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# Impact of Cosmobiological Factors on Chromosomal Anomalies Rates - Ethical Consideration

**Danielius Serapinas [a,b,c*] and Andrius Narbekovas [b]**

*[a] Mykolas Romeris University, Vilnius, Lithuania.*
*[b] Vytautas Magnus University, Kaunas, Lithuania.*
*[c] Lithuanian University of Health Sciences, Kaunas, Lithuania.*

***Authors' contributions***

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

**Backround:** In recent years, there is an increasing number of data supporting the relation between lunar cycle and alterations in human body. For instance, it has been proved that hospitalized spontaneous abortions are significantly associated with the lunar cycle . Given that the most common cause of spontaneous abortion is chromosomal abnormalities of the embryo, we presumed that the lunar cycle could influence the occurrence of chromosomal diseases. From the point of bioethics it is a question if it is applicable to talk with patients about possible impact of cosmobiological factors on their case of chromosomal anomaly.
**Patients and Methods:** We have selected 52 patients, who were bearing a fetus with a prenatally diagnosed chromosomal disorder, which included Down, Turner, Klinefelter, Patau and Edward syndromes. The control group (n=92) consisted of families, that were prenatally tested for chromosomal abnormalities and the results were negative. Then we gathered and analyzed information from patients' medical histories about various factors, which could have predisposed chromosomal disorders: age of both progenitors, consumption of medications during pregnancy, number of miscarriages, number of abortions, cases of genetic disorders in relatives, lunar phase on the day of conception.
**Results:** Lunar phases at the time of conception in the test group distributed as following: new Moon 32.7 percent, first quarter 25.0 percent, full Moon 28.8 percent, third quarter 13.5 percent. In

**Corresponding author: E-mail: dserapinas@gmail.com;*

the control group lunar phases distributed as following: new Moon 29.3 percent, first quarter 27.2 percent, full Moon 26.1 percent, third quarter 17.4 percent. There was observed no statistically significant difference between test and control groups ($p>0.05$). OR for conception with chromosomal anomalies were increased in July (2.7(CI 95% 1.5-4.9) and December (3.2 (CI 95% 1.5-5.2) ($p<0.05$). OR showed decreased risk for chromosomal anomalies during conception at January (0.3 (CI 95% 0.1-0.7) , April (0.5 (CI 95% 0.2-0.7) and June 0.5 (CI 95% 0.2-0.8) ($p<0.05$).
**Conclusions:** Our study showed there were no associations between lunar phase at the time of conception with the rates of chromosomal mutations. Conception in July and December increases the risk of chromosomal anomalies during conception. In contrast conception in January, April and June decreases chromosomal anomalies rates.

*Keywords: Cosmobiology; ethical consideration; chromosome anomaly.*

## 1. INTRODUCTION

Calendar factors affecting human diseases and the occurrence of certain conditions have been known for many decades. In recent years, there is an increasing number of data supporting the relation between lunar cycle and alterations in human body. By now it is evidently known how Moon phases influence the duration and structure of the sleep [1,2]. Also there exists a relation with life-threatening conditions. For example, there is an association between admission to the acute stroke unit with a diagnosis of medically unexplained stroke symptoms and lunar phase [3,4]. Another study shows that admissions to intensive care unit because of status epilepticus varied significantly across the lunar cycle [5]. There are 4 phases of the Moon: new Moon, first quarter, full Moon and third quarter. The new Moon position in space: the Moon is between the Sun and Earth. The first quarter position in space: the Moon has gone one quarter of the way around Earth. Full Moon position in space: the Moon and the Sun are on opposite sides of Earth. The third quarter position in space: the Moon has gone three quarters of the way on its orbit around Earth.

Furthermore, lunar cycle has been proved to have an impact on human reproduction, in particular fertility, menstruation and birth rate. Even hospitalized spontaneous abortions are significantly associated with the lunar cycle [6]. Given that the most common cause of spontaneous abortion is chromosomal abnormalities of the embryo, we presume that the lunar cycle could influence the occurrence of chromosomal diseases. The reasons of recurrent miscarriages may be not limited to de novo mutations but also to balanced chromosomal translocations in the couple. To our knowledge, this relation has not yet been explored.

## 2. METHODOLOGY

This study was approved by the Center of Bioethics at Lithuanian University of Health Sciences. This was a retrospective case-control study. We have selected 52 patients, who were bearing a fetus with a prenatally diagnosed with invasive testing chromosomal disorder, which included Down, Turner, Klinefelter, Patau and Edward syndromes. Inclusion criteria were: age between 18 and 48, diagnosis of chromosomal anomaly during prenatal diagnostics. Exclusion criteria: other than chromosomal genetic disorders in the child. The control group (n=92) consisted of age matched families, that were prenatally tested for chromosomal abnormalities and the results were negative. Inclusion criteria of control group were: age between 18 and 48, not increased risk for chromosomal anomalies during prenatal diagnostics. Exclusion criteria for control group: any genetic disorders in the child. We enrolled patients from the Hospital of Lithuanian University of Health Sciences from year 2007 through year 2014.

