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National Prevalence of Obesity

Overweight and obesity in Portugal: national prevalence in 2003–2005

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Summary

Obesity is an endemic health problem in most developed countries, requiring serious public health attention. The first Portuguese nationwide representative survey about obesity (with objective anthropometric measurement) was undertaken from 1995 to 1998. This paper presents data coming from the second and most recent nationwide representative study of obesity, with objective measurement of weight, height, waist and hip circumferences. Data were collected between January 2003 and January 2005. The survey collected objective body mass index (BMI) values of 8116 participants aged 18–64. Main findings were: 2.4% of the sample had low weight (BMI < 18.5), 39.4% were overweight (BMI between 25.0 and 29.9), and 14.2% obese (BMI ≥ 30). Waist circumference measurement showed that 45.6% of the sample suffers increased cardiovascular health risks associated with high waist circumference. The overall overweight/obesity prevalence increased from 49.6% (in 1995–1998) to 53.6% (in 2003–2005). These data suggest that although obesity was identified as a public health problem one decade ago, action to reduce it does not seem to have been very effective to date. Well-defined public health intervention must be targeted to specific population groups where higher levels of obesity prevalence were found: low socioeconomic level groups and low-education level groups.

Keywords: Overweight, obesity, prevalence, Portugal.

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Introduction

Obesity is currently seen as an endemic disease in developed countries, with serious public health implications because of the associated morbidity and mortality (1,2). The importance of this health problem is also emphasized by the fact that prevalence rates tend to increase for children, adolescents and adults in most socioeconomic developed countries.

Portugal is not an exception regarding this health problem. In this country, several regional studies included objective assessment of obesity, but none of them was representative of the general population. Two nationwide health surveys provided self-reported overweight/obesity prevalence for the Portuguese adult population (in those over 19 years of age): the 1995–1996 and the 1998–99 National Health Surveys (3). In both surveys, data collection was done through face-to-face interview with self-reported weight and height. The most relevant epidemiological finding coming from those two National Health Surveys was the trend found for increase in the overall overweight/obesity prevalence for both men and women (especially when considering the short period between assessments): from 50.2% (in 1995–1996) to 54.0% (in 1998–1999) for men, and from 44.9% to 46.5% for women.

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Until now, few large and nationwide representative surveys using objective anthropometric measurements have been reported. The first national representative study with objective measurement of height and weight for assessment of obesity prevalence in adults was conducted between 1995 and 1998 (4,5). Not surprisingly, it revealed a high prevalence of overweight and obesity in adults between 18 and 64 years of age. Those results highlighted the need to make public health authorities and society in general more aware of this problem. More recently, a large scale survey also indicated high rates of obesity among children between 7 and 9 years of age (6). Those obesity rates are comparable with childhood obesity prevalence rates found in other Southern European countries, and higher than those found in North European countries (6,7).

This paper presents definitive results (preliminary results were published elsewhere) (8) of the second and most recent nationwide representative survey, regarding obesity prevalence in the adult Portuguese mainland population. Having in mind the assessment of temporal epidemiological evolution of this phenomenon, this survey followed the same methodology defined for the study of 1995–1998.

The main goals of this paper are: (i) to report data regarding prevalence of overweight and obesity in the Portuguese mainland population; (ii) to report data regarding distribution of waist circumference; (iii) to analyse the evolution of body mass index (BMI) and of waist circumference since the 1995–1998 population-based study and (iv) to analyse the association between BMI and waist circumference with sociodemographic variables.

Method

This was an observational, cross-sectional and descriptive study. Data were collected between January 2003 and January 2005, using a standardized questionnaire in structured face-to-face interviews with anthropometric measurements (weight, height and waist and hips circumferences) taken at the same time.

Sampling procedure

Collected data refer to a representative random sample of adults aged 18–64 living in mainland Portugal. The survey had a participation rate of approximately 80%. Overall, 8116 participants (3796 men, 4320 women) participated in the study.

