Centre d'Estudis Demogràfics

ROBUSTNESS AND BMI IN 20TH-CENTURY SPAIN. CULTURAL AND SOCIOECONOMIC DETERMINANTS

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PAPERS DE DEMOGRAFIA

2010

UNIVERSITAT AUTÒNOMA DE BARCELONA
08193 Bellaterra (Barcelona)

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L'article va ser presentat, com a comunicació, al
8th European Social Science History Conference-ESSHC 2010,
a Gant (Bèlgica), 13-16 d'abril de 2010.

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2010

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CULTURAL AND SOCIOECONOMIC DETERMINANTS

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1.- Research background and hypotheses

Two levels of analysis (individuals and populations) must be distinguished in the study of the regulation of weight as well as the determinants and implications of excess weight of which overweight and obesity take part.

At the individual level, obesity is recognized to be the result of the interaction of a number of genetic and environmental factors (the latter taken in a broad sense, i.e. physical, cultural and socioeconomic). Thus, given an environmental scenario, there are people more likely to develop excess weight with respect to some standard. Likewise, within a given socioeconomic strata (i.e. educational level and/or income level) there are people more likely to suffer from excess weight problems due to hormonal characteristics, medical ailments or, more often, dietary habits and lifestyle. Also, some cultures both in the past and nowadays highly value excess weight for different reasons. Any of these factors or a

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Associated research project: *Implicaciones sociodemográficas de las condiciones de salud en las edades maduras* funded by the Spanish Ministry of Science and Innovation (Ref- CSO2009-09851-SOCI).

combination of them may trigger the process leading the individual or a population to develop overweight and/or obesity. However, proportionally, it seems that relatively few cases of obesity can be exclusively attributed to a metabolic disorder, such as hormonal imbalance and low thyroid function. Furthermore, experimental human obesity has suggested that there exist a powerful mechanism by which body weight is regulated (i.e., in the short term, weight gains caused by an increasing intake of high caloric food and the decreasing of physical activity will be relatively soon neutralized once the individual recover his/her normal dietary habits and lifestyle) (Powers, 1980: 97-121). For this reason permanent attitudes with regards to food consumption and lifestyle are usually argued as the strongest explanatory factors of an excess weight status which is particularly relevant at a population level.

From this view, it must be bear in mind that profound changes in food consumption patterns and lifestyles have to occur to invalid that homeostasis and alter the body energy balance to the extent of deriving in a high increase of fatness. Consequently, at a population level, environmental and socioeconomic variables clearly prevail as explanatory factors since it is highly unlikely that genetic mechanisms that regulate weight could shift in the short term (at least between few generations). For instance, it would be difficult to assume any genetic factor behind the dramatic increase of overweight and obesity across contemporary societies during the last decades. In sum, this is because attention is addressed to nutritional practices and lifestyles that in addition are mediated by socioeconomic and cultural variables. Whereas the socioeconomic background is usually defined by a concrete range of well-known indicators (i.e. income and educational levels) cultural factors are a more ambiguous group of determinants.

Usually, the research on obesity uses the term cultural to refer social attitudes and perceptions towards the phenomenon (for instance, body image). Also, culture encompasses ethnicity, rituals and their influences on food choices. In this work we will refer to cultural factors to denote behaviors or specific lifestyle related to food and nutrition that were acquired as a part of the individual's cohort adscription by means of the influence of environmental conditions (i.e. socioeconomic in this context). Our point for Spain is that whereas these socioeconomic contexts have changed in a relative short period of time, those attitudes, behaviors and social norms and practices towards food and eating remained longer in time. In other words, a society might rapidly shift from scarcity to food security and even affluence. Likewise, less physical occupations may increase together with the spread of a more sedentary lifestyle (e.g. in the leisure practices). By contrast people's attitude towards eating and nutrition (e.g. the size of portions, the number of dishes at meals and the valuation of food as a scarce and precious good) may not parallel such changes. For instance many may not perceive the need to reduce food portions in times of the spread of high caloric diets or increasing sedentary lifestyle. Similarly, overweight and obesity, seen as a health and wealth indicator in past times may not concern as a health problem when scarcity has been overcome. This is logic since during severe scarcity episodes excess weight or simply a weight over the mean, represented a vital stock that might improve the likelihood of survival. This is supported by bio-medical research that has shown that human body has adapted to keep the maximum weight attained. The energy storage, not its expenditure or waste, takes part in the basis of human survival. Actually this metabolic ability to store energy in the form of fat represents a major evolutionary step forward from which one may regard that there was *a necessity of fat for evolution* (Powers, 1980:2). Thus after millions of years of adaptation, our body is designed to optimize the energy, rationalize it and keep it as it was scarce, which may or may not be the case. It is worth noting that until very recently in poor or less affluent countries, the poor were seldom obese since only in rich countries could the poor afford to be obese (i.e. highly caloric and carbohydrate foods be inexpensive and widely available). Accordingly, what was feared in a non affluent society was underweight because this feature in such circumstances may derive in higher exposure to death. Excess weight was thus effectively constrained by the lack of food. Furthermore, only since the late 19th century have any parts of the world had more than enough food for the majority of the population, and therefore it is only recently that overnutrition and obesity have been widespread even in poor countries. The latter is very remarkable although the determinants of this new epidemic as well as the most affected segment of population are necessarily different from those in rich countries. In general, profound changes in diet entailed to the globalization process in the field of crops and foodstuffs must be bear in mind to explain the high prevalence of obesity in many developing countries that were starving until very recently. In these cases, lower classes are more affected contrarily to what happened in the past when overweight and obesity were clearly associated to upper socioeconomic status. The issue in affluent societies seems much more complex since they became so much before the aforementioned globalization process took place. A number of studies have shown that lower educated people in rich societies are more likely to be obese but less is known about the cultural background and mechanism that result in these differentials.

2.- What makes Spain an interesting case study?

Spain has experienced dramatic economic and sociodemographic changes as well as a large improvement of general living standards during the last few decades. Today the country is one of the most affluent societies of the world and it is also internationally top ranked in health and well-being indicators.

The Spanish case, similarly to other Southern European countries, is very interesting among Western European affluent societies due to the rapidness of those changes. As a result, one may find very different alive generations of Spaniards with respect to life cycles and vital experiences: from those who experienced hunger born during the first half of the 20^{th} century to those who only know Spain as a modern, industrialized and economically powerful country born since the 1990s. From the current image of the country, it is difficult to guest that as late as 1950 food security and proper protein and caloric intake for the whole of the population was not yet ensured. In contrast, by 1920's there was a discussion in Sweden on the possibility to set a tax on obesity and by 1950, the marketing of diet food products had begun in the US where dieting and weight control were spreading out. In that country, by the 1960's, weight control had become a normal way of life (Casell, 1995). At that time Spain had merely overcome scarcity and thus the health risks associated to some consumption patterns were completely secondary if not inexistent (and so likely was the prevalence of obesity). To this regard, rapidness has also characterized changes. Increases in overweight and obesity levels within the context of most developed Western European countries have been dramatic over the last two decades since public health statistics are available. Significant BMI gains have recently been observed for the majority of age-sex categories among adults aged 20-80 (Cámara and Spijker, 2010) between 1987 and 2006.

