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## The Effect of the Gravitation of the Moon on Frequency of Births

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**Abstract:** The purpose of this study was to examine the influence of the gravitation of the Moon on the frequency of births in Kyoto, Japan. A retrospective cohort analysis of 1007 consecutive births without the use of the induction agents was conducted on a population of births in a private midwife hospital from January, 1966 to December, 2000. There was a significant increase in the cases of births, when the gravitation of the Moon to the Earth was less than 31.5 N. Results of this study suggest that the gravitation of the Moon has an influence on the frequency of births.

**Keywords:** birth, the gravitation of the Moon, regulation, biological clock

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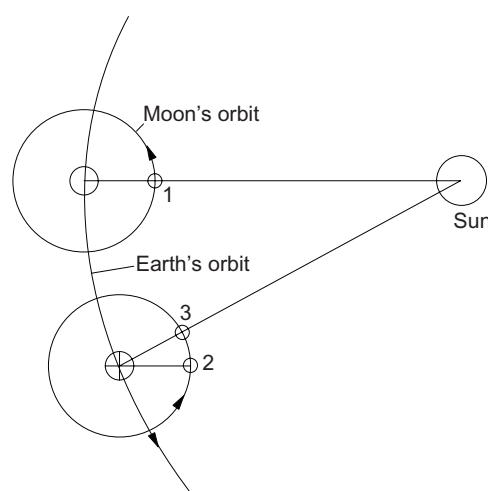
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## Introduction

According to previous studies, all mammalian cells seem to possess internal biological clocks.<sup>1</sup> There seem to be three major components of biological clocks. These are (1) input signals, such as light in the case of the mammalian eye or hormonal factors for peripheral tissues; (2) the clock mechanism itself; and (3) the output genes.<sup>2,3</sup>

The lunar cycle has played many important roles in various aspects of human lives for thousands of years. The first calendars were based on the lunar cycle. If such variations were found in a predictable pattern, it would be beneficial to the care and treatment of pregnant women. If we predict the timing of the birth, we can distribute the standby obstetricians effectively. Previous reports, however, have shown that lunar phases do not relate or a few relate to the frequency of births.<sup>4-9</sup> The period of time that it takes the Moon to the Earth and the period of the phase of the Moon are different. These periods are referred to as the sidereal month and synodic month, respectively. One sidereal month is 27.32 days, the following which the Moon has returned to the same point in the heavens. The synodic month is 29.53 days, the time after which the Moon returns to exactly the same position relative to the sun. The Moon moves in an easterly direction relative to the Earth, by  $360^\circ/29.53 = 12.2^\circ$  each day, and relative to the Earth, by  $360^\circ/27.32 = 13.2^\circ$  each day. The difference between the sidereal and synodic daily motion of the Moon is equal to the daily motion of the sun. The Figure 1 shows the relation among the Earth, the Moon and the sun. The synodic month (1→3) is longer than the sidereal month (1→2), because the Earth moves onwards in its orbit in the meantime. The lunar phase is the location among the Earth, the Moon, and the sun. The gravitation of the Moon depends on the locations between the Earth and the Moon (Fig. 1).<sup>10</sup> Both the sun and the Moon may have an influence on humans. The study of frequency of births may provide clues to know the mechanism of birth relative to the Moon's movements.

There have, however, been few studies concerning the gravitation of the Moon. Our research group showed that the gravitation of the Moon related to the occurrence of acute myocardial infarction, although lunar phase did not relate to the occurrence according to previous studies.<sup>11</sup> The aim of this study was



**Figure 1.** The Figure shows the relation among the earth, the moon and the sun. The synodic month (1→3) is longer than the sidereal month (1→2), because the Earth moves onwards in its orbit in the meantime.

to investigate the relation between the frequency of births and the gravitation of the Moon in a midwife hospital in Kyoto, Japan.

## Methods

### Participants

Our study population was comprised of 1007 (mean age  $29 \pm 8$  years old) consecutive births in a private hospital located in Kyoto, Japan from January, 1966 to December, 2000. We got the medical records in the approval from the manager of the midwife hospital. All cases were spontaneous labor without the use of induction agents for delivery.

### Outcome measures and data collections

Physical examinations were carefully conducted by trained midwives in the midwife hospital. The staff of the hospital carefully reviewed the patients' detailed clinical history by interview and confirmed the end time of deliveries, after performing the delivery.

