Israel Exhibits a Homogenous Male-to-Female Ratio at Birth for All Races and Religions

V Grech

ABSTRACT

Objective: *Male live births occur in excess of female live births and their ratio (M/F) is usually expressed as male divided by total births. The value of M/F varies, declining with stress. Israel has been shown to have a relatively stable M/F. This study was carried out in order to ascertain whether there were any racial or religious differences in M/F in Israel, and to compare with totals for Europe and North America.*

Methods: *Annual data for male and female live births were available from the Israel Central Bureau of Statistics for the period 2002–2011. Excel was used for data entry, overall analysis and charting. For race, data were available as Jews and others, and Arabs. For religion, data were available as Jews and Moslems.*

Results: *There were a total of 1 523 956 live births. Overall M/F was 0.5127 (95% CI: 0.5119, 0.5135). There were no significant differences between the races and no significant trends with time. Male-to-Female Ratio (M/F) is mid-way between that of Europe and North America.*

Conclusion: *The psychological and psychiatric effects of stress in Israel are well documented. However, there was no apparent effect on M/F that is manifested as racial or religious differences in M/F. This could be due to equal levels of stress in all groups or insufficient levels of stress or insufficient births to demonstrate M/F differences.*

INTRODUCTION

Male live births occur in excess of female live births and their ratio (commonly referred to as M/F) is usually expressed as male divided by total births. The value of M/F varies. It has been shown to exhibit broad secular trends (1) and to be sensitive to stress (2). Indeed, all forms of stress have been shown to reduce M/F and these include natural calamities (3, 4).

Man-made events, such as terrorist attacks, have also been shown to reduce M/F. For example, following the September 11 attacks, M/F was shown to have dropped not only in the New York (5) but also in the entire United States (6). Short periods of war have also been shown to reduce war (7) as has economic turmoil and uncertainty (8).

Overall, Israel has been shown to have a relatively stable M/F with no influence from maternal or paternal age, gravidity or parity over the period 2003–2006 (9). However, a study over a longer period showed a significant decline in M/F from 1950 to 1989 with one outlier year (1981) in temporal relation to the destruction of a nuclear reactor that was still under construction near Baghdad. It was speculated that the spectre of war may have resulted in sufficient stress to cause a dip in M/F in this year (10).

Racial differences in M/F have also been demonstrated in countries wherein such races coexist (11). This study was carried out in order to ascertain whether there were any racial or religious differences in M/F in Israel.

SUBJECTS AND METHODS

Annual data for male and female live births were available from the website of the Israel Central Bureau of Statistics for the period 2002–2011. Excel was used for

---

From: Department of Paediatrics, Mater Dei Hospital Medical School, Malta.

Correspondence: Prof V Grech, Department of Paediatrics, Mater Dei Hospital, Malta. Email: victor.e.grech@gov.mt

data entry, overall analysis and charting. For race, data were available as Jews and others, and Arabs. For religion, data were available as Jews and Moslems.

The quadratic equations of Fleiss were used for exact calculation of 95% confidence intervals for ratios (12). Chi tests and Chi tests for trends for annual male and female births were used throughout using the Bio-Med-Stat Excel add-in for contingency tables (13). A p-value ≤ 0.05 was taken to represent a statistically significant result.

Overall M/F for Israel was also compared to amalgamated data for the European and the North American Continents (14).

RESULTS

There were a total of 1 523 956 live births for the period 2002–2011. Overall M/F was 0.5127 (95% CI: 0.5119, 0.5135). Annual M/F for the study period overall, and by race and by religion are shown in Table 1. There were no significant differences between races and religions and no significant trends with time.

For the European Continent, M/F over the period 1950–1999 was 0.5142 (95% CI: 0.5142–0.5143), and for the North American Continent, M/F over the period 1958–97 was 0.5112 (0.5111–0.5112). Male-to-female ratio for Israel was significantly less than for Europe ($p = 0.0002$) but significantly greater than North America ($p = 0.0001$), as per Table 2.

DISCUSSION

Man-made stress is known to reduce M/F. This may be due to contracting economies (15), hotly contested political referenda (16) and even civil strife (17) that falls short of actual warfare (7).

Male-to-female ratio in Israel appears to be mid-way between that of the European and the North American Continents, with no racial or religious differences within the country and significant time trends over the period studied.

