Super size Spain: A cross-sectional and quasi-cohort trend analysis of adult overweight and obesity in an accelerated transition country

Title: SUPER SIZE SPAIN? A CROSS-SECTIONAL AND QUASI-COHORT TREND ANALYSIS OF ADULT OVERWEIGHT AND OBESITY IN AN ACCELERATED TRANSITION COUNTRY.

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Running title: Trends in Adult Overweight and Obesity in Spain.

Summary. Excess weight is becoming widespread in Spain due to changes in nutritional habits and lifestyles. Previous studies on this issue have focused on specific Spanish regions, subpopulations or relatively short time-spans. By applying a demographic methodology, we aim to analyse sex-, age- and cohort-trends in the prevalence of adult overweight and obesity over the last two decades. Data come from the Spanish National Health Surveys that were held between 1987 and 2006. The respondent's demographic characteristics and self-reported height and weight were aggregated to a single dataset in order to analyse changes in weight and Body Mass Index (BMI) by age, sex, over time and within and between quasi birth-cohorts. After correcting for sample bias and coding errors a total sample of about 100.000 subjects aged 20-79 was obtained. Results showed that between 1987 and 2006 adult males and females increased their average weight by 8.2% and 2.8%, respectively. While among younger adults this is partly explained by height increases, prevalence in excess weight increased among 50-79 year-old males. Persons of the same 10-year age group but of a more recent 10-year quasi birth-cohort observed a BMI that was 0.2-0.8 points higher. BMI increases were lower for women and mainly affected 60-79 year-olds. In fact, even decreases were observed for 40-49 and 50-59 year-old women. Potential explanatory factors are discussed.

Introduction

Spain, like any other European country, has recently observed increases in the prevalence of overweight and obesity due to changing diets and activity patterns (Serra-Majem et al., 1995; Moreno et al., 2002; WHO, 2006; OECD, 2008). For instance self-reported data from the Spanish National Health Surveys (SNHS) that will be used in this study indicate that obesity among the Spanish population aged 16+ increased during the period 1987-2006 from 10% to

15%. In fact, according to the last survey more than half (52%) of all adults were either overweight or obese compared to 43% in 1987.

In this study we aim to provide a detailed description of trends in adult weight and BMI by disentangling age and sex differences. We also perform a quasi birth-cohort analysis on the data in order to better capture changing trends among different segments of the population. This is because exclusively employing standard cross-sectional analyses may mask generation-specific life course experiences related to nutrition, especially given the pace of the socioeconomic changes that have taken place in Spain since the 1950s.

Data and methods

The Spanish National Health Survey

The dataset consists of self-reported height and weight from the microdata of the SNHS (waves of 1987, 1993, 1995, 1997, 2001, 2003 and 2006). It is the only Spanish national and sub-national representative health survey that has been conducted on a regular basis.

Subjects are randomly sampled by means of a complex multi-stage stratified sampling design according to age, sex and place of residence (region, province and municipality size). The adult health survey is taken among the non-institutionalized population aged 16+ and subjects are interviewed face-to-face. The wording of the questions on height and weight has remained constant across all waves. People were asked for their approximate height without shoes on and their approximate weight without clothes on. In the case of pregnant women, they were asked for their weight before pregnancy. For this study, respondents 20 years or older have been selected to prevent both large variations in body weight and height related to the completion of the physical growth process, and younger than 80 years of age in order avoid sex-, age- and time/cohort-combinations containing fewer than 500 cases. Moreover, previous studies on adult overweight and obesity from self-reported measures have mostly used ages up to 70 or 80 as irregularities are often observed in the information provided by elderly respondents (Kuczmarski et al., 2001). Older people are also underrepresented in the non-institutionalized population that is usually targeted for health surveys.

Cross-sectional and quasi-cohort approaches

The SNHS is not a panel survey, meaning that people interviewed in one survey wave are not followed up in successive waves. Although this impedes performing a more typical longitudinal cohort study where the cohort acts as a baseline group whose health status is periodically checked, in demography and other social sciences alternative methods are applied

to approximate a longitudinal study using cross-sectional data. Two illustrative examples are the calculation of life-expectancy or the total fertility rate using *synthetic cohorts*.

What was done for this study was to aggregate the different SNHS's, that covered almost two decades and included 120,550 persons aged 20-79, into one database. Individuals were subsequently designated to so-called *quasi birth-cohorts* in function of their age and the year they were interviewed. The same dataset was recently used to show that average height – a personal characteristic that should not change over time once adulthood is reached and until the ageing related shrinkage process sets in – varied insignificantly between surveys for all but the elderly population (Spijker et al., 2008). Hence, the data was considered suitable for the study of age- and time-specific changes in the average levels of weight and BMI of quasi birth-cohorts.

Notwithstanding, some small sample biases did have to be dealt with. As the elderly and the less populated regions were oversampled during certain waves, samples were weighted with official population data from the National Statistics Institute (INE). Data were also screened for errors and omissions with respect to the variables age, sex, residence region, height and weight, reducing the sample size to 105,878 persons. In addition, the 1995 and 1997 waves were combined for the cross-sectional analyses due to their low sample sizes (respectively 4,790 and 4,970 respondents compared to 20,283 in 1987, 15,780 in 1993, 17,083 in 2001, 18,977 in 2003 and 23,995 in 2006).

We further increased the sample reliability and its comparability across time and quasi birth-cohorts by calculating 10-year birth cohorts and aggregating single ages into 10-year age groups, whereby age-cohort combinations with fewer than 500 respondents were also discarded. This provided a final sample size of almost 100,000 (see Table 1).