### 2.1 Sample Size Calculation

$$\text{Sample size} = \frac{\frac{z^2 \times p\,(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p\,(1-p)}{e^2 N}\right)}$$

N = population size – 3000 (Annual patients of prenatal diagnostics program at University Hospital)
e = Margin of error (percentage in decimal form) - 5%
p = prevalence of patients with high risk for chromosomal was 10% (0.1)
z = z-score - 1.96
Calculated minimal sample size for enrolling to the study = 40

We gathered and analyzed information from patients' medical histories about various factors, which could have predisposed chromosomal disorders. These factors included age of both progenitors, consumption of medications during pregnancy, number of miscarriages, number of abortions, cases of genetic disorders in relatives, lunar phase on the day of conception. The date of conception was determined according to the ultrasound testing of the fetus.

Statistical analysis was performed using the SPSS 20.0 program. Quantitative variables were expressed as means with standard deviation (SD). The differences for their statistical significance were analyzed with the *Mann-Whitney* test. Effect model of particular factor was used for identifying OR [CI 95%]. A P value of less than 0.05 was considered significant.

## 3. RESULTS

Complete data for 144 patients were analyzed. Average age of the test group's female parents at the time of labor was 35.88 ± 5.69 years, with a range of 20 years to 46 years; the control group's average age at the time of labor was 35.08 ± 5.54 years, with a range of 19 years to 45 years. Average age of the test group's male parents was 38.98 ± 7.51, with a range of 25 years to 67 years. Average age of the control group's male parents was 37.75 ± 7.19, with a range of 21 years to 55 years. The consumption of possibly teratogenic medications was observed in 7.7 percent of the patients in the test group and in 12 percent of the patients in control group. In the test group 19.23 percent of female parents have had a spontaneous abortion (13.46 percent once; 5.77 percent twice). In the control group 21.7 percent of female parents have had a spontaneous abortion (16.3 percent once; 4.3 percent twice; 1.1 percent three times). In the test group 26.9 percent of female parents have had an induced abortion (19.2 percent once; 5.80 percent twice; 1.9 percent three times). In the control group 20.7 percent of female parents have had an induced abortion (9.8 percent once; 7.6 percent twice; 3.3 percent three times). Hereditary diseases in families occurred in 9.6 percent of test group's parents and in 20.7 percent of control group's parents. Both test and control groups were statistically equal according to the age of both female and male parents, occurrence of spontaneous and induced abortions, consumption of possibly teratogenic medications and hereditary diseases in families.

Lunar phases at the time of conception in the test group distributed as following: new Moon 32.7 percent, first quarter 25.0 percent, full Moon 28.8 percent, third quarter 13.5 percent. In the control group lunar phases distributed as following: new Moon 29.3 percent, first quarter 27.2 percent, full Moon 26.1 percent, third quarter 17.4 percent. There was observed no statistically significant difference between test and control groups ($p>0.05$). The month of conception in the test group distributed: January 3.8 percent, February 9.6 percent, March 9.6 percent, April 3.8 percent, May 5.8 percent, June 5.8 percent, July 15.4 percent, August 7.7 percent, September 9.6 percent, October 5,8 percent, November 5,8 percent, December 17,3 percent; while in the control group: January 10,9 percent, February 7,6 percent, March 7,6 percent, April 7.6 percent, May 7.6 percent, June 12 percent, July 6.5 percent, August 10.9 percent, September 12 percent, October 6.5 percent, November 5.4 percent, December 5,4 percent. 48. 1 percent of conceptions in the test group were registered from March 21 to September 21, and 51.9 percent were registered from September 22 to March 20; respectively in the control group: 58.7 percent and 41.3 percent. We haven't found any statistically significant difference between test and control groups in general cohort comparing lunar phases ($p>0.05$). While performing Odd ratio (OR) calculations we have found that conception in July and December statistically significant increases the risk of chromosomal anomalies during conception. In contrast conception in January, April and June decreases chromosomal anomalies rates.

**Table 1. Demographic data and consumption of medications during pregnancy, miscarriages, abortions, cases of genetic disorders in relatives in test and control groups**

| Patient characteristics | Test group | Control group |
|---|---|---|
| Female parents average age, yrs | 35.8 ± 5.6 | 35.8 ± 5.5 |
| Male parents average age, yrs | 38.9 ± 7.5 | 37.7 ± 7.1 |
| Consumption of possibly teratogenic medications, % | 7.7 | 12.0 |
| Percentage of female parents, who had spontaneous abortions | 19.2 | 21.7 |
| Percentage of hereditary diseases in parents' relatives | 9.6 | 20.7 |