Data collection followed a proportional multi-etapic stratified sampling procedure, considering population gender, age and geographical (districts) distribution. Sampling quotas were calculated on the basis of the demographic structure reported by the 2001 National Census (9). Portugal (without islands) has 18 districts. Within each district, a first random selection of local areas (villages and towns) was made, ensuring that any location with at least 100 000 inhabitants was included in the sample. Within each local area, a random route sampling of households was made (no more than three households in the same street were involved). Finally, in each household, every person between the ages of 18 and 64 was asked to participate in the study. Pregnant women and individuals with physical disabilities were excluded. In the case of acceptance to the study, all household members were interviewed and anthropometric measurements (weight, height, and waist and hips circumferences) were taken. The random route procedure was continued until the necessary number of participants of each stratum was obtained.

All data were collected by trained interviewers. In total, 21 interviewers participated in the survey, each of them receiving training in: (i) anthropometric measurement skills and (ii) interpersonal skills regarding initial contact with participants, explanation of the goals of the study, requesting participation and interviewing.

Questionnaire and interview process

Before weight and height were directly (objectively) measured, each participant answered a standardized questionnaire administered face to face. Whenever possible, both questionnaire administration and anthropometric measurements were conducted individually, out of the presence of other members of the household.

The questionnaire was presented as a life-habits questionnaire, assessing demographic and three major dimensions: regular physical activity, smoking habits and food habits.

The average time of each interview (including questionnaire administration and anthropometric measurements) was 40 min. The interview started with the face-to-face administration of the questionnaire, followed by the objective anthropometric measurements, conducted by trained interviewers.

In this paper, only BMI and some sociodemographic variables are analysed. The association between BMI and the other sociocultural variables (physical activity, smoking and food habits), and with self-perceived general health will be reported elsewhere.

Anthropometric assessment

For each participant, four anthropometric measures were taken: height, weight, hip circumference and waist circumference.

All measurements were performed according to World Health Organization (WHO) guidelines (10). Participants were wearing light clothing and no shoes. They were

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standing, with their arms relaxed in a neutral position and with their feet together. The following order of measurement was used: height, weight, waist circumference and finally hip circumference.

Portable digital scales (brand: Taurus; model: Level-MS/8608, Oliana, Spain) were used to measure the participant's weight in kilograms and kilograms to one decimal place. Multiple (at least two) measures were taken on stable ground, in order to improve accuracy. During height assessment, participants were asked to keep their head in the position described by the Frankfurt horizontal plan (11). This measure was taken with portable stadiometers (with a maximum of 2.00 metres), specifically designed for the survey. Both weight and height were registered in the database. BMIs were calculated through Quetelet's formula: BMI = weight height^{-2} (12).

For waist circumference measurement, participants were asked to stand erect, to breathe normally and to relax the abdomen. Circular tapes were used in direct contact with but not compressing the skin. This measure was taken at the mid-point of the subcostal margin of the rib cage and the highest point of the iliac crest. The hip circumference was measured with participants standing erect with their arms by their sides and with their feet together. The measure was taken with circular tapes placed around the hip, at the level of the greater trochanter (when possible, in direct contact with but not compressing the skin; when not possible, with light and tight contact with clothing). At least two measurements were taken for both waist and hip circumferences to improve accuracy. Both waist and hip circumferences were registered in the database and waist-to-hip ratio was then calculated (by dividing waist values by corresponding hip values), as an indicator of fat distribution.

The BMI cut-offs for overweight and obesity categories, as well as the waist circumference cut-off for increased cardiovascular health risk, were the ones proposed by the WHO (1,2): for BMI, low weight <18.5; normal weight 18.5–24.9; overweight 25.0–29.9; obesity I 30.0–34.9; obesity II 35.0–39.9 and obesity III ≥ 40; regarding increased risk due to waist circumference ≥80 cm for women and ≥94 cm for men; regarding greatly increased risk due to waist circumference ≥88 cm for women; ≥102 cm for men.

Professional categories

Participants who indicated that they were employed were asked about their main job position/role. The answers were then recoded into a 5-point scale of professional activities (following a classification of professions used by the National Institute of Statistics) (9), as a socioeconomic level proxy – as can be seen in Table 1.

Statistical analyses

All statistical analyses were performed using SPSS for Microsoft Windows (version 15.0).

Descriptive and inferential analyses were conducted to study overall prevalence of overweight and obesity, and the association between BMI and demographic and socioeconomic variables. When comparing proportions, the *z*-test was used. Comparisons between means were done with the *t*-student test for independent groups. When studying the association between nominal variables, chi-square tests were used. Spearman correlation was applied for ordinal variables and Pearson correlation for ratio variables. Multiple regression analysis was performed by a stepwise method to estimate BMI variation as dependent variable, and several sociodemographic variables as independent variables.

