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Descriptive Finding

A reversal in the obesity epidemic? A quasi-cohort and gender-oriented analysis in Spain

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Contents

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Abstract

BACKGROUND
The prevalence of obesity has recently stabilized in some developed countries. Some studies show this stabilization in Spain, but they do not analyse its evolution by cohort.

OBJECTIVE
This paper analyses the transformation of the Spanish population over time and between quasi-cohorts of weight change by age and sex.

METHODS
Data was taken from seven waves of the National Health Survey of Spain between 1995 and 2017, with a sample of 100,206 individuals aged 20–79 years old. Adjusted prevalence of being overweight and obesity were calculated. The changes in body mass index (BMI) by sex and age, by and between quasi-birth cohorts, and over time were analysed using test of proportions, ANOVA, and the t-test.

RESULTS
The prevalence of excessive body weight has stabilized or decreased in men since 2017 and in women since 1997. Among men, the prevalence of obesity stabilized recently and weight gain with age decreased after the 1950s cohort. Among women, mean BMI and excessive body weight decreased after the 1940s cohort.

CONCLUSIONS
Our findings showed a stabilization and subsequent decrease in excessive body weight that is recent among men but took place more than two decades ago among women.

CONTRIBUTION
This is the first study that analyses the evolution of obesity by comparing the age-related weight gains between quasi-cohorts. This is also the first study that analyses the stabilization of excessive body weight in Spain by quasi-cohort, age, and sex, and that

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shows that this stabilization is due to a bigger weight control among the older cohorts in the older ages.

1. Introduction

After increasing for several decades, in recent years the prevalence of obesity has stabilized and even decreased in some developed countries (Gard 2010; Rokholm, Baker, and Sørensen 2010; Olds et al. 2011; Sperrin et al. 2014; Wabitsch, Moss, and Kromeyer-Hauschild 2014; van Jaarsveld and Gulliford 2015). Several authors (Popkin and Gordon-Larsen 2004; Jaacks et al. 2019) claim this change is generational and marks a new stage of the nutritional transition: The youngest cohorts have changed their nutrition and physical activity behaviours by incorporating public health discourse about the health risks of a sedentary lifestyle and obesity.

Theories attempting to explain changes in obesity prevalence trends have sparked an important debate: are they generational changes, or epochal changes that affect all cohorts? Cross-sectional data lead to confusion: when grouping data from different cohorts, they do not allow differentiating three types of time-linked effects. First, regarding age effects, body weight increases up to age 60 or 70 due to physiological changes (lower metabolism) or living conditions associated with changes in status (marriage, work, family, etc.) (Baum and Ruhm 2009). Second, social, economic, or political changes are period effects that simultaneously affect all age groups. Third, cohort effects are period changes that differentially affect people born in different time periods (Reither, Hauser, and Yang 2009). Age-period-cohort analysis has been widely used to study obesity trends, and most of these studies indicate that the principal causes of the changes in obesity are period effects, especially in the United States of America (An and Xiang 2016; Reither, Hauser, and Yang 2009), and cohort effects, especially in Europe (Vidra et al. 2018; Diouf et al. 2010).

Most research in Spain still highlights increases in obesity and being overweight (Aranceta-Bartrina et al. 2016; Basterra-Gortari et al. 2017; Hernáez et al. 2019; López-Sobaler et al. 2016). In recent years some exceptions show a stabilisation or decrease in obesity in children and adolescents (de Bont et al. 2020; Miqueleiz, Lostao, and Regidor 2016) and in the adult population (Bartoll et al. 2015; Gutiérrez-Fisac et al. 2013). However, they do not analyse the changes in obesity by age and cohort.

Given that body weight increases with age and that weight gains are difficult to reverse, when an age group has a bigger BMI than the same age group ten years earlier the difference may be due to one of two evolutions: a bigger BMI increase at that age for the recent cohort, or a bigger BMI increase at younger ages for the recent cohort. When

we compare cross-sectionally we cannot estimate the difference between the evolutions by cohort and age simultaneously, so recent greater weight control by older cohorts may go unnoticed. Therefore, analysis by quasi-cohort gives a better estimation of the differences in weight trends between the different age groups (Nooyens et al. 2009).

