



ORIGINAL RESEARCH

Trends in overweight and obesity in Portuguese conscripts from 1986 to 2000 in relation to place of residence and educational level

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Received 8 March 2005; received in revised form 7 April 2006; accepted 18 May 2006
Available online 8 August 2006

KEYWORDS

Overweight;
Obesity;
Trends;
Young adults;
Portugal

Summary Objective: The aim of this study was to analyse changes in the prevalence of overweight and obesity between 1986 and 2000 in Portuguese conscripts, and to examine the role of place of residence and educational level.

Study design: Cross-sectional study.

Methods: Data sets from the cross-sectional annual surveys of all 18-year-old Portuguese males born between 1966 and 1981 and examined between 1986 and 2000 (850 081 subjects) were used in this study. Height and weight were measured and body mass index was calculated. Data on educational level (4, 6, 9, 11 and 12+ years) and residence (urban, semi-urban and rural) were collected.

Results: The prevalence of overweight increased from 10.5% in 1986 to 21.3% in 2000, and the prevalence of obesity increased from 0.9% to 4.2% in the same period ($P < 0.001$). After adjustment for year of examination, the odds ratio (OR) for being overweight increased with educational level (reference 4–6 years: 1.19; 9 years: 1.30; 11 years: 1.47; 12+ years: 2.41) and place of residence (reference urban–semi-urban: 1.04; rural: 1.06). The prevalence of obesity increased with educational level (reference 4–6 years: 1.27; 9 years: 1.79; 11 years: 1.83; 12+ years: 2.66) and decreased with place of residence, i.e. those who lived in rural areas had a lower risk of becoming obese (OR: 0.94).

Conclusions: Despite the low prevalence of obesity in young males in Portugal compared with other European countries, the sharp increase in recent years indicates that public health strategies are needed to prevent obesity.

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Introduction

An increased prevalence of overweight and obesity has been reported in many developed countries over the past decades.^[1–8] Moreover, there is growing evidence that excess weight is causally related to chronic diseases and all-cause mortality.^[9] Obesity is associated with an increased risk of hypertension, non-insulin-dependent diabetes mellitus, hyperlipidaemia and other chronic diseases.^[10–12]

Several studies have shown that obesity in young adults has an adverse effect on morbidity and mortality. Many countries have reported an increase in the prevalence of obesity during the last few decades, and a serious increase in the associated health problems is anticipated.^[13] Obesity is a multifactorial problem and its development is due to multiple interactions between genes and the environment.^[14]

Portugal has the highest stroke mortality rate in Western Europe, and cardiovascular diseases cause around 40% of deaths in Portugal.^[15,16] The only study of time trends in the prevalence of overweight and obesity used a selected sample of young males, from the District of Lisbon, at the time of military examination, and showed an increase in the percentage of males with body mass index (BMI) $>25\text{ kg/m}^2$ from 8.1% in 1960 to 18.0% in 1990.^[17] Another Portuguese study with a random sample of 1436 residents of Porto, aged 18–90 years, found that obese subjects showed a significantly higher prevalence of hypertension, hypertriglyceridaemia, diabetes and high-density-lipoprotein cholesterol concentration compared with subjects of normal weight.^[18]

Obesity-related costs have been estimated to represent approximately 7% of the total healthcare expenditure in the USA, 1–5% in Europe and 3.5% in Portugal.^[13,19,20]

This paper reports the first national study of overweight and obesity in 18-year-old Portuguese males. The aims were: (i) to analyse time trends in BMI distribution and the prevalence of overweight and obesity from 1986 to 2000; and (ii) to examine the influence of place of residence and educational level on the prevalence of overweight and obesity.

Methods

Study population

Data were obtained from medical examination records at the Portuguese district recruiting centres. Military service is compulsory in Portugal. All

males born in a given year are examined by military physicians during their registration visit, which lasts for 3 days. The sample can thus be regarded as representing all regions of the country and all the social strata. All 18-year-old Portuguese males born between 1966 and 1981 and examined between 1986 and 2000 (850 081 subjects) were included. For 1991, data are absent due to technical problems, and for some other years, such as 1990 and 1993, the Portuguese Army only requested some males for the general examination. However, selection was made on a random basis throughout Portugal.