Whenever statistical tests have been applied, the considered level of significance was $\alpha = 0.05$.

Results

Table 1 summarizes the demographic characteristics of the sample and corresponding prevalence of BMI categories and of waist circumference associated with increased cardiovascular health risk. The proportion of participants in each age and gender subgroup closely follows the corresponding official demographic data for Portugal. The distribution of the collected sample also corresponds well with the official geographical (by districts) distribution data.

Considering both genders, 40.8% of the sample are not married or living with a partner. Prevalence of obesity was found to be significantly higher ($\chi^2 = 539.20$; $n = 8089$) among married participants (8.8%; $n = 4785$) than among non-married subjects (17.8%; $n = 3303$).

As can be seen at the bottom of Table 1, less than half of the overall sample (44.2%) had a normal weight, whereas 2.2% had low weight and 39.4% had overweight. For the obesity categories, the prevalence in the overall sample was 14.2%. These data reveal that the overweight/obesity prevalence increased from 49.6% to 53.6% over the last decade (men and women together – Fig. 1). This increase seems to result mainly from a shift from normal (47.8% in 1995–1998 data and 44.2% in 2003–2005 data; $P < 0.0001$) to overweight categories (35.2% in 1995–1998 data and 39.4% in 2003–2005 data; $P < 0.0001$).

The prevalence of overweight/obesity among men is higher (60.2%) than among women (47.8%). This difference between genders is consistent with what was found in the survey of 1995–1998.

The prevalence of BMI categories by educational level and by professional activity, for the overall sample (men and women together) was also analysed. As can be seen (Table 1), the lower the educational level, the higher the

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Table 1 Sample characteristics and corresponding prevalences of BMI categories and increased-risk waist circumference

		Women ($n = 4320$), %					Men ($n = 3796$), %					Women & Men ($n = 8116$), %					*P**
		Low	Normal	Overweight	Obese	%	Low	Normal	Overweight	Obese	%	Low	Normal	Overweight	Obese	%	
Age (years)	18–19	10.0	69.2	15.1	5.7	8.1	4.5	66.8	26.2	2.5	5.3	8.0	68.4	19.2	4.5	6.8	0.001
	20–29	5.3	67.4	21.8	5.5	29.1	2.0	55.1	34.5	8.5	22.4	4.0	62.4	26.9	6.7	25.9	0.000
	30–39	2.8	47.1	36.8	13.3	23.4	0.3	36.4	45.8	17.4	23.8	1.6	42.1	41.0	15.2	23.6	0.000
	40–49	1.2	35.4	46.1	17.2	19.3	0.4	31.5	51.3	16.8	22.5	0.8	33.5	48.8	17.0	20.8	0.040
	50–59	0.5	28.6	46.7	24.2	13.8	0.3	26.7	51.0	22.0	17.1	0.4	27.6	48.9	23.1	15.4	–
	60–64	0.7	29.4	45.7	24.2	6.2	0.6	29.8	54.8	14.9	0.9	0.7	29.6	50.7	19.0	7.5	0.026
Family status	Single	6.7	66.6	20.7	6.0	34.6	2.6	59.5	29.8	8.1	29.4	5.0	63.6	24.6	6.9	32.2	0.000
	Married/living together	1.6	39.5	41.5	17.3	53.8	0.3	29.8	51.7	18.2	65.2	0.9	34.5	46.8	17.8	59.2	0.000
	Divorced/separated	1.8	43.1	42.2	12.9	7.8	36.8	52.0	9.9	1.3	4.0	1.2	41.2	45.3	12.3	6.0	–
	Widow	0.6	30.9	43.0	25.5	3.8	37.3	41.2	19.6	2.0	1.3	0.5	32.4	42.6	24.5	2.7	–
Educational level†	Low	1.6	29.0	45.1	24.3	24.5	1.0	28.5	47.9	22.6	21.3	1.3	28.8	46.3	23.6	23.0	–
	Medium-low	3.0	44.7	37.9	14.4	17.5	0.4	36.2	47.4	16.0	21.0	1.7	40.3	42.8	15.2	19.2	0.000
	Medium-high	4.2	54.2	31.1	10.5	31.4	1.2	40.2	45.7	12.9	31.6	2.8	47.7	38.0	11.6	31.5	0.000
	High	4.2	63.8	25.9	6.1	26.5	1.1	47.8	40.4	10.7	26.1	2.8	56.3	32.7	8.3	26.3	0.000
Occupational activity‡	A ($n = 382$)	3.6	46.7	36.4	13.3	5.7	0.5	32.3	49.8	17.5	7.4	1.8	38.5	44.0	15.7	6.6	0.002
	B ($n = 1105$)	2.3	53.3	33.7	10.7	20.6	0.6	38.8	46.1	14.6	17.3	1.5	46.6	39.4	12.5	19.0	0.000
	C ($n = 687$)	2.8	54.5	32.9	9.8	12.3	0.3	36.1	49.1	14.5	11.3	1.5	45.7	40.6	12.2	11.8	0.000
	D ($n = 1953$)	4.2	50.4	33.9	11.6	38.5	0.4	36.9	47.6	15.2	28.6	2.6	44.6	39.7	13.2	33.5	0.000
	E ($n = 1698$)	1.1	37.0	42.6	19.3	22.9	0.4	35.0	46.4	18.1	35.4	0.6	35.8	44.9	18.6	29.2	–
Total (%)		3.4	48.9	34.4	13.4		0.9	38.9	45.2	15.0		2.2	44.2	39.4	14.2		0.000
Waist circumference	Increased risk (≥80 cm for women; ≥94 cm for men)§			47.8					52.1					49.8			0.000
	Greatly increased risk (≥88 cm for women; ≥102 cm for men)			24.6					25.3					24.9			–