The psychological effects of stress in Israel (manifesting even in psychosomatic manifestations) (18) along with the outright psychiatric effects have been well documented in this region (19). However, there was no apparent effect on M/F that is manifested as racial or religious differences in M/F. This could be due to one or more of the following reasons:

All individuals may be equally stressed, so that there may be no difference in M/F outcomes. Another alternative is that the stress levels present are insufficient to affect M/F. Another possibility is that the number of births available for study is too small to detect M/F changes, which may be subtle and require larger numbers of births in order to manifest.

REFERENCES

1. Gini C. Sulla probabilita che termini di una serie erratica sieno tutti crescenti (o non decrescenti) ovvero tutti decrescenti (o non crescenti) con applicazioni ai rapporti dei sessi nascite umane in intervalli successivi e alle disposizioni dei sessi nelle fratellanze umane. Metron 1955; **17:** 1–41.
2. James WH. The human sex ratio. Part 1: a review of the literature. Hum Biol 1987; **59:** 721–52.
3. Fukuda M, Fukuda K, Shimizu T, Møller H. Decline in sex ratio at birth after Kobe earthquake. Hum Reprod 1998; **13:** 2321–2.
4. Lyster WR. Altered sex ratio after the London smog of 1952 and the Brisbane flood of 1965. J Obstet Gynaecol Br Commonw 1974; **81:** 626–31.
5. Catalano R, Bruckner T, Marks AR, Eskenazi B. Exogenous shocks to the human sex ratio: the case of September 11, 2001 in New York City. Hum Reprod 2006; **21:** 3127–31.
6. Bruckner TA, Catalano R, Ahern J. Male fetal loss in the U.S. following the terrorist attacks of September 11, 2001. BMC Public Health 2010; **10:** 273.
7. Zorn B, Sucur V, Stare J, Meden-Vrtovec H. Decline in sex ratio at birth after 10-day war in Slovenia: brief communication. Hum Reprod 2002; **17:** 3173–7.
8. Catalano RA. Sex ratios in the two Germanies: a test of the economic stress hypothesis. Hum Reprod 2003; **18:** 1972–5.
9. Ein-Mor E, Mankuta D, Hochner-Celnikier D, Hurwitz A, Haimov-Kochman R. Sex ratio is remarkably constant. Fertil Steril 2010; **93:** 1961–5.
10. Grech V. The effect of warfare on the secular trends in sex ratios at birth in Israel, Egypt, and Kuwait over the past 60 years. Libyan J Med 2014; **9:** 23448.
11. Grech V. State and regional differences in the male-to-female ratio at birth in the United States, 1995–2012. West Indian Med J 2015. doi: 10.7727/wimj.2014.284. [Epub ahead of print]
12. Fleiss JL. Statistical methods for rates and proportions. 2nd ed. New York: John Wiley and Sons; 1981: 14–15.
13. Slezák P. Microsoft Excel add-in for the statistical analysis of contingency tables. Int J Innovation Educ Res 2014; **2:** 90–100.
14. Grech V, Savona-Ventura C, Vassallo-Agius P. Unexplained differences in the sex ratio at birth in Europe and North America. BMJ 2002; **324:** 1010–11.
15. Catalano RA. Sex ratios in the two Germanies: a test of the economic stress hypothesis. Hum Reprod 2003; **18:** 1972–5.
16. Grech V. The male:female ratio at birth was depressed in Québec by the sovereignty referendums. J Obstet Gynaecol Can 2015; **37:** 405–11.
17. Grech V. Population stress, civil unrest and the male to female ratio at birth in Chile, Argentina, Australia and Finland. Int J Tropical Dis Health 2015; **6:** 27–34.
18. Ablin JN, Cohen H, Clauw DJ, Shalev R, Ablin E, Neumann L et al. A tale of two cities - the effect of low intensity conflict on prevalence and characteristics of musculoskeletal pain and somatic symptoms associated with chronic stress. Clin Exp Rheumatol 2010; **28:** S15–21.
19. Slone M, Shoshani A. Psychiatric effects of protracted conflict and political life events exposure among adolescents in Israel: 1998-2011. J Trauma Stress 2014; **27:** 353–60.