It has often been argued that this situation is the result of a progressive abandon of the Mediterranean diet together with the spread of a more sedentary lifestyle. With regard to the former aspect, there is evidence on the increase of fat consumption rather than an actual change in dietary patterns. For instance, 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 society has also become more sedentary it is not surprising that overweight and obesity has recently become more widespread regardless of the continuity of a Mediterranean-style diet. Furthermore, Cámara and Spijker (2010) showed that 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. Conversely, those born between 1930 and 1949, particularly males, presented the most significant increases in overweight and obesity between 1987 and 2006. For these reasons, authors concluded that the upward trends in excess weight in Spain were a more complex issue than a hypothetical path towards a *Super Size Spain* due to rapid changes in dietary habits and lifestyles[2]. Their results revealed interesting generational differentials that could reflect different attitudes towards food and nutrition entailed to earlier vital experiences lived in a very different socioeconomic scenario. It turned out that the highest prevalence of excess weight in Spain was found among those generations who experienced severe deprivation, even hunger, during infancy and/or adolescence. Although an age effect must be kept in mind to interpret those results, this invited to hypothesize that those cohorts, at least their more impoverished counterparts, could be more likely to perceive excess weight as a desirable condition or, at least, to be more permissive with it nowadays. There were nevertheless no means to approach to their weight status as young adults to test such hypothesis since no longitudinal data source was implemented in Spain for these purposes.

[2] In the film, *Super Size Me*, released in 2004, Martin Spurlock explored the prevalence of obesity in the US by submit himself to 30 days of eating only McDonald's food with no exercise. This cause him to pass from lean to overweight.

Consequently, there was no solid evidence to conclude that severe deprivation during early life and early adulthood in Spain had to do with the levels of excess weight today; in words, that there would be any kind of causation between undernutrition (in the past) and overnutrition (at present).

In this paper we combine self-reported anthropometric data from health surveys with historical cross-sectional anthropometric data from military recruitments in the aim to go in depth with cultural and socioeconomic factors that lie behind the recent trends and differentials in overweight and obesity in Spain.

We will apply both geographical and demographic approaches. Data from Spanish regions and different cohort groups are analyzed to observe whether populations exposed to nutritional deficits in the past (reflected by relatively low statures, low BMI values and low robustness index values) are more prone to suffer from excess weight.

3.- Data

The data used in this work refer only to Spanish male population because only males were recorded in both health surveys and military statistics which is needed to carry out this methodological approach as explained forward.

Males (and females) were surveyed in different waves of the Spanish National Health Survey (SNHS) since 1987 so that cross-sectional self-reported anthropometric data are available for a wide range of cohorts born since the beginning of the 20th century. However, these data only permit the follow-up of cohorts between 1987 and 2006 thus far from the main stage of nutritional and sanitary transition in Spain that occurred during the central decades of the 20th century. Those decades can only be covered by means of the anthropometric data from the military recruitment system (mandatory in Spain until the end of the 1990s though its information is reliable and enough representative of the whole of population only until 1990[3]). It is from these military statistics that we have the oldest

[3] From then on, many potential conscripts chose alternative social services in substitution of the military service and consequently they were not registered by the military statistics.

data on height and weight (and chest circumference) by region and for the whole of the country. These data trace back to 1954 (cohorts born in 1934) so that they report on weight status of males that lived their infancy and adolescence well before the attainment of food security in Spain.

Military sources

Firstly, as a valuable characteristic of these statistics, they also included those who finally were excluded of the military service for any legal reason (e.g. shortness) so that these numbers are representative of the mean anthropometrics of the whole of population (Guillén Rodríguez, 1959).

Despite the notable development of the anthropometric history in Spain over the last decades, weight-based studies have been very few due to the absence of historical sources containing this information. For instance, local military recruitment books, profusely used to construct long-term height series, only included data on weight in 1912 (male cohorts born in 1891).

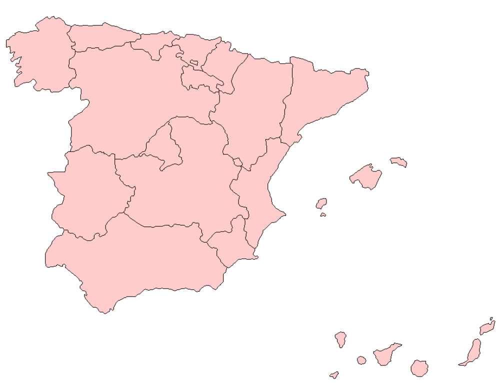
Since 1954, once the individual was enlisted, measurements of height, weight and chest circumference were collected and, more importantly, centralized to elaborate a national statistic to be published as a part of the Annual Statistics since 1955 (data by region in 1958 contain the first four years of available information). These statistics encompass a vast amount of information collected from individual forms filled up during the mandatory recruitment process until the end of the 1990s. A summary of basic statistics from these forms was elaborated and included in the *Estadística de Reemplazos y Reclutamiento de los Ejércitos*. Another summary, including anthropometric information, was then added into the aforementioned Annual Statistics (*Anuarios Estadísticos de España*) since 1958. What is found here is the aggregated numbers of the original statistics (e.g., means and percentage distributions of height, weight and chest circumference by intervals). This information is available until 1994 (there was no enlistment in 1986) and reliable for our purposes until 1990 (since then, an increasing number of recruits were not finally enlisted due to the progressive shift toward a voluntary military service in the country). Therefore, our indicators based on this source refer to males born in 1970 backwards.

To be noted, age at measurement is neither constant in time nor uniform for all conscripts in the military statistics. Until 1968 most of them were measured at age 21. In the next years, age at measurement was shifted to 19. For this reason we opted to not include in the analysis those recruitments that derived in a noticeable decrease of mean height, weight and chest circumference. Forward in time, in 1987, the age at measurement was again set down to 18 years but this did not seem to have any effect in mean height but mainly in weight and chest circumference. This would be explained by the anticipation of the end of the physical growth process at earlier ages as one society attain higher levels of development as stated by auxology (Tanner, 1981; Falkner and Tanner, 1986; Bogin, 1988; Eveleth and Tanner, 1991).

A last remark on this source refers to its contents. We find height (in centimeters), weight (in kilograms) and chest circumference (in centimeters and assumed to be taken at rest position). The figures are provided in five-unit intervals as a percentage of the total for both the overall country and the so called anthropo-demographic regions. The latter roughly coincide with the administrative regions (Autonomous Communities) in current Spain and that division was established following an interesting physical (i.e. hydrographic-ethnical criteria) by doctor Hoyos-Sainz (1942; see Group of Figures 1).

Figures 1.- Current administrative division of Spain (Autonomous Regions) and Anthropo-demographic regions

Current administrative division of Spain (Autonomous Regions)



Anthropo-demographic regions

Since a good part of our analysis lies on the regional differentials in anthropometric indicators next it is presented some figures on GDP per capita and Infant Mortality Rate that contribute to capture historical differences in living standards across Spain (Table 1).