Validity of self-reported height, weight and BMI for trend studies

Self-reported anthropometric measures are known to be biased in function of the age, sex and actual anthropometric measures of a respondent. For instance, with regard to height, older adults tend to over-report it (as they recall it from early adulthood) as well as those who are short (Gunnel et al., 2000). However, even though an over-reporting of height among the elderly produces an underestimation of the BMI, the bulk of BMI changes between successive age groups can be ascribed to weight changes. This is because shrinkage occurs gradually after age 50 (Birrell et al., 2005) and mainly at older ages, accounting for a total loss of about 2-5 cm. depending on the age reached by the subject (Borkan et al., 1983; de Groot et al., 1996; Dey et al. 1999). This bias is also less relevant for age-specific *cohort* differences in

BMI. In addition, the average self-reported male height obtained by the SNHS was also comparable to Spanish military recruitment records (mandatory until the mid 1990s and accordingly, contains height data for male cohorts born before the mid 1970s) and should therefore be taken as the maximum height reached by a given cohort before the ageing related shrinkage process sets in. This is to say that self-reported height provides a type of age-standardised measure that allows trends in BMI to be interpreted by changes in weight status.

Table 1. Number of after-screening sample cases used in the analysis by sex, age and quasi birth-cohort

	Age group					
	20-29	30-39	40-49	50-59	60-69	70-79
Quasi birth-cohort			Males			
1910-1919						861
1920-1929					2067	2185
1930-1939				2633	3097	1676
1940-1949			2683	3144	1738	
1950-1959		3052	4083	1925		
1960-1969	3992	4922	2896			
1970-1979	4543	2454				
			Females			
1910-1919						804
1920-1929					1846	2619
1930-1939				2283	3505	2438
1940-1949			2414	3578	2321	
1950-1959		2737	4219	2561		
1960-1969	3774	5242	3463			
1970-1979	4624	3141				

Source: Microdata from the Spanish National Health Surveys 1987-2003. Own calculations.

As to the weight component of BMI, overweight and obese persons are more likely to underreport their weight, particularly young adult females (Rowland, 1990; Nawaz et al., 2001; Ezzati et al., 2006). Self-reported measures may therefore not be valid for epidemiological or clinical studies where a high accuracy at the individual level is required. However, given the high correlation between both types of data – even among the elderly who are less susceptible to the cultural pressures that lead to underreport weight (Lawlor et al., 2002) – self-reported measures may still be used to establish long-term trends within large populations. Likewise, earlier tests on the reliability of the self-reported weight from the SNHS showed that, at least at the aggregated level, age- and sex-specific patterns match standard biological growth and maturation cycles (Cámara & Spijker, 2008). As the human

physical maturation process concludes around age 25, any increase in weight observed for the aggregated age interval 20-29 years may be partly attributable to it. After that, weight is more dependent on the individual's control irrespective of existing differences in metabolism that influence the exposure to overweight and obesity and therefore any weight change should be mostly read in environmental terms. Additionally, for women both pregnancy prevention (e.g. contraceptive pills contain estrogens that may cause metabolic changes) and motherhood (women permanently keep some of the weight gained during pregnancy) are also factors that attribute to weight gain (Bogin, 1991). The data used in this study seems to affirm this.

Finally, a regional health survey held in Catalonia (Northeastern Spain) in 2006 included both self-reported and actual anthropometric measures, thus allowing to estimate potential biases of self-reported height and weight of this Spanish subpopulation aged 15-65 (Gil & Mora, 2009). It was found that, as expected, the oldest age group (56-65) tended to over-report its height the most (1.42 cm). The largest bias for weight was found among those aged 25-35. In total, authors estimate a mean underestimation of 1.42 kg in self-reported weight and a 0.64 cm gap between self-reported and measured height (i.e. individuals over-reported their statures). In terms of BMI this corresponds to a 3.5% and 2.1% bias for women and men aged 15-65, respectively. Similar values are obtained when BMI *categories* were analyzed. For instance, if corrections based on this regional sample were applied to the last SNHS in 2006, obesity prevalence would rise from 15% to about 18%.

After the required data from the seven SHNS were screened, the Body Mass Index (BMI) was calculated by dividing the respondent's weight by the square of its height. Given its high correlation with weight and fatness and low correlation with height, this indicator is often used to assess the prevalence of overweight and obesity once adulthood has been reached (Rolland-Cachera, 1998). Both continuous and the customary categorical BMI values are analysed, i.e. *underweight* (< 18.5 kg/m^2) *normal weight* (18.5-24.9 kg/m^2), *overweight* (25.0-29.9 kg/m^2) and *obesity* (>30.0 kg/m^2).

Results

Cross-sectional analysis by sex and age

Between 1987 and 2006 average weight among Spanish adult males aged 20-79 increased steadily from 73.4 kg to 79.4 kg, a difference of 6 kg, an increase of 8.2%. Women, in turn, restricted the increase in average weight to just 1.8 kg (2.8%), equalling 65.1 kg in 2006, with no increase being observed since the mid-1990s. As shown in Figure 1, age-specific increases observed for men were quite uniform over time. Increases ranged between 5.0 and 6.3 kg that

were statistically significant at the 95% level. In contrast, weight increases observed between the first and last survey were much less among women, but nevertheless statistically significant for most age groups (20-29, 30-39, 60-69 and 70-79), ranging from 1.3 to 3.8 kg.

