Poverty and rural height penalty in inland Spain during the nutrition transition

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POVERTY AND RURAL HEIGHT PENALTY IN INLAND SPAIN DURING THE NUTRITION TRANSITION

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ABSTRACT

The article analyses nutritional inequalities and stunting in inner rural Spain from a case study carried out in Castile-La Mancha. The examination of the height military draftees explores the gap between urban and rural populations and analyses the evolution of growth patterns in different habitational contexts. The results indicate that stunted growth and undernourishment were pervasive in the two initial decades of the 20th century, that the situation improved slightly in the 1920s and the first half of the 1930s, and that in the 1940s and 1950s the conditions again deteriorated considerably. Stunted growth was significant especially in rural areas, which were particularly penalized during Francoism. Height increased considerably in the 1960s and 1970s and, although this improvement also reached the rural areas, the gap that separated the countryside and the urban area did not disappear until the early 1980s. The data suggests that a poor and limited diet, the economic policies and the social assistance-related institutional framework were key factors in the evolution of growth. Finally, the results also stress the need to extend the study to adolescent circumstances, and not only children, as well as the need to investigate social inequality among different professional groups during the nutritional transition.

Keywords: Height, Stunting, Rural Poverty, Nutritional Transition, Spain.
JEL Codes: D63, I14, I32, N34

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1. INTRODUCTION

Nutritional deficiencies and stunted growth during childhood and adolescence constitute one of the principal concerns of public health and development economics. The most prominent determinants of child health are disparities in income and wealth distribution, unequal access to land and other resources, and inequality in access to goods, institutions and basic services. Deprivation and poverty are the principal factors which determine malnutrition, and one of the best indicators of deficiency and nutritional inequalities is human height (Deaton, 2013). Although genetics influences height, economic growth in the last few centuries has much improved human well-being, as reflected in body size. Height variability depends on socioeconomic and environmental disparities and the institutional contexts that promote public health (Fogel, 2004; Floud, Fogel, Harris and Hong, 2011).

In Spain, the generational increase in height over the last century demonstrates dramatic changes in biological well-being which have gone hand in hand with economic progress and epidemiological and nutrition transition processes.[1] Until the end of the nineteenth century, vegetable-based diets low in calories predominated, and there were animal protein and nutritional shortages. A large proportion of the population was on the brink of starvation. This situation persisted until well into the twentieth century, affecting the low-income classes and the most vulnerable segments of the population, mainly children, women and the elderly, particularly in the rural environment. One century later, the abundance of diets high in calories and animal proteins has generated high rates of people who are overweight and those who are obese, which is worrying as this affects not only adults but also school children. Starvation and chronic malnutrition due to deprivation and dietary deficiency have been replaced by malnutrition caused by an excess of and the abundant consumption of foods with a high fat content.[2] Europe extricated itself from a situation of starvation and deficient diets, and the population transformed from thin and short to robust and tall. The spectacular growth in height over the last century reflects the enormous progress achieved in wealth and health, but also inequality, which is visible in the significant differences still existing between countries and even within the same territories.

[1] Martínez-Carrión (2011, 2012); Nicolau and Pujol (2011).
[2] See Moreno, Sarría and Popkin (2002); Marrodán, Montero and Cherkaoui (2012); Pujol and Cussó (2014).

There is little doubt that environmental and socioeconomic determinants of height other than genetic factors are important. Anthropological studies using data panels, mainly in Europe, have shown that body size has increased owing to improvements in food consumption, in terms of both quantity and biological quality, but also owing to an increase in income and revenues, the progress made in medical science and public health and the diffusion of mass education (Hatton and Bray, 2010, Hatton, 2014). The effect of the State, e.g. redistributive policies and welfare provision actions, is more questionable (Lindert, 2004). The majority of European countries began to develop health and social welfare programmes at the end of the nineteenth century and the beginning of the twentieth century, and these were particularly focused on the provision of healthcare and nutrition assistance for the poorer segments of the population in need of resources.[3] However, these programmes were not widely implemented until after the Second World War with the promotion of the Welfare State (Baines *et al* 2010). Social policies to mitigate inequality in the most unequal countries were insignificant until the 1930s (Espuelas, 2015).