In Spain, to the best of our knowledge, only one quasi-cohort analysis of weight changes has been published, using data from the National Health Survey of Spain (NHSS) from 1995 to 2006 (Cámara and Spijker 2010). Our study updates those results with two new NHSS waves and adds new indicators of weight change. The objective of this work is to find evidence of a plateau of obesity by analysing the changes in body weight of the Spanish population from 1995 to 2017.

2. Methods

2.1 Data

We used microdata from seven waves (1995, 1997, 2001, 2003, 2006, 2012, 2017) of the NHSS, a nationally representative cross-sectional survey for which personal interviews are conducted with non-institutionalized individuals aged 16 and older. We aggregated the data from the seven waves into a single database, selecting only individuals aged 20 to 79 years in order to avoid problems due to weight changes resulting from body growth at young ages and weight loss associated with loss of muscle mass at advanced ages. The final sample consisted of 100,206 individuals.

We used an approximation by quasi-birth cohort, calculated based on age and survey year – a common procedure in social sciences (Suissa 2015).

Similar to the majority of studies on obesity (Boström and Diderichsen 1997; Stommel and Schoenborn 2009), we grouped the data by age, decade, and quasi-cohort to avoid having population sub-groups with very few cases (Table 1).

Table 1: Number of cases by cohort, age, and sex

Men	20–29	30–39	40–49	50–59	60–69	70–79
1910–1919						81
1920–1929					171	1,557
1930–1939				204	2,066	2,591
1940–1949			240	2,027	3,130	1,313
1950–1959		295	2,708	3,425	1,592	
1960–1969	382	3,158	4,700	1,939		
1970–1979	2,712	4,253	2,051			
1980–1989	2,462	1,359				
1990–1999	824					
Women	**20–29**	**30–39**	**40–49**	**50–59**	**60–69**	**70–79**
1910–1919						117
1920–1929					284	2,445
1930–1939				243	2,768	4,458
1940–1949			279	2,666	4,228	1,645
1950–1959		283	2,972	4,429	1,784	
1960–1969	327	3,640	5,369	1,984		
1970–1979	2,949	4,976	2,129			
1980–1989	2,637	1,555				
1990–1999	798					

2.2 Measures

In all of the surveys, self-reported weight and height data were obtained using the same questions: What is your approximate weight (kilograms)? What is your approximate height (centimetres)? The response rate of between 93.8% and 98.6% was higher than in similar studies (57%–80%) (Boström and Diderichsen 1997; Elgar and Stewart 2008; Stommel and Osier 2013).

BMI was calculated using the most common formula (BMI = weight [kg]/height [m^2]) and categorized in four groups according to the conventional World Health Organisation classification: 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 kg/m^2).

We calculated the mean BMI and the adjusted prevalence of overweight and obesity by quasi-cohort, sex, and age. We tested the statistical differences by quasi-cohort and age using the t-test and ANOVA for mean BMI, and the two-sample test of proportions for prevalence of obesity and being overweight. Statistical analyses were carried out using Stata 14.

To estimate the change in mean BMI by age group for each cohort we created a simple but useful index, the Age-Related Weight Increase (ARWI): for each quasi-cohort we calculated the change in mean BMI between two consecutive age groups. This allowed us to measure the weight gains at different ages of each cohort and between different cohorts and each age, in order to differentiate recent and older weight gains in each cohort and assess whether in each age a cohort controlled its weight more than a preceding quasi-cohort.