Table 1.- GDP per capita (1930, 1955 and 1995) and Infant Mortality Rate (1901-5; 1946-50 and 1975-79). Spain

GDP per capita (Spain = 100) and Infant Mortality Rate (per thousand)

Anthropo-demographic region	**Administra-tive regions**	GDP 1930 (rank)	GDP 1955 (rank)	GDP 1995 (rank)	IMR 1901-5 (rank)	IMR 1946-50 (rank)	IMR 1975-79 (rank)
Madrid	Madrid	173 (1)	155 (2)	136 (1)	196 (9)	68 (6)	13 (1)
Andalucía	Andalucía	80 (9)	68 (10)	68 (11)	199 (10)	76 (9)	18 (7)
Extremeño-Manchega	Extremadura, Castilla-La Mancha	61 (11)	61 (11)	74 (10)	210 (11)	85 (10)	18 (9)
Levantina	Valencia, Murcia	84 (6)	90 (6)	91 (6)	172 (6)	56 (3)	16 (3)
Catalana	Cataluña, Islas Baleares	136 (3)	140 (3)	132 (2)	117 (1)	38 (1)	13 (2)
Aragonesa-Riojana	Aragón, La Rioja, Navarra	99 (5)	107 (5)	116 (3)	170 (5)	68 (5)	16 (4)
Castellano-Leonesa	Castilla-Leon	67 (10)	83 (7)	89 (7)	184 (8)	93 (11)	20 (10)
Vasca	País Vasco	149 (2)	177 (1)	110 (4)	137 (2)	45 (2)	17 (6)
Cantábrica	Cantabria, Asturias	117 (4)	113 (4)	88 (8)	142 (4)	61 (4)	18 (8)
Galaica	Galicia	83 (7)	70 (9)	83 (9)	134 (3)	72 (8)	21 (11)
Canaria	Islas Canarias	81 (8)	75 (8)	101 (5)	181 (7)	70 (7)	17 (5)

With few exceptions the rank of the GDP per capita taken as a percentage of the Spanish GDP per capita have varied very little since 1930. Then, the richest regions were Madrid, the Basque Country and Catalonia-Balearic Islands. In turn the Southern regions (Extremadura, Castilla-La Mancha and Andalusia) and the interior Northern region of Castilla-León were the poorest. There is a strong positive relationship between economic development and infant mortality levels with the exception of the urban region of Madrid that was probably affected by an urban penalty until the improvement of sanitary and hygiene conditions since the 1960s (note that by 1975-79, Madrid already rank the first also with respect of infant mortality rates). Also, the maintenance of the anthropo-demographic criteria by Hoyos creates some distortions. Usually, this criterion fits well the socioeconomic profile of the administrative regions aggregated into an anthropo-demographic region (e.g. Asturias and Cantabria). Sometimes this is not the case as with the Eastern anthropometric region (Región Levantina) that includes Valencia and Murcia. The former is closer to Catalonia and Balearic Island in socioeconomic and cultural traits than the latter. In turn, Murcia, until recent times, participated of the relative delay of Southern regions like Andalusia.

The Spanish National Health Survey (SNHS)

It has been held periodically since 1987 and provides self-reported data on height and weight. In this study we have used the first and last waves (1987 and 2006) to obtain two more time references for the group of cohorts that were originally measured and mapped from the military statistics. In this survey we count on self-reported height and weight belonging to Spanish cohorts born since the first decades of the 20th century thus permitting to cross this information with that from the Annual Statistics.

The microdata of the SNHS also allow for the estimation and regional distribution of the prevalence of overweight and obesity which is not possible from the military data. For significance needs, overweight and obesity have been joined in a category of *excess weight*. For the same reasons, ages 18 to 22 were chosen for the cross-sectional approach instead of only one single age which would have been derived in a lack of statistical significance given that the data is also disaggregated by region. The final sample of valid cases is provided in the Appendix. Note, however that all the calculations of BMI are based on weighed data. The weighting of the survey is based on sex, age, region and province of residence.

Finally, it must be noted that what we have in these sources are, respectively, the region where the conscript was enrolled and the region of residence at the time of the survey. No information either on the region of origin nor on the migration time, if it was the case, is provided in these sources.

4.- Methods

Data have been analyzed and interpreted in three supplementary manners: continuous time-cohort series, cross-sectional trends and quasi-cohort trends.

Continuous time-cohort series

These series are constructed with the data from military statistics between 1955 and 1990 and they are referred to Spanish male cohorts born 1934-1972. These figures can be interpreted both in terms of time and in terms of birth-cohort final outputs (that is, as indicators of the nutritional status of a birth cohort once the physical growth cycle has been completed or nearly completed). When this approach is applied, some of the anthropometric indicators that have been used, namely adult cohort height, are referred to the environmental conditions reflected in the so called net nutritional status, lived by the population during infancy and adolescence. Thus, for instance, height at age 21 has the ability to capture energy inputs and outputs and its potentiality derives from its stability once the individual have reached adulthood. In turn, weight and the composed indicators that include it like the robustness index or the BMI may be highly varying for different reasons so that one must be very cautious to use it for certain types of analysis. Consequently, in absence of concrete values of BMI for our cohorts of study at young adult ages, it is adult height, though not exclusively, that better approximates to the nutritional status of the population. This is particularly valuable to identify situations of potential undernutrition in the past that will be related to overweight and obesity at present.

Trends in height and weight

We present trends in mean cohort adult height and weight (also in mean BMI and robustness) by birth cohort at national level and by anthropo-demographic region.

Means for cohorts born after 1940 are transcribed from the military statistics whereas those for older cohorts are estimated from the proportions. Regional trends in height are of particular utility since aggregated data on weight do not allow to estimating any percentage of population exposed to either underweight or overweight. We might assume that behind a lower BMI for a Southern region there is a higher percentage of population undernourished. However, weight is a very unstable variable and by no means adequate to conclude on the nutritional status of a cohort or group of cohort over a part of the life-cycle. For instance it is unlikely that differences in mean weight between Andalusian and Basque males in 1965-69 mirror the actual difference in living conditions and nutritional status between the two populations during infancy and adolescence. Adult height, by contrast, has this informative capacity so that it results very valuable to complement and interpret regional differentials in weight, BMI and robustness.

Continuous trends in BMI

Technically, obesity refers to an excess of body fat whereas overweight does to the body weight is in excess of some arbitrary standard. Most of the literature, nevertheless, use these two terms as a categorical scale to describe two levels of excess weight with respect to any standard (in this and many other works, the Body Mass Index that relates an individual's weight in kilograms and the square of his/her height in meters). Body Mass Index has been calculated as the weight in kilograms divided by the Squire of the height in meters. BMI categories have been set following the most accepted classification (i.e. overweight for BMI values over 24.9 and obesity for values higher than 29.9 kg/m2).

Finally, it should be remembered here that we addressed questions to the past by using current standards (in this case BMI categories as usually set). Thus the results should be interpreted in a more relative manner.