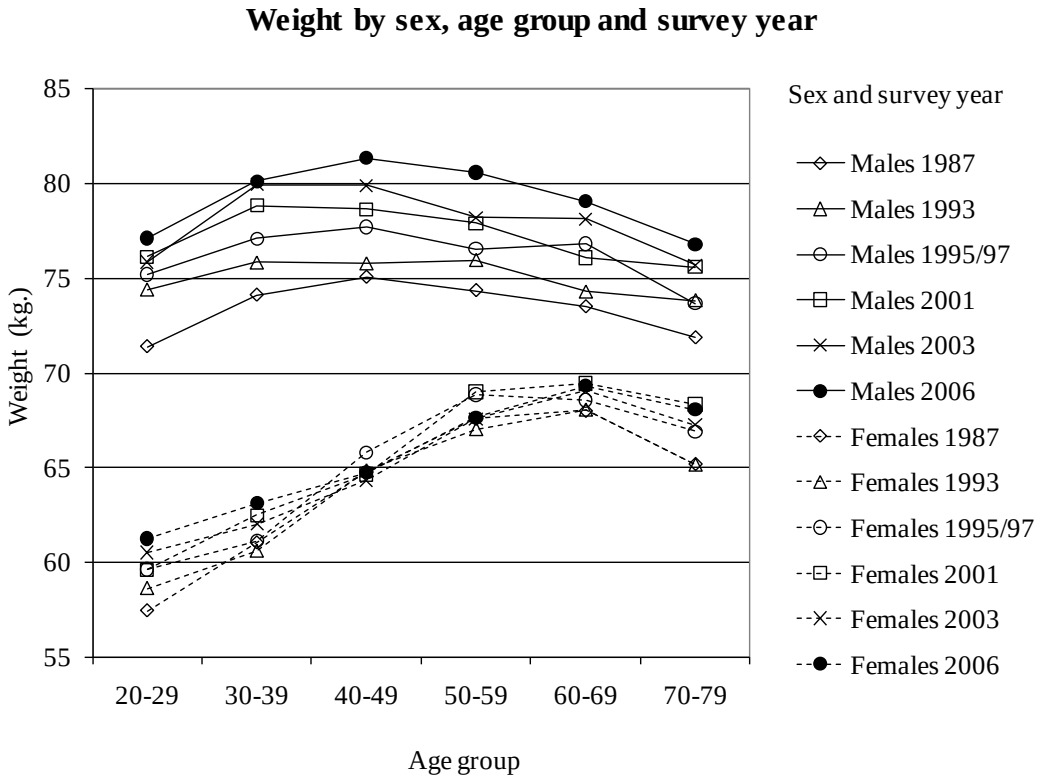


Fig. 1. Source: Microdata from the Spanish National Health Surveys 1987-2003. Own calculations.

Quasi birth-cohort analysis by age and sex

Figure 2 presents the change in average weight experienced by people belonging to quasi birth-cohorts at different ages. Results show for men that at any given age, each birth cohort is on average heavier than the previous one. For instance, the cohort 1920-29 weighted on average 74.6 kg when they were 60-69 years old. When the generation 1930-39 reached the same age, they weighted on average 76.7 kg. This increased a further 1.9 kg to 78.6 kg for those born between 1940 and 1949. While the results in Figure 1 may partly be explained by changes in height across the different generations, in this case it pertains to changes within the same quasi birth-cohort. It would also appear that the slope of changes in average weight between two 10-year age groups in the same cohort is steeper for the earlier cohorts, i.e., that weight increase occurs for younger cohorts at a faster rate and perhaps for a shorter period.

For females, 20-29 year-olds born in the 1970s were on average 1.3 kilograms heavier than those born 10 years earlier. A similar pattern can be found among 30-39 year-olds: the

1970-79 cohort weighted about 0.4 kg more than those born between 1960 and 1969, who, in turn, were 0.7 kg heavier than the 1950-59 quasi birth-cohort. On the other hand, regarding the 40-49 year-olds, the youngest 10-year cohort actually weighted less on average than when both older cohorts reached that age. For the two oldest age groups the pattern was again similar, though less pronounced, to that for men as the younger quasi birth-cohorts were heavier than the older ones. The exception was the 70-79 age group born in the 1920s who were 2.4 kg heavier on average than the 1910-19 cohort.

As regards to the results for male cohorts born since the 1940s and females after 1960, the heavier average weight observed in younger cohorts for a given age group is partly explained by their concomitant height increase, which is why BMI was analysed (Figure 3). However, BMI also augmented over time among most adult age groups, especially men aged 30-79, the same age group that observed the largest increases in weight. If we would compare the first and last surveys (1987 and 2006) differences are most apparent in age groups 50-59, 60-69 and 70-79. The latter two age groups also witnessed BMI gains in the female population, whereas the younger age groups maintained relatively stable levels. The increase in average weight observed among 20-29 year-olds appears to be exclusively the result of an increase in height. To better assess whether the increases observed for the middle-aged and young-old are due to a shift towards overweight or obesity, we have also analysed for the first and last SNHS wave the BMI distribution for each age group and sex according to the different ordinal categories.

The proportion of the population between ages 20 and 79 years old with a normal BMI declined between 1987 and 2006, although more among men (from 50.1% to 38.9%) than among women (55.3% to 52.1%). From this 11% net shift in the male population from normal to higher levels of BMI, overweight increased by 4.6% and obesity by 7.0%. Regarding women, the prevalence of overweight was stable between the two periods, although obesity increased by 3.3%.

As regard to specific age-groups (Figure 4), declines in normal levels of BMI among men are especially noticeable among young adults aged 20-29 (-10.4%) and those between ages 50 and 79 (13-14% lower). Rather disconcerting as well is that for some age groups this came almost entirely on the account of the BMI category obesity. For instance, obesity in the male population aged 50-59 and 60-69 increased between 11% and 12%, i.e. doubling its level with regard to 1987. Although we cannot test this, the most likely scenario would be that most people move from one BMI category to a higher one, for example, from normal to

overweight or from overweight to obesity. Overall, in 2006 three-quarters of 50-79 year-old men were either overweight or obese.

