

The Possible Correlation of Lunar Phases with the Birth Rate in Estonia in the Period of 2018 - 2019

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Abstract

Introduction: Different studies have been carried out on population groups from different parts of the world, using different research methods to find a link between the lunar phase and the onset of labor. The results of previous studies on the relationship between lunar phases and the number of births are contradictory, and there is no consensus among researchers. The issue needs attention, as there is an opinion among healthcare professionals as well as mothers that the lunar phases are related to the number of births. It is important that midwives are familiar with the subject, as the mother can also believe in the relationship of the lunar phases to the number of births, and midwives must inform the patient about the subject based on evidence-based sources. If the connection of the lunar phases with the number of births is confirmed, then it allows calculating the time of the onset of labor more precisely, and based on this, the use of a larger labor resource can be planned due to the increase in the number of births in certain lunar phases. No evidence-based study has been conducted in Estonia to investigate the possible relationship of lunar phases to the number of births.

Methods: A cross-sectional study belonging to quantitative research has been used as a method. As part of the research, Estonia birth rate statistics for the time period 2018 - 2019 were collected. The data was analyzed, and the results were presented as tables and figures.

Results: The results of the research show that in both 2018 and 2019, the average number of births per day is very similar in the lunar phases. The highest number of births per day in 2018 was in the Full Moon and in 2019 in the waxing lunar phase. The connection of the lunar phases with the number of births in Estonia in the period 2018 - 2019 was not found, on the basis of which it can be concluded that the lunar phases in Estonia in the period 2018 - 2019 did not affect the daily changes in the number of births.

Conclusion: No similar study has been conducted on this topic in Estonia before. Therefore, these results are important. It was confirmed that the lunar phases have no connection with the number of births in Estonia in the period 2018 - 2019. The authors of the research are convinced that this topic is of interest and provides evidence-based knowledge to healthcare professionals, especially midwives working in the field of childbirth.

Keywords: Lunar Phase; Impact; Correlation; Birth Rate

Introduction

For thousands of years, people have lived according to lunar cycles. The first calendars were based on the lunar cycle, and crops were planted and harvested based on the lunar phases [1]. The view that stars and planets affect human health and behavior dates back to

ancient Rome, when the Moon was considered to be the cause of supernatural forces in the emergence and course of natural phenomena [2] and in the ability to influence pregnancy and childbirth [1]. In different cultures and mythologies, the Moon is associated with fertility, pregnancy, and childbirth [3]. The Babylonians believed that since the menstrual cycle corresponds to the lunar Moon, the Moon is associated with female reproduction [4]. Women were affected by the Moon, and it was believed that fertility and the onset of labor vary with the lunar phase [1].

The relationship between the lunar phase and the frequency of births was given a factual basis in medical textbooks in the 18th century [5]. Many people around the world, regardless of their level of education, believe that the full Moon is something sinister [6]. One common belief that persists today is health care workers working in the maternity ward, who are convinced that the lunar cycle has an effect on the onset of labor and that the number of births increases during the full Moon [6,7]. For example, midwives working in the Indian maternity ward have a perception that the need for maternity care increases during the full Moon, especially in rural areas [3].

Some studies have shown that the biological system may be dependent on the position of the Moon in orbit [2]. The Moon takes about 29 days and 12 hours to reach orbit around the Earth and returns to the same place in relation to the Sun and the Earth, and it is called the lunar Moon [8]. The time it takes for the Moon to make one full turn on its axis relative to the Sun is about 24 hours and 50 minutes; this is called the lunar day [9]. The combined effect of these two cycles - the lunar Moon and the lunar day - creates lunar phases [10]. There are eight lunar phases: Full Moon, Waning Gibbous, Last Quarter, Waning Crescent, New Moon, Waxing Crescent, First Quarter, Waxing Gibbous [4]. Lunar phases affect the Earth and living organisms on Earth, including reproduction [2], either through the moonlight and/or through the gravitational force of the Moon, as these are the only factors that change depending on the lunar phases [10].