Robustness Index (or Pignet Index)

The inclusion of the chest circumference in the military statistics results of particular interest because it will allow to comparing trends in robustness and BMI thus distinguishing two aspects that are seldom observable in historical perspective. The Robustness Index (RI) has been constructed as follows:

$$IR = \text{Height (cm.)} - \text{Weight (kg.)} - \text{Chest Circumference (cm.)}$$

It must be outlined that the interpretation of this index substantially differs depending on the context and its original purposes. Currently, the RI is a fitness indicator (the higher the values the better the person's fitness). Contrarily, in this work, the IR celarly correlates with the BMI in a negative way and the lower its mean values the stronger the population. This is simply the result of the combination of three measures in the index and the prevalence of one or another (or a combination of two) when calculating the index. Note in this case, for instance, that Madrid, does not appear in the bottom group in any indicator but in the RI. This is a result of a particular relationship between height (relatively high) and the sum of weight and chest circumference (relatively small). Next it is presented the scale under which the IR must be interpreted in this work according with the criteria used by the military authorities at that time:

> 0-10 (very strong); 11-15 (strong); 16-20 (good); 21-25 (intermediate); 26-30 (weak); 31-35 (very weak); +35 (pathologic problems)

Cross-sectional trends in BMI

This approach consists on the observation of the regional map of BMI for young adults (around age 20) across time (between 1955 and 2006). We have opted to separate those results from the military data (measured and referred to different single ages depending on the year of recruitment) and those from the health survey (self-reported and with a range of age 18-22 to obtain a reasonable representativeness at the regional level).

In the military register, due to the lack of statistics for the regions in some years, the mean has had to be estimated from the percentage distributions as a weighed average. To do this, the mid point of each interval was taken as the reference value. The final open interval has been managed as equivalent to another five-unit interval so that the reference value was set in an analogous way (see Appendix for a summary table of the information contained by this source). Bearing in mind that the percentages in the open intervals are always very small, this estimation is not likely to bias the results. Illustratively, if the national averages were estimated in the same way, results would not substantially differ from the figures provided in the source (see Figure 1 in the Appendix).

The aim of this approach is to find out whether any geographical pattern with respect to undernutriton or overnutrition may be established across time for young adults Spaniards. In addition, only for self-reported data, it is possible to observe the prevalence of excess weight by region between 1987 and 2006.

Quasi-cohort trends

As previously commented, in Spain no longitudinal source of enough time span is adequate for our purposes. This is because we simulate the follow-up of some cohorts by using pieces of cross-sectional information that come from the aforementioned sources. In some cases we have referred to this simulation as a *quasi-cohort* approach to make a distinction with a cohort used in epidemiologic studies which implies the follow-up of the same group of individuals across time (Spijker et al. 2008; Cámara and Spijer, 2010). This is not the case since our birth cohorts are made of different individuals in each time reference. In this case, both military records and self-reported data from the health surveys are used. For instance, we follow up the BMI of the group of cohorts 1934-43 in 1955-64 around age 20 (from military statistics), forward in time in 1987 at ages 44-53 (from self-reported data) and finally in 2006 at ages 63-72 (also by using self-reported data).

Our quasi-cohort follow up is focused on three ten-year birth cohorts:

- 1934-43: These cohorts were born under severe scarcity and economic crisis during the immediate pre-Civil War period, the Spanish Civil War and immediate post-war years (Spanish Civil War lasted from 1936 to 1939). Those born in 1934 reached their twenties by the middle of the 1950s, just in the threshold of the attainment of food security in the country. Those born in 1943, in turn, could go through their adolescence during the second half of the 1950s and the first half of the 1960s so that their life-cycle until adulthood was not so hazardous. In any case, this group of cohorts might be defined as a pre-affluence group of cohorts.
- 1944-53: These cohorts were still born under the sign of autarchy but could benefit from the economic recovery and modernization experienced by the country since the middle

of the 1950s and particularly during the 1960s in the case of those born since the end of the 1940s. Thus they are representative a sort of transition cohorts.

- 1954-63: These cohorts were born and grown up completely out of severe scarcity and deprivation of the post-war decade. The country was not yet an affluent society within Western Europe but undoubtedly a *new* Spain had emerged with respect to the former decades. We might define these cohorts as representative of an incipient affluence.

5.- Results

Results are structured in three parts. First, cross-sectional BMI by region and continuous trends in height, weight, BMI and robustness are presented. Then, the quasi-cohort approach for the aforementioned groups of birth cohorts is commented.

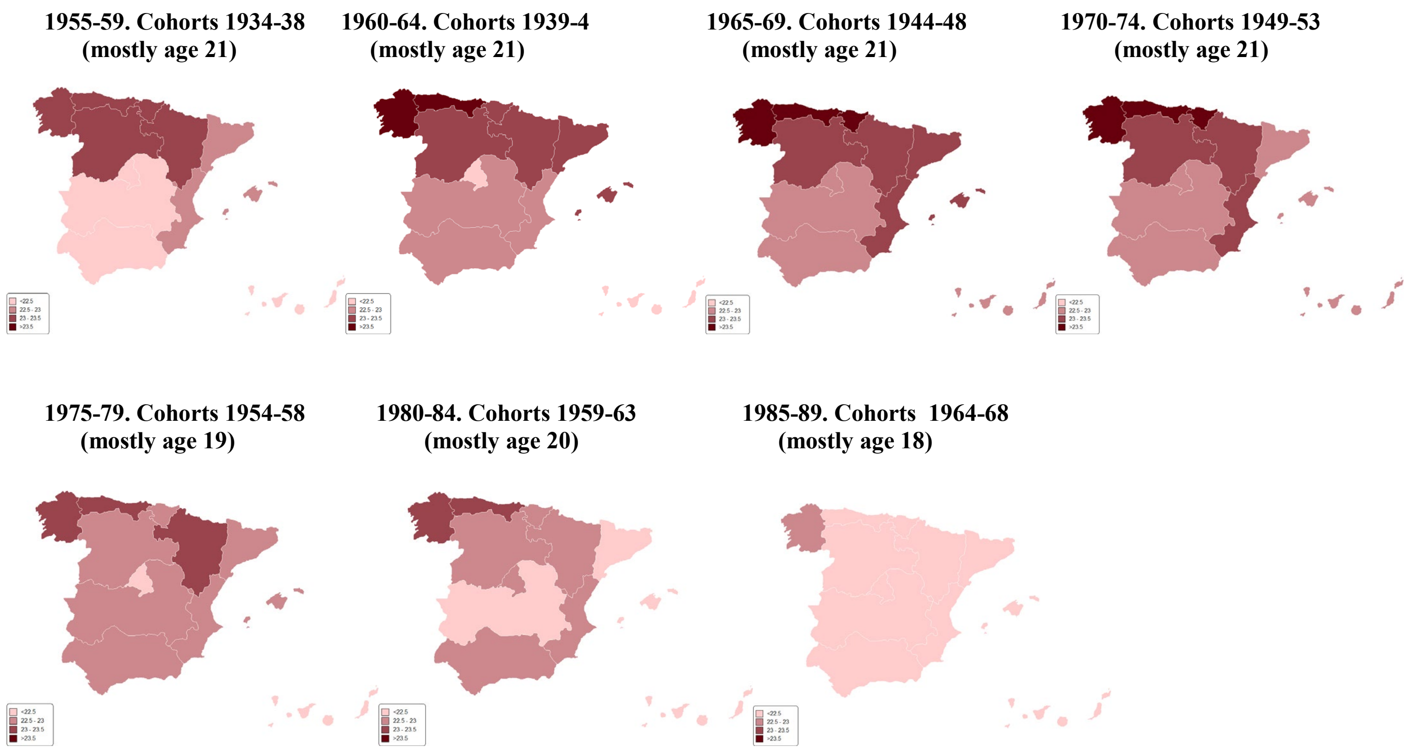
Groups of figures 2 and 3 present the trends in mean BMI by anthropo-demographic region for young adult males in Spain. The Group 1 presents the data from Military Statistics whereas the Group 2 presents the self-reported data from the SNHS. Altogether, it is obtained a time-trend in BMI from 1955 to 2006 for roughly the same segment of population (young adult males ranging from 18 to 22 years).