Figure 2. Weight by sex, age group and cohort

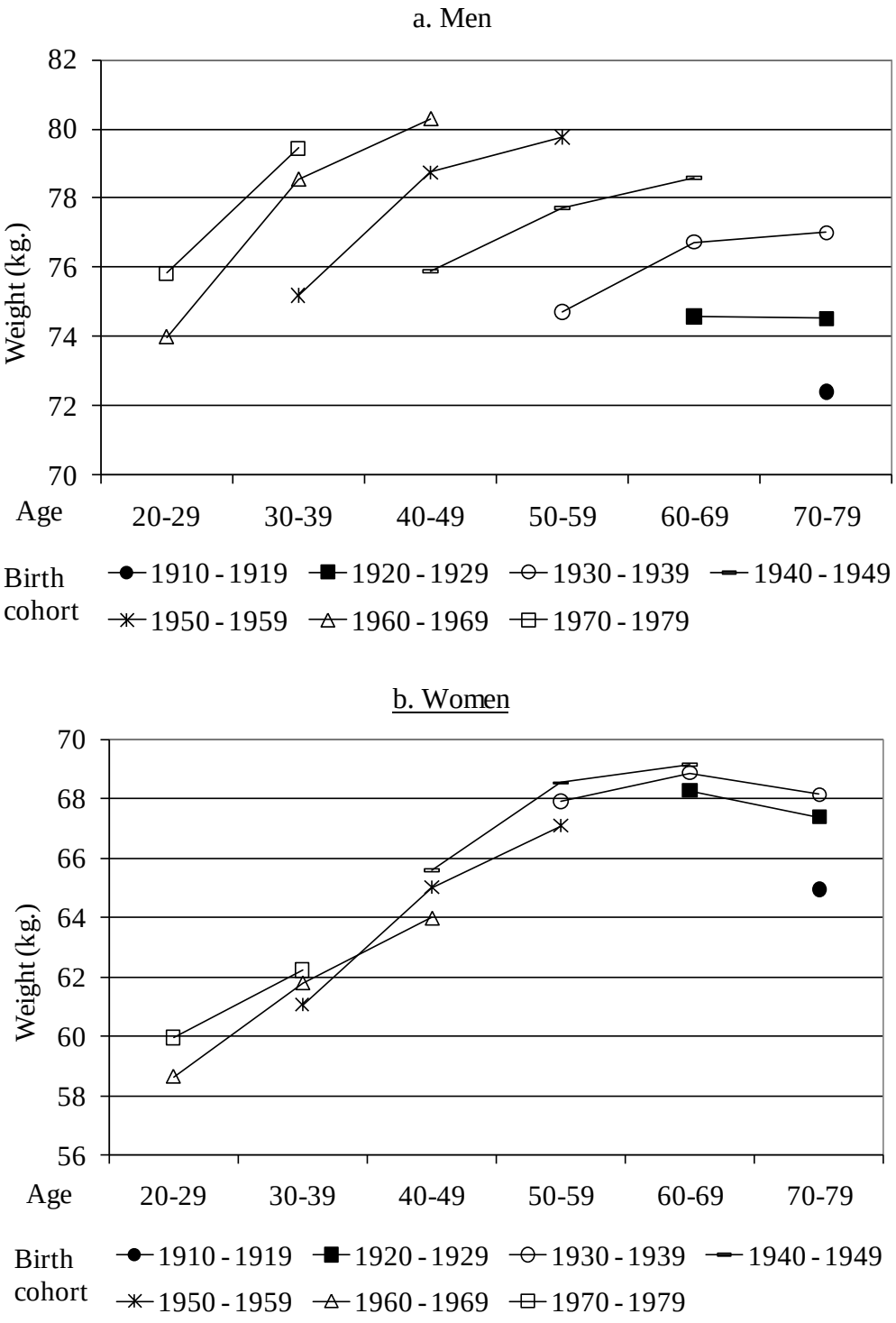
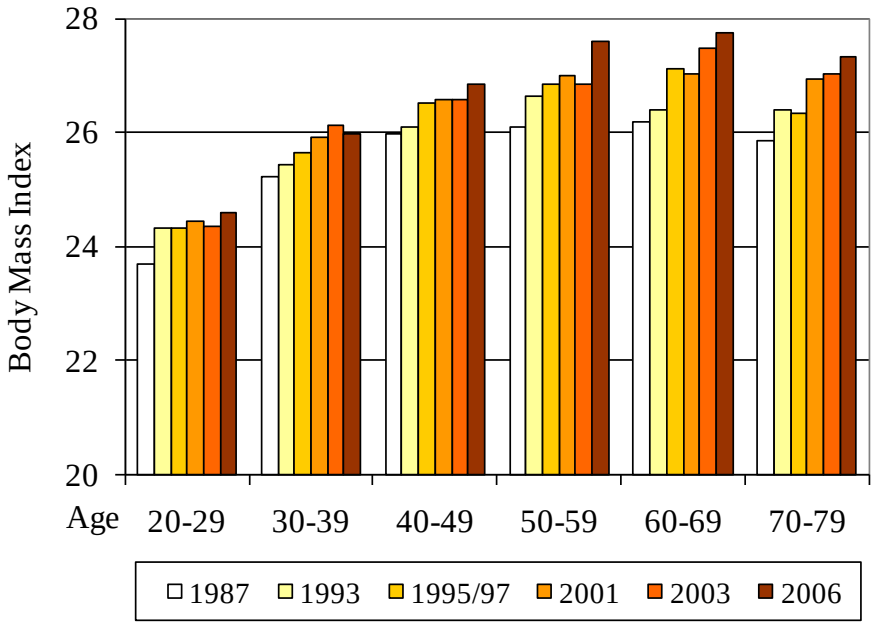


Fig. 2. Source: Microdata from the Spanish National Health Surveys 1987-2003. Own calculations.