The impact of the Welfare State in Spain came later than in other European countries due to the country's economic and democratic backwardness (Comín, 1999). However, some institutions formed in the decades preceding 1930 were influential in the improvement of nutritional health, such as the Gotas de Leche ("Drops of Milk") campaign or the lactation consultancies, as were a series of actions carried out in the fields of healthcare and public hygiene by national, local, and provincial governments.[4] It is difficult to assess the impact of institutional action, but it could have been decisive for the low-income population who had scarce resources or difficulties accessing the most basic public services, such as healthcare and education. After the progress made in the first third of the twentieth century, the effect of the early years of the Franco regime's institutions with respect to inequality improvement and relative poverty is debatable (Prados de la Escosura, 2008). Deprivation increased after the Civil War and shortages persisted until the 1950s, widening nutritional health inequalities at a territorial and social level.[5]

[3] See Harris and Bridgen (2007); Millward and Baten (2010); Harris (2014).
[4] Rodríguez-Ocaña (2005); Barona and Bernabeu-Mestre (2008); Moll, Pujades and Salas (2014); Pérez Moreda, Reher and Sanz (2015).
[5] Castelló-Botía (2011); Martínez-Carrión, Puche-Gil and Ramón-Muñoz (2012); Spijker, Cámara and Blanes (2012); Cámara (2015); Trescastro-López *et al* (2014).

The spread of industrialization and urbanisation brought about significant changes in the living standards of the urban working classes but also had a significant impact in the countryside. The deterioration of health in rural areas has been well documented in Spain until well into the nutritional transition process.[6] Although there was an *urban height penalty* during the first industrialisation process (Komlos, 1998, Steckel and Floud, 1997), the *rural height penalty* persisted in Europe until at least the adult generations preceding the Second World War.[7]

Despite the interest shown recently, more research is required on the rural-urban gap to determine its size in the interior areas during the nutritional transition. We do know that in rural Spain deficiencies in health services and infrastructure were dramatic until the mid-twentieth century and persisted even after the intense rural depopulation process. Consequently, the rural-urban gap increased amid the economic developmentalism phase (1960s). In fact, nutritional poverty in large rural areas gave rise to institutional programmes aimed at improving child nutrition in those areas suffering from greatest economic backwardness. This was the case of the EDALNU programme in 1961, after the School Food and Nutrition Service (SEAN) was created in 1954 with the help of the FAO.[8] Research and surveys carried out in the field of child nutrition since 1939, which were promoted on a national scale between 1956 and 1961 by the School of Bromatology, warned of the nutritional deficiencies and revealed social and territorial disparities using anthropometric indicators (Varela, Moreiras and Vidal, 1965). The decrease in the apparent consumption of energy and proteins, meat, eggs and milk, mainly between 1936 and 1960 (Cussó, 2005, Collantes, 2014), was reflected in height deterioration, which was particularly significant among conscripts measured during the Civil War and the long post-war period, considered the 'years of hunger' (Barciela, 2013).

Height provides information on health inequality and nutritional variations that other indicators cannot. This is significant, as there is a lack of alternative sources in Spain on poverty and malnutrition in the past. Adult height is a good indicator of the net nutritional status, which is the energy and calorie intake derived from the gross

[6] Martínez-Carrión, ed., (2002); Martínez-Carrión and Moreno-Lázaro (2007); Collantes and Pinilla (2011); Barona, Bernabeu-Mestre and Galiana-Sánchez (2014); Martínez-Carrión *et al*, (2014). It should be remembered that social security coverage in the rural areas was not implemented until the 1960s, Vilar and Pons (2015).

[7] See Alter, Neven and Oris (2004), Heyberger (2005), Reis (2009); Floud, Fogel, Harris and Hong (2011) and Schoch, Staub and Pfister (2012).

[8] Bernabeu-Mestre (2011); Trescastro and Trescastro (2013).

consumption of food and nutrients minus the energy consumption generated by illness and physical effort during growth phases in childhood and adolescence. Diet, illness and work are the principal determinants of height, which is also affected by income and revenues, inequality, food prices and prices of other goods, technology, climate, infection-prone environments, public health, personal hygiene, education, habits and food culture and other less important factors (Steckel, 1995). Height and other anthropometric indicators, therefore, are a good indicator of the environment during childhood and adolescence (Tanner, 1986; Bogin, 2005; Deaton, 2013). Height is a function of income, health, and environment and is useful for analysing the impact of nutritional shocks during the most sensitive periods of growth.