During the medical examination, height and weight are measured by a physician. For the present study, overweight and obesity were defined as a BMI of 25.0–29.9 and $\geq 30.0\text{ kg/m}^2$, respectively, using the cut-off points proposed by the World Health Organization.^[21]

Social data

Residence details of the subjects were obtained and classified into three categories based on population size, following the classification of the Instituto Nacional de Estatística (INE): rural areas (population below 2000); semi-urban areas (population 2000–5000); and urban areas (population over 5000). Educational attainment was categorized into five levels according to the INE classification: primary (4 years); 6 years; secondary incomplete (9 years); secondary incomplete (11 years); and more than 12 years. Data on occupation were not collected.

Statistics

A simple χ^2 method, using a significance level of 0.05, was used to determine the increase in overweight and obesity between 1986 and 2000. Logistic regression analysis was performed to calculate odds ratios (OR) and 95% confidence intervals (CI) for educational level and place of residence as risk factors for overweight and obesity. The results were adjusted for year of examination.

Statistical analysis was performed using SPSS Version 11.0 (SPSS Inc., Chicago, IL, USA).

Results

Sociodemographic and health characteristics

Table 1 summarizes the evolution of sociodemographic and health system characteristics in Portu-

Table 1 Evolution of sociodemographic and health system characteristics in Portugal.^a

	1920	1930	1940	1950	1960	1970	1980	1990
Demography								
Birth rate ^b	33.6	29.7	24.3	24.3	24.1	20.9	16.13	11.8
Age group <15 years	32.6	31.9	31.8	29.2	29.2	28.5	25.5	20
Age group ≥65 years	5.9	6.2	6.4	6.9	8	9.7	11.5	13.6
Fecundity index ^c	—	3.9	3.2	3.2	3.2	3	2.2	1.5
Infant mortality rate ^d	177	144	126	94.1	77.5	55.5	21.8	10.8
Postneonatal mortality rate ^e	—	95.5	87.5	62.9	46.77	31.86	10.46	3.34
Life expectancy—men (years)	35.8	44.8	48.6	55.5	60.7	64.2	69.3	70.3
Life expectancy—women (years)	40	49.2	52.8	60.5	66.4	70.8	75.3	77.5
Adult literacy (%)	34.6	39.6	46.4	58.3	66.9	74.4	81.4	89
Health								
Number of physicians per 1000 population	—	—	—	—	352	508	1056	1256
Maternal mortality ^f	—	741	752	355	115.5	73.4	19	10.3
Born in hospital (%)	—	—	—	—	18.4	37.5	73.8	95.5
Economy								
Agricultural sector	—	48.2	51.4	49.4	43.3	39.7	19.4	10.6
Industrial sector	—	17.3	19.7	23.8	28.7	40	38.8	37.2
Services sector	—	34.5	28.9	26.8	28	20.3	41.8	50.4
House conditions								
Tap water (%)	—	—	—	—	28.9	47.4	72.4	86.8
Shower and bath (%)	—	—	—	—	18.6	28.7	58.2	81.8
Sanitary equipment (%)	—	—	—	—	41.8	58.1	79.1	88.5
Electricity (%)	—	—	—	—	40.5	63.8	90.7	97.7
Sewerage systems (%)	—	—	—	—	38.3	58.1	68	90.7

^aAdapted from Barreto.^{22,23}

^bNumber of births per 1000 population.

^cNumber of children, on average, for each woman during their reproductive life (15–49 years).

^dDeaths from birth to 1 year of age per 1000 live births.

^eDeaths from 1 month to 1 year of age per 1000 live births.

^fDeaths per 100 000 women.

gal during the 20th Century.^[22,23] From 1920 to 1990, birth rate, percentage of young people (<15 years), infant mortality rate and postneonatal mortality rate all showed a strong decrease. Simultaneously, the percentage of old people (≥65 years), life expectancy in both sexes, and adult literacy increased. The Portuguese health system also showed large changes. Between 1960 and 1990, the number of physicians per 1000 population and the percentage of newborns that were delivered in a hospital increased, and maternal mortality decreased. In the economic sector, the agricultural system decreased from 48.2% in 1930 to 10.6% in 1990. On the other hand, the industrial and services sectors both increased in the same period, especially the industrial sector.