*Significance levels are for chi-square association between genders regarding BMI categories and waist-circumference-associated risk (not reported when over $\alpha = 0.05$).

†Low educational level, up to the sixth year of school; medium-low educational level, from the sixth year to the ninth; medium-high educational level, from the ninth year to the 12th, high educational level, more than the 12th year of school.

‡Including prevalence of greatly increased risk.

§A, directors and other superior staff; B, intellectual and scientific experts; C, medium-level technicians; D, administrative staff and sellers; E, farmers, fishermen, factory-hand men, artisans and other non-qualified workers.

BMI, body mass index.

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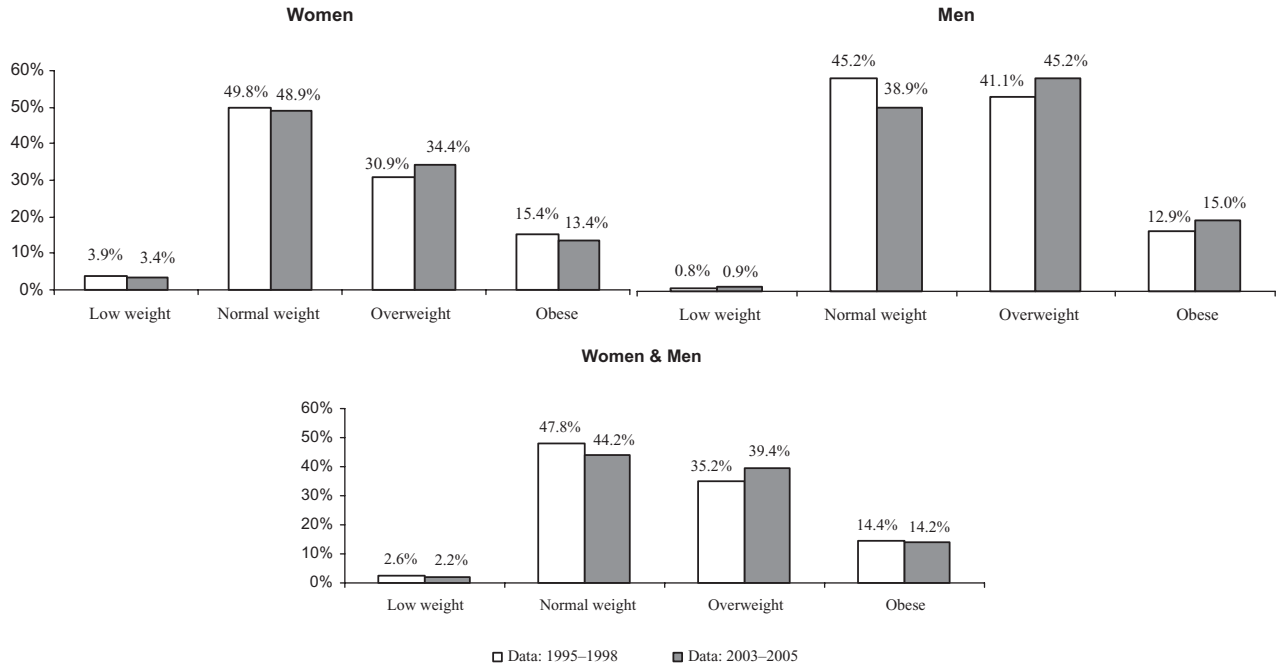

