Original Article

The male to female ratio at birth in different regions in Malta

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Abstract

Introduction: Males are usually born in excess of females and the ratio of male births to female births is conventionally referred to as M/F. Many factors, including stress, privation and natural disasters are associated with a lowering of M/F.

Malta has a North-South divide, with a more affluent North as opposed to a more industrialised and less prosperous South. This study was carried out in order to ascertain whether regional economic differences influenced M/F in Malta.

Methods: Births by gender, year of birth and locality from 1999 to 2013 were subdivided into ten regions in a geographic distribution devised by the Department of Health Information and Research. Regions were also amalgamated into two groups of five which represented North-West and South-East Malta. The island of Gozo was considered separately.

Results: There were no statistically significant differences in M/F between the ten regions nor between North-West, South-East and Gozo regions. There were no significant secular trends in M/F in these regions.

Discussion: M/F declines under adverse environmental factors (including economic stress) but despite the overall poorer economic circumstances in the South of the Island, this study failed to show a significant difference in M/F by region. This may be due at least in part to the relatively small numbers involved. Alternatively, the purported socio-economic differences may not have been sufficiently large so as to skew M/F to statistically significant levels.

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Introduction

Males are usually born in excess of females and the ratio of male births to total births is conventionally referred to as M/F. Many factors have been shown to influence this ratio.[1-2] These include stress,[3] privation,[4] and natural calamities,[5] all of which tend to lower M/F.
Studies regarding the Maltese population have shown that the M/F appears to favour the male conceptus during the antenatal period, markedly so by the beginning of the third trimester, a situation that persists throughout most of childhood and into the reproductive phase of life.[6] It appears that the female foetus with congenital malformations is more likely to succumb and die during the second and third trimesters of pregnancy. Other biological and nutritional factors may also play a role in favouring the male conceptus during antenatal existence.[6]

Indications of seasonal variation in M/F in Malta has also been documented,[7-8] as well as evidence that parliamentary elections tend to lower M/F.[9]
Malta has traditionally had a North-South divide, with a more affluent North as opposed to a more industrialised and less prosperous South and this has been confirmed by several studies including a national social status survey and the latest (2011) census.[10-11] These showed overall higher literacy and educational achievement in the North with larger dwellings and a greater proportion of home ownership as opposed to renting arrangements for personal housing.

Furthermore, there were higher levels of unemployment in the South along with lower individual and family incomes, older and poorer quality personal

housing conditions. Differences between North-South included even differences in important amenities such as having a kitchen or bath/shower in the house. There were also differences in less important household amenities such as ownership of a gararge, a dishwasher and internet access.[10-11]

Stress related to contracting economies and unemployment has also been shown to decrease M/F.[12] This study was carried out in order to ascertain whether regional economic differences influenced M/F in Malta.[10-11]

Methods

Anonymised births by gender, year of birth and locality were directly obtained from the Directorate for Health Information and Research for 1999-2013 (Dr. Miriam Gatt – personal communication).

Data was subdivided into ten regions in a geographic distribution devised by the Department of Health Information and Research (table 1). The regions were also amalgamated (in an attempt to gain greater statistical power) into two groups of five which represented North-West and South-East Malta. Gozo was also considered separately.

Microsoft 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.[13] 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.[14] A p value ≤ 0.05 was taken to represent a statistically significant result

***Table 1**: Malta by region*

North-West group of regions				
West	**North**	**Central**	**Central North**	**Central West**
Zebbug	Mellieha	Hamrun	Sliema	Attard
Siggiewi	Mgarr	Sta Venera	St. Julian's	Balzan
Mdina	St Paul	Msida/G'Mangia/Pieta	San Gwann	Birkirkara
Dingli	Gharghur	Gzira/Ta' Xbiex		Lija/Iklin
Rabat	Mosta			
	Naxxar			
South-East group of regions				
Central East	**Harbour**	**Central South**	**South**	**East**
Fgura	Valletta	Qormi	Gudja	Zejtun
Paola	Floriana	Marsa	Kirkop	Birzebbugia
Sta Lucia	Vittoriosa		Luqa	Ghaxaq
Tarxien	Senglea		Mqabba	Marsaxlokk
	Cospicua		Qrendi	Zabbar/Xghajra
	Kalkara		Safi	Marsascala
			Zurrieq	

Results

Live births by region are shown in table 2. There were no statistically significant differences in M/F between regions. There were also no statistically significant differences when North-West was compared with South-East or when any of the two regions (or their sum) were compared with Gozo.