Several studies confirm that there is a relationship between lunar phases and the number of births. Studies in the city of New York (USA) in the 1950s and 1960s, in France in 1968 - 1974, in the city of Florence (USA) in the 1950s and 1960s and in the city of Cleveland (USA) in 1980 found that there is a relationship between the lunar phase and the onset of labor. These studies have found different results according to the lunar phases, but most of them have found that the number of births is highest during the full moon and moon creation phases [5]. Several studies have also shown that there is no relationship between the lunar cycle and the number of births. Studies proving this have been done in the city of Danville (USA) in the 1940s and 1950s, in Los Angeles (USA) in the 1970s, in Ravenna (USA) in the 1970s, in Phoenix (USA) in the 1990s, in Murcia (Spain) in the 2000s, in São Paulo (Brazil) in the 2000s, in the state of Baden-Württemberg (Germany) in the 1960s and 2000s, in Austria in the 1970s and 1990s, in North Carolina (USA) from 1990 to 2000, in the city of Madrid (Spain) in 2007 and in the city of Messina (Italy) in 2011 [5].

Various studies have been conducted on populations from different parts of the world, using different research methods to find the relationship between the lunar phase and the onset of labor [1,4,11]. It has been observed that health care professionals who work in obstetrics and emergency departments are more likely to believe in the effect of the lunar phase [12]. Despite a number of studies that do not show a relationship between the menstrual cycle and the number of births, the faith still remains among many educated people [1,4].

The authors of the present study consider that the topic of the research is important and needs attention because, according to the available data, the first research in this field was conducted in the last century, and no common position among researchers has been found so far. Many health professionals believe that the lunar phases are related to the number of births [7]. It is important that midwives are familiar with the subject, as the mother can believe that the lunar phases are related to the number of births, and healthcare professionals must advise the patient on the subject based on evidence-based sources. The study of this topic is useful for midwives because if the connection of the lunar phases with the number of births is confirmed, it allows to estimate more precisely the time of the onset of labor [13] and based on this, due to the increase in the number of births in certain Lunar phases, it is possible to plan the use of a larger labor resource.

The impact of natural phenomena on human health and their connection with health events has been little studied in Estonia. Previously, the meteorological indicators in Estonia in the summer of 2010 and the impact of the heatwave in the summer of the same year on the mortality of the Estonian population have been studied within the framework of the field of public health of the University of Tartu in 2013 [14]. According to the authors of the present research, no evidence-based research has been conducted in Estonia so far to investigate the possible relationship of the lunar phases with the number of births.

Purpose of the Research

To analyze the possible connection of the lunar phases with the number of births in Estonia in the period 2018 - 2019.

Methods

The present research is empirical; the method used is a quantitative research method, which is a cross-sectional study. In this cross-sectional study, the number of births in Estonia in 2018 - 2019 has been collected and presented by dates. The study period has been chosen from 01.01.2018 to 31.12.2019 as the data of this period are the most recent published statistical data on the number of births in Estonia at the time of writing the research. The data to be examined are the numbers of non-personalized births in 2018 and 2019 by days.

Statistics on the number of births were requested based on the purpose of the research in May 2020 and for this purpose, a query was made to the information system of the registries department of The National Institute for Health Development. In June 2020, data on the number of births in Microsoft Excel format for each day of the study period were released. Statistics are non-personalized and aggregated. The data are cross-Estonian, and the data are not processed separately on the basis of regions or hospitals. As a result, it is not possible to identify persons. As the data are non-personalized and aggregated, they were allowed to be released without the permission of the Ethics Committee.

Astronomical data on lunar phases come from the website at <http://ilm.pri.ee/kuufaaside-kalender>. The lunar Moon is divided into eight lunar phases: Full Moon, Waning Gibbous, Last Quarter, Waning Crescent, New Moon, Waxing Crescent, First Quarter, Waxing Gibbous. The Lunar phases of 2018 and 2019 have been manually entered by the authors of the work into a Microsoft Excel spreadsheet for each day of the research period.

Results

Statistical relationship between Lunar phases and number of births in Estonia in 2018

In 2018, 14,044 births took place in Estonia. For a better overview, the results are presented as a table and a figure (Table 1 and figure 1). The table below (See table 1) shows the number of births in 2018 by Lunar phases. In 2018, most days were in the Waning Gibbous (79 days). In 2018, the fewest days were in the First Quarter phase (18 days).