The distance from the center of the Moon to the center of the Earth was calculated with the Software: Moon 32 in the Moon age calendar website. Universal gravitation of the Moon was derived by  $G \cdot m/d^2$  ( $G$ : universal gravitation constant:  $6.67259 \cdot 10^{-11} \text{m}^3 \text{s}^{-2} \text{kg}^{-1}$ ,  $m$ : the magnitude of the Moon:  $7.3471 \cdot 10^{22} \text{kg}$ ,  $d$ : the distance between the center of the moon and the center of the earth). The relationship between  $G \cdot m/d^2$  and the cases of births were determined.



### Statistical analysis

When we do Statistical analysis, qualitative data are presented as numbers. The numbers were compared using Poisson distribution. A  $P$  value  $< 0.01$  was applied as appropriate for the Poisson distribution. The statistical analyses were performed using the software program SPSS for Windows (version 14.0, SPSS Inc., Tokyo, Japan). Key percentages are provided with 95% confidence intervals of rate ratio.

### Results

Firstly, the number of births did not change significantly with every 30 degrees of lunar phase. Therefore, the lunar phase did not relate to the frequency of births (Fig. 2).

Next, considering  $G \cdot m/d^2$  as an index of the gravitation, an increase of births is found at periods of less than 31.5 N (Fig. 3). The lunar gravitation of 31.5 N occurs when the distance from the earth to the moon is 394485 km. It was confirmed that the number of births increased significantly ( $P < 0.01$ ) during periods of gravitation of less than 31.5 N, unrelated to Moon phases. 95% confidential intervals of rate ratio are from 1.597 to 2.069.

### Discussion

These results suggest that the gravitation of the Moon may have an influence on the frequency of births.

The effect of the gravitation on human is receiving increased media attention due to Randall's<sup>12</sup> report that the gravitation may have an influence on our body more than we have known before.<sup>12</sup> Results of this study seem to support this contention.

A previous study showed that the gravitation of the Moon may regulate the cardiovascular system.<sup>11</sup> While there is little evidence to support the relationship of the cardiovascular system with childbirth, this is an area of potential future research.

Generally, the development of regular and spontaneous ovulatory menstrual cycles is regulated by complex interactions of the hypothalamic-pituitary axis, the ovaries, and the genital tract. The hormonal system plays roles in the labor system.<sup>13</sup> The duration of the cycle in women of reproductive age is approximately 28 days. The duration is very similar to a lunar cycle.<sup>14</sup> The hormonal system related to labor may be regulated by lunar gravitation.

