
How has pregnancy duration been determined throughout history?

IN BYGONE DAYS

PER E. BØRDAHL

Per E. Børdahl, specialist in obstetrics and gynaecology, retired senior consultant and professor

The author has completed the ICMJE form and declares no conflicts of interest.

ERLEND HEM

erlend.hem@medisin.uio.no

Erlend Hem, head of the Institute for Studies of the Medical Profession, professor at the University of Oslo and chairman of the Health History Forum

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The end of pregnancy can be recorded with precision, but determining when it started is more challenging. Should it be calculated from the intercourse that led to fertilisation, from ovulation, from fertilisation itself, or from implantation? In any case, pregnancy does not actually begin on the first day of the last menstrual period, as has long been the reference point.

Modern pregnancy monitoring and obstetric care are difficult to imagine without knowledge of how to calculate gestational age [\(1\)](#). From the late 1950s, it was possible to examine the fetus in utero using ultrasound [\(2\)](#), and technological advances since the 1970s have allowed for increasingly precise determination of fetal age. This is essential for diagnosing growth abnormalities, assessing fetal health and well-being, and deciding whether

labour should be induced before the onset of spontaneous contractions. Ultrasound has also made it possible to estimate fetal growth and weight, and to distinguish between preterm and growth-restricted infants.

The end of pregnancy can be recorded to the minute. But when should it be calculated from? (3) Neither ovulation nor implantation can be easily determined, and fertilisation is only rarely the result of intercourse that can be precisely dated.

In this article, we examine how pregnancy duration has been determined throughout history, drawing largely on the first author's historical obstetrics library.

Tradition and theology

Notions of pregnancy duration date back centuries in the literature. In 'Rígsþula', part of the collection of poems named *Den eldre Edda* (the elder Edda) (c. 1000 AD), the god Heimdall embarks on a journey (4). He visits three married couples, sleeps with each of the wives, and sires the beginnings of three social classes: slave, farmer and noble. In each case, the woman gives birth nine months after Heimdall's visit.

In medieval folk ballads, pregnancy duration is frequently rendered as 40 weeks (5, 6). The ballad 'Hustru og Mands Moder' (wife and mother-in-law) is known in Norwegian, Danish, Swedish and English variants:

*I fyrretyv Uger gik Marri mæ Krist;
å så gör hver en Dankvin for vist.*

(7. pp. 412)

*[Forty weeks went Mary with Christ;
And so each Danish woman must.]*

(English version from
<https://www.gutenberg.org/cache/epub/44969/pg44969-images.html>)

In modern language:

*I førti uker gikk Maria med Kristus;
og slik gjør hver en kvinne, det er visst.*

*[Mary carried Christ for forty weeks;
and so, of course, does every woman.]*

In Landstad's collection of folk ballads, we find:

*Heime sat hon Kristi fruga
úti mánanne níe,
til deð leið at stundo dei
hon sill' eige sonen friðe.*

*[At home she sat, Christ's wife
for nine long months,
until the appointed hour arrived,
and she gave birth to her own Son of Peace.]*

(8)

In modern language:

*Hjemme satt hun, Kristi kvinne,
mens de ni månedene gikk,
til det led mot tiden
da hun skulle eie fredens sønn.*

*[At home she sat, Christ's woman,
through the nine months,
until the time approached
when she would give birth to the Son of Peace.]*

In Christian tradition, Jesus was believed to have been conceived by the Holy Spirit on the Annunciation, 25 March. Drawing on such theological reasoning, the doctor, anatomist and physiologist William Harvey (1578–1657) wrote in the mid-17th century that pregnancy from fertilisation to birth was 275 days; from the Feast of the Annunciation to the birth on 25 December (9). This stance was frequently adopted, including in Norwegian medical literature, well into the 19th century (10, pp. 257–8). The Virgin Mary was regarded as the protector and guardian of pregnant and labouring women, and her pregnancy was considered a model for all others (Figure 1). Her role as a biological exemplar reached its zenith in the 17th century (11).