This article contributes to the study of the nutritional status of the population of interior Spain during the twentieth century and, using anthropometric data, seeks to further research and examine this status in Spain until the beginning of the democratic period. Using recruitment records between 1908 and 1985, it seeks to analyse the impact of socio-economic changes in biological well-being and confirms the existence of a penalty or a premium in different environmental or residential contexts, particularly within the relatively more backward rural environments. In addition to male height at the end of adolescence, the population living in urban (towns and cities) and rural (villages and dispersed population) environments will also be examined. In this way, the study explores the nutritional poverty of the rural population and the evolution of inequality, when exactly the rural-urban gap widened or narrowed and the impact of political and institutional changes.

The article structure is as follows. After this introduction, the second section outlines the objective and analytical methodology and describes the characteristics of the sample data. The third section presents and discusses the results, analyses the dynamics of the rural-urban gap, and confirms that there was a '*rural height penalty*'. The following section explores the inequality evolution through dispersion measures, examining the extent of malnutrition by studying those with stunted growth and the percentiles and comparing these figures with modern population standards. Finally, this article concludes by suggesting new lines of research.

2. DATA AND METHODOLOGY

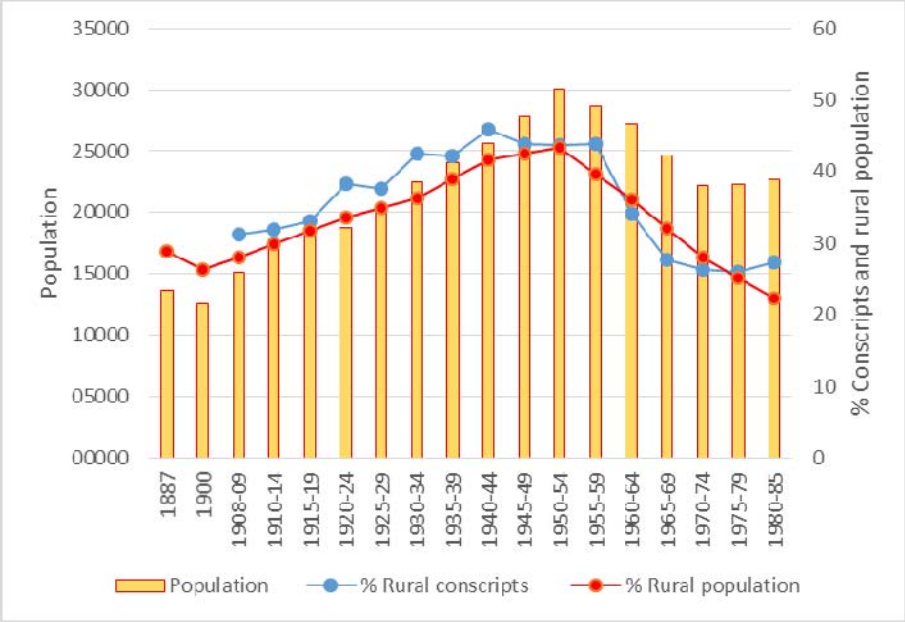
The study of nutritional status and the rural-urban gap is based on a case-study of a town in interior Spain – Hellín – which is located on the southern border of Castile-La Mancha. Near the Sierra del Segura in the southwest, it is bounded on the south by Cieza, bordering the north of the Region of Murcia. Data are drawn from enlistment records and declarations of soldiers and substitutes and the conscript classification records (hereafter, DSS and CCR). With respect to the period analysed, the study contemplates conscripts measured between 1908 and 1985 (born between 1887 and 1965). To analyse the rural-urban gap and confirm whether there was a '*rural premium*' or '*rural penalty*', relative weights of the rural population and trends in the population residing in villages and manors dispersed (rural environments), as opposed to the town (urban environment), are considered. Distances between some rural settlements and Hellín town were significant: six were over 10 km from the urban nucleus where the administrative activity and most of the welfare services were concentrated, but the settlement of Las Minas was 26 km away (Table 1). Distances could condition access to basic services, such as education and healthcare and act as decisive factors for the rural-urban gap. Hellín is the second most populated town in the province of Albacete and was amongst those with the largest populations in Castile-La Mancha since the mid-nineteenth century.

