



## EDITORIAL

### Secular growth acceleration in Spain. Spanish Growth Studies 2010. Spanish-born population and immigrant population<sup>☆</sup>



### Aceleración secular de crecimiento en España. Estudios Españoles de Crecimiento 2010. Población autóctona y población inmigrante

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Cross-sectional studies report the current situation of the population assessed and allow for inclusion of a significant number of subjects, but since the pubertal growth spurt does not start in all subjects at the same age, they do not allow for accurate assessment of growth during pubertal development.

Longitudinal studies allow for individualized evaluation of growth from birth to achievement of the adult height. They also allow for grouping subjects by maturational category based on age of start of their pubertal growth spurt (very early, early, intermediate, late, and very late) and provide differential data for each maturational group. They provide data on growth velocity from birth to the adult height and are the only ones that allow for a reliable

analysis of pubertal growth. However, these studies require long periods of time and usually include a limited number of subjects. They also involve the risk of some bias in selection of the study population.

In recent years, there has been in Spain an increase in populations of other ethnic groups coming from various geographic areas of the planet. The question has therefore arisen as to whether growth of these ethnic groups is similar to that of the native Caucasian population and whether the growth patterns in the latter may also be applicable to the former.

Cross-sectional and longitudinal growth studies conducted on the native Caucasian population and growth data of the immigrant population are currently available in Spain. All these data are posted on the website <http://www.estudiosdecrecimiento.es>, from which a calculation and graphic representation software (Auxolog) may be freely downloaded.<sup>1</sup>

Two cross-sectional studies and one longitudinal study are available in the native Caucasian population. Cross-sectional studies assess weight and length in premature and term

<sup>☆</sup> Please cite this article as: Carrascosa A. Aceleración secular de crecimiento en España. Estudios Españoles de Crecimiento 2010. Población autóctona y población inmigrante. *Endocrinol Nutr.* 2014;61:229–233.

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newborns (NBs), and weight, height, and BMI in children, adolescents, and young adults from birth to 22 years of age respectively. The longitudinal study assesses height from birth to 18 years of age.

The cross-sectional study in NBs at 26–42 weeks of gestational age included 9362 subjects (4884 males, 4478 females), and its data show sexual dimorphism, different values as compared to other populations, secular weight and height acceleration in premature NBs as compared to prior Spanish studies, and absence of secular acceleration in term NBs as compared to prior Spanish studies.<sup>1–9</sup>

These studies are helpful to classify NBs by weight and gestational age and for monitoring the weight and length of premature NBs during their postnatal development until the age corresponding to 42 weeks of their gestational age.

The cross-sectional study from birth to 22 years of age included 38,461 subjects (19,975 males, 18,486 females), and its data show the adult height of the Spanish population to be similar to that in other Mediterranean countries, the United Kingdom, and the United States, but lower than that of the German, Swedish, and Dutch populations. A secular growth acceleration of approximately 3 cm in adult height was shown as compared to Spanish studies prior to 1988 (Bilbao 1988, Catalonia 1987).<sup>10–40</sup>

BMI values when adult height was reached were similar in women and slightly higher in men as compared to all other European populations, but lower than those of the US population. A secular BMI acceleration was seen as compared to Spanish studies prior to 1988 (Bilbao 1988, Catalonia 1987), but only for values equal to or higher than the 75th percentile. These data suggest that approximately 75% of our children and adolescents would protect themselves well from overweight and obesity, while 25% would not.<sup>10,33–40</sup>

In females, values of the 97th percentile in the Bilbao 1988 study would correspond to values of the 97th percentile (0–5 years of age) and to those of the 95th percentile (5–22 years) in the 2010 Spanish Cross-Sectional Growth Study. In males, values of the 97th percentile in the Bilbao 1988 study would correspond to values of the 95th percentile (0–5 years of age) and to those of the 90th percentile (5–22 years) in the 2010 Spanish Cross-Sectional Growth Study.

Secular BMI acceleration was seen from 3 to 5 years of age in males and from 5 to 7 years of age in females, and reached maximum intensity in both sexes during pubertal development. These data suggest that ages of 3–5 years in boys and 5–7 years in girls are key times for the start of overweight and obesity, while puberty is the time with the greatest risk for their occurrence.