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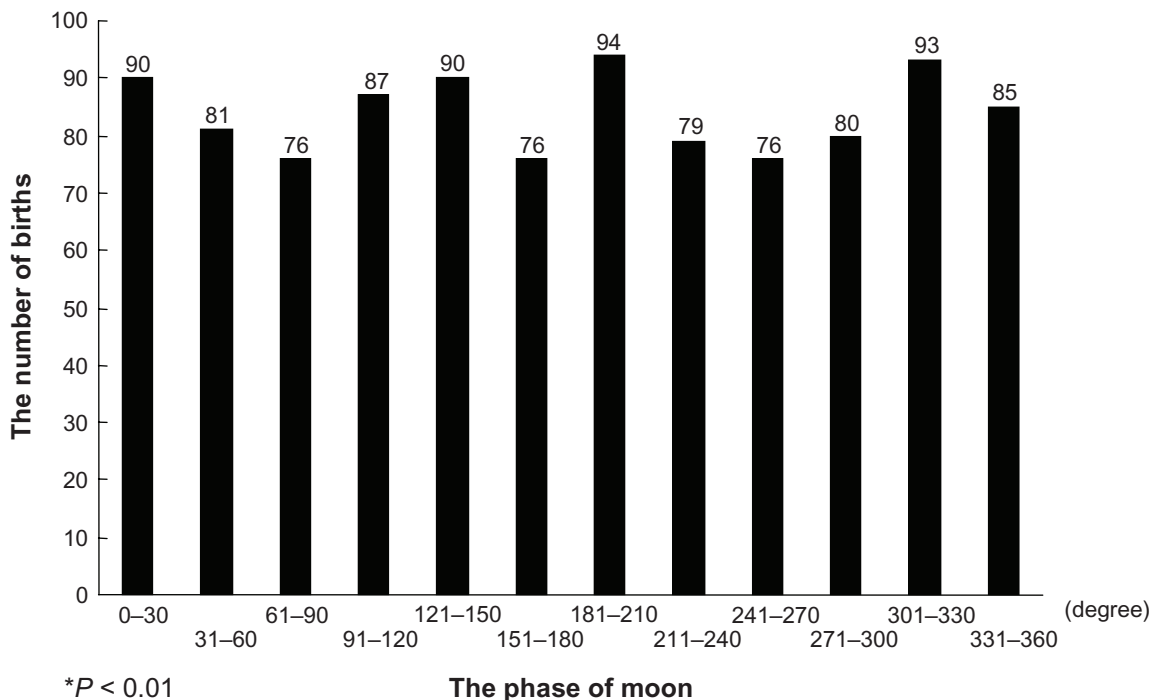
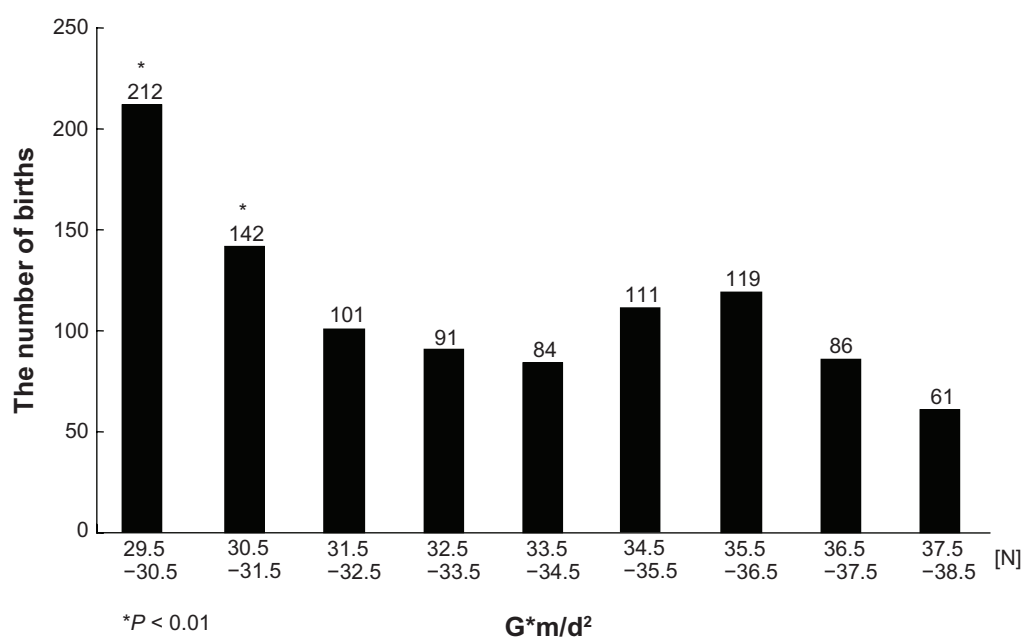


Figure 2. This bar graph shows the relation between the phase of the moon and the number of births.



**Figure 3.** This Figure shows the relation of the gravitation of the moon and the number of births. The number of births is shown on the each bar. The bar graph is increasing, when the gravitation of the moon is less than 31.5 N.  $G \cdot m / d^2$  was used as an index of the universal gravitation.

**Notes:** \*Shows  $P < 0.01$  which is considered as significant difference in Poisson distribution. G: universal gravitation constant, d: the distance from the center of the moon to the center of the earth, m: moon's magnitude.

The gravitation of the moon may also regulate the labor system via internal biological clock genes as well as input signals.

In conclusion, this study showed the possibility that the gravitation of the Moon may alter the frequency of births without the relation to the phase of the Moon. This information may aid health care providers in preparing personnel, equipment, supplies and other resources for the treatment of pregnant women.

### Strengths and limitations

There is less information on the gravitation of the Moon and frequency of the births, although there are some reports on the lunar phase and the frequency of the births. The strengths of the manuscripts are that this is the first report on the relation between the gravitation of the Moon and the frequency of births. The limitations are that we can not investigate the detail mechanisms, because we do not have the serum of the patients.

### Conclusions

We show that the gravitation of the Moon seems to have an influence on the frequency of births. The

precise mechanism of the relationship between the gravitation of the Moon and birth is not yet clearly defined. Further investigations are required.

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### Disclosures

This manuscript has been read and approved by all authors. This paper is unique and not under consideration by any other publication and has not been published elsewhere. The authors and peer reviewers report no conflicts of interest. The authors confirm that they have permission to reproduce any copyrighted material.



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