Lunar phase	Number of days	Average number of births per day	Standard deviation	Min of births	Max of births
Full moon	20	38	10.5	22	65
Waning Gibbous	79	38	8.1	16	60
Last quarter	25	36	6.9	22	48
Waning Crescent	62	39	7	21	58
New Moon	22	40	6.8	26	54
Waxing Crescent	68	39	6.9	25	57
First Quarter	18	38	7.3	27	50
Waxing Gibbous	71	39	8.7	21	63

Table 1: Number of births by lunar phases 2018.

In 2018, the maximum number of births per day was 65 births in the full moon phase. The full moon phase in 2018 was 20 days. In 2018, the minimum number of births per day was 16 during the Waning Gibbous. This was the most common Lunar phase in 2018. The average number of births per day by Lunar phases is very similar. The average number of births per day for all Lunar phases has been in the range of 36 - 40, with the highest average of 40 births per day during the New Moon and the lowest average number of births - 36 - during the Last Quarter. The standard deviations of the Last Quarter, Waning Crescent, New Moon, and Waxing Crescent are the lowest and most similar.

The figure below (See figure 1) shows the number of births in different lunar phases in 2018. The box diagram shows the boxes: Full Moon (1), Waning Gibbous (2), Last Quarter (3), Waning Crescent (4), New Moon (5), Waxing Crescent (6), First Quarter (7), Waxing Gibbous (8). It can be seen from the box diagram that the dispersion varies in each group, but the interquartile range has remained in the range of 30 - 45 in all groups. The dispersion of the growing waxing lunar phase group differs to a greater extent from other groups. The medians have shifted in most groups, but most can be seen in the groups Last Quarter, the New Moon, and the First Quarter).

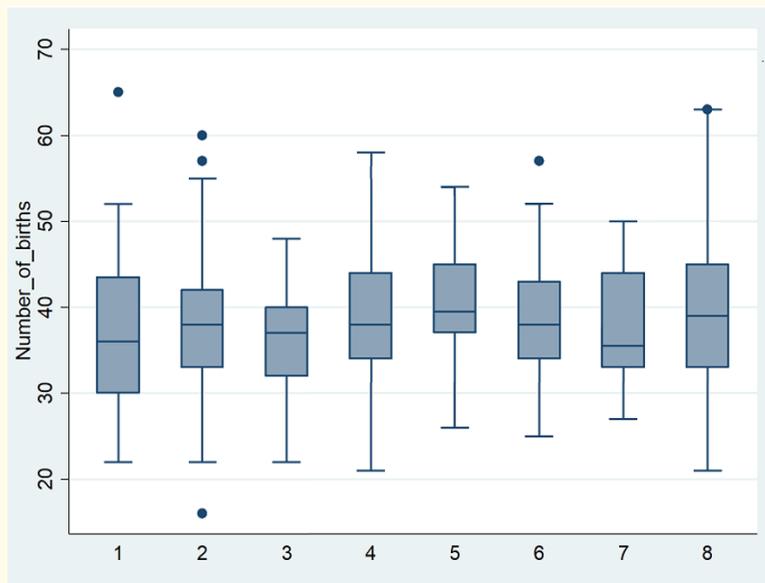


Figure 1: Dispersion of the number of births by lunar phases 2018.

An ANOVA test was performed to compare the means of the eight groups (mean number of births in the lunar phases), and the probability of significance is $p < 0.129$. As a result, it can be said that there is no possible connection between the lunar phases and the number of births in Estonia in 2018.

Statistical relationship between Lunar phases and number of births in Estonia in 2019

In 2019, 13731 births took place in Estonia. For a better overview, the results are presented as a table and a figure (Table 2 and figure 2). The table below (See table 2) shows the number of births in 2019 by Lunar phases. Table 2 shows that in 2019, the Moon was mostly in the Waxing Crescent phase (75 days). In 2019, the shortest time of the Moon was the Full Moon, New Moon and the First Quarter phases, all 19 days.

Lunar phase	Number of days	Average number of births per day	Standard deviation	Min of births	Max of births
Full moon	19	38	8.2	25	51
Waning Gibbous	74	37	7.2	19	59
Last quarter	21	38	5.8	24	48
Waning Crescent	69	37	7.3	23	49
New Moon	19	40	9.4	22	54
Waxing Crescent	75	37	8.2	17	53
First Quarter	19	38	8.3	27	56
Waxing Gibbous	69	38	8.2	22	57

Table 2: Number of births by Lunar phases in 2019.