Figure 1 Prevalence of body mass index categories in 1995–1998 and in 2003–2005 (by gender).

prevalence of overweight and obesity. In the lower educational level (which represents 23.0% of the overall sample), an overweight/obesity prevalence of 69.9% was found. In the upper level of education, the corresponding prevalence was 41%. In fact, significant negative correlation was found between the number of successful school years and BMI ($r_s = -0.24$; $P < 0.0001$).

Significant association was found ($\chi^2 = 36.18$; $P < 0.0001$; $n = 5825$) between BMI categories and professional group.

Significant positive correlation was found between age and BMI ($r = 0.34$; $P < 0.001$; $n = 8115$). For both 1995–1998 and 2001–2003 data, the mean BMI increases in an approximately linear manner with age of participants until the 50–59-year-old group. After this age interval, there is a tendency towards a slight decrease in BMI mean values. When looking at the 2003–2005 prevalence of BMI categories by age group (Table 1), it is striking that 8.0% of 18 and 19-year olds have low weight. However, this high prevalence of low weight decreases to half in the 20–29 years age group. From this point onward, there is a pronounced decrease in normal weight (from 62.4% in the 20–29 age group to 42.1% in the 30–39 age group; $z = 12.8$, $P < 0.0001$), and an increase in overweight/obese categories ($z = 9.4$, $P < 0.0001$ and $z = 8.6$, $P < 0.0001$) – with a maximum of 50.7% overweight in the 60–64 age group and a maximum of 23.1% obese in the 50–59 age group (this is also the age group where the combined prevalence of overweight and obese individuals is higher: 72.0%) (Fig. 2).

As can be seen in Table 2, from the five sociodemographic variables that were included in the linear multiple regression model, age was the one with highest impact on the BMI (2003–2005 data).

Waist circumference and waist/hip ratio

As can be seen in Table 1, 49.8% of the sample (52.1% of men) have an increased cardiovascular health risk (including 24.9% with very increased risk) associated with high waist circumference. Significant association was found between the prevalence of increased cardiovascular health risk (and greatly increased cardiovascular health risk) due to high waist circumference and age interval groups (Fig. 3). Significant association was also found regarding these waist circumference prevalences and educational level categories (Fig. 4).

As can be seen in Fig. 5, female participants older than 30 years in the 2003–2005 survey had significantly higher mean waist circumference than women with corresponding age categories who participated in the 1995–1998 survey. Among men, significant differences were only verified for ages below 40 years.

Discussion

Portugal has 10.4 million inhabitants (9), predominantly Caucasian. Within the last three decades, this country has benefited from improved socioeconomic conditions. In common with other Southern European nations (7), social