BMI by sex, age and survey year

a. Men



b. Women

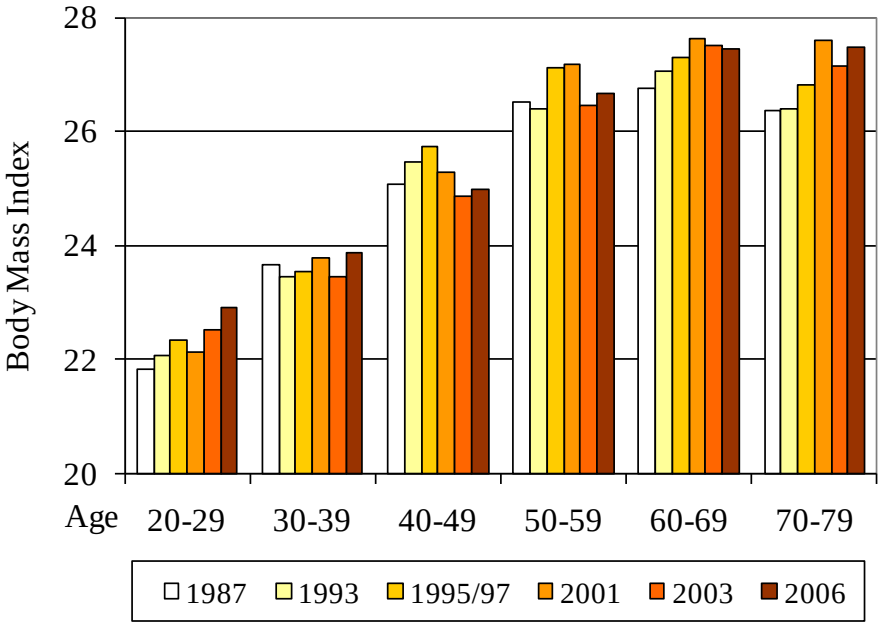


Fig. 3. Source: Microdata from the Spanish National Health Surveys 1987-2003. Own calculations.

