Reduced Male:Female Ratio at Birth in Small Islands
V Grech

ABSTRACT

Background: The male:female ratio at birth (M/F: male births divided by total births) is anticipated to approximate 0.515. The M/F in Micronesia in the Pacific Ocean has been noted to be higher than anticipated. This study analysed M/F in island populations available from a World Health Organization dataset.

Methods: The following islands were identified from the dataset as being sufficiently complete for analysis: Bahamas, Barbados, Puerto Rico, Trinidad and Tobago, and Mauritius.

Results: There were 540,8629 live births available for analysis over the period 1960–2009 with an overall M/F of 0.5106 (95% CL 0.5101, 0.5110). There were no secular trends in M/F.

Conclusion: The M/F in these equatorial islands is lower than anticipated, and the reason for this is unknown.

Keywords: Birth rate, birth trends, infant, newborn, sex ratio

INTRODUCTION

Gender is determined at conception in humans. Males occur slightly in excess in a ratio that approximates 515 males to 485 females (1). This ratio is conventionally expressed as the ratio of male live births divided by total live births (M/F).

The reason for this discrepancy is undecided, but a very wide number of factors have been shown to influence this ratio (2). These include stress which decreases M/F (3) and long-duration warfare (e.g. the World Wars) which increases M/F (4). The ratio may also exhibit slow secular changes (5).

Micronesia (from Greek mikrós, “small” and nēsos, “island”) is a subregion of Oceania that comprises thousands of small islands in the western Pacific Ocean. Some studies have shown that M/F in the Micronesian islands exceeds 0.521 (6, 7) and this was attributed to habitually increased coital activity even for couples with high birth orders and parental ages.

This study identifies secular trends in M/F in available small islands from a World Health Organization (WHO) dataset that includes the past fifty years.
SUBJECTS AND METHODS

Annual male and female live births were obtained directly from the WHO. The following islands were identified from the dataset as being sufficiently complete for analysis: Bahamas (1961–87), Barbados (1955–95), Puerto Rico (1955–92), Trinidad and Tobago (1950–94) and Mauritius (1952–2008).

The MF for these countries was also compared with the adjacent countries of Australia and New Zealand, which had a total of 874,5183 male and 829,0142 female births between them for the period 1950–2009 [M/F 0.5134; 95% CI: 0.5131, 0.5136] (8).

Excel was used for data entry, overall analysis and charting. The quadratic equations of Fleiss were used for exact calculation of 95% confidence intervals for ratios (9). Chi tests for trend were used for annual male and female births. These were performed using the Bio-Med-Stat Excel add-in for contingency tables. This add-in is based on the original work by Cochran and Armitage personal communication Dr Peter Slezák, Institute of Normal and Pathological Physiology, Slovak Academy of Sciences]

RESULTS

There were 540,8629 live births available for analysis over the period 1960–2009 (276,1476 boys and 264,7153 girls), with an overall M/F of 0.5106 (95% CL 0.5101, 0.5110).

Five-year live births and corresponding M/F are summarized in Table 1. The M/F remained relatively low (<0.515) throughout and was significantly lower than that of Australia and New Zealand (x = 127.6, p < 0.0001).

There were no significant secular trends in M/F (Table 2). Based on an anticipated M/F of 0.515, the expected number of males was 278,5444, implying a deficit of 23,968 male births.

DISCUSSION

Earlier studies have shown that in Micronesia, M/F is significantly greater than the anticipated rate of 0.515. It is known that M/F follows a U-shaped regression on cycle day of insemination, such that female conceptions result most often from conceptions that occur around ovulation, while male conceptions occur more frequently at the beginning and end of the menstrual cycle (12, 13). These findings have been confirmed by recent meta-analyses (14, 15).

This U-shaped regression is further confirmed by the higher M/F that is found after the failure of rhythm methods of contraception, such that female conceptions result most often from conceptions that occur around ovulation, while male conceptions occur more frequently at the beginning and end of the menstrual cycle (12, 13). These findings have been confirmed by recent meta-analyses (14, 15).

Table 1: Five-year total live births and M/F for the Bahamas, Barbados, Puerto Rico, Trinidad and Tobago, and Mauritius, 1950–2009

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<tbody>
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<td>Bahamas</td>
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<td>11098</td>
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<td></td>
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<td>13218</td>
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<td>21868</td>
<td>22216</td>
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<td>23370</td>
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<td></td>
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<tr>
<td>Mauritius</td>
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<td></td>
<td>5137</td>
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<td>0.5109</td>
<td>0.5098</td>
<td>0.5096</td>
<td>0.5076</td>
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<tr>
<td>Trinidad and Tobago</td>
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<td>0.5114</td>
<td>0.5106</td>
<td>0.5105</td>
<td>0.5103</td>
<td>0.5107</td>
<td>0.5106</td>
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<td>0.5109</td>
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Table 2: Chi tests for secular trends in M/F

<table>
<thead>
<tr>
<th>Island</th>
<th>x</th>
<th>p</th>
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<tr>
<td>Bahamas</td>
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<td>Barbados</td>
<td>1.9</td>
<td>0.2</td>
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<tr>
<td>Mauritius</td>
<td>0.7</td>
<td>0.4</td>
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</table>

M/F – male:female ratio at birth; UCI – upper confidence interval; LCI – lower confidence interval
birth control, since such failures would theoretically, on average, occur earlier or later in the menstrual cycle (16).

Thus, couples with increased coital rates inadvertently skew M/F in favour of a male excess. This was proposed as the reason for the increased M/F noted in Micronesia, and is contrary to the situation found in Europe and North America where a decline in M/F has been noted with marriage duration and spousal age, implicating a reduction in coital frequency as the cause of the M/F reduction (6, 7).

The high M/F noted in Micronesia is also consistent with studies from Europe that have shown that this ratio increases the closer the location studied is to the equator (17).

The converse was found in the islands analysed in this paper. All, bar one (Bahamas, Barbados, Puerto Rico, Trinidad and Tobago), are located in the western Atlantic Ocean close to the Americas, and span a latitude range of 10–25 °N. Mauritius also lies close to the equator at around 20 °S in the Indian Ocean. The M/F noted in this study is more consistent with the pattern noted in the Americas, where for both the North American and South American continent, M/F was lower as the equator was approached (17, 18).

In conclusion, the small islands analysed in this paper tend to produce lower M/F than anticipated and the reason for this is unknown.

ACKNOWLEDGMENTS
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