Lunar Cycle and the Number of Births: A Spectral Analysis of 4,071,669 Births from South-Western Germany

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In obstetrics, there is a still ongoing controversy about the influence of the full moon on the number of daily births. Papers supporting the hypothesis of a lunar influence (1;2) alternate with papers rejecting it (3;4), only recently also in this journal (5). In a meta-analysis of the papers up to 1988 (6) and a following update (7), the authors concluded that "… there is insufficient evidence to support a relationship between lunar phase and birth rate. Most studies report negative results, and the positive studies contradict each other". Surprisingly, and although requested as early as 1985 (8), only a few of the numerous papers used the statistical method of spectral analysis to check the asserted hypothesis. Spectral analysis is a part of time series analysis and relies on the basic fact that a time series (here: the daily number of births) can be seen as an overlay of sinus waves at certain fixed frequencies or periods. The spectrum shows how the whole variability in the original time series is divided up into the variability at specific periods. Peaks in the spectrum thus would represent periods which contribute largely to the variability in the series. As such, if we expect the moon to have an influence on birth numbers this influence will obviously have a cyclic behaviour and we will find a peak in the spectrum at the period corresponding to the lunar cycle.

We performed a spectral analysis of all 4,071,669 life- and stillbirths that occurred from January 1966 to December 2003 in the federal state of Baden-Württemberg, which covers the south-western part of Germany. Our data set was made available from the federal statistical office ('Statistisches Landesamt'). As spectral analysis requires stationarity (constant mean and constant variance of observations in the time course) of the observed time series we detrended the original series with a cubic spline (SAS® PROC TRANSREG). The spectrum of the time series was estimated by the periodogram (SAS® PROC SPECTRA). Following the recommendations of Wei ((9), Chapter 13.1.3) we calculated an F-test (SAS® PROC REG) to check the

significance of the periodogram ordinate at the synodic lunar period, corresponding to a period length of 29.53059 days.

Figure 1 shows the estimated spectrum. The figure consists of two parts (A and B) where part B is an extract from part A that depicts the region of most interest here, covering the periods of various lunar cycles. We observe large peaks at the weekly and annual cycles and their corresponding harmonics, that is, peaks at periods of half, third, quarter etc. length. No distinctive peak can be observed in part B. The result from the F-test for the synodic lunar period is p=0.688.

Our analysis is, at least to our knowledge, the one with the largest data set (in terms of completed lunar cycles) to date for the problem under investigation. Using methods of spectral analysis we found overwhelming evidence for the hypothesis that there is no association of the lunar cycle and the number of births. Using spectral analysis here explicitly accounts for (1) the cyclic behaviour of the moon and (2) the autocorrelation of subsequent days. It especially prevents from arbitrary partitioning the lunar cycle in several phases.

Of course, our study has some limitations. As it is a mere register study it was only possible to model the overall number of daily births. There was no possibility to check if an association exists for certain subgroups like different kinds of births (e.g., vaginal births vs. caesarean sections) or different kinds of women (e.g., nulliparae vs. multiparae).

We finally emphasize that the current study goes somewhat beyond a humorous investigation of a popular myth. The real existence of a lunar effect would have consequences for medical staff and administration in hospitals, e.g., labor wards and emergency units should have adequate staff number in times with expected higher birth numbers.

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Disclosure of interest

The authors declare that there is no conflict of interest. The study has been conducted without any funding.

