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Changes in stature of Portuguese women born between 1966 and 1982, according to educational level



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Abstract Studies which document secu-

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Introduction

Studies on secular trends in stature are almost exclusively based on male data and most are based on military conscript records (van Wieringen, 1986; Komlos, 1987; Padez, 2003). In European countries, the 19th century male height increased rapidly until the early half of the 20th century, slowing down afterwards.

This trend mirrors major improvements in living conditions of the Europeans. In Portugal this positive trend has been documented for the 20th century, with an increase in stature of approximately 0.99 cm per decade, but accelerated only in the middle to late 20th century (Padez, 2003). Studies reporting changes in female stature are less frequent, since large sources of stature data from females are

generally unavailable. Several studies on female stature have, nonetheless, been published over the years (Shatrugna and Rao, 1987; Sanna and Danubio, 2009; Wronka and Pawli ska-Chmara, 2007; Komlos, 2010). Some studies found no secular trend (Shatrugna and Rao, 1987) suggesting similar degrees of malnutrition and environmental deprivation between generations, while other studies found a very slow positive trend (Sanna and Danubio, 2009). In general, the secular trend in females is less pronounced when compared with males from the.

trends, our study has three main objectives. Firstly, we wish to document the change in female stature using a sample of Portuguese women born between 1966 and 1982. Secondly, we wish to assess whether the individual's educational level, used as a proxy measure of socio-economic status, influences changes in stature. Finally, we aim to compare height changes between Portuguese males and females during the same time period. To our knowledge, this is the only Portuguese study reporting changes in female stature based on recent data. For this reason, our study may provide valuable insights into recent changes in the Portuguese female height related to the improvement of the general living and health conditions that occurred in Portugal during the late dictatorship and early democracy years.

Materials and methods

The sample

This study analyzed a sample of 30,629 of women who gave birth at the *Dr. Alfredo da Costa* Maternity Hospital from 1991 to 2004 (Table 1). During this time period, the Maternity collected biographical and medical history data from each of the women which were included in one single database. Stature

was among the data collected, which is self-reported by the pregnant woman. The database also includes details of the delivery and of the newborn.

After excluding repeated records and cases not correctly recorded, the baseline sample is composed of 97,388 women born between 1938 and 1991. Since changes in female stature were assessed according to educational level, cases which did not report the women's height and their educational level were excluded. The sample was further selected based on year of birth. In order to compare changes in female stature with previously reported data on Portuguese males born in the same period we only analyzed the sample of women born between 1966 and 1982. For these reasons, the final sample is composed of 30,629 women. The distribution of the sample by year of birth is shown in Table 1. Only women with a minimum of 18 years of age were included in the sample, to insure that growth in height has ceased. The large majority of pregnant women assisted at the *Dr. Alfredo da Costa* Maternity Hospital lived in the city of Lisbon and its surrounding urban areas, therefore, may be considered representative of the Lisbon urban area. With respect to ethical concerns for the use of this database, all information was made available in an anonymous form. The second source of height data derives from a male sample composed of 19,255 conscripts

Table 1. Sample sizes (n) per year and educational level (five-groups). Percentages are calculated by educational level.

Year of birth	Sample Size (n)															Total	
	1-4 years of schooling			5-6 years of schooling			7-9 years of schooling			10-12 years of schooling			Total				
	n	%		n	%		n	%		n	%		n	%			n
1966	259	8.4		185	5.0		367	4.5		576	6.1		478	7.7		1865	6.1
1967	465	15.1		331	9.0		554	6.8		636	6.7		599	9.7		2585	8.4
1968	236	7.7		280	7.6		446	5.4		625	6.6		647	10.5		2234	7.3
1969	231	7.5		258	7.0		549	6.7		655	6.9		686	11.1		2379	7.8
1970	238	7.7		280	7.6		518	6.3		737	7.7		697	11.3		2470	8.1
1971	230	7.5		298	8.1		554	6.8		705	7.4		706	11.4		2493	8.1
1972	248	8.1		277	7.6		498	6.1		831	8.7		603	9.8		2457	8.0
1973	198	6.4		236	6.4		522	6.4		734	7.7		505	8.2		2195	7.2
1974	195	6.3		269	7.3		535	6.5		742	7.8		408	6.6		2149	7.0
1975	191	6.2		225	6.1		541	6.6		685	7.2		281	4.6		1923	6.3
1976	132	4.3		193	5.3		584	7.1		611	6.4		214	3.5		1734	5.7
1977	114	3.7		202	5.5		554	6.8		542	5.7		138	2.2		1550	5.1
1978	79	2.6		139	3.8		448	5.5		433	4.5		86	1.4		1185	3.9
1979	79	2.6		139	3.8		442	5.4		362	3.8		69	1.1		1091	3.6
1980	68	2.2		126	3.4		422	5.1		280	2.9		29	0.5		925	3.0
1981	56	1.8		113	3.1		372	4.5		217	2.3		17	0.3		775	2.5
1982	59	1.9		114	3.1		290	3.5		146	1.5		10	0.2		619	2.0
Total	3078			3665			8196			9517			6173			30629	