Taking in to account the changes in nutrition in the Portuguese population, Table 2 presents the total daily energy intake of some products. From the 1960s to the 1990s, the consumption of some products increased substantially, such as milk (from

76 to 237 cal/day), meat (from 78 to 328 cal/day), fats (from 407 to 788 cal/day), sugar (from 209 to 350 cal/day) and eggs (from 14 to 30 cal/day). The consumption of calories increased from 2671 to 3577 calories between 1960 and 1990.

BMI distributions

Figure 1 shows the BMI distributions in 1986 and 2000. Mean BMI values have increased over time, and the BMI distributions are skewed to the right in the last period of 2000.

Trends in overweight and obesity

The prevalence of overweight and obesity in 1986 and 2000 are shown in Figs. 2 and 3, respectively. The prevalence of overweight increased from 10.5% to 21.3%, and the prevalence of obesity increased from 0.9% to 4.2% ($\chi^2 = 14079.5$, $P < 0.001$).

Table 2 Total daily energy intake (cal/day).^a

Food	Year						
	1963	1970	1980	1985	1990	1995	1997
Meat	78	123	197	192	270	312	328
Milk	76	117	140	172	213	227	237
Fats	407	518	617	687	734	784	788
Sugar	209	279	344	332	335	345	350
Eggs	14	16	21	25	29	30	30
Calories	2671	2940	2980	3127	3389	3544	3577
Calories ^b	2843	3098	3093	-	3601	3752	3773
Proteins (g)	—	—	87.9	92.2	108.5	115.1	116.5
Fats (g)	—	—	99.7	109.3	123.7	132.7	135.3
HC (g)	—	—	432.9	443.7	463.5	476.6	477.9

^aAdapted from Barreto.^{22,23}
^bCalories including alcohol.

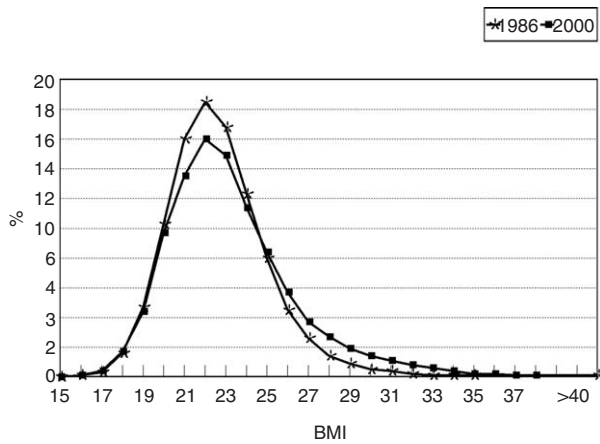


Figure 1 Distributions of body mass index for 18-year-old males observed in 1986 and 2000.

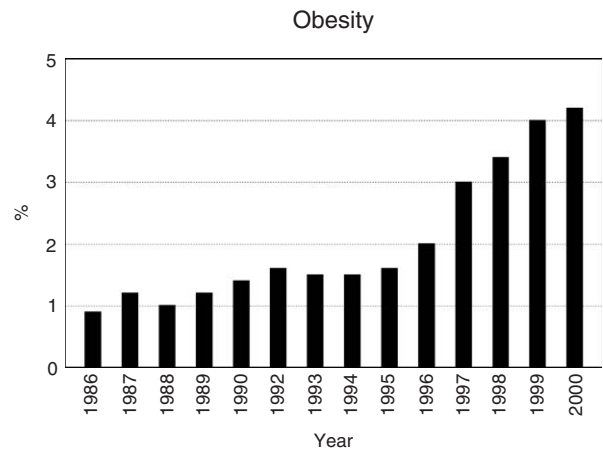


Figure 3 Prevalence of obesity (body mass index ≥ 30.0) by year of examination.