Table 1: M/F overall and by race and by religion, 2002–11

All	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
M	71 318	74 272	74 694	73 956	76 078	77 830	80 254	82 398	85 415	85 162	781 377
F	68 217	70 664	70 513	69 957	72 092	73 849	76 669	78 644	80 840	81 134	742 579
Total	139 535	144 936	145 207	143 913	148 170	151 679	156 923	161 042	166 255	166 296	1 523 956
UCI	0.5137	0.5150	0.5170	0.5165	0.5160	0.5156	0.5139	0.5141	0.5162	0.5145	0.5135
M/F	0.5111	0.5124	0.5144	0.5139	0.5135	0.5131	0.5114	0.5117	0.5138	0.5121	0.5127
LCI	0.5085	0.5099	0.5118	0.5113	0.5109	0.5106	0.5089	0.5092	0.5114	0.5097	0.5119
Jews and others	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
M	50 480	53 220	53 554	54 062	56 136	57 697	60 018	62 158	64 572	64 626	576 523
F	48 124	50 379	50 803	51 050	53 052	54 846	57 455	59 085	60 933	61 924	547 651
Total	98 604	103 599	104 357	105 112	109 188	112 543	117 473	121 243	125 505	126 550	1 124 174
UCI	0.5151	0.5168	0.5162	0.5174	0.5171	0.5156	0.5138	0.5155	0.5173	0.5134	0.5138
M/F	0.5119	0.5137	0.5132	0.5143	0.5141	0.5127	0.5109	0.5127	0.5145	0.5107	0.5128
LCI	0.5088	0.5107	0.5101	0.5113	0.5112	0.5097	0.5080	0.5099	0.5117	0.5079	0.5119
Arabs	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
M	20 838	21 052	21 140	19 894	19 942	20 133	20 236	20 240	20 843	20 536	204 854
F	20 093	20 285	19 710	18 907	19 040	19 003	19 214	19 559	19 907	19 210	194 928
Total	40 931	41 337	40 850	38 801	38 982	39 136	39 450	39 799	40 750	39 746	399 782
UCI	0.5140	0.5141	0.5224	0.5177	0.5165	0.5194	0.5179	0.5135	0.5163	0.5216	0.5140
M/F	0.5091	0.5093	0.5175	0.5127	0.5116	0.5144	0.5130	0.5086	0.5115	0.5167	0.5124
LCI	0.5042	0.5044	0.5126	0.5077	0.5066	0.5095	0.5080	0.5036	0.5066	0.5118	0.5109
Jews	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
M	48 365	50 915	51 319	51 742	53 729	55 377	57 600	59 764	62 085	62 051	552 947
F	45 962	48 212	48 743	48 915	50 784	52 609	55 203	56 835	58 588	59 469	525 320
Total	94 327	99 127	100 062	100 657	104 513	107 986	112 803	116 599	120 673	121 520	1 078 267
UCI	0.5159	0.5167	0.5160	0.5171	0.5171	0.5158	0.5135	0.5154	0.5173	0.5134	0.5138
M/F	0.5127	0.5136	0.5129	0.5140	0.5141	0.5128	0.5106	0.5126	0.5145	0.5106	0.5128
LCI	0.5095	0.5105	0.5098	0.5109	0.5111	0.5098	0.5077	0.5097	0.5117	0.5078	0.5119
Moslems	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
M	18 439	18 588	18 683	17 579	17 560	17 796	17 857	17 868	18 481	18 207	181 058
F	17 760	17 841	17 555	16 638	16 777	16 776	17 003	17 385	17 740	17 040	172 515
Total	36 199	36 429	36 238	34 217	34 337	34 572	34 860	35 253	36 221	35 247	353 573
UCI	0.5145	0.5154	0.5207	0.5191	0.5167	0.5200	0.5175	0.5121	0.5154	0.5218	0.5137
M/F	0.5094	0.5103	0.5156	0.5138	0.5114	0.5148	0.5122	0.5069	0.5102	0.5166	0.5121
LCI	0.5042	0.5051	0.5104	0.5084	0.5061	0.5095	0.5070	0.5016	0.5051	0.5113	0.5104

M/F = male to female ratio; M = male; F = female; UCI = upper 95% confidence interval; LCI = lower 95% confidence interval.

Table 2:   A comparison of M/F for Israel *vs* amalgamated data for the Europe
            and the North American Continents

	Europe	Israel	North America
Years	1950–1999	2002–2011	1958–1997
M	159 194 981	781 377	127 034 732
F	150 384 968	742 579	121 488 464
Total	309 579 949	1 523 956	248 523 196
UCI	0.5143	0.5135	0.5112
M/F	0.5142	0.5127	0.5112
LCI	0.5142	0.5119	0.5111
Chi	13.7		15.0
***p*-value**	0.0002		0.0001

M/F = male-to-female ratio; M = male; F = female; UCI = upper 95%
confidence interval; LCI = lower 95% confidence interval.