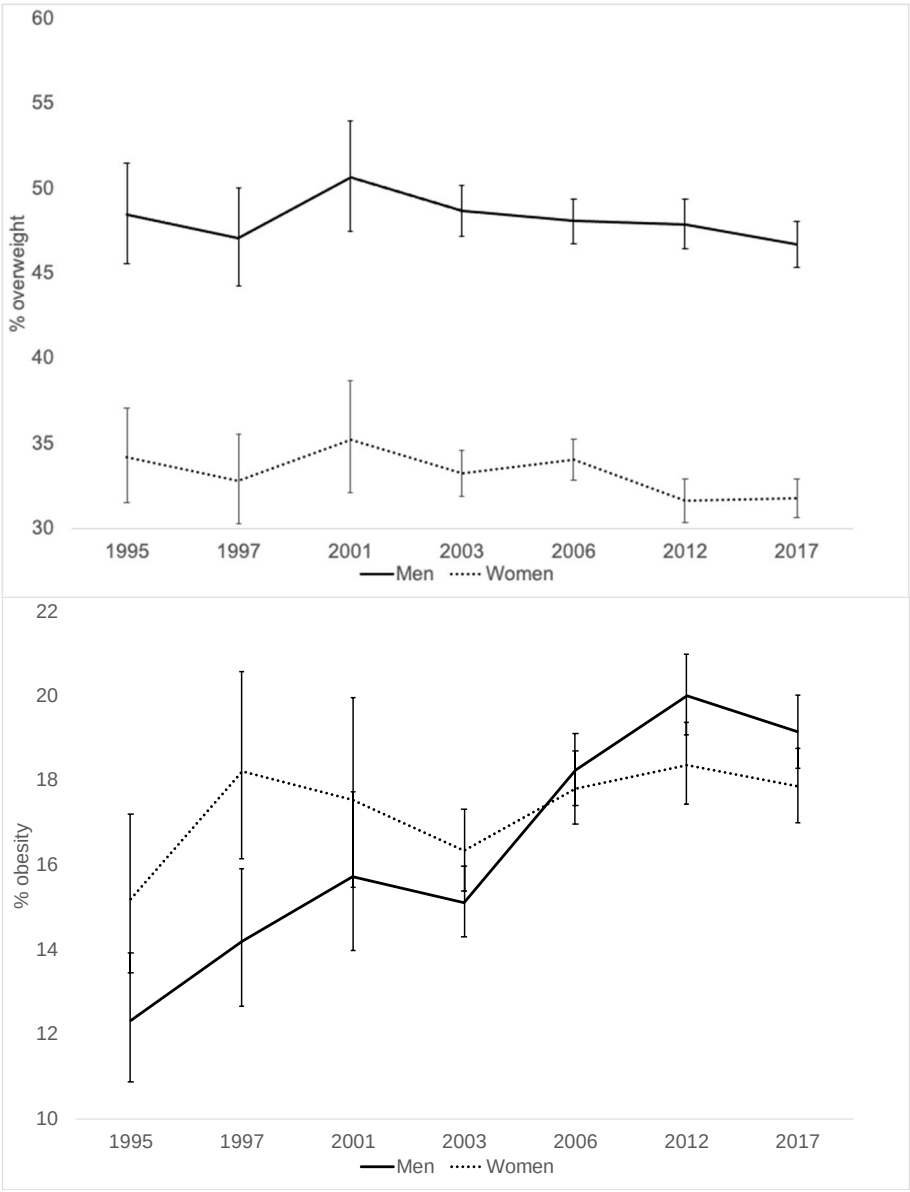
3. Results

We began our analysis by comparing the different waves of the surveys. A comparison of the different waves of the surveys from 1995 to 2017 shows that being overweight stabilized earlier among women (Figures 1a–1b). Obesity began decreasing in 2012 for men, after a substantial increase between 2003 and 2012, and in 2001 for women, with a slight rise in 2006.

However, the stabilization pattern is not very clear, especially for obesity. There might be a compositional effect in each wave so the comparisons do not show the real change or stabilization prevalence. Therefore, an analysis by quasi-cohort and age group is required.

When we analyse the evolution of body weight by quasi-cohort and age we find different trends for males and females. The prevalence of male obesity increased slightly in the first cohorts of the oldest ages, but only considerably in two of them. The most recent cohorts show smaller increases. The prevalence of men being overweight generally decreased in youngest cohorts and stabilized in the oldest cohorts (Figure 2a). Among females, obesity and being overweight followed a different trend: remarkable declines in the 1940–1949 cohort for ages 40+, and small but insubstantial increases in the most recent cohorts at younger ages (Figure 2b).

Figure 1: Adjusted prevalence of being overweight and obesity, by survey



Note: Prevalence adjusted by the population of each age group of the NHSS 2017. Error bars reflect 95% confidence intervals.