quently, final attained height. These comparisons assume that women with more years of schooling originate from higher socioeconomic status families, therefore, had greater access to resources (e.g. like better nutrition, sanitary living conditions or health care) when compared to women with less years of schooling. In Portugal there is a strong connection between parental socioeconomic status and the education level of their children (Instituto Nacional de Estatística, 2010). For illustrative purposes, the sample was divided into the five established educational subgroups, according to the referred Portuguese educational system: (1) *Primeiro Ciclo – Ensino Básico* (1st to 4th grade); (2) *Segundo Ciclo – Ensino Básico* (5th and 6th grades); (3) *Terceiro Ciclo – Ensino Básico* (7th to 9th grade); (4) *Ensino Secundário* (10th to 12th grade); (5) *Ensino Superior* (University level).

In our sample the secondary level is the most represented with 31.1% of the women having between 10 and 12 years of schooling, followed by women with between 7 and 9 years of schooling (26.8%) and university level (20.2%). Twelve per cent of women in our sample had between five and six years of schooling and only 10% of the women had between one and four years of education. Although in the 1980s near 100% of the children concluded the *Ensino Básico* (1st to 4th grade), between 1966 and 2004 the educational level of the Portuguese im-

proved considerably. In 1966 only 3.1% of the Portuguese students were enrolled in the secondary level, but the proportion increased steadily, reaching 12.2% in 1981 and 40% in 1991. Presently, more than 60% of the children with the ap-t

(SPSS Inc., 2008) and with significance level of 0.05.

ference between these two groups is 4.2 cm. However, mean heights over

Results

Results show that female stature tends to increase between 1966 and 1982 and those women of higher educational level are systematically taller than those of lower educational level (Table 2). Figure 1 illustrates the changes in mean stature in the women who attended school, according to five groups of educational level. Women with no schooling were excluded because they could not be effectively included (see above). A clear difference in height between women of different educational levels can be observed. Women of lower educational levels are consistently shorter than women of higher educational levels and mean height calculated per year of birth of women with lower education level never surpasses mean height of women of higher educational level. The mean dif-

Mean differences in height between

stature found in the present study (4.2 cm) are similar to that found in Portuguese males, but over a longer period of time (Padez, 2003).

Two potential sources of bias can be detected in our sample. The first is that stature was self-reported by the women during admission in the maternity hospital, and the second is that women with no schooling were excluded from the final sample. The effects of self-reported stature are probably very small because this is a consistent directional bias, which does not affect the actual variations in height between women over the years, and self-reported information on stature has been considered very reliable (Nakamura *et al.*, 1999; Gozzi *et al.*, 2010). For a similar reason, excluding women with no schooling is unlikely to change variations in stature between groups and years, because they were systematically eliminated. However, this made impossible to assess changes in height at the lowest educational/socioeconomic level.

If one compares the results found in the present study with findings from the only other study of a Mediterranean population (Sanna and Danubio, 2009), Portuguese women in our sample are, on average, taller (mean height 161.2 cm) than Italian women from Sardinia (159.1 cm), but are shorter when compared to women from Latium (162.4 cm – the Italian region including Rome) (Sanna and Danubio, 2009). Mean increase in height

of Portuguese women born between 1966 and 1982 is considerably less than the increase in height of women from both Italian samples born in the same period. Sanna and Danubio (2009) argue that the differences between women from Latium and women from Sardinia are due to the slowing or stabilization of the secular trend in women from Latium, whereas a continuing secular trend is observed for the Sardinian women. The results are difficult to compare because the Italian samples are small (579 and 179) and SES was assessed based on the occupation of the father. Besides, the sample from Latium is composed only of women from middle/upper classes.

Height is a marker of the biological well-being and general health, at the individual and population level, which is mediated by environmental conditions and family lifestyle choices (Komlos, 2010). Studies in other European populations suggest that the secular trend is more marked amongst the lower social classes than in the upper ones, at least in males (Laska-Mierzejewska *et al.*, 1982; Chinn *et al.*, 1989; Padez, 2003; Komlos and Baur, 2004). However, frequently the reverse occurs, where the early impact of improvements in living conditions affect the upper classes first, namely when analysing mortality rates (Marmot *et al.*, 1987; Haines, 1995; Cambois *et al.*, 2001). Victora *et al.* (2000), for example, have shown that improvements in living and health

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