A highly controversial issue is how should obesity be defined during childhood and adolescence based on BMI levels, because these change with age. In this regard, it should be noted that the cut-off percentiles used to define overweight and obesity provide guiding data on the proportion of subjects in a community who are overweight and obese, but do not allow for quantifying the degree of obesity. Moreover, the values used to define them are not always the same. Thus, differences exist between the values proposed by Cole (2000) and by the WHO (2007). Thus, data obtained will differ depending on the criteria used.<sup>10,33–40</sup>

However, morbidity and degree of obesity are seen to be related to each other in daily clinical practice. Therefore, not only presence of obesity, but also its degree, should be assessed. The 2010 Spanish Cross-Sectional Growth Study provided data on the mean and standard deviation for each age with intervals of 0.5 years, except for the first 2 years of life, in which intervals were of 0.25 years. These data allow for calculating the degree of obesity of each subject as standard deviations from the mean BMI corresponding to age (z-score value). This z-score value is helpful to relate morbidity to the degree of obesity and for monitoring the short and long-term effects of treatment.<sup>1</sup>

The longitudinal study from birth to adult height enrolled 540 subjects (259 males, 281 females), and its data show that each subject has his/her own maturational pace to start the pubertal growth spurt, which starts as early as at 8–9 years in girls and 10–11 years in boys. Grouping in five one-year periods allowed for defining five maturational groups (very early, early, intermediate, late, and very late) and for specifically assessing pubertal growth in each of these groups, unlike what was previously done in most longitudinal studies, which used a single group because of the small number of subjects.<sup>1,41–60</sup>

In both sexes, each of these five groups had different heights at the start of puberty, different pubertal growth velocities, and different pubertal height gains, but similar adult heights. The earlier the age of start of the pubertal growth spurt, the lower the starting height but the greater the total height gain during puberty, so that both phenomena mutually compensate and allow for achievement of a similar adult height in each of the five maturational groups.<sup>59,60</sup>

This new methodology to assess pubertal growth using five different patterns instead of a single one, as previously done, allows for a better evaluation of pubertal growth, avoiding the mistakes made when a single pattern was used. Such mistakes were clearly evident in very early and very late maturational groups, because the single pattern is representative of growth of the intermediate maturational group.<sup>59,60</sup>

In the immigrant population, cross-sectional studies have been conducted on populations from African origin (the Maghreb and sub-Saharan regions) born in Spain and on South American populations with Inca and Mayan ancestors.<sup>1</sup>

Two studies have been conducted on subjects from Maghrebi and sub-Saharan origin born in Spain, one on term NBs and the other from birth to adult height. Both populations were separately assessed, and data collected showed values similar to those found in the native Caucasian population.

The population born in America with Inca and Mayan ancestors consisted of a group of subjects born in Spain (term NBs to children aged 4–6 years) and another group of subjects not born in Spain (4–6 years to adult height). In the group of term NBs, weight and length were similar to those of the Caucasian population. In both sexes, height and BMI were similar to those of the native Caucasian population during the first four years of life. However, height progressively differed after that age, and was some 5–6 cm lower when adult height was reached. BMI values were similar or slightly

higher in this American population. It should be noted, however, that these data are only a guidance, because of the small number of subjects evaluated, and studies on a greater number of subjects are needed to confirm or refute these findings.

To sum up, a secular acceleration in adult height values has occurred in recent years in the Spanish Caucasian population. Such acceleration is seen in both sexes and similarly affects all subjects, both those who grow by high percentiles and by intermediate and low percentiles. An increase was also seen in BMI values, but did not occur in the whole population, being only evident in both sexes for BMI values equal to the 75th percentile or higher. BMI values lower than the 75th percentile were similar to those seen 30 or more years ago.

In the immigrant population of African origin, data were similar to those of the Caucasian population during childhood and adolescence. In the American population with Inca and Mayan ancestors, however, adult height values clearly differed from those of the Caucasian population. This phenomenon is also seen when adult heights of different populations of our planet are compared, and clearly shows the need for having adequate reference patterns for each population for adequate growth assessment.

Finally, by evaluating a significant number of subjects, longitudinal studies have allowed for showing for the first time differential pubertal growth data depending on the age of start of the pubertal growth spurt.

## Annex 1. Investigators participating in the 2010 Spanish Growth Studies

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