Figure 2a: Prevalence of being overweight and obesity: Men

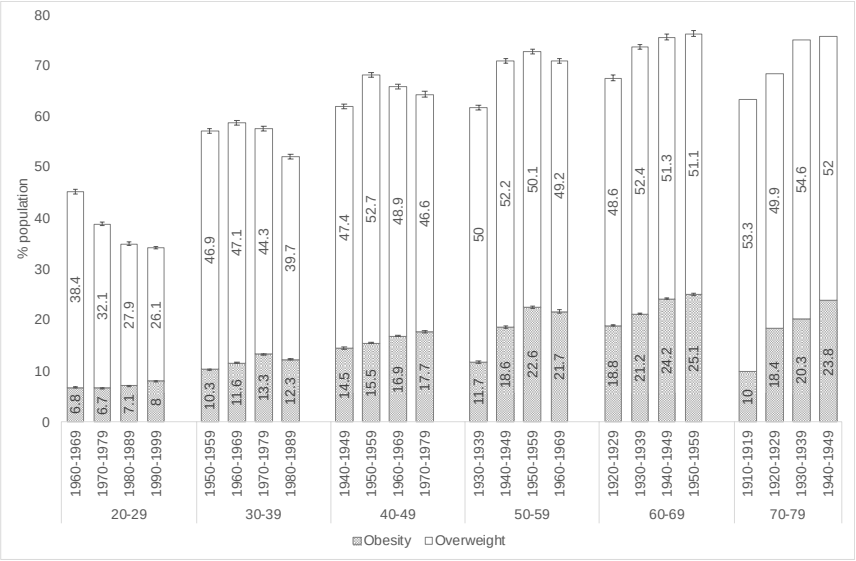
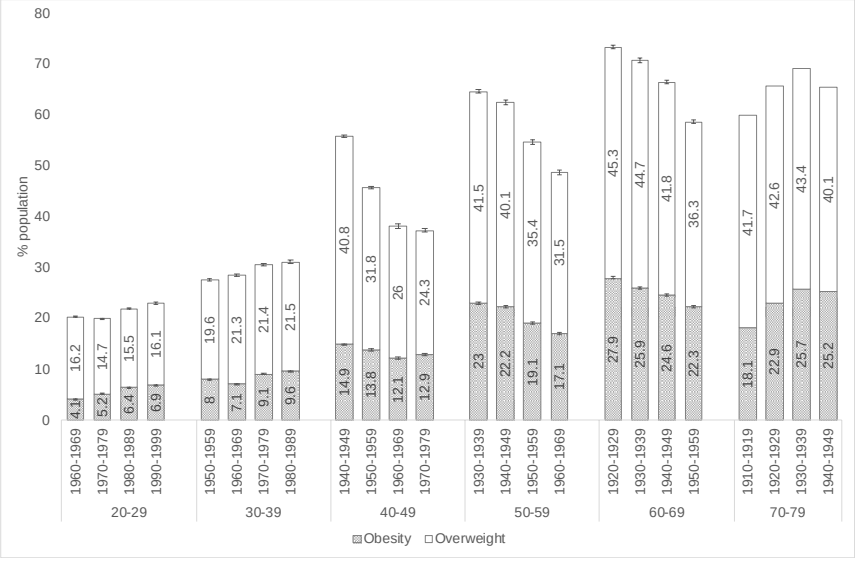


Figure 2b: Prevalence of being overweight and obesity: Women



Note: Prevalence in % of total population. Overweight (BMI 25.0-29.9 kg/m^2) and obesity (BMI ≥ 30 kg/m^2). Error bars reflect 95% confidence intervals.

Comparisons of mean BMI by age and quasi-cohort also give different results. Calculated by age and survey, mean BMI shows a slight increase in both sexes. Results by quasi-cohort show a different picture. In men, the mean BMI substantially increased at practically all ages between the quasi-cohorts of 1920–1929 and 1950–1959, while the 1960–1969 quasi-cohort marked an inflection point: the mean BMI slightly increased at 30–39 years, stabilized at 40–49, and decreases slightly at 50–59 years after a strong increase in the oldest cohort. The subsequent quasi-cohorts had a mean BMI similar to or lower than those of the previous quasi-cohorts (Figure 3a). Among women, the mean BMI presented two different trends according to age range starting with the 1940–1949 cohort, while between 20 and 39 years of age the mean BMI experienced a general stabilization and decreased in cohort after cohort at ages over 40 (Figure 3b).