BMI category by sex, age group and first and last survey year

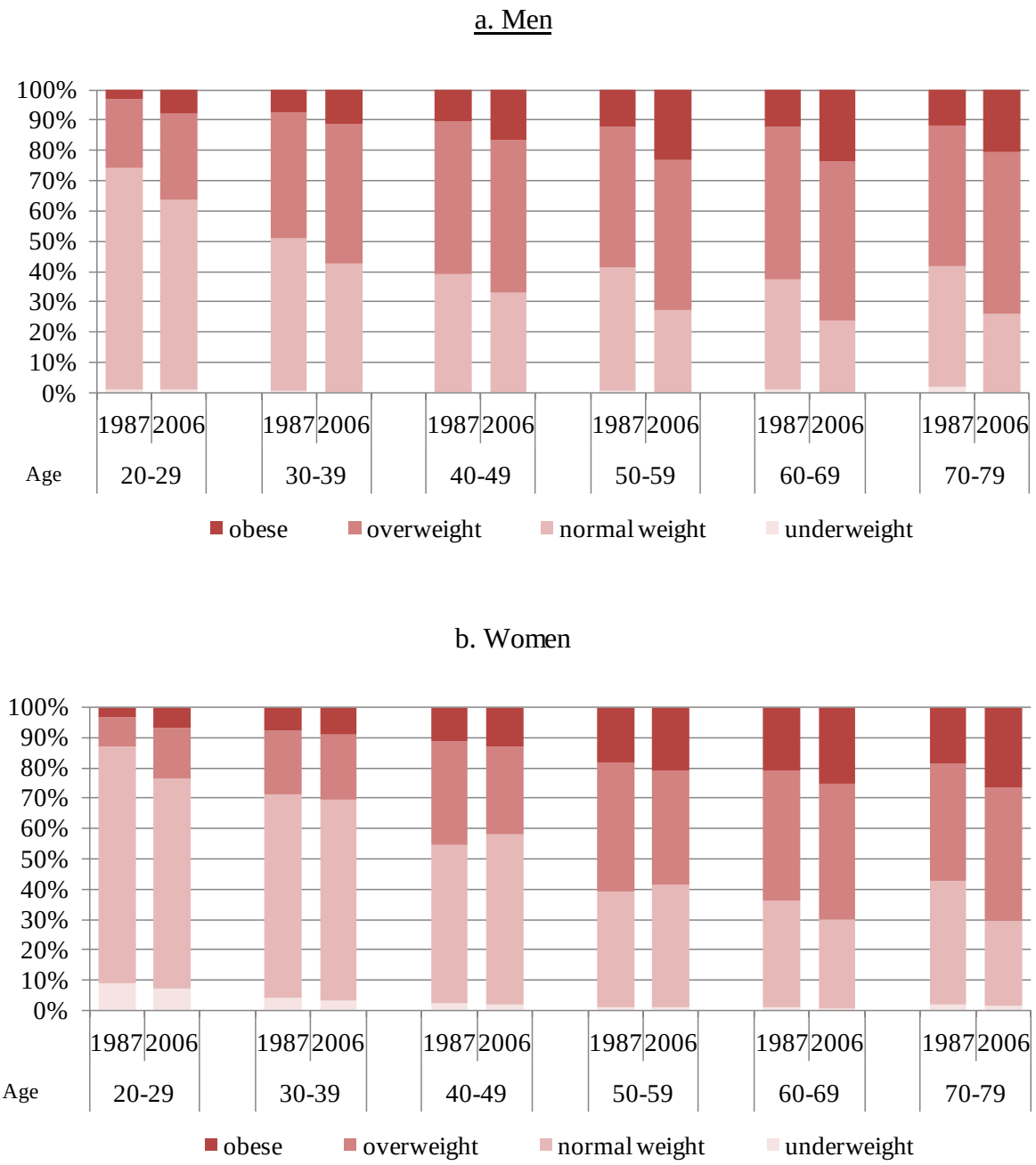


Fig. 4. Source: Microdata from the Spanish National Health Surveys 1987-2003. Own calculations.

For each age group and both the first and last year analysed there were proportionally more women than men with normal BMI levels, whereby the sex-difference also increased over time. Even so, the proportion with normal weight among women aged 20-29 and 70-79 declined substantially (respectively, from 78.1% to 69.3% and from 40.9% to 28.3%). Concomitantly, both the proportion of overweight and obese women aged 20 to 29 increased respectively, from 9.7% to 16.8% and from 3.1% to 6.7%, while only the prevalence of

obesity increased in the case of elderly women aged 70-79 (from 17.5% to 26.5%). Other age groups observed fewer changes in the BMI structure between the two periods. In 2006, the highest proportions with excess weight in the female population were observed for 60-69 and 70-79 year-olds (about 70%). While this is slightly less than for men, more women were perceived as obese.

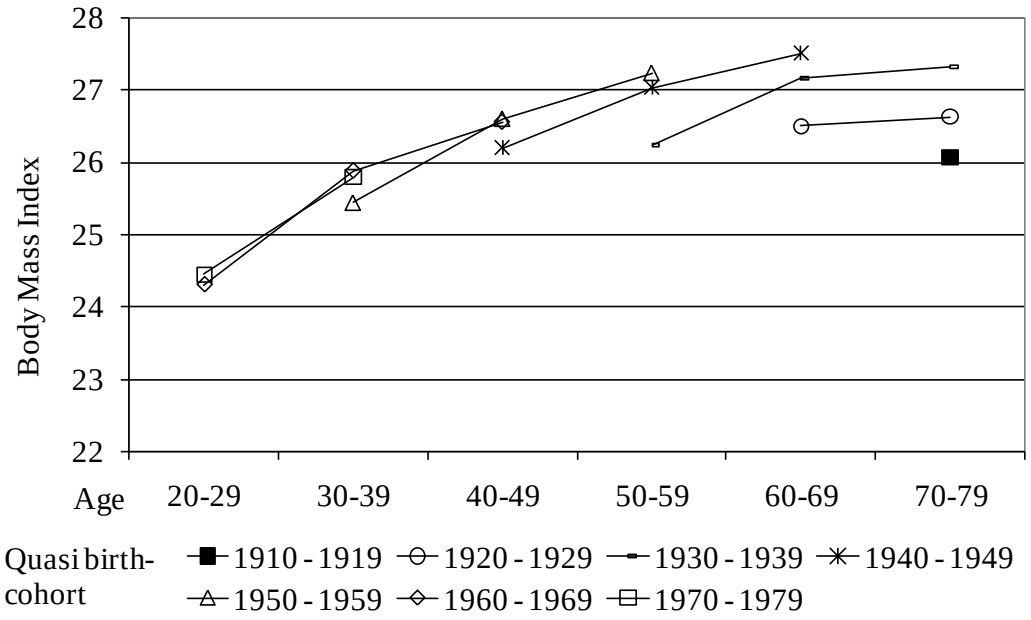
Finally, while underweight plays an insignificant role among men, 7% of young women suffered from it in 2006. Among older women (30+), underweight is much less prevalent, with age-specific rates ranging between 1% and 3%. No clear discernable trend in underweight could be observed across health surveys.

The final results that are presented here are the sex-specific trends in BMI from a cohort perspective. As shown in Figure 5 and Table 2, nearly all surviving adult male Spanish cohorts increase their mean BMI as they move from one 10-year age-interval to the next until they are in their sixties. As height has been controlled for, differences between cohorts are much less as was observed earlier. The 30-39 year-olds of the cohorts born during the 1960s and 1970s have only a slightly higher, though statistically significant at the 95% level, average BMI than those who were born in the 1950s. Much larger cohort differences, however, can be observed for age groups 50-59 to 70-79 with regard to the cohorts 1910-19 to 1940-49. This confirms the more concerning situation affecting the older middle-aged and elderly population, as average levels of BMI observed in each 10-year age group increase by between 0.2 and 0.8 for each successive 10-year cohort.

Although the average level of BMI among women is lower for the youngest age groups and only converges to the male level around the age of 50, the general age-specific pattern is similar. The cohort pattern, however, is less clear-cut, as some cohorts reported a lower rather than higher average BMI than an earlier-born cohort, such as the case with the 1950s versus the 1940s cohort when they were aged between 50 and 59 years. On the other hand, women born in the 1920s had a much higher average BMI when aged 70-79 years than those born in the 1920s, who in turn, were significantly heavier than those born in 1910-19, i.e. a similar pattern as to what was observed for men.