Table 1. Population groups in the town of Hellín, 1857-2012

Place	Residence	Km (*)	1857	1887	1910	1930	1950	1970	1991	2012
Agra	Rural	6	91	271	175	435	676	343	129	152
Agramón	Rural	12	496	729	900	1,482	2,540	1,176	738	723
Cancarix	Rural	17	217	185	205	440	698	275	160	83
Cañada de Agra	Rural	6	-	-	-	-	-	353	422	405
HELLÍN	Urban	0	7,685	9,735	12,490	14,281	17,026	15,934	18,909	26,872
Horca (La)	Rural	11	74	-	83	228	466	-	-	44
Isso	Rural	5	1,216	1,778	2,227	2,639	4,054	2,364	1,896	2,332
Minas (Las)	Rural	26	741	423	1,328	1,933	2,741	510	220	125
Minateda	Rural	10	410	334	314	629	765	370	186	82
Mingogil	Rural	7	-	-	-	-	-	352	349	312
Nava Campaña	Rural	4	-	-	-	-	-	-	467	585
Rincón del Moro	Rural	15	197	204	59	201	352	-	27	16
Torre Uchea	Rural	7	-	20	-	180	708	475	37	20
Total			11,127	13,679	17,781	22,448	30,026	22,152	23,540	31,751
% Rural			28.8	26.4	29.8	36.2	43.3	26.2	19.7	15.3

Source: INE (Spanish Institute of Statistics), *Nomenclátor(es) de Población*. Archivo Municipal de Hellín (AMH): Statistics Department of the Town Council of Hellín. (*) Distance from the town of Hellín.

Figure 1. Population in the town of Hellín and percentage of conscripts residing in the rural area (villages), 1908-1985



Source: Based on INE, Population census, 1910-1970, 1981; AMH, based on enlistment records and declarations of soldiers and substitutes and conscript classification records (hereafter, DSS&CCR).

As could be expected, the demographic dynamics of the town mirrored that of the enlistments (Figure 1). The size of the population and the number of conscripts increased in the first half of the twentieth century, largely due to the surge in the rural population which increased its relative weight: from 26.4% in 1900 to 43.3% in 1950. The population growth was based on the colonisation of the countryside and the expansion of farming activities that were first implemented in the mid-nineteenth century with the exception of a slight demographic decline due to the end-of-the-century crisis. From the 1950s onwards, the population decreased due to intense emigration during the 1960s. In the 1970s it remained stable, and in the 1980s it slowly recovered. The demographic decline was due mainly to the rural depopulation process. By the 1990s, the population had decreased by one-third. This phenomenon was acute in almost the whole of Castile-La Mancha and in rural Spain (Romero, 1980; Collantes and Pinilla, 2011). The recovery in around 1980 was due to immigration after the European economic crisis and expectations of political change arising during the transition from the dictatorship to democracy (Díaz-Martínez, 1990). The dynamics of the military drafts matched the pattern of the local demographics: in the period 1980-85

the percentage of rural conscripts was similar to that of the whole rural population, estimated at 28.9% in 1981.

Table 2. The sample: composition and size. Hellín, 1908-1985 drafts

Years of birth	Conscription	Nº Conscripts	Conscripts with height	*Rural*	*Urban*	% Rural
1887-88	1908-09	325	318	94	209	31.02
1889-98	1910-19	1,950	1,649	517	1,061	32.76
1899-1908	1920-29	2,256	1,878	683	1,122	37.84
1909-18	1930-39	2,609	1,769	722	981	42.40
1919-28	1940-49	2,994	2,364	1,027	1,266	44.79
1929-38	1950-59	3,178	2,758	1,177	1,511	43.79
1939-48	1960-69	2,469	2,056	594	1,325	30.95
1949-60	1970-79	2,634	2,286	548	1,553	26.08
1961-66	1980-85	1,422	1,243	322	858	27.29
1887-1966	**1908-1985**	**19,837**	**16,321**	**5,684**	**9,886**	**36.51**