Figure 3a: Mean BMI by quasi-cohort and age: Men

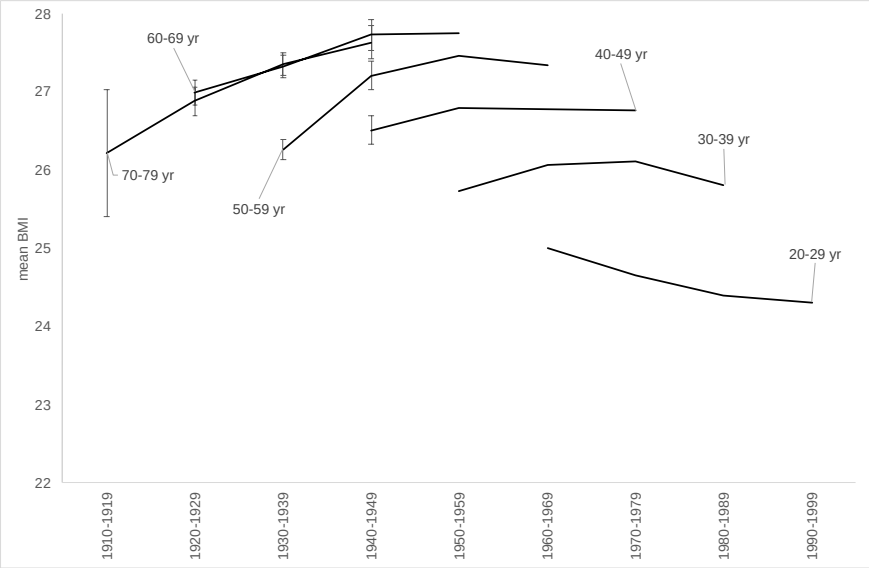
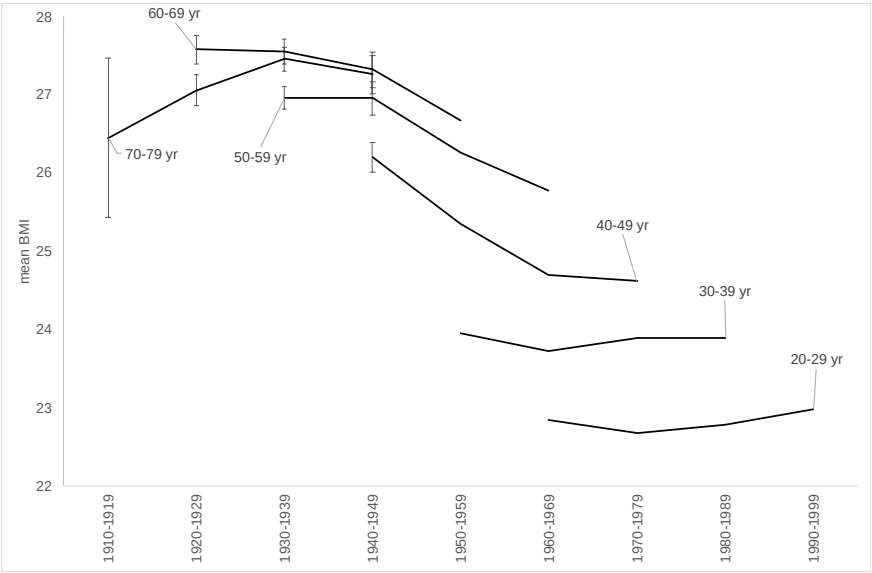


Figure 3b: Mean BMI by quasi-cohort and age: Women



Note: Error bars reflect 95% confidence intervals.

We calculated the age-related weight increase (ARWI) for each cohort. Figures 4a and 4b show different evolutions in ARWI by sex. Among men the ARWI decreased after the 1940–1949 cohort in ages above 40. There was no clear evolution of the ARWI among women, but the downwards movement at 40+ years is more extreme than the upward movement after the 1940–1949 quasi-cohort – a logical evolution if we take into account their overall decrease in mean BMI and the prevalence of being overweight and obesity.