BMI by sex, age group and quasi birth-cohort

a. Men



b. Women

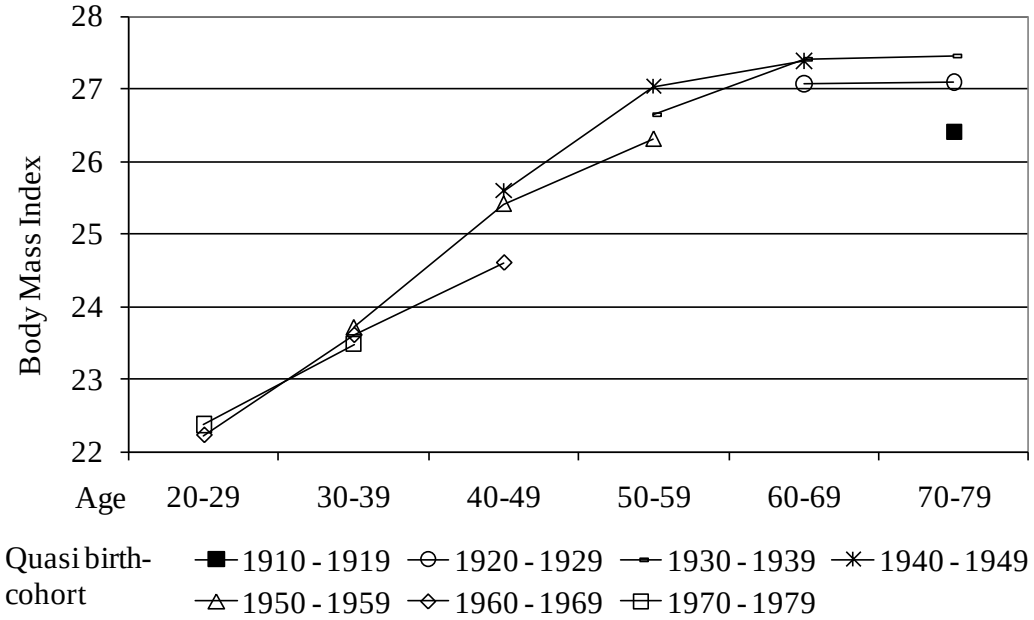


Fig. 5. Source: Microdata from the Spanish National Health Surveys 1987-2003. Own calculations.

Table 2. 95% confidence intervals of BMI by sex, age group and quasi birth-cohort

	Age group					
	20-29	30-39	40-49	50-59	60-69	70-79
Quasi birth-cohort			Males			
1910-1919						25.81-26.30
1920-1929					26.32-26.63	26.52-26.82
1930-1939				26.10-26.36	27.08-27.34	27.16-27.50
1940-1949			26.06-26.30	26.90-27.15	27.34-27.70	
1950-1959		25.33-25.57	26.48-26.70	27.08-27.44		
1960-1969	24.23-24.42	25.76-25.95	26.42-26.68			
1970-1979	24.35-24.54	25.66-25.93				
			Females			
1910-1919						26.04-26.66
1920-1929					26.88-27.27	26.90-27.24
1930-1939				26.47-26.81	27.30-27.59	27.25-27.62
1940-1949			25.39-25.71	26.91-27.21	27.18-27.55	
1950-1959		23.56-23.83	25.30-25.56	26.12-26.48		
1960-1969	22.14-22.35	23.49-23.70	24.48-24.77			
1970-1979	22.27-22.48	23.33-23.61				

Source: Microdata from the Spanish National Health Surveys 1987-2003. Own calculations.

Discussion

The main strength of our research was being able to analyse changes in the prevalence of overweight and obesity in Spain among both age and quasi birth-cohorts. We did this by aggregating the data from all seven cross-sectional National Health Surveys held since 1987. It provided us with a sample of about 100.000 subjects aged 20 to 79. Results in terms of trends over time should not substantially change if corrected by actual anthropometric measurements given their high correlation (usually over 0.90) with BMIs that are obtained from self-reported height and weight for both the overall adult population (Ezzati et al., 2006; Gil & Mora, 2009) and specifically the elderly (Gunnell et al, 2000). Furthermore, although height over-estimation cannot prevent the prevalence rates of BMI to be underestimated, differences are not necessarily large. Moreover, biases tend to be set within acceptable margins when the data are not analysed at the individual level but in representative age-by-sex groups (Lawlor et al., 2002). Furthermore, the results for obesity are almost identical with those from a compendium of epidemiological studies carried out in Spain in the period 1990-2000. For instance, according to Aranceta et al. (2005), 14.5% of the population aged 25-60 was considered obese. If we would use the 1995/7 results for this same population, a

prevalence of 14.2% is obtained. Nevertheless, as expected, our categorical BMI status calculated from self-reported weight and height is likely to be lower than those from real measurements in clinical studies, particularly among the elderly (c.f. Gutiérrez-Fisac et al., 2005).

According to the results obtained in this study the prevalence of obesity among Spanish adults has risen sharply over the last two decades, especially among men. Indeed, after controlling for height, statistically significant BMI gains were observed for almost all age-sex categories that were analysed. Results showed that the average adult puts on weight with age regardless of quasi birth-cohort until the age of 80. It means that becoming older does not seem to lead to a stabilization or weight decline, even when accounting for the associated biological processes leading to the loss of muscle and bone mass (Ulijaszek, 1998a; Stini, 1998). Conversely, young adults (supposed to be leading the main shifts in food consumption and lifestyle patterns) seem to be more successful in maintaining their weight as almost 70% of women until the age of 39 and 63% of men in their twenties recorded normal levels of BMI in 2006. Similarly, the 40-49 year-old women born in the 1950s actually had a 1 point lower BMI than the 1930-39 cohort, while the 50-59 year-olds born between 1940 and 1949 had a BMI level that was 0.7 lower than the 1930-39 cohort. Conversely, the 60-79 year-olds presented the most significant increases in overweight and obesity, particularly males born between 1930 and 1949. Finally, although the transition from normal to overweight was less severe among women than for men, among older women the prevalence of obesity increased more than overweight did.