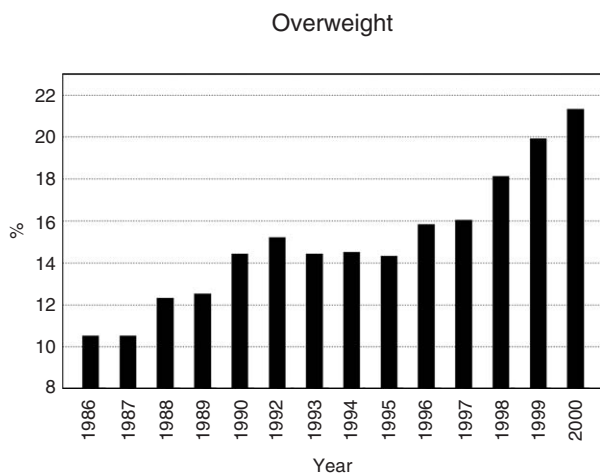


Figure 2 Prevalence of overweight (body mass index 25.0–29.9) by year of examination.

Educational level and place of residence

Table 3 shows the ORs for overweight and obesity in relation to educational level and place of residence, both adjusted for year of examination. Males with more than 12 years of education showed a higher risk of being overweight (OR = 2.41, 95% CI 2.40–2.42) or obese (OR = 2.66, 95% CI 2.65–2.67) compared with males with a lower level of education.

Males who lived in rural areas were at greater risk of being overweight (OR = 1.06, 95% CI 1.05–1.07) and at lower risk of being obese (OR = 0.94, 95% CI 0.93–0.95) compared with males who lived in urban and semi-urban areas. The present place of residence was used in this study, which is not an indicator of how long subjects

Table 3 Predictors of overweight and obesity for young adults examined between 1986 and 2000

	Overweight			Obesity		
	<i>n</i>	OR	(95% CI)	<i>n</i>	OR	(95% CI)
Educational level						
4 years	14 873	1		133 734	1	
6 years	291 969	1.19*	(1.18–1.19)	258 471	1.27*	(1.26–1.27)
9 years	316 151	1.30*	(1.29–1.31)	278 418	1.79*	(1.78–1.8)
11 years	92 425	1.47*	(1.46–1.48)	79 921	1.83*	(1.82–1.84)
12+ years	150 798	2.41*	(2.40–2.42)	119 885	2.66*	(2.65–2.67)
Place of residence						
Urban	724 564	1.0*			1	
Semi-urban	202 442	1.04*	(1.034–1.046)		0.97*	(0.96–0.974)
Rural	50 633	1.06*	(1.051–1.068)		0.94*	(0.93–0.95)

OR, odds ratio; CI, confidence interval. Each adjusted for year of examination. * $P < 0.001$.

have lived in the same residence. However, for both overweight and obesity, the difference between the place of residence and the place of birth were not statistically significant (data not shown).

Discussion

Trends in the prevalence of obesity in European countries are available for several countries including England, Sweden, Finland, Germany, Spain and The Netherlands.^[24] The prevalence of obesity has increased by approximately 10–40% in the majority of European countries over the past 15 years. The most dramatic increase has been reported in the UK, where the prevalence of obesity has doubled in the past 15 years.

The present findings are of national relevance because they give a unique picture (because this sample represents all regions of Portugal and all social strata) of the magnitude of the problem of obesity in young Portuguese males. The main findings of this nationwide population-based study were an increase in mean BMI over time, and that BMI distributions are skewed to the right. In consequence, there has been a fairly strong upward trend in the prevalence of overweight and obesity in Portugal between 1986 and 2000; overweight increased from 10.5% to 21.3% and obesity increased from 0.9% to 4.2%.

It is difficult to compare these results with those from other European studies because most other studies have reported prevalence for all adult age groups. However, it is possible to determine the overweight and obesity values in studies that separated their samples according to age group. For 2000, the present values are lower (4.2%) than

those observed in The Netherlands (4.4%),^[25] Norway (10%),^[26] Denmark (4.6%)^[27] and Finland (8.6%).^[28] Only Sweden (3.2%)^[5] and France (2.0%)^[29] showed lower values than those found in 18-year-old Portuguese males. However, despite these low values, the prevalence of overweight and obesity in Portugal has increased notably between 1986 and 2000.