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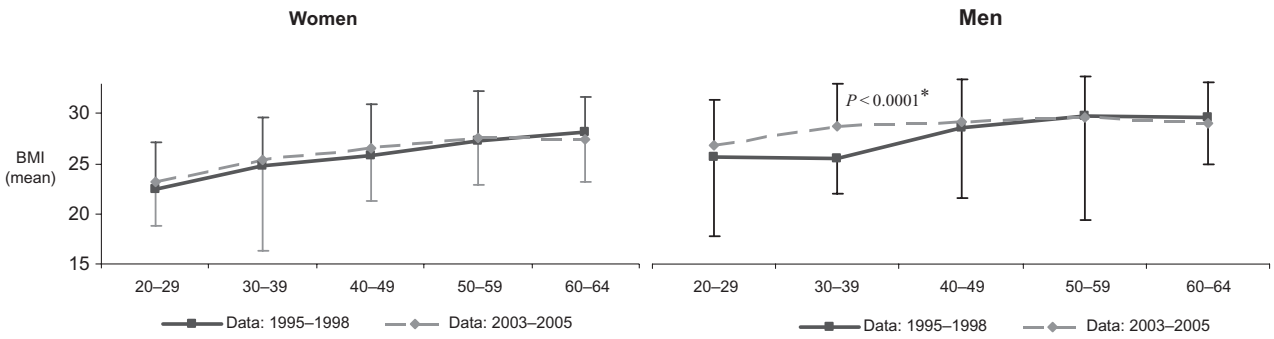

Figure 2 Mean body mass index (BMI) by gender and age group (from 1995 to 1998 and from 2003 to 2005).*P-values refer to comparison of means (*t*-test) between data from 1995–1998 and data from 2003–2005 (only reported when significant).

Table 2 Multiple regression analysis (stepwise method)

Variables in the equation	Adjusted R^2	Lack of fit test		Unstandardized coefficients	Standardized Coefficients
		t	*P*		
(Constant)		67.03	0.000	21.79	0.229
Age		19.66	0.000	0.07	0.132
Civil status		11.38	0.000	1.14	–0.137
Educational level (number of years of school)		–12.42	0.000	–0.133	0.082
Gender		7.96	0.000	0.702	–0.029
Professionally active or not*	0.158	–2.75	0.006	–0.279	

*Professionally active, employed/having a paid activity; Not professionally active, student, pensioner/retired, housekeeper, unemployed/looking for a job.

issues such as urbanization, modernization of working practices and improvement of social conditions, were followed by sedentary lifestyles and bad nutritional habits. These lifestyles are considered to be associated with increased rates of obesity, which is therefore described as a 'disease of civilization' (13).

This paper presents the results of a survey that provided objective measures of height, weight, waist circumference and hip circumference (and additional lifestyle indicators) through the application of a multidimensional questionnaire. The sample included 8116 participants and is representative of the general Portuguese mainland population regarding age, gender and geographical (by district) distribution.

The results show that more than half of the Portuguese population between 18 and 64 years is overweight or obese and has increased cardiovascular health risk associated with high waist circumference. They also show that middle age is the period of life where the highest prevalence of overweight/obesity can be found.

The overweight/obesity total prevalence is higher among men than women. As a matter of fact, the female/male ratio for obesity (0.9) is lower in Portugal than in several other countries, such as USA, Brazil, Tunisia, France (1.1, 2.4, 3.5 and 1.0 respectively) (14). The overweight/obesity prevalence found in the present survey is also higher than estimates coming from other previous studies based on self-reported weight and height data (for Portugal) (3). The prevalence of obesity is lower than that reported for USA (15) and when comparing with other European countries, it can be concluded that Portugal has a similar rate of obesity prevalence to Spain (16), but higher than the rates found for Holland (17), France (18) and Sweden (19). Similar to the findings for children, adults' obesity is higher in the South of Europe compared with Northern Europe (with the exception of Great Britain) (20).

When comparing these results with those from the survey of 1995–1998 (with a similar survey and data collecting methodology), it can be inferred that the prevalence of overweight and obese adults (male and female together) is rising with time in Portugal. It is important to say that within the period 1991–2001, the population got older and that the age-pyramid suffered a serious deviation (lowering the proportion of people less than 25 years of age and increasing the proportion of people over 60 years). As the collected sample is proportional to the population distribution in terms of age, more older adult people were included in this survey than in the survey of 1995–1998.