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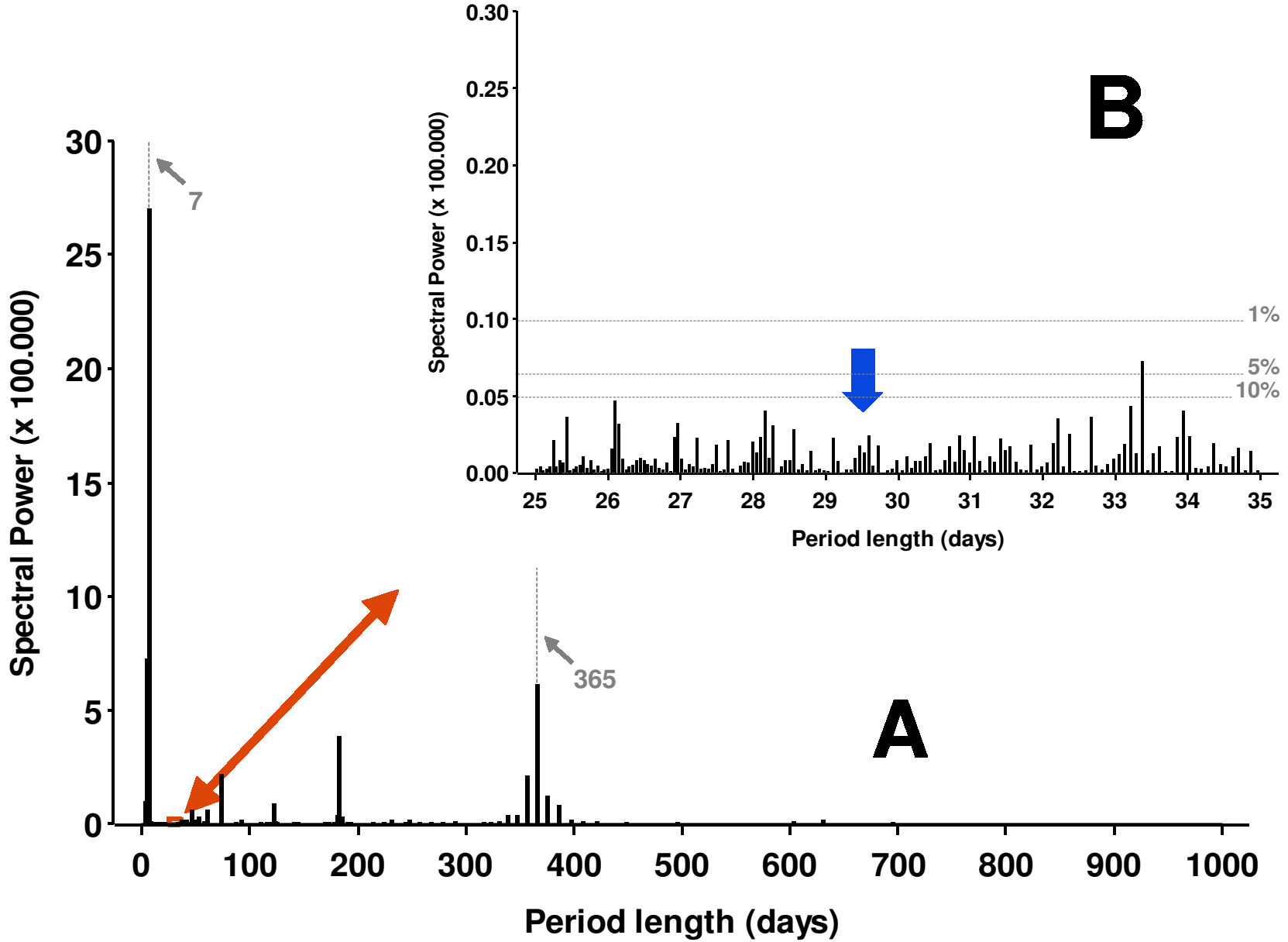
Legend

Figure 1

Estimated spectrum (periodogram) for the detrended time series. The figure consists of two parts (A and B) where part B is an extract from part A that depicts the region which is of most interest here, covering the periods of the various lunar cycles. The blue arrow in part B points to the period of the synodic cycle. Vertical reference lines in part A point to the weekly and annual period, horizontal reference lines in part B represent significance borders for testing the periodogram ordinate at the respective α level.

Figure 1:


Spectral Power (x 100.000)
30
25
20
15
10
5
0
7
365
0
100
200
300
400
500
600
700
800
900
1000
Period length (days)
A
B
Spectral Power (x 100.000)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1%
5%
10%
25
26
27
28
29
30
31
32
33
34
35
Period length (days)