Potential factors involved

Cross-sectionally, the bulk of the obtained results are consistent with the general trends in food consumption and lifestyle shifts in Spain during the last decades. By 1970, the average intake among adults older than 20 was estimated at about 2734 kcal (29% coming from fats) and three decades later (2001) this had risen to 3422 kcal (40% coming from fats) (INE, 1995; MHC, 2005a). Given that Spanish and European society has also become more sedentary (Varo, 2002) and is ageing, as basal metabolism slows down with age (Rolland-Cachera, 1998; Shetty, 1998) it is not surprising that overweight and obesity has recently become more widespread.

Analysing the data from a quasi birth-cohort perspective invites one to consider historical and cultural factors as additional components of this complex causality. Most elderly in Spain lived their infancy or adolescence close to the threshold of food shortage at

least until the mid-1950s after which a proper food intake level was attained (Cussó, 2005). In the case of the oldest cohorts they also faced hunger and severe deprivation during the Spanish Civil War (1936-39) and postwar years under Franco's dictatorship. For some people, having experienced hardship may have made overfeeding, obesity and fatness a desirable condition, even associated with health, thereby creating a culture where fatness is appreciated beyond the reproductive goals as it used to be in traditional societies (Ulijaszek, 1998b). To this regard, previous studies have shown the relevance of educational levels in managing nutritional status and controlling excess weight in developed societies (Halkjær & Sørensen, 2004). Moreover, Gutierrez-Fisac et al. (1999) detected an increasing negative association between educational level and obesity among Spanish adults aged 20-64 between 1987 and 1993. From a cohort perspective a considerable portion of the above mentioned age group in Spain attained a low level of education. In addition, there was also a lack of educational programmes or public policies regarding nutritional behaviour in Spain until 2005 when the first public health strategy to prevent overweight and obesity was implemented (MHC, 2005b). As a consequence, the rapid transition towards a society with a high standard of living led many people to adopt unhealthy eating habits. In this sense, a sort of retrospective echo with potential perverse cumulative effects may occur: adults who were neither overweight nor obese in their infancy and adolescence, becoming so now and bringing their descendents into the same situation. This is coherent with studies on weight status during childhood and adolescence that showed how low-income and/or low educated parents do not perceive their offspring being overweight but 'well nourished' (Kirchengast & Schober, 2006). In the case of Spain, particularly many of those born before 1940 experienced stunted growth due to the higher prevalence of childhood illnesses, shortage of (nutritious) food and other adverse childhood and adolescent environmental conditions (e.g. the Spanish Civil War). However, once the country overcame irregular food supply and general uncertainty, there were few factors that compensated weight gain caused by a positive energy intake. For instance, in relation to the educational levels, few changes are detectable in the Spanish population with regard to the concept of 'time preference' that refers to the rate at which people are willing to trade current benefit for future benefit and is used in economics to explain savings and investment behaviour. When applied to health research, weight control requires one to forego current consumption in order to gain future potential health benefits, so the rate at which future benefits are discounted will bear directly on the individual's current food consumption decisions (Komlos et al., 2004). In other words, in the case of Spain and in the absence of preventive mechanisms to control weight gain, the harder that early life

conditions were, the lower the will to manage current lifestyle towards future health utility. This appears to be the case for cohorts born between 1920-59, especially men, many of whom experienced both the Civil War (1936-39) and the difficult post-war period (1940s) that experienced significant increases in BMI levels over time. The fact that this argument does not seem to hold for those born prior to 1920 is likely to be due to a selection effect (excess mortality among obese persons) and because elderly are less prone to partake in changing food consumption patterns and lifestyles.

Finally, we should also acknowledge the importance of genetic explanations for the observed sex differences and cohort trends in BMI levels. We know that part of the reason that women accumulate more body fat than men is attributed to women's reproductive history and sex differences in hormonal metabolism as pregnancy and accompanying hormonal alterations is known to promote weight gain in women (Brown et al., 1992; Harris et al. 1997; Szklarska & Jankowska, 2003). Given the sharp decline in the total cohort fertility rate in Spain (from 2.55 in the 1930 birth cohort to 1.76 in the 1960 cohort, respectively; Frejka & Sardon, 2004) it is perhaps of no coincidence that 40-49 year-old women born between 1950 and 1959 observed significantly lower average BMI levels than the 1930-39 cohort when they were of the same age. As women beyond the childbearing age are also no longer exposed to maternity and lose more muscular and bone mass than males due to menopause and the subsequent ageing process (Leidy, 1998) also coincided with the result that their weight at older ages was less than for men.

In answering the question whether Spain will become a "super size" country, the overall dimension of the obesity epidemic among the adult population aged 20-79 is currently not too alarming as it affected 15% of the population in 2006. However, this is not to say that there are no risk groups. Although levels are still highest among elderly women, since 1987 obesity rates almost doubled among 50-79 year-old men. Given the high prevalence and increasing trend in childhood and adolescent obesity in Spain (Serra Majem *et al.*, 2003; Moreno *et al.*, 2001; Rios *et al.*, 1999) whether obesity will reach epidemic proportions in future will depend on the effectiveness of ongoing public health measures targeted at promoting healthier lifestyles .

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Social Services (IMSERSO) (research project *'Cambios generacionales de la salud en España'* ref. 85/05).

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