijk in Amsterdam om zo de verzameling rachitische beenderen en skeletten in het museum meer achtergrond te geven. Daarnaast is de hoop dat het onderzoek naar de verzamelingen rachitische beenderen van Hovius en Vrolik een uitbreiding of verbetering zal opleveren van de bestaande kennis over de historie van deze ziekte. Tenslotte zal dit onderzoek een pilotstudie zijn om te kijken in hoeverre de verzamelingen (de rachitische beenderen in het bijzonder en de gehele collectie in het algemeen) een bijdragen kunnen leveren aan medisch historisch of wetenschapshistorisch onderzoek. Los hiervan hoopt het onderzoek enig licht te werpen op de rol van de verzameling in het onderwijs in het verleden.

### **Methoden:**

macroscopisch morfologisch onderzoek aan skeletten en skeletdelen, literatuurstudie, archiefonderzoek.

### **Taakomschrijving en suggesties voor aanpak:**

#### ***1: onderzoek collecties museum vrolik:***

Aan de hand van eerder gedaan onderzoek<sup>\*</sup> en met behulp van de oorspronkelijke catalogi van de museumverzamelingen zal de student een inventarisatie maken van het door rachitis aangedane botmateriaal en de andere duidelijk te diagnosticeren ziekten. Aan de hand daarvan zal hij een inschatting maken van het percentage aan rachitis in de collectie in verhouding tot andere aanwezige ziekten. Hierbij zal gebruik gemaakt worden van bestaande medische literatuur over aard en oorzaak van de ziekte en archeologische literatuur over de morfologie van door de ziekte aangedane skeletdelen.

#### ***2: literatuur en archiefonderzoek***

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<sup>\*</sup> zie en Van Velzen (2002) en Man int’ veld (2004)

Vervolgens zal er aan de hand van secundaire en primaire literatuur en archieven onderzoek gedaan worden naar ziekte, gezondheid, armoede en voeding in het 18<sup>e</sup>- en 19<sup>e</sup>-eeuwse Amsterdam in het algemeen, en naar het voorkomen van rachitis in Amsterdam, Nederland en indien nodig in andere Europese landen. Tevens zal gekeken worden naar de 18<sup>e</sup>- en 19<sup>e</sup>-eeuwse opvattingen over het ontstaan en voorkomen en eventuele behandeling van deze en andere ziekten. Tenslotte zal getracht worden het onderzoek naar de collectie in verband te brengen met de resultaten uit het literatuuronderzoek.

### **Tijdschema:**

02-02-2009 -13-03-2009: onderzoek collectie

16-03-2009 - 08-05-2009: literatuur en archiefonderzoek

11-05-2009 - 05-06-2009: schrijven van het verslag.

### **Referenties:**

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