**Table 2. Distribution of conceptions among lunar phases, months, year periods**

| | Test group | Control group | OR CI 95% |
|---|---|---|---|
| Lunar phases according to date of conception, % | | | |
| New moon | 32.7 | 29.3 | 1.1 (0.7-1.3) |
| First quarter | 25.0 | 27.2 | 0.9 (0.7-1.1) |
| Full moon | 28.8 | 26.1 | 1.1 (0.8-1.2) |
| Third quarter | 13.5 | 17.4 | 0.8 (0.7-1.0) |
| Distribution of months according to time of conception, % | | | |
| January | 3.8 | 10.9 | 0.3* (0.1-0.7) |
| February | 9.6 | 7.6 | 1.3 (0.9-1.6) |
| March | 9.6 | 7.6 | 1.3 (0.9-1.6) |
| April | 3.8 | 7.6 | 0.5* (0.2-0.7) |
| May | 5.8 | 7.6 | 0.8 (0.6-0.9) |
| June | 5.8 | 12.0 | 0.5* (0.2-0.8) |
| July | 15.4 | 6.5 | 2.7* (1.5-4.9) |
| August | 7.7 | 10.9 | 0.7 (0.5-1.1) |
| September | 9.6 | 12.0 | 0.8 (0.5-1.1) |
| October | 5.8 | 6.5 | 0.9 (0.7-1.2) |
| November | 5.8 | 5.4 | 1.1 (0.9-1.4) |
| December | 17.3 | 5.4 | 3.2* (1.5-5.2) |
| Percentage of conceptions between March 21st and September 21st | 48.1 | 51.9 | 0.9 (0.5-1.4) |
| Percentage of conceptions between September 22st and March 21st | 58.7 | 41.3 | 1.4 (0.8-2.2) |

**p<0.05*

## 4. DISCUSSION

There are various cosmobiological factors that have been proved to have influence on human's health. For example, there is a possibility that geomagnetic activity can affect human health at the Earth's surface. E. Stoupel in his study has found, that periods of low geomagnetic activity show a related increase in in-hospital non-myocardial infarction-related cardiovascular deaths. Only in times of lowest geomagnetic activity did inferior wall myocardial infarction exceed anterior wall myocardial infarction. Low geomagnetic activity was also associated with higher levels of growth hormone and 11-ketosteroids in the peripheral blood, more sudden deaths, some increase in electrical heart instability/hourly number of ventricular and supraventricular extrasystoles and higher rate of ventricular tachycardia [7]. Another study shows, that the number of sudden cardiac death is rising on the highest and lowest daily levels of geomagnetic activity. The relatively rare geomagnetic activity storms concentrate most of sudden cardiac death at days of lowest geomagnetic activity [7].

We have found that conception in July and December increases the risk of chromosomal anomalies during conception. It can be related that day duration becomes reduced during this period. In contrast conception in January, April and June decreases chromosomal anomalies rates. The current results show, that birth at October, January and March is with reduced risk of chromosomal anomalies.

Meanwhile, in our study, statistically significant results were not obtained in lunar phases due to several reasons. First of all, our sample may have been too small. Secondly, we investigated specifically lunar phase link with aneuploidy induction, but we had not set the goal to find the link between lunar gravitational forces applied to the Earth and the occurrence of aneuploidies. Possible explanation for current results also could be, that mechanisms (especially meiotic) for chromosomal mutations can begin much earlier than the process of conception.

The idea that the Moon affects human physiology and behavior is based on the fact that 80 percent of the body weight is water [8]. Since the gravitational force of the Moon causes the tides, it is believed that the same gravitational forces can operate and the human body. However, there are two reasons why the Moon phase should not affect the processes of the human

body. In particular, gravitational forces do not depend on the phases of the Moon, but on the distance between the Earth and the Moon , and the alignment of the Sun, the Earth and the Moon [9]. Secondly, the lunar gravity is an extremely weak force. Although the Moon obviously affects the oceanic tides, it does not cause these effects in smaller bodies of water - seas, lakes, especially human [10].

The third goal to improve our study would be to investigate male parents more extensively, while the majority of sex chromosome aneuploidies in live births have a paternal origin. You YA et al. study revealed the novel finding that the frequency of aneuploid spermatozoa with fertilization capability significantly increased compared to that of euploid spermatozoa over 3 days, suggesting that aneuploid spermatozoa can survive longer than euploid spermatozoa and have a greater chance of fertilizing oocytes [11]. Different preconceptional factors should be discussed including al environmental factors [12]. Our study has some limitations. Even the sample of the study is not so big. Also we can't exclude other coincidental factors important for chromosomal anomalies incidence.

So arises a question, from the ethical point of view is it ethical to deliver such information for the couples. Taking into account informed patients consent it is advised during consultation of couples before planning a pregnancy discuss all possible issues concerning unborn child health, including facts of cosmobiology.

## 5. CONCLUSIONS

Our study showed that lunar phase at the time of conception has no influence on the occurrence of chromosomal diseases. Furthermore, there is no link between the period of year of conception (from March 21 to September 21 and from September 22 to March 20) and the occurrence of chromosomal diseases. From the point of bioethics it remains a question if it is applicable to talk with patients about possible impact of cosmobiological factors on the case of chromosomal anomaly in their family.

## DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

## CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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