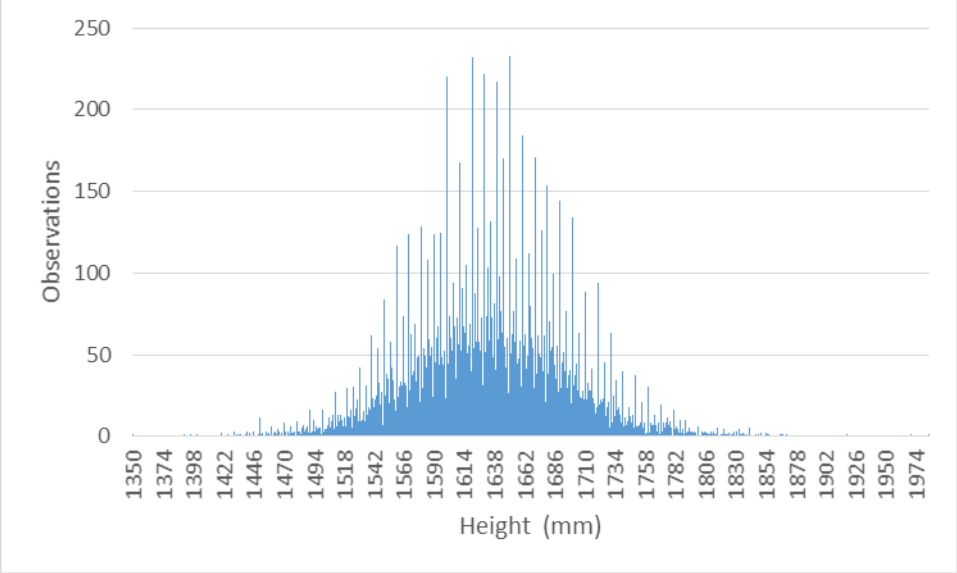
Source: AMH: DSS&CCR

The data consists of draftees whose height data is available: 82% of the conscripts born between 1887 and 1966 (Table 2). Of these, 78.5% were native and 95.4% stated their residence, of which 36.5% were from rural areas. We can confirm that the sample is consistent with the evolution of the production structure and literacy rates of the area studied, which allows us to establish firm comparisons with other studies. The sample also reflects the demographic change and rural depopulation from the mid-twentieth century onwards. The decline in farming activities, which were concentrated in hamlets, contrasts with an increase in industrial activities and services which were mainly concentrated in Hellín town, particularly from 1940 until the beginning of the 1960s, and were due to the expansion of the grass industry (*esparto*). Subsequent economic growth accelerated the structural change that had been gradually taking place in the inter-war period (Cañabate, 2016). The urban nucleus, however, maintained agro-town features until well into the twentieth century.

Spanish anthropometric historical literature does not provide an exhaustive account of the problems relating to the sources (Cámara, 2006). Although reports corresponding to recruitment and universal drafts at the age of twenty date back to 1857-58, data for Hellín are available uninterruptedly from 1908 until 1985. Except for

1983, for which period there are no draft reports, the series' data quality is excellent. The series correspond to the heights of the conscripts born between 1887 and 1966 who were aged around 20 years. Therefore, it is not necessary to standardise the height at a specific age. The height series is fairly homogeneous, as all of the conscripts, or almost all of them, were the same age at the time of measurement: on average 20.7 years until 1973, after which the age fell to 19.5 years until 1985. The only exceptions were 1943 and 1947, when conscripts were measured after turning 21 years of age. The effects of the "baby's bottle draft" during the Civil War are not visible, as the average age remained at 20.6 years between 1936 and 1940. The most significant changes in statutory age took place with the enlistments between 1969 and 1982, when it fell from 19-20 to 18-19 years. This decrease in the age of measurement at the end of the period did not affect the average height because it is considered that the populations of this age stopped growing at the age of eighteen, as they enjoyed good nutrition standards (García, Fernández and De Palacios, 1972). Finally, we can confirm the statistical normality of height data in millimetres (Figure 2). The histogram is symmetric and bell shaped with no problems in the tails of the height distribution, even though some heights have been rounded. Therefore, the distribution is Gaussian distribution and allows us to make comparisons.

Figure 2. Histogram of height distribution in millimetres: Hellín, 1908-1985



Source: AMH, DSS&CCR.

To estimate inequality, we have followed a methodology which uses dispersion indicators, standard deviation (SD) and coefficients of variation (CV) as disparity coefficients. Certain authors compare CV with income inequality based on the Gini coefficient of the last two centuries (Baten and Blum, 2012; Blum, 2013; Baten and Blum, 2014). The study of inequality in height based on CV was undertaken by Baten (2000) and Quiroga and Coll (2000). Ayuda and Puche (2014) have explored inequality in heights for the Region of Valencia, but we know very little about their evolution in interior Spain and other regions.

Finally, data are presented by year of birth and year of recruitment in order to assess the impact of environmental changes from birth to adulthood. For populations suffering from deprivation, such as the case in hand, nutritional requirements could be as decisive in childhood as they were in adolescence. Nutritional requirements are high in the early years of life, and after falling during the prepubertal period they increase considerably during the subsequent adolescent growth spurt. Studies on height and income during the Spanish industrialisation process have revealed the relationship existing between the two indicators at the age of 13-14 (Martínez-Carrión and Pérez-Castejón, 2000; Quiroga 2002b).