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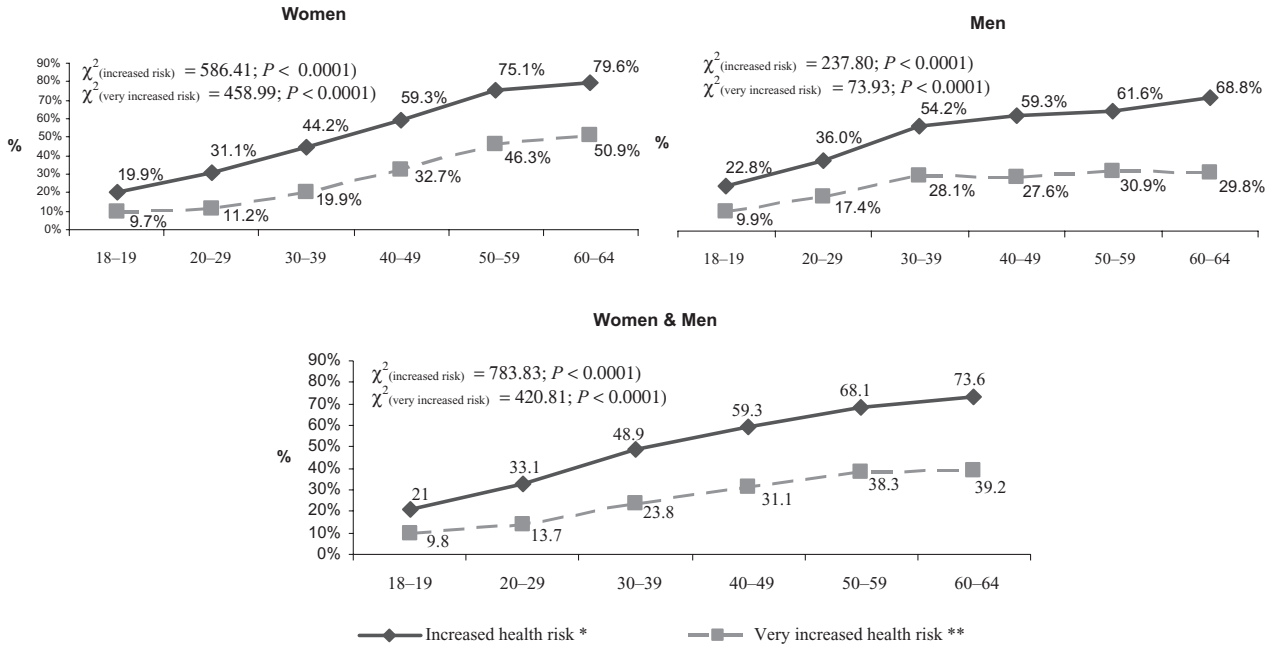

Figure 3 Prevalence of increased risk and greatly increased risk associated with high waist circumference by gender and age group (2003–2005).*waist circumference associated with increased risk: ≥80 cm for women; ≥94 cm for men. **waist circumference associated with greatly increased risk: ≥88 cm for women; ≥102 cm for men.