There were no significant time trends in M/F in the three main regions studied over the period of study (North-West, South-East and Gozo; figures 1-3 respectively).

The years 2000 and 2010 showed significantly low/reversed M/F in the South-East region. There were no such dips for the NW region. Gozo also had a similar M/F dip in the year 2000. These dips were statistically significant (table 3).

***Table 2**: Live births by gender and M/F for Malta by region, 1999-2013*

	North-West (NW)					
	West	**North**	**Central**	**Central North**	**Central West**	**Total**
M	2920	5106	2103	3621	3224	16974
F	2776	4886	1883	3416	3060	16021
T	5696	9992	3986	7037	6284	32995
UCI	0.5257	0.5209	0.5432	0.5263	0.5255	0.5198
M/F	0.5126	0.5110	0.5276	0.5146	0.5130	0.5144
LCI	0.4996	0.5012	0.5120	0.5028	0.5006	0.5090
	South-East (SE)					
	Central East	**Harbour**	**Central South**	**South**	**East**	**Total**
M	2232	1593	1579	2207	4800	12411
F	2113	1468	1408	2056	4377	11422
T	4345	3061	2987	4263	9177	23833
UCI	0.5287	0.5382	0.5466	0.5328	0.5333	0.5271
M/F	0.5137	0.5204	0.5286	0.5177	0.5230	0.5207
LCI	0.4987	0.5025	0.5105	0.5026	0.5128	0.5144
	NW	**SE**	**Gozo**			
M	16974	12411	2221			
F	16021	11422	2034			
T	32995	23833	4345			
UCI	0.5198	0.5271	0.5261			
M/F	0.5144	0.5207	0.5112			
LCI	0.5090	0.5144	0.4962			