Specialised literature has not yet provided an unequivocal answer regarding the most critical stages – data which could be used to ensure healthy conditions in adulthood. Growth between birth and maturity can be delayed by episodes of deprivation during childhood, but a sufficient level of nutrition during adolescence can recover normal adult height patterns. Similarly, adverse conditions during the pubertal growth spurt can generate a delay in growth despite favourable conditions during childhood (Steckel, 1995). Longitudinal studies have discussed the influence of health and nutrition during the pubertal growth spurt which occurs in children between the ages of 11 and 17, sometimes even in children as young as nine, and have revealed the importance of these factors by studying the difference in health among adults.[9] This new perspective on development indicates the importance of policies on nutritional education during adolescence and providing the opportunity to catch-up in terms of growth during puberty (Conti and Heckman, 2013). Hence, our data correspond to the

[9] There is an abundance of literature emerging which uses this new perspective on child development: see Vecek *et al*, (2012); Hirvonen (2014); Van den Berg *et al*, (2014); Hõrak and Valge (2015); Qi and Niu (2015).

year of measurement of the conscripts, which is close to the age of the adolescent growth spurt.

3. INEQUALITY IN THE NUTRITIONAL STATUS: RESULTS AND DISCUSSION

3.1. The rural-urban gap

Early anthropometric studies conducted with national and regional aggregates in Spain revealed the existence of a significant rural-urban gap, which was detrimental to the rural population until the mid-twentieth century.[10] Subsequent research validated the existence of the '*rural penalty*', although some industrial nuclei experienced episodes of urban penalty during the second half of the nineteenth century, suggesting that the rural-urban disparity depended on environmental and institutional factors, unequal access to basic goods and services and, particularly, the availability of resources. At times, the biological costs of the industrial take-off were more intense in the urban environment and gave rise to a strong deterioration in the standard of living of the working classes. From the beginning of the twentieth century, the industrialisation process and urban development had a positive impact on biological welfare in towns and later on rural populations.[11]

Table 3. Mean heights grouped by rural (R) and urban (U) residence in Hellín (1908-1985)

Recruitment period	Residence	N	%	Mean Height (cm)	U/R Difference (cm)	σ
1908-1935	Rural	1,676	34.73	161.97	0.95	5.99
	Urban	3,150	65.27	162.93		5.96
1936-1969	Rural	2,987	38.69	163.05	1.42	5.93
	Urban	4,734	61.31	164.47		6.37
1970-1985	Rural	865	26.40	167.07	1.73	6.56
	Urban	2,412	73.60	168.80		6.42

Source: AMH, DSS&CCR.

[10]Martínez-Carrión and Pérez-Castejón (2002); Quiroga (2002a), and Martínez-Carrión and Moreno-Lázaro (2007).
[11] Ramon-Muñoz (2011), Martínez-Carrión *et al* (2014), Martínez-Carrión and Cámara (2015).

According to recent research on Spain, there was an undisputable 'rural height penalty' among cohorts born before the First World War and for adult generations born before the Civil War of 1936, but what happened after that? Did rural communities benefit from the nutritional improvement that went hand in hand with post-1960s economic development? Were urban dwellers still taller than country dwellers? What factors determined the possible rural-urban gap? Table 3 demonstrates the rural penalty, which increased at the end of the period, including the standard deviation (σ). Less significant are the differences between the conscripts of the first third of the twentieth century (0.95 cm, σ =5.9) and those between conscripts drafted between 1970 and 1985 (1.73 cm, σ = 6.5). Data suggest that there was an increase in inequality in terms of nutrition and biological welfare. This phenomenon may have extended across wide areas of Castilla-La Mancha and to the bordering towns in Murcia where the large rural population outside of the urban nuclei housed the municipal districts of southeast Spain. The standard deviations (σ) also increased significantly, being somewhat higher in the rural areas.