As expected, BMI means by the middle of the 20th Century results in a total absence of excess weight in the Spanish regions because 1) measures were taken on young population that was less likely to be either overweight or obese and 2) the socioeconomic context in Spain was one of recent attainment of food security so that little prone to favor excess weight for the majority. Actually, it may be assumed that many people still did not access to a proper food and caloric intake at that time.

Interestingly, although the intervals of BMI values range within narrow margins, it is observed a geographical pattern whereby relatively well and malnourished regions emerge. This assertion is supported by a very similar pattern in height and robustness (see also Group of Figures 4).

There is a group of three regions clearly below the mean in BMI and robustness. Differences in mean height at that time where also very remarkable. These anthropo-demographic regions encompass the South of the country and the Canary Islands, corresponding to the current administrative regions of Extremadura, Castilla-La Mancha, Andalucía and Canarias. Their disadvantage in BMI, though little in absolute terms, is very noticeable also regarding the rest of anthropometric indicators (i.e. height and robustness).

Figures 2.- Trends in BMI of young adult males by anthropodemographic region. Spain, 1955-1989 (cohorts born between 1934 and 1968)



Source: Summary of anthropometric measures from the Annual Military Statistic

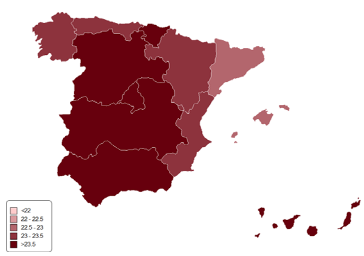
It must be noted, nevertheless, that if undernutrition is approximated not only through relative values of BMI but also through height, the group of malnourished regions is widened to four: Andalucía, Extremeño-Manchega, Castellano-Leonesa-Galaica with Canarias out of this group. This disadvantage lasted until the decade of 1970 when an intense process of convergence is detected in mean height and weight thus resulting in the progressive homogenization of the BMI across regions.

Figures 3.- Trends in BMI of young adult males by anthropodemographic region. Spain, 1987-2006 (cohorts born between 1934 and 1968)

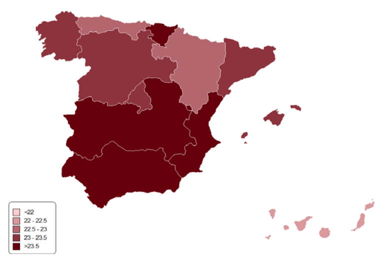
1987. Ages 18-22 (cohorts 1965-69) (ages 18-22)

1993. Ages 18-22 (cohorts 1971-75) (ages 18-22)

2001. Ages 18-22 (Cohorts 1979-83) (ages 18-22)



2006. Ages 18-22 (Cohorts 1984-88) (ages 18-22)



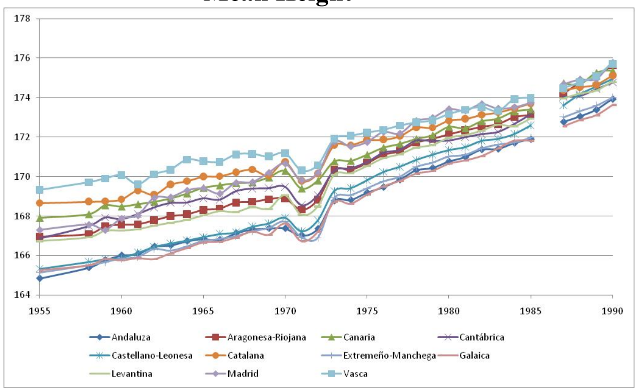
	GAL	CAN	VAS	CAS-LEO	MAD	EXT-MAN	ARA-RIO	CAT	LEV	AND	CAN	**SPAIN**
1987	22.19	22.61	23.38	22.02	23.31	23.37	23.33	23.04	23.32	23.17	22.87	**23.02**
1993	23.32	23.69	23.19	23.45	23.03	23.39	23.58	23.72	23.20	23.89	22.99	**23.46**
2001	23.12	23.48	23.87	23.58	23.54	23.59	23.07	22.67	23.25	23.77	23.76	**23.37**
2006	23.06	22.89	25.62	23.30	23.40	24.03	22.91	23.27	24.17	23.71	22.18	**23.59**

Source: Own estimations from the microdata of the SNHS (waves of 1987, 1993, 2001 and 2006)

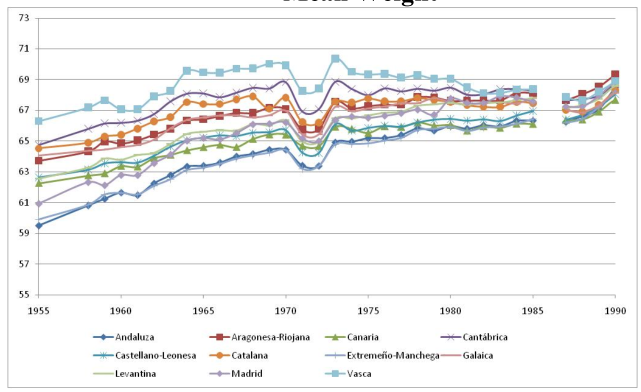
In the other extreme, the group of Northwestern regions with the highest BMI by the middle of the 20th century from which a more selected group of Northern regions emerged and maintained mean values over 23.5 until the aforementioned process of regional convergence. Remarkably, within this group of well-nourished regions, we find poor and rich regions and, also, some discrepancies between BMI and robustness and height should be mentioned. For instance, Castille-Leon ranked very well in BMI but among the lowest in mean height.