Figure 4a: Age-Related Weight Increase (ARWI): Men

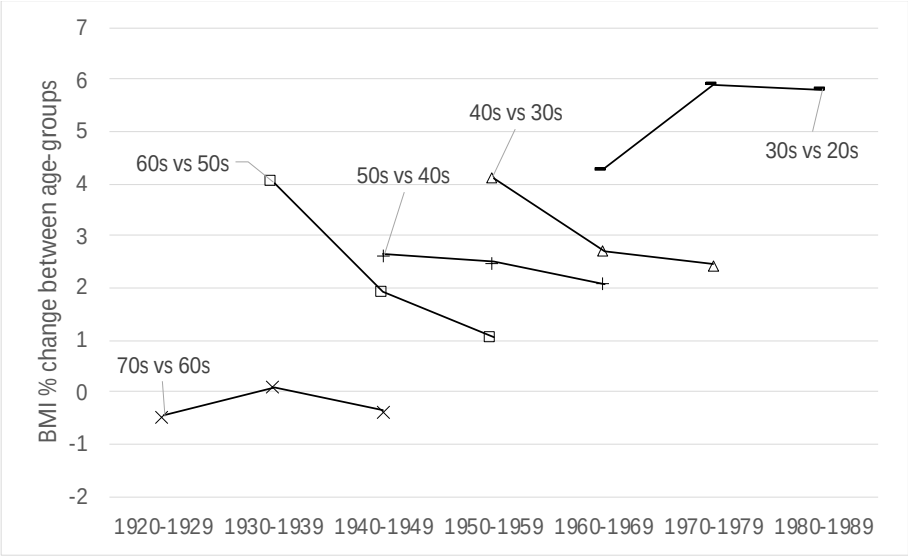


Figure 4b: Age-Related Weight Increase (ARWI): Women

Note: ARWI shows the change in mean BMI between two consecutive age groups for each quasi-cohort. For example, compared with their mean BMI at 20–29 years old, the mean BMI of women aged 30–39 in the 1960–1969 quasi-cohort increased by 3.81%.

4. Discussion

We analysed the changes in BMI and the prevalence of obesity and being overweight of an aggregated sample of about 100,000 subjects aged 20–79 years from seven cross-sectional Spanish national health surveys. Our analysis showed very different results when comparing by age and survey or by age and quasi-cohort. Comparison by age and survey showed no clear trends except for a decrease in being overweight among women. Comparison by age and quasi-cohort showed stabilisation trends and even decrease in body weight. These trends differed by sex, age, and quasi birth-cohort.

Our main objective was to find evidence of a plateau in the so-called obesity epidemic. Our analysis showed that the overall prevalence in Spain stabilized and even decreased. This evolution is recent among men but has been ongoing for more than two decades among women. In the first quasi-cohorts, obesity in men increased continuously, to slow down or stabilize in the last quasi-cohorts at the same time as the increase in obesity with age decelerated, as measured by the ARWI, denoting an increase in weight control at ages over 40. Among women, after the 1940–1949 cohort, mean BMI, the prevalence of being overweight, and obesity decreased at ages over 40.

This trend coincides with that detected in other developed countries among adults (Gard 2010; Rokholm et al. 2010; Stamatakis, Wardle, and Cole 2010; Olds et al. 2011; Sperrin et al. 2014; Wabitsch, Moss, and Kromeyer-Hauschild 2014; van Jaarsveld and Gulliford 2015). In Spain, this trend has also been discovered in adults, adolescents, and children, using data from both the NHSS (Bartoll et al. 2015; Miqueleiz et al. 2014, Miqueleiz, Lostao, and Regidor 2016) and from surveys that directly measure weight and height (Gutiérrez-Fisac et al. 2013; Sánchez-Cruz et al. 2013; Aranceta-Bartrina et al. 2016; López-Sobaler et al. 2016).

This stabilization and decrease in body weight and obesity cannot be attributed to the success of anti-obesity campaigns, which did not begin in Spain until 2005 (Miqueleiz et al. 2014; Sperrin et al. 2014). The symbolic devaluation of obesity preceded these campaigns and contributed to changing eating and exercise habits (Popkin, Siega-Riz, and Haines1996; Baum and Ruhm 2010; Vandebroeck 2015). In Spain in particular, the amount of calories consumed has been declining on a regular basis (Martín-Cerdeño 2008; Ruiz et al. 2015) and participation in sports and walking has increased progressively since 1980 (Casado-Pérez et al. 2009; Gutiérrez-Fisac et al. 2013; Mielgo-Ayuso et al. 2016).