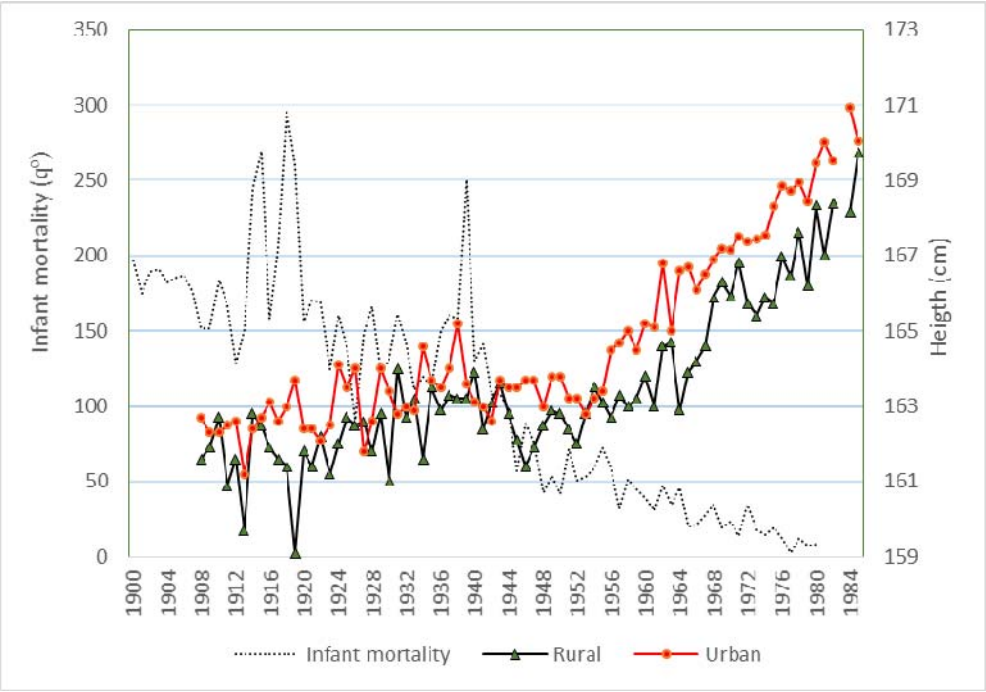
In general, the town exhibited slightly higher nutritional values than the countryside because the social groups with highest incomes and revenues resided there, including those with professional occupations. The rural area was inhabited by mainly farm labourers and low-income farmers. In addition, the town had welfare and healthcare infrastructures which did not exist in rural areas until much later, such as the Hospital de la Caridad (Charity Hospital) and the Residencia Santa Teresa de Jesús Jornet, and later the Centro de Higiene y Salubridad (Health and Hygiene Centre) which provided health services from 1894 onwards.[12] In 1932, the creation of a Centro Secundario de Higiene Rural (Rural Hygiene Secondary Centre) as part of the health reforms promoted by the Second Republic and the implementation of a public-health pilot centre sponsored by the Fundación Rockefeller[13], may have had a positive impact on preventive healthcare for children belonging to the most deprived social groups.

[12] At the end of the nineteenth century, there were five doctors and two chemists. During the Second Republic, these figures increased to 15 and 4 respectively. The Centro de Higiene y Salubridad created in 1894 had five functions: I) food inspection, II) the disinfection of housing, III) the promotion of hygiene in prostitution and vaccination among the population, IV) inspection of manufacturing centres and V) the review of the plans of new buildings with respect to hygiene conditions (Cañabate, 2015: 383).

[13] This centre was led by Dr José Pérez-Mel, who was also the chief of the Provincial Institute of Hygiene of Albacete; see Barona and Bernabeu-Mestre (2008: 124). In 1934, this centre also employed a nurse, who was a member of the association of health visitors, and was responsible for collecting information on

The evolution of the urban-rural gap can be noted in Figure 3. The differences, which are favourable for the urban context, are small until the conscripts drafted in 1954 (born between 1887 and 1933). The greatest divergences can be found in the years of the First World War and the 1940s, when the height of those in rural areas decreased more than that of those in the urban areas. The rural environment was more sensitive to crises and nutritional shocks (poor harvests and environment-related morbidity and mortality) and the stimuli of economic recovery, probably due to the scale of poverty.