Figures 4.- Trends in height, weight, chest circumference, BMI and robustness by anthropodemographic region for young adult males. Spain, 1955-1990

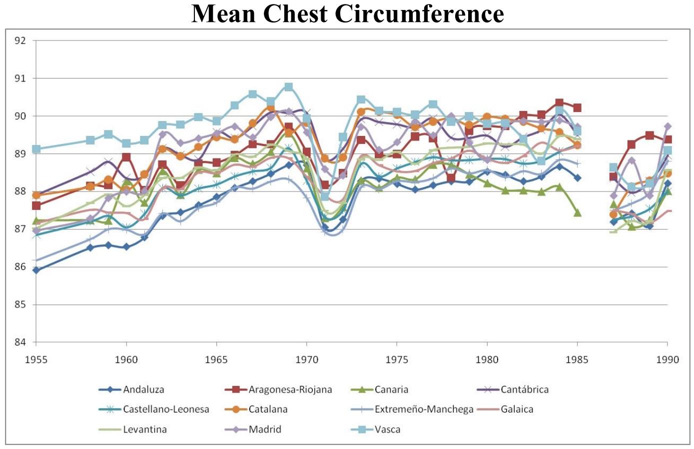
Mean Height



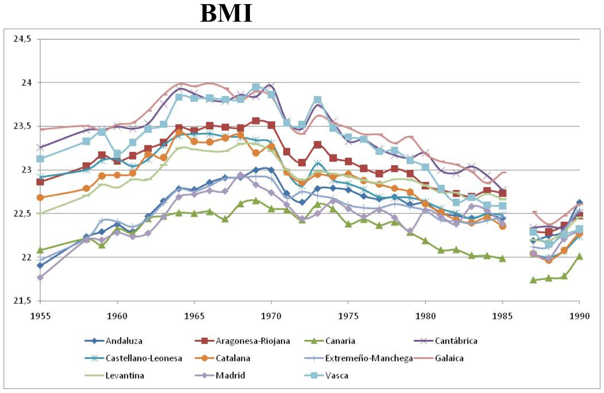
Mean Weight



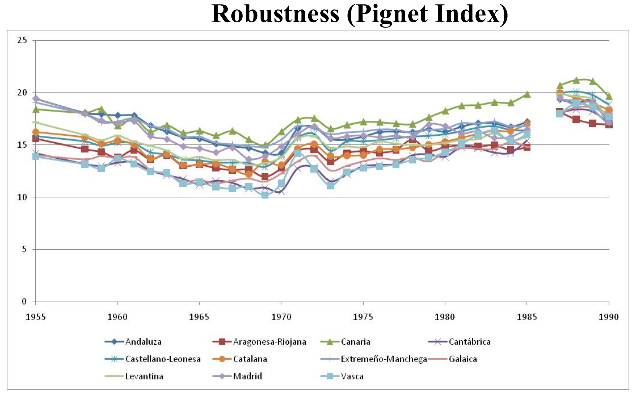
Mean Chest Circumference



BMI



Robustness (Pignet Index)



- Since 1975 two dynamics are observed: The general decrease of mean BMI that had to do with two factors (a rapid increase of adult cohort height and the lowering of the age at recruitment that resulted in a decrease of mean weight).

  The convergence in BMI across regions among Spanish Young males. This led any geographical pattern of BMI to disappear during the second half of the 1980s (cohorts born during the second half of the 1960s). This relevant fact is associated with the dramatic convergence of mean cohort height and weight across regions which point to the significant improvement of nutrition during the period analyzed. Illustratively, the weight range in 1987 was approximately 67.5-69 whereas it was 59.5-66.5 in 1955.

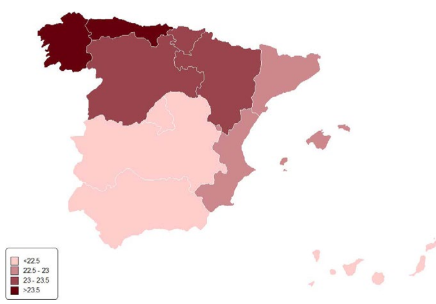
  A final interesting remark is that the process of convergence was strictly hierarchized. Note for instance that 3 out of the 4 regions initially at the bottom are clustered so also in 1990. The exception in this case is Castilla-León whose progress was been dramatic to set it out of the bottom group.

- Since the end of the 1980s (this time from self-reported data) we see a noticeable increase in mean BMI across regions as a result of the inclusion of ages over 20 but also, probably as a result of an increase in mean weight proportionally higher than the progress of height which is already quite moderated by this time. Taking 1987 as a new starting point given the different nature of the data, together with this general increase, we cannot appreciate a so well defined geographical pattern as that from the middle of the 20th century. However, those regions that were in a situation of poor nutritional status are invariably among those with highest BMI values. Furthermore, in 2006, what is observed is a North-South pattern, the South having the highest BMI values. Given that differences in mean stature were still in favor of Northern regions, what it must be concluded is that this inversion of the BMI map is caused by a remarkable increase in weight of the Southern regions. Forward in the paper it will show that this new map correlates with percentages of overweight and obesity. For now, the idea to keep in mind is that in 2006 the prevalence of excess weight approximated by mean values of BMI was higher in those regions that presented a disadvantageous situation with respect to nutritional status just before the rising of living standards in Spain.

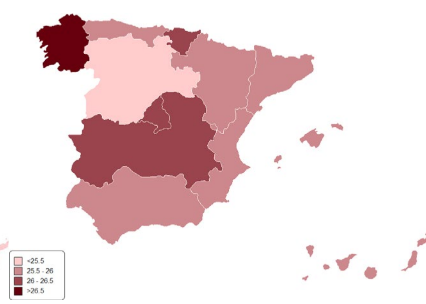
Next it is proceeded to explore the data from a cohort perspective to find out if some generational implications lie behind of this geographical pattern and its inversion during the last decades of the 20th century. To do that, the three selected ten-year cohort groups will be followed up in time since 1955 to 2006 (Group of Figures 5).

Figures 5.- Follow-up of BMI by region and ten-year birth cohort. Groups of cohorts 1934-43, 1944-53 and 1954-63

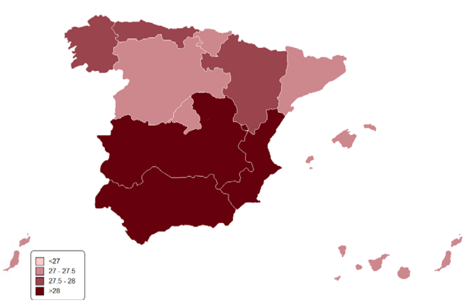
Birth cohorts 1934-43
(recruitments 1955-64 at about age 20)



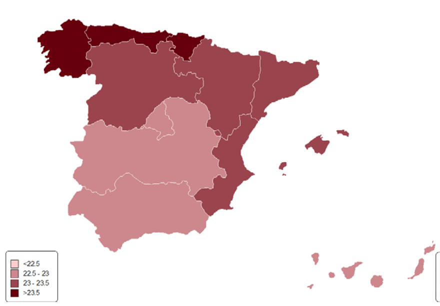
In 1987 (ages 44-53)