In 2019, the maximum number of births per day was 59, and they took place during the waning lunar phase. In 2019, the waning lunar phase was the second in terms of the number of days. 2019, the minimum number of births per day was 17, and it was in the lunar phase of the Waxing Crescent, which is the most frequent lunar phase in 2019 in terms of the number of days. The average numbers of births by Lunar phases are very similar and do not differ much from each other. The average number of births per day for all Lunar phases has ranged from 37 to 40. The highest average number of births (40) per day was during the Waxing Crescent and the lowest average (37) number of births per day was in the phases of Waning Crescent, Waning Gibbous, Waxing Crescent. The standard deviations of the lunar phases shown in table 2 are similar. In the Last Quarter phase, the standard deviation is 5.8, which indicates that the average number of births per day is not uniform but is more uniform than during the other Lunar phases.

Figure 2 shows the number of births in different lunar phases in 2019: The box diagram shows the boxes: Full Moon (1), Waning Gibbous (2), Last Quarter (3), Waning Crescent (4), New Moon (5), Waxing Crescent (6), First Quarter (7), Waxing Gibbous (8). The box diagram shows that the lunar phases are not symmetrical, and the dispersion varies in each group, but the interquartile range has remained in the range of 30 - 48 in all groups. The dispersion of the Last Quarter group differs significantly from other groups and has the narrowest interquartile range. The medians of the boxes are mostly shifted but very similar. It has shifted the most in the Last Quarter and Full Moon phase.

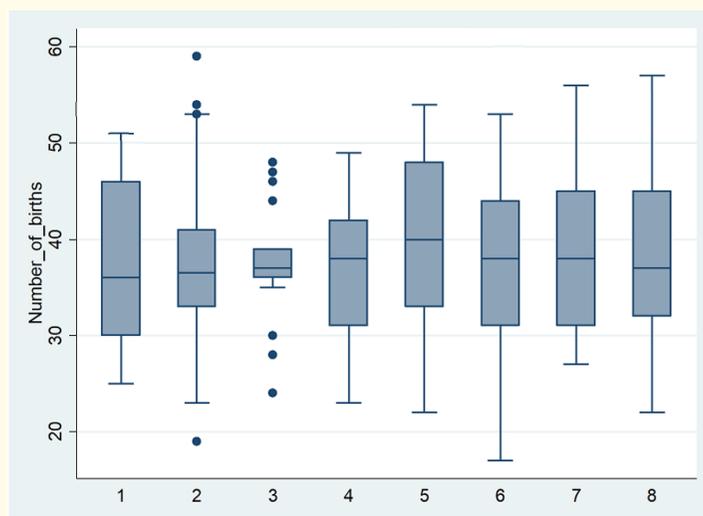


Figure 2: Dispersion of the number of births by lunar phases in 2019.

An ANOVA test has been performed to compare the means of the Lunar phases and the number of births, and the result is that the probability of significance is $p < 0.467$. This shows that there is no connection between the Lunar phases to affect the number of births in Estonia in 2019.

Discussion

Lunar phases have historically been important in the lives of many people. There are also people today who believe in the relationship between the lunar phases and the number of births. Contradictory research results can be found in the scientific literature on the relationship between the lunar phases and the number of births. As a result of the present study, it was found that the lunar phases have no connection with the number of births in Estonia in 2018-2019. A similar study result has been obtained with several other studies [5,13], which also confirms the absence of a relationship between Lunar phases and the number of births. The opposite view is taken by the authors [11,15], who in their research has found a relationship between the lunar phases and the number of births.

The view that the Full Moon phase is related to the increase in the number of births is supported by the authors of the study [11,15], who find that the Moon has a greater impact on the increase in the number of births in a given Lunar phase. A similar belief is also prevalent among many health professionals [3,6,7]. The above-mentioned position differs from the results obtained in the present study, which showed that the maximum number of births per day in Estonia in 2018 was 28.06.18, which was 65 births, and it coincided with the Full Moon phase. However, as this day was exceptional, it cannot be considered as a rule and was rather a coincidence. The same is confirmed by statistics, where no significant relationship was found between the lunar phases and the number of births. In 2019, the highest daily number of births in Estonia was 17.09.19, which was 59 births, and it coincided with a waning lunar phase. Statistics for 2019 also do not find a connection between the lunar phases and the number of births.