Figure 1 The Annunciation is an early Renaissance fresco painted by Fra Angelico (c. 1395–1455) in the San Marco Monastery in Florence. The scene depicts the angel Gabriel announcing to the Virgin Mary that she will give birth to the Son of God – a key moment in Christian iconography. Mary is shown in a posture of humility, while Gabriel bows in reverence. Public domain

The duration of pregnancy as a cultural concept is also recognised in other societies, often associated with particularly important numbers (12). In these accounts, the period is measured from intercourse to birth. Pregnancy was

traditionally counted as ten lunar months, each comprising four weeks, with each week consisting of seven days. The number 40 holds a special place in culture, religion and tradition, including in connection with other phenomena [\(1\)](#). Comparisons with livestock led to human pregnancy being considered to last nine months. A rhyme from Helsingør on the Danish island of Zealand reads

*En Ko og en Kone,
en Pige [dansk uttale: pie] og en Kvie
de gaar lige [dansk uttale: lie] længe*

*[A cow and a wife,
a girl and a heifer,
they all go equally long]*

[\(6\)](#)

This comparative physiology was not confined to popular accounts. In Christiania (now known as Oslo), the Faculty of Medicine employed the same line of reasoning in 1847 when justifying to the Ministry the duration of a human pregnancy resulting in a live birth: 'likewise by analogy, drawn from reliable observations of domestic animals, particularly the gestation period of cows, which in days corresponds with that of humans [...]' [\(13\)](#).

The obstetrician Kristian Brandt (1859–1932) continued to refer to the cow throughout the 20th century in his textbook for midwives (several editions 1913–44): 'The cow is closest to the woman with regard to the duration of pregnancy; it is on average 285 days, but ranges between 240 and 321 days' [\(14, 67\)](#).

Medical literature

The medical view that pregnancy in most women lasted an average of 40 weeks, ten lunar months of four weeks each, or nine calendar months, dates from antiquity or possibly earlier. The same applies to the consensus that fertilisation occurs shortly after menstruation. Both Aristotle (384–322 BC) and the doctor Soranus of Ephesus (1st–2nd century AD) held that the greatest likelihood of intercourse resulting in a child was when it occurred shortly after the end of menstruation. Soranus' explanation was that before menstruation, the uterus was full and had no room for anything else [\(15, 16\)](#).

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The views of antiquity endured for centuries. The Scottish obstetrician William Smellie (1697–1763), whose works were quickly translated into German and French, claimed in 1752 that the likelihood of conception was greatest 'in those embraces (= sexual intercourse) which immediately follow the evacuation of the menses' [\(17\)](#). According to him, the uterus could not receive the child until it had been cleansed of blood.

A sophisticated study from the United States in 1995 demonstrated that the fertile period lasts approximately six days, concluding on the day of ovulation (18). Using prospective data from couples' attempts to conceive, combined with daily records of sexual intercourse, hormone measurements and urine testing, the researchers were able to pinpoint ovulation and delineate the fertility window.

«In older literature, it is not always clear whether the duration of pregnancy was calculated from the intercourse that led to fertilisation or from the first or last day of the last menstrual period»

Nordic medical literature

In the oldest Danish-Norwegian textbook for midwives, there is no mention of pregnancy; it was childbirth that the midwife was expected to learn about (Figure 2) (19). Nevertheless, several authors noted that the duration of pregnancy could impact on the labour process. In the Danish translation of the French textbook by Mesnard (1685–1746) from 1743, a question is posed that recurs in numerous textbooks from the mid-18th to the 19th century: 'Is the course of nine months absolutely necessary to ensure an easy and natural delivery?' (20). This question can be understood in the context of folk ballads; in the medieval ballad 'Hustru og Mands Moder' (wife and mother-in-law), the mother-in-law casts a spell so that little Kirstenn remains pregnant for eight years:

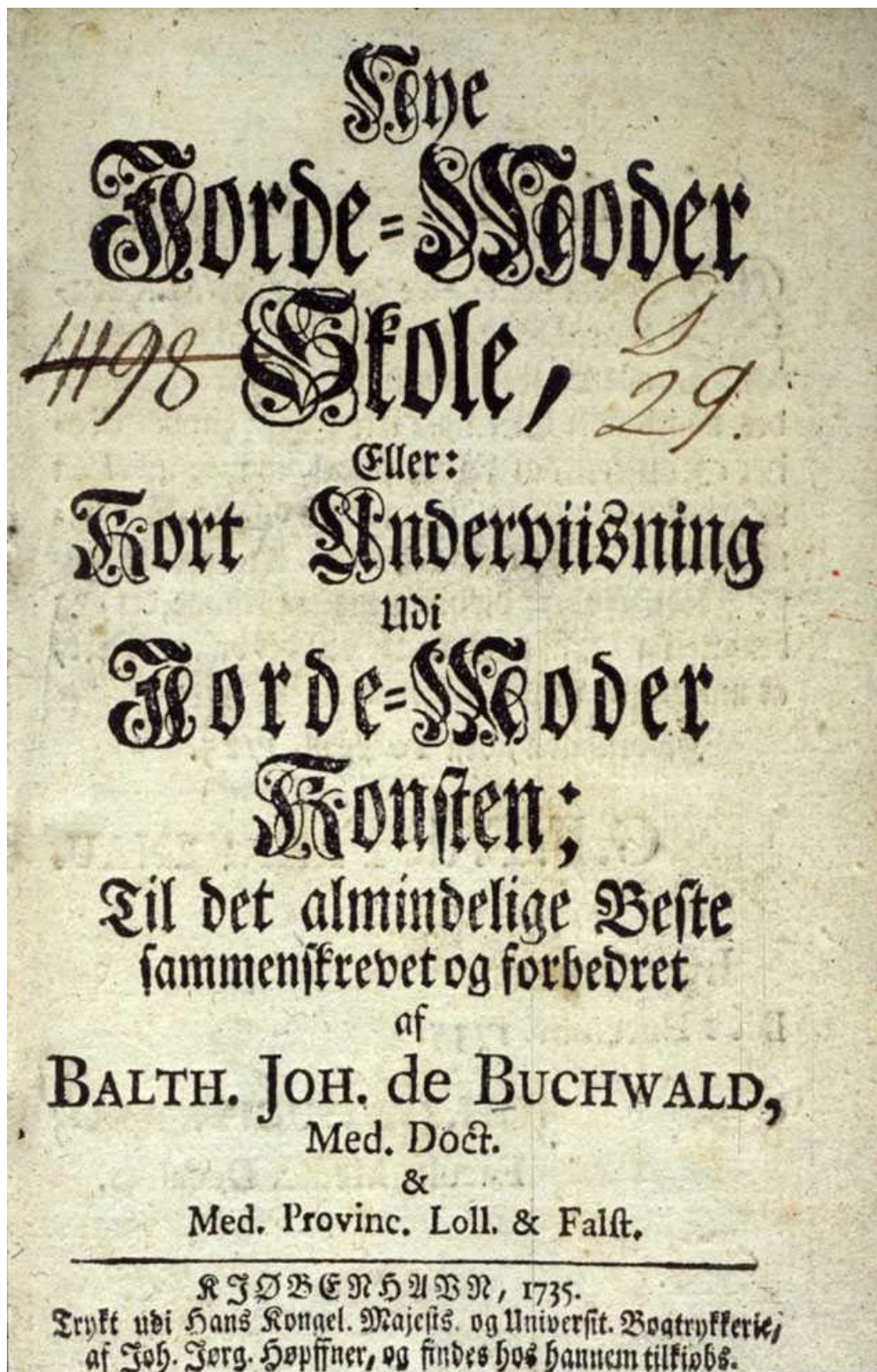


Figure 2 In the oldest textbook for Norwegian midwives, the Dane Buchwald's (1697–1763) *Nye Jorde-Moder Skole* from 1725, there is no mention of pregnancy. It was childbirth that the midwife was expected to learn about. Facsimile from the 1735 edition (19).

*I fyrretiffue ugger och icke mer:
ganger hun lenger, da bliffuer det hindis død.*

*[At forty weeks and no more:
should she go further, then it shall be her death.]*

(7, pp. 409).

In modern language:

*I førti uker og ikke mer:
går hun lenger, så blir det hennes død.*

*[At forty weeks and no longer:
if she goes beyond, it will be her death.]*

In older literature, it is not always clear whether the duration of pregnancy was calculated from the intercourse that led to fertilisation or from the first or last day of the last menstrual period. In 1766, Christian Johan Berger (1724–1789), professor of obstetrics in Copenhagen, used intercourse as the starting point and estimated that pregnancy lasted approximately 40 weeks [\(21\)](#).

The notion that pregnancy lasts 280 days was repeated by Danish and Swedish textbook authors throughout the 19th century, though they did not always explain the basis of their calculation. The same applies to the Norwegian textbook authors Frans Christian Faye (1806–1890) and Peter Herman Vogt (1829–1900). From Edvard Schønberg's (1831–1905) textbook of 1897 onwards, however, the 280 days were counted from 'the day on which the last menstruation began' [\(22\)](#).