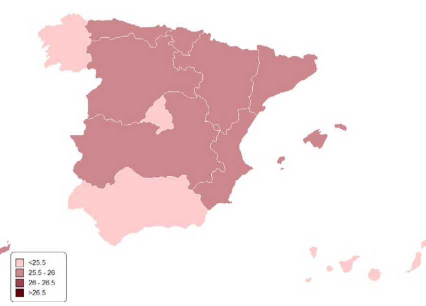
In 2006 (ages 63-72)



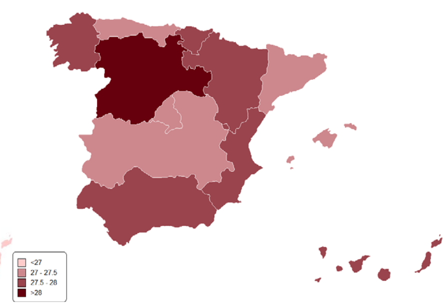
Birth cohorts 1944-53
(recruitments 1965-79 at about age 20)



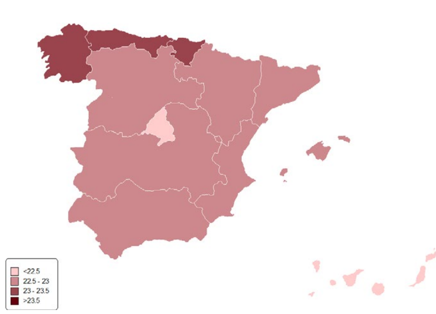
In 1987 (ages 34-43)



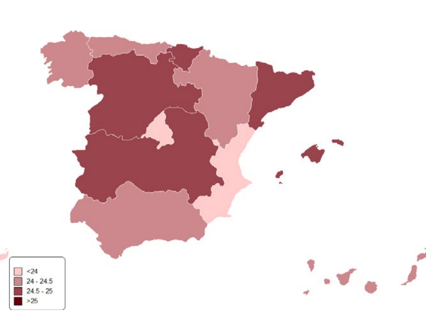
In 2006 (ages 53-62)



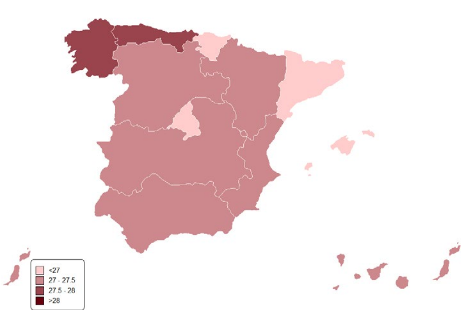
Birth cohorts 1954-63
(recruitments 1975-84 around age 20)



In 1987 at ages (24-33)



In 2006 at ages (edad 43-52)



Firstly, it must be noted that the trend in BMI is not the mere result of age within adulthood at a population level. Its behavior seems to be more complex. Some regions and some cohorts have been more successful in maintaing BMI values and its normal categories (see also Table 2).

Table 2.- Prevalence and increases of excess weight by region and birth cohort, 1987-2006

Birth cohort and (survey year)	Gal	Cant	Vas	Cas-Leo	Ara-Rio	Cat	Lev	Mad	Ext-Man	And	Can	SPA
1934-43 (1987)	69.9	57.9	61.3	60.6	61.1	56.9	61.0	60.9	63.2	57.5	58.0	60.2
1934-43 (2006)	71.3	73.8	77.1	70.1	77.3	73.0	78.6	73.3	81.2	85.0	74.3	76.8
Absolute increase	1.4	15.9	15.8	9.5	16.2	16.1	**17.6**	12.5	**18.0**	**27.5**	16.3	16.6
Relative increase	2.0	27.0	26.0	16.0	27.0	**28.0**	**29.0**	21.0	**28.0**	**48.0**	**28.0**	27.6
1944-53 (1987)	62.0	59.8	52.5	53.0	58.5	62.2	47.5	44.6	57.6	50.0	47.5	53.7
1944-53 (2006)	76.9	69.4	77.3	71.3	72.7	73.6	73.7	62.0	72.5	75.3	71.1	72.2
Absolute increase	14.9	9.6	**24.8**	18.3	14.2	11.4	**26.1**	17.3	14.8	**25.2**	**23.5**	18.5
Relative increase	24	16	**47**	34	24	18	**55**	**39**	26	**50**	**49**	34.4
1954-63 (1987)	34.6	38.7	42.0	43.3	33.4	37.8	29.7	25.0	38.5	35.5	31.6	34.7
1954-63 (2006)	72.0	69.7	71.5	78.1	71.3	69.0	66.6	66.4	72.0	66.7	66.1	69.0
Absolute increase	**37.4**	31.1	29.5	**34.8**	**37.9**	31.2	**36.9**	**41.4**	33.5	31.3	**34.5**	34.3
Relative increase	**108**	80	70	80	**113**	83	**124**	**165**	87	88	**109**	98.7

Secondly, no trace of the aforementioned inverted geographical pattern is visible for the group of cohorts born after 1943. In turn the inverted dichotomous pattern (smoothed in the North though) is very noticeable for those cohorts born during the most hazardous times of the Spanish 20th century (cohorts born 1934-43). Thus, there is a first evidence of a cohort gap between cohorts born under severe scarcity and those born or mostly grown up in a context of food security and incipient affluence. In Table 2 it is shown that the former approximations through mean values of BMI may be highly representative of the geographical distribution of overweight and obesity. Both categories of excess weight have been joined and the results show that the younger the cohort group the larger the geographical dispersion of the high prevalence and its increase between 1987 and 2006 (both in absolute and relative terms).

6.- Discussion

Our results point to generational implications of current high BMI in Spain. We hypothesize that these figures at present are associated with specific socioeconomic backgrounds in the past. Cohorts born during harsh periods and in the formerly more impoverished regions of the country seem to be the most affected by overweight and obesity nowadays. Among these cohorts born between 1934 and 1943 an inverse geographical pattern is observed: regions that most suffered from undernutrition (reflected by short statures, high prevalence of relative underweight and low BMI and RI mean values) during the decades preceding the Spanish socioeconomic taking-off are currently the regions with highest BMI values and they are also among those with higher prevalence of obesity. Recent increases in excess weight, moreover, are much more significant in these regions (i.e. Southern Spain) when this group of cohorts is regarded. By contrast cohorts born in the context of food security of the middle of the 1950s and thereafter are less affected and no geographical pattern may be established for them.

Although we lack of individual data in a longitudinal perspective that would allow to ensuring the actual evolution of the weight status within these cohorts, the geographical pattern that has been found suggest that the hungry of yesterday are the overweighed of nowadays in Spain. Though the mechanisms that mediated this inversion are far from being accurately described, our results invite to think in terms of what we might call an *obedere hypothesis*[4] (i.e. that that the rapid transition toward affluence in Spain without being paralleled by a change in attitudes towards food and eating may have caused that

[4] *Obedere* is the etymological root of obesity. It comes from Latin ***ob*** (over everything) and ***edere*** (to eat), that is to say, to devour (an obese person is someone who eats or devours everything). The point is that in mid-20th century Spain 'eat everything' was to eat what was needed to survive and the same behavior fifty years later would derive in severe obesity.

inverted effect). Such effect is not observed for younger generations that were not exposed (at least not so heavily to scarcity) and its impact is particularly relevant in those regions that previously afforded higher levels of deficient nutrition. In our view, an unchanged attitude toward food (i.e. a basic nutritional behavior) rather than dramatic changes in dietary habits and increasing sedentary lifestyle might have contributed to explain the current map of excess weight in Spain as well as the different prevalence between subpopulations.