This evolution has differed considerably by gender. In the 1920–1939 cohorts, there was a higher prevalence of female obesity, and in the 1940–1949 cohort, the prevalence of male and female obesity was similar. Since then, male obesity has increased, and the difference from female obesity grew until the 1970–1979 cohort. The combination of the

decrease in female obesity and increase in male obesity reversed the relationship between those two.

According to some studies, this gender discrepancy in the evolution of obesity is closely related to the greater importance of physical attractiveness for women: female obesity is more stigmatized than male obesity, and women experience more pressure to lose weight and feel that their life opportunities depend more on their physical appearance (Sobal and Stunkard 1989; Parsons et al. 1999). The ideal weight for women is lower than that for men, and women subject themselves more frequently and intensely to food restriction practices (Crawford and Campbell 1999; Regnier 2006; Williams, Germov, and Young 2007; Vandebroeck 2015). In addition, at advanced ages, freed from family and work constraints, women spend more time participating in sports and walking and monitor their eating more (Dumas and Laberge 2005).

In women with family responsibilities, controlled eating and physical exercise have a contradictory relationship with gender inequality. On the one hand, the greater weight control among women indicates the persistence of traditional gender divisions where physical attractiveness is much more valued in women. On the other hand, the possibility of controlling eating and having sufficient time to participate in sports or walking depends on exactly the opposite: the legitimacy of enjoying self-care and personal time, free from the traditional obligation of caring for family (Martín-Criado 2015).

We also analyse if the changes in body weight gains were the result of new generations controlling their weight more, or were due to greater weight control in the older generations. The comparison by cohort and age and the ARWI show that the plateauing of obesity in Spain was mainly due to greater weight control in the over-40 population. This was very clear among women: after the 1940–1949 cohort, BMI and obesity started to decrease at ages over 40. Among men the trend started in the 1960–1969 quasi-cohort. Nevertheless, since ARWI started to decrease from the age of 40+ in the 1940–1949 quasi-cohort, the weight control began before the stabilization or decrease in weight.

Many studies explain the changes in body weight by cohort by changes in socialization: the cohorts are distinguished by different socializing experiences in childhood that lead them to act differently for the rest of their lives (Allman-Farinelli et al. 2008; Reither, Hauser, and Yang 2009; Nooyens et al. 2009; Cámara and Spijker 2010). This idea does not fit with our data: the change by quasi-cohort did not begin from youth but occurred at mature or advanced ages. The change took place in adulthood as living conditions transformed and a changing relationship with health and the body led to greater body care (Dumas and Laberge 2005; Martín-Criado 2015). Transformations by cohort seem to be linked to changes in the perception of what type of body care and eating practices are legitimate or imperative at adult and mature ages.

Our study has three main limitations. First, BMI is only an approximate and imperfect indicator of obesity compared to more valid measures, such as fat level or abdominal circumference. Second, the NHSS are based on statements, not on direct measurements, and therefore suffer from social desirability bias (Gorber et al. 2007; Elgar and Stewart 2008; Stommel and Schoenborn 2009). However, this bias affects all the surveys we use for comparison and these measures are typically considered valid for time series in large populations. In addition, comparison with Spanish studies conducted using direct anthropometric measurements revealed that although the NHSS systematically shows slightly lower BMI values the trends shown are similar to those in the studies (García-Álvarez et al. 2007; Gutiérrez-Fisac et al. 2012; 2013). Third, the information in the surveys did not allow us to estimate the effect of migration flows and the role of mortality selection.

In conclusion, the quasi-cohort analysis showed a stabilization and decrease in the mean BMI and in the prevalence of being overweight and obesity. These trends differed by sex and age. The body weight of men stabilized very recently; however, weight gain among men has reduced progressively with age since the 1950s cohort. For women over 40, born in the 1940s and later, it has been more than two decades since the mean BMI and obesity decreased.

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