Contrary to other studies that found a higher prevalence of obesity in subjects with low levels of education, this study found an inverse association between obesity and educational level, with subjects with a low level of education presenting with lower values of overweight and obesity than those with a higher level of education. To give some examples, in Belgium, Stam-Moraga et al.^[30] found a highly significant inverse gradient between level of education and the prevalence of obesity, even after adjustment for age. The same trend was found in Sweden and Canada.^[31–33] In The Netherlands, Visscher et al.^[34] adjusted for age and town and found an inverse association between obesity and educational level; those with a primary school education had a prevalence of obesity of 15.4% and those with a university education had a prevalence of obesity of 4.7%. The reverse relationship found in Portugal could be related to occupation. Those with a low level of education generally had an occupation that required more physical work than those with a higher level of education. Unfortunately, the questionnaire completed during the registration visit did not collect data related to occupation or socio-economic status.

The ultimate cause of obesity is an energy imbalance in which the relative excess in energy intake is translated into an accumulation of fat in the organism. However, obesity is considered to be the result of a large number of factors, including

genetic background and several factors related to the environment. The current prevalence and trends in obesity seem to be the result of rapid changes in socio-economic living conditions that have occurred in Portugal since the 1970s. The Portuguese nutrition pattern changed a great deal between 1960 and 1997. Consumption of some products, such as milk, meat, eggs, sugar, proteins and fats, increased considerably. In Italy, Ullizi and Terrenato^[35] stressed the importance of these dietary components on secular trends in Italian conscripts born in 1874 and 1960. In Japan, Takahashi^[36] linked the secular trend in height to the consumption of milk, which has risen steeply since the Second World War, and concluded that milk consumption among the younger generation was one of the most important reasons for the acceleration of growth. Some of the changes in consumption of some products had a positive effect on the secular changes in height in the Portuguese population,^[37] but an increase in total energy from 2671 cal/day in 1963 to 3577 in 1997 and an increase in fat intake from 407 cal/day to 788 in 1997 also occurred.^[22,23] It is likely that these changes also contributed to the increase in obesity, although a paradoxical effect can be shown if one looks at this relationship in different parts of the world. In the UK, the prevalence of obesity and overweight has increased in spite of a decrease in total energy intake accompanied by a relative increase in fat intake,^[38] whereas in the USA, the increased prevalence of obesity has been accompanied by an increase in energy intake and a decrease in fat consumption.^[39]

In addition to energy intake, the amount of energy expended, particularly that component of energy which is most variable and susceptible to modification (i.e. physical activity), may explain the increased prevalence of obesity in the developed world. In Portugal, the industrial and services sectors have increased over the last century, with the greatest changes in the 1970s. At the same time, the agricultural sector almost disappeared. All these changes show that the amount of energy expenditure at work is now minimal because the industrial and services sectors do not require a great amount of physical energy. There is observational and experimental evidence that increased physical activity reduces, or at least stabilizes, body weight.^[40] Diet and physical activity, along with many other factors related to the recent social and economic changes in Portugal, could explain the increased prevalence of obesity in young Portuguese males in the last decade, despite the positive trend in stature in the Portuguese conscripts,^[37] which represents a general improve-

ment in living conditions. This problem was also observed in children; Portugal showed the second-highest mean values in overweight/obesity (31.56%) compared with other European countries. Portugal has followed the trend of other Mediterranean countries such as Spain (30%), Greece (31%) and Italy (36%).^[41]

The increased prevalence of obesity reported in Western societies and the Portuguese values reported in this study represent a threat for public health, as obesity is related to several chronic morbidities and disabilities.^[32] Weight gain prevention programmes are urgently required to stop this burden of disease and disability.

Acknowledgements

The author thanks the Portuguese Army High Command (Estado Maior do Exército) for their kindness in providing all the raw data.

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