For some people, having experienced hardship may have made overfeeding and fatness a desirable condition even associated with good health. In other words, the Maslowian physiological need for food is not real nowadays in Spain but would have remained as such due to the rapidness of socioeconomic changes and the nutritional transition in 20th-century Spain. It is for these reasons that nutrition education and information on health risk of excess weight are important. 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) found an increasing negative association between educational level and obesity among Spanish adults aged 20-64 between 1987 and 1993. From a cohort perspective a good part of the current Spanish population above the age of 50 attained a low level of formal education. In addition, there was also a lack of educational programs or public policies regarding nutritional behavior in Spain (the first public health strategy specifically addressed to prevent overweight and obesity was implemented as late as in 2005). It is difficult at this point to distinguish generational from educational effects because they are both highly correlated and further research must be done on the influence of education at the individual level. One may question whether those with lower education are also more prone to excess weight within the aforementioned group of cohorts and within the poorer anthropodemographic regions.

In conclusion Spanish cohorts born during hard deprivation times and located in the most impoverished regions seem to have been more negatively exposed to the rapidness of the socioeconomic changes in Spain in that these changes were not paralleled by adequate nutrition education. If this were the case it would be interesting to rethink overweight and obesity as products of a socialization process. This process begins in the household where parents' attitudes leave an indelible impression on children´s attitude towards food and eating as well as towards body perception. To this respect it is worth remembering that, on one hand, weight status particularly among males has been a secondary concern in Spain until very recently. On the other, some cultural attitudes are very difficult to modify which in this case, with Massara (1980), promote a very permissive attitude towards weight regulation.

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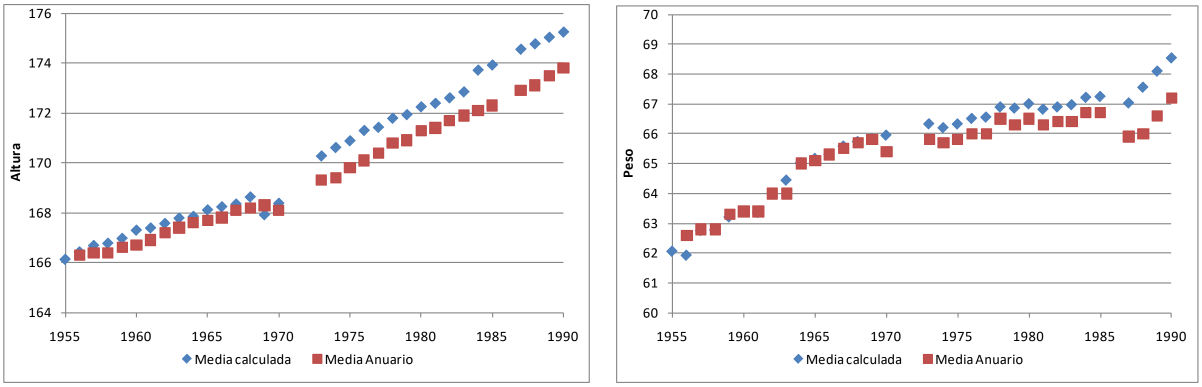
Appendix:

Table 1A.- Summary table with the characteristics of the aggregated data from the Military Statistics

Year	**Height**		**Chest circum**		**Weight**		**Information provided**	
	Min	Máx	Min	Máx	Min	Máx	**Geographical scope**	**Statistics**
1996	<150	190>	<75	105>	<50	90>	Only national	No mean
1995	<150	190>	<75	105>	<50	90>	National + regional	No mean
1994	<150	190>	<75	105>	<60	90>	Only national	No mean
1993	<155	190>	<75	105>	<50	90>	National + regional	No mean
1992	<155	190>	<75	105>	<50	90>	National + regional	No mean
1991	<150	190>	<75	105>	<50	90>	National + regional	Nat. & reg. means and modes
1990	<150	190>	<75	105>	<50	90>	National + regional	Nat. & reg. means and modes
1989	<150	190>	<75	105>	<50	90>	National + regional	Nat. & reg. means and modes
1988	<150	190>	<75	105>	<50	90>	National + regional	Nat. & reg. means and modes
1987	<150	190>	<75	105>	<50	90>	National + regional	Nat. & reg. means and modes
1986								Nat. & reg. means and modes
1985	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1984	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1983	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1982	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1981	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1980	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1979	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1978	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1977	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1976	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1975	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1974	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1973	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1972	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1971	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1970	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1969	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1968	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1967	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1966	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1965	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes
1964	<150	180>	<75	>100	<50	75>	National + regional	National mean and mode
1963	<150	180>	<75	>100	<50	75>	National + regional	National mean and mode
1962	<150	180>	<75	>100	<50	75>	National + regional	National mean and mode
1961	<150	180>	<75	>100	<50	75>	National + regional	National mean and mode
1960	<150	180>	<75	>100	<50	75>	National + regional	National mean and mode
1959	<150	180>	<75	>100	<50	75>	National + regional	National mean and mode
1958	<150	180>	<75	>100	<50	75>	National + regional (1955-58)	National mean and mode
1957	<150	180>	<75	>100	<50	75>	Only national	National mean and mode
1956	<150	180>	<75	>100	<50	75>	Only national	National mean and mode
1955	<150	180>	<75	>100	<50	75>	National + regional	Nat. & reg. means and modes

Figure 1A.- Estimated (in blue) and provided means (in brown) of height and weight at the national level



Source: Military Statistics

Table 2A.- National Spanish Health Survey. Valid cases of males aged 18-22

	GAL	CANT	VAS	CAST-LEO	MAD	EXTR-MAN	ARA-RIO	CAT	LEV	AND	CAN	**Spain**
1987	41	150	78	49	34	204	190	96	145	212	217	1416
1993	62	69	94	41	88	123	127	134	124	92	59	1013
2001	56	64	66	47	85	99	85	114	111	83	39	849
2006	61	35	15	18	42	33	86	80	77	61	19	527

Table 3A.- National Spanish Health Survey. Valid cases of males from the analyzed birth cohorts

Birth Cohorts	Year	GAL	CANT	VAS	CAST-LEO	MAD	EXTR-MAN	ARA-RIO	CAT	LEV	AND	CAN	**Spain**
1934-43	1987	43	235	119	69	65	308	263	103	181	252	295	1933
	2006	181	108	53	66	78	85	288	178	154	106	43	1340
1944-53	1987	50	288	141	66	65	277	277	120	183	266	244	1977
	2006	203	163	45	60	103	95	286	200	171	109	66	1501
1954-63	1987	67	338	156	84	93	358	361	162	229	359	336	2543
	2006	174	199	73	100	136	143	418	274	231	158	79	1985