***Figure 1**: M/F by year for the North-West Region, 1999-2013*

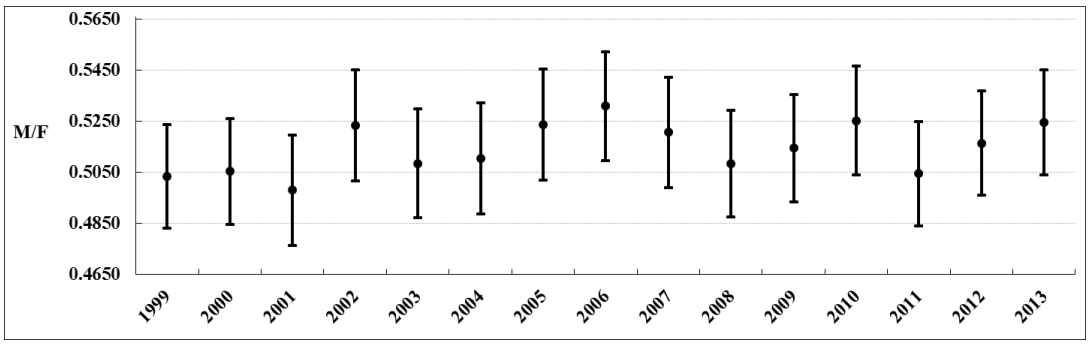

***Figure 2**: M/F by year for the South-East Region, 1999-2013*

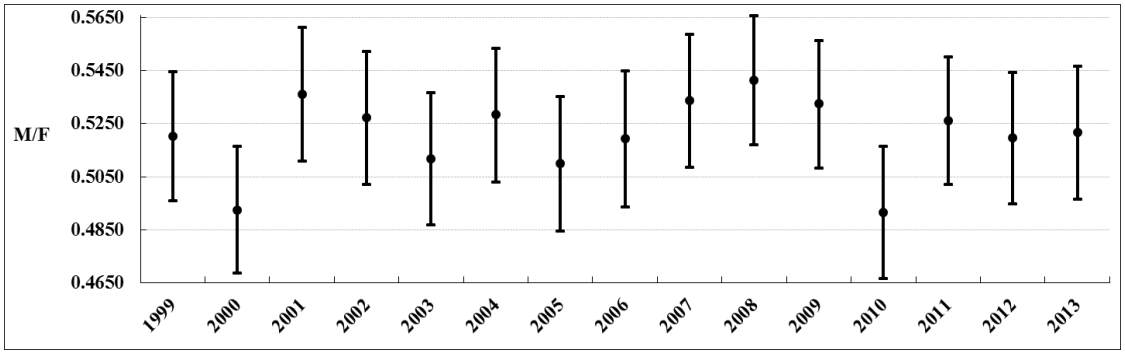

***Figure 3**: M/F by year for Gozo, 1999-2013*

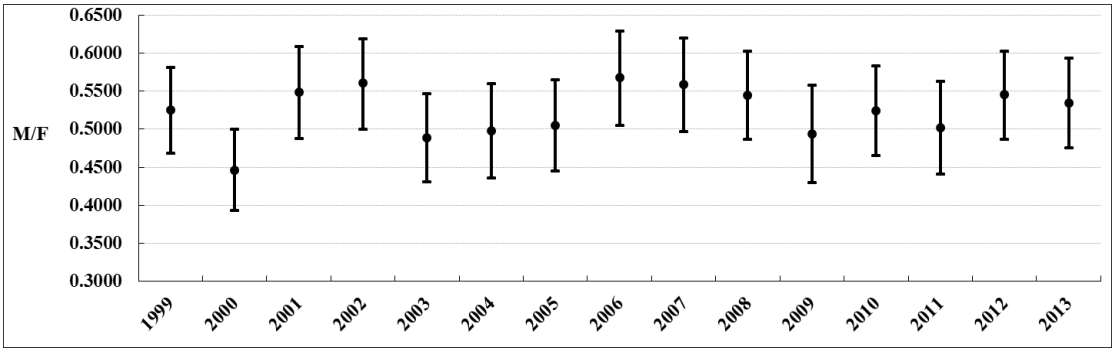

***Table 3**: Chi tests for years wherein M/F dipped*

	SE 2000	SE minus 2000	SE 2010	SE minus 2010	Gozo 2000	Gozo minus 2000
M	844	11567	773	11638	153	2068
F	870	10552	800	10622	190	1844
T	1714	22119	1573	22260	343	3912
UCI	0.5164	0.5295	0.5164	0.5294	0.5004	0.5444
M/F	0.4924	0.5229	0.4914	0.5228	0.4461	0.5286
LCI	0.4685	0.5163	0.4664	0.5162	0.3929	0.5128
chi		5.9		5.8		8.6
p		0.015		0.016		0.003

Discussion

M/F generally declines under conditions of adverse environmental factors (including economic stress).[12] this is in accordance with the Trivers-Willard hypothesis which suggests that natural selection has selected parents who bias investment in favour of the sex with the best reproductive prospects in accordance with extant periconceptual and gestational conditions.[15]

More specifically, poor ambient conditions may preclude the carriage of a male foetus to term since a male requires a greater maternal investment in terms of physical resources for gestation.[16] Should such pregnancies reach term, the outcome may be a frail male who may not survive infancy and childhood. Furthermore, a frail adult male would not be able to compete for mating privileges with stronger males. However, even under adverse circumstances, a female foetus is likelier to be successfully carried to term and survive, and eventually have offspring of her own.

On the other hand, under favourable conditions, a robust male has far more reproductive opportunities than an equivalent female who is hampered by a long gestational period and subsequent nursing. Thus, since resource abundance or scarcity affects reproductive success, the Trivers–Willard hypothesis predicts that natural selection has favoured parents who tend to produce females under poor conditions and males in good circumstances. [15]

Research has shown that one possible mechanism is that of excess prenatal foetal losses under stressful/adverse conditions which are skewed such that male foetuses are lost at a higher rate than female foetuses, reducing M/F.[17]

Despite the overall poorer economic circumstances in the south of the island, this study failed to show a significant difference in M/F over the period studied. Indeed, the analysis showed an overall higher M/F in the Southern part of the region, albeit not at a statistically significant level. This may be due to the relatively small numbers involved, which may lead to a type 2 error. Alternatively, the purported socio-economic differences may not have been sufficiently large such as to skew M/F to statistically significant levels. The authors are unable to explain the significant dips noted in specific regions in this study.

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