Calculation of the expected delivery date

It has always been useful for pregnant women, their families and birth attendants to know when the birth might occur. Three methods of calculation were used: from the intercourse that led to fertilisation, from the last menstrual period, and from the time the woman first felt fetal movements. The first method was generally impossible to determine accurately, and the timing of initial fetal movements varied between women. Consequently, in most cases, the expected delivery date (EDD) was calculated from the woman's last menstrual period.

Naegele's rule

The method that long served as the standard for estimating the EDD, until routine ultrasound became common, was named after Franz Carl Naegele (1778–1851), a professor in Heidelberg. In 1812, he published the book that linked his name to the most widely used method (Figure 3) [\(23\)](#). Naegele did not claim to have developed a new approach, he was citing one of the great natural scientists of the 18th century, the Dutchman Herman Boerhaave (1668–1738), who had studied the duration of pregnancy since 1715. In his posthumously published lectures, Boerhaave wrote in 1744 that '[o]f one hundred births, ninety-nine occur in the ninth month after the last menstruation, assuming we count one week after the last menstrual period and from that period calculate nine months during which the child is carried' (our translation of the translation from Latin by Amund Børdahl) [\(24\)](#).



Figure 3 Naegele's 1812 book, in which he introduced what has since become known as Naegele's rule: from the first day of the last menstrual period, subtract three months and add seven days (23). Facsimile

Adding seven days to the date of the last menstrual period and subtracting three months to calculate the EDD has since become known as Naegele's rule. Neither Boerhaave nor Naegele clearly stated whether the calculation should begin from the first or last day of the last menstruation. In his textbook for midwives, published in multiple editions between 1830 and 1883, Naegele originally wrote that 'we calculate from the day on which the woman last

menstruated, three months back, and then add seven days' (25). It was not until the seventh edition, in 1847, that he specified that the calculation should begin from the first day of the last menstrual period (26).

«Adding seven days to the date of the last menstrual period and subtracting three months to calculate the EDD has since become known as Naegele's rule»

Naegele's son, Hermann Franz Joseph Naegele (1810–1851), also authored a textbook for midwives. Published in eight editions between 1843 and 1872, it was the most widely used textbook of its time in Germany. In all editions, the method of calculation is described, with the EDD determined from the first day of the last menstrual period. It was not until the third edition in 1850 that he mentioned his father; prior to this, both Hermann Fr. Kilian (1800–1863) in Frankfurt and Friedrich Wilhelm von Scanzoni (1821–1891) in Würzburg had cited the EDD calculation as described by Naegele in his textbooks (27, 28). Throughout the 19th century, several textbook authors debated whether the calculation should begin from the first or last day of menstruation. It was also noted early on that the method could only be applied to women with regular four-week menstrual cycles.

Naegele cited Boerhaave's view that women become pregnant immediately after menstruation and rarely at any other time. He added that '[t]here exists an unusually large number of statements in texts both from earlier and more recent times that confirm what has just been said' (23). He then quotes a number of authors, including the Frenchman Mauriceau (1637–1709), who expressed the same view. This had been general medical knowledge since antiquity (16). Although Naegele was only citing Boerhaave, he was, as far as we know, the only 19th-century author to conduct such a thorough study of what had been written about fertilisation. He also introduced the calculation as the practical tool it has remained for over 200 years. It is therefore justified to attribute the rule to his name (29, 30).

In Norwegian medical literature, Naegele is not mentioned in Faye's textbook for midwives, published in four editions (1844, 1857, 1872, 1886) (31). Nor do other key textbook authors, such as Edvard Schönberg (22) and Kristian Brandt (14), refer to him. It was not until 1959 that Naegele was introduced by name, along with his rule, in a Norwegian textbook for midwives (32). In a 2006 publication, Boerhaave rather than Naegele is credited (33); however, the authors pragmatically note that 'it would only cause confusion to give the rule a new name now'.

Naegele's rule today

Naegele's rule has recently been re-evaluated in light of modern science (34). Several factors have been found to significantly influence the length of pregnancy, including ethnicity, height, variations in the menstrual cycle, timing of ovulation, parity and maternal weight. The author reasonably concluded that Naegele's rule should be regarded as a guideline for estimating the EDD, rather than a definitive date.

Biological variation is such that all births occurring between 37 and 42 weeks of gestation are considered term. The median duration of pregnancy is 283 days when calculated from a reliably known last menstrual period, and 281 days when estimated by ultrasound dating [\(1\)](#).

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