The authors of studies supporting the view that the Full Moon phase is related to the reduction in the number of births [5,16] have found that the production of melatonin, a hormone involved in the initiation of labor, is inhibited in the Full Moon phase and inhibits the onset of uterine contractions and the progression of labor. The above position differs from the results obtained in the present study, which showed that in 2018 the lowest average number of births per day in Estonia was in the Last Quarter phase, which was 36 births; in the Full Moon phase, the average number of births per day was 38. In 2019, the lowest average number of births per day in Estonia was 37 in the Waning Crescent; in the Full Moon phase, the average number of births per day was 38.

The present study found that the New Month phase has had the highest average number of births per day in both 2018 and 2019, but no statistical relationship was found between the Lunar phases and the number of births for any of the Lunar phases. Analyzing the existing literature, it can be observed that the New Moon phase has been singled out by some authors [5,15], namely, in the New Moon phase, a greater gravitational force of the Moon has been observed, and it is expected that through this effect the number of births in the different phases of the Moon will increase. This view is not shared by Ochiai., *et al.* [15], who have observed in their study that due to the high gravitational force of the Moon in the New Moon phase, the number of births is inversely lower compared to other phases of the Moon. This view is also not shared by Wake., *et al.* [13], who are convinced that the number of births increases as the lunar gravitational force weakens. It can be concluded from this that the highest average number of births in Estonia during the 2018 - 2019 period in the New Moon phase is contradictory to the results of studies conducted by several authors.

In the literature, the conclusions of the authors of various studies are contradictory, and there is no definite position on the relationship between the lunar phases and the number of births. Researchers have proposed the theory that people living in cities today are less affected by the lunar phases [17]. Researchers argue that exposure to artificial light is higher, and natural melatonin production is disrupted [18]. Researchers believe that women living in rural areas are significantly more connected to nature; they might think that their lives are more affected by the lunar phases, as they have significantly less exposure to disturbing factors such as television and computer

[19]. According to the authors of the study, in today's developed countries, people living in both urban and rural areas are less affected by nature and natural factors, as today's people use many digital devices in their daily lives, such as computers and smartphones, which disrupt the daily rhythm. People living in cities may be even less affected by the lunar phases, as there are many other factors that interfere with melatonin production in the city, for example, street and advertising light, light emitted from the windows of shops and apartment buildings, etc., and therefore under these conditions the connection of the lunar phases with the number of births may not appear in urbanized Estonia, where all maternity homes are located in larger cities.

Strengths and Limitations

One of the strengths of the study is the focus on the topic, as the possible impact of the lunar phases on the number of births in Estonia has not been studied before. This study is important for professional science because it is useful for expanding the knowledge of midwives and increasing professional development. Midwives could be aware of the relationship between lunar phases and the number of births in order to dispel myths among women giving birth or co-workers based on evidence-based sources. A limitation of this study is the fact that only a two-year period was studied, a longer period of study can provide the most reliable results. However, the number of births can be affected by many other factors. The authors consider that further research on this topic should take into account other so-called meteorological factors that can affect the number of births, such as magnetic storms, air pressure and its alternation, heat and cold waves, and solar activity.

Conclusion

The results of the research show that in both 2018 and 2019, the average number of births per day is very similar in the lunar phases. The highest number of births per day in 2018 was in the Full Moon and in 2019 in the waxing lunar phase. The connection of the lunar phases with the number of births in Estonia in the period 2018 - 2019 was not found, on the basis of which it can be concluded that the lunar phases in Estonia in the period 2018 - 2019 did not affect the daily changes in the number of births. No similar research has been conducted on this topic in Estonia before. Therefore, these results are important. In the present study, it was confirmed that the lunar phases have no connection with the number of births in Estonia in the period 2018 - 2019. The authors of the research are convinced that this topic is of interest to healthcare professionals, especially midwives working in the field of childbirth.

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