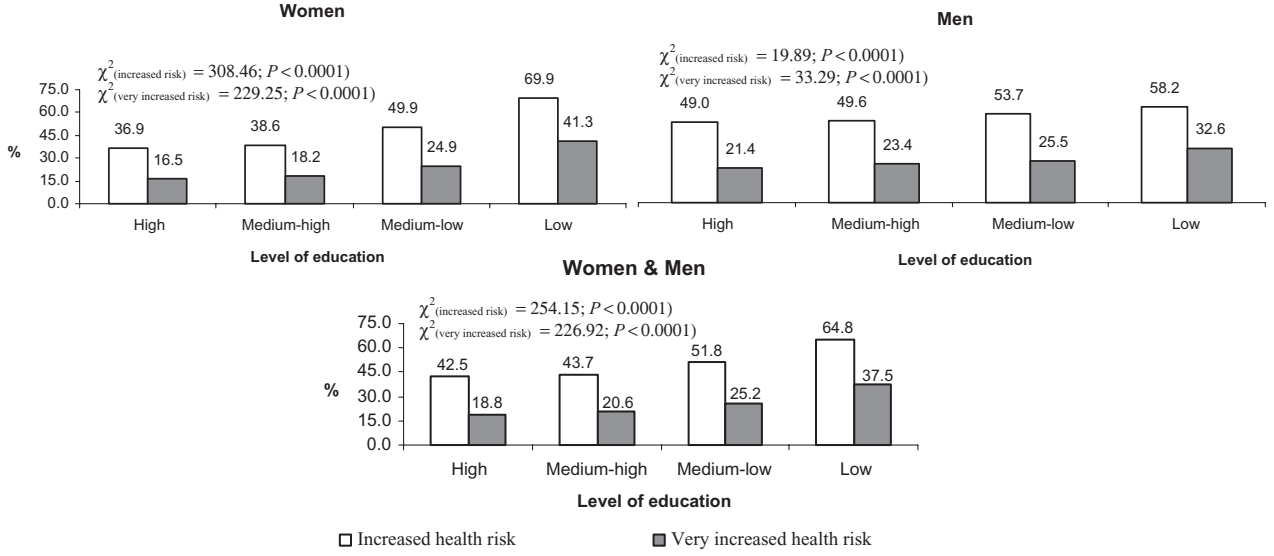

Figure 4 Prevalence of increased risk and greatly increased risk associated with high waist circumference by gender and level of education (2003–2005).

Therefore, the global increase of overweight/obesity prevalence may be, partially, explained as a result of demographic changes in the Portuguese population. Anyway, the rising trend of the prevalence of obesity is also supported by the comparison of data presented in this paper with the 31% of overweight/obesity found by Padez *et al.* (6) for children aged between 7 and 9 years. The fact that the overweight/obesity prevalence found among children of that age group is higher than the one found now among young adults aged 18–20 years (21%), suggests that the next Portuguese generation will face a serious aggravation of this health problem.

A more detailed analysis reveals that the overweight prevalence has increased for both men and women, and

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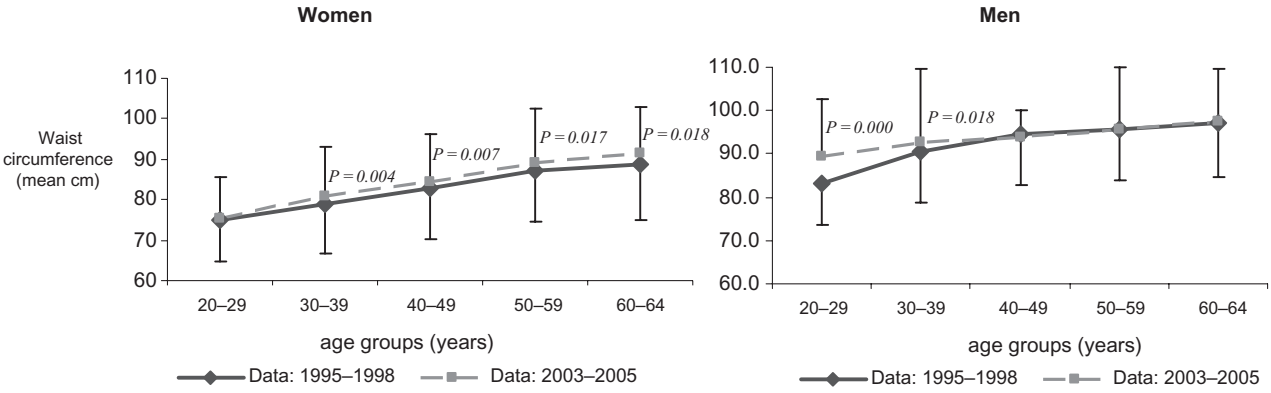

Figure 5 Mean waist circumference by gender and age group (1995–1998 and 2003–2005). **P*-values refer to comparison of means (*t*-test) between data from 1995–1998 and data from 2003-2005 (only reported when significant).

obesity prevalence has decreased among women (from 15.4% to 13.4%) but increased among men (from 12.9% to 14.2%). The epidemiological decrease in the trend of obesity prevalence in women may be an expression of growing body-related concerns among the female population, already reported in urban populations from Brazil (21).

The association with educational level and occupation corroborate findings from other studies conducted in developed countries (22): less education and lower income are associated with obesity. Thus, education and campaigns against being overweight or obese, supported by a legislative framework may be an effective way to prevent obesity and its health complications. This is in line with the European Charter on Counteracting Obesity, declared on 17 November 2006 in Istanbul.

In Portugal, the economic burden related to obesity was recently estimated to represent 3.5% of total expenditure for health (23). Considering the global burden of this health problem, it seems mandatory to create a task force for fighting obesity, which should (i) define concrete actions for changing eating and physical activity behaviours (including *pro-healthy-eating* legislation) and (ii) continuously monitor the numbers of overweight and obese individuals with a national register for obesity.

Conflict of Interest Statement

No conflict of interest was declared.

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