Figure 3. Average rural and urban height (cm) and child mortality (q^o) in Hellín (1900-1985)



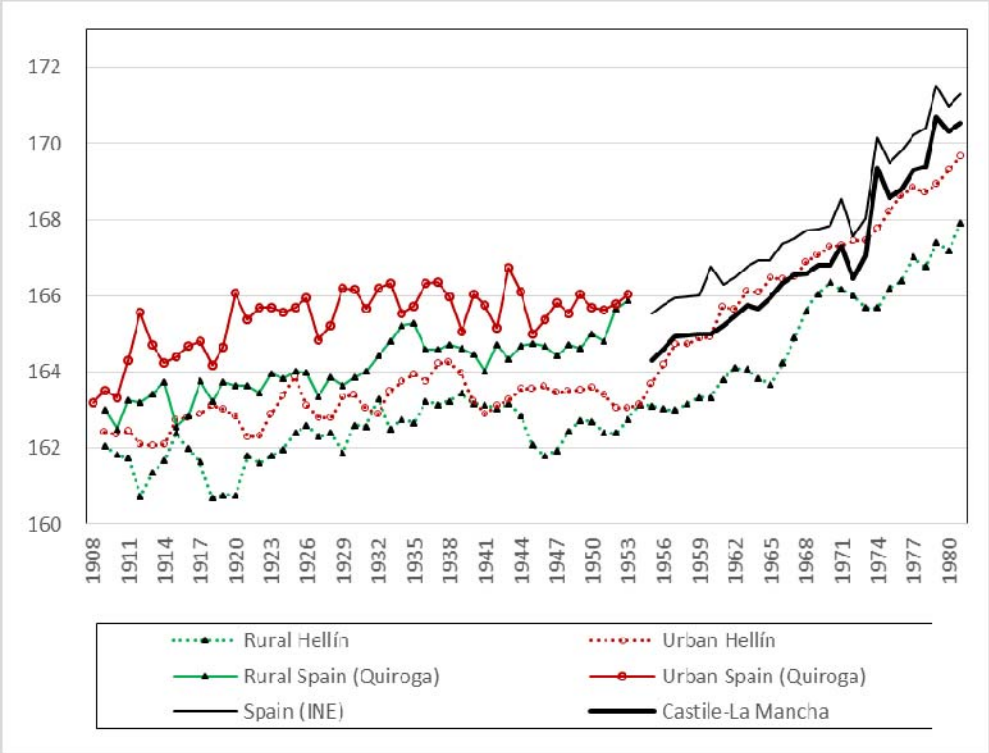
Source: AMH. DSS&CCR.

One of the nutritional crises that could have affected height occurred during the First World War. Between 1900 and 1910, the gross mortality rate increased from 31.1 to 34.6 per thousand inhabitants. Infant mortality stood at 162.9 per one thousand live births in 1910, rose sharply in 1913-1915, and escalated futher in 1918-1919 to a level greater than 200 per one thousand live births. Measles (1910), smallpox (1914-16) and influenza (1918) epidemics could have caused deterioration in nutritional status, but the most influential factor was the unusual upsurge of infectious diseases transmitted

living and housing conditions of the most humble families and giving them notions of social hygiene and public health; see Bernabeu-Mestre and Gascón-Pérez (1995:174).

through food and water, such as gastroenteritis, which was responsible for 24% of total deaths in 1915 and an average of 19% between 1912 and 1920; it accounted for half of child and youth deaths.[14] The association between childhood diarrhoea and height in later life has been established by Checkley *et al* (2008). Consequently, the heights of those in rural areas fell between 1916 and 1923 and the heights of those in urban areas dropped between 1919 and 1923, and subsequently stagnated. Nutritional poverty reflected in the rural heights of Hellín constrasts with the averages of those in rural and urban Spain (Figure 4), which were slightly greater although they were still among the lowest in Europe (Martínez-Carrión, 2012). This demonstrates the extent of the rural population at risk of poverty and the prevalence of malnutrition in a good part of interior Spain. Data are consistent with those described living standards for the rural population of Castile-La Mancha (Valle-Calzado, 2010).

Figure 4. Rural and Urban mean height (cm) in Hellín, Spain, and Castilla-La Mancha: 1908-1980 drafts



Source: AMH. DSS&CCR. Data for rural and urban Spain (Quiroga, 2002b). Averages for Spain and Castile-La Mancha (INE and Quiroga, 2002b).

[14] On the impact of the epidemics and infectious diseases transmitted through food and water in the town, see Cañabate (2015: 199-203) and (2016: 39-40).

The greatest nutritional crisis was recorded during the Franco regime. The 'years of hunger' (autarkic period) constituted the worst economic crisis of contemporary Spain, and this crisis derived from serious food shortages and health and hygiene deficiencies. Urban heights diminished between 1938 and 1953 and rural heights fell from 1931 and dramatically between 1940 and 1946 with values falling to levels seen at the beginning of this century.

Meanwhile, the child mortality rate reached levels of 250 per thousand in 1939, and even in 1941 rates of 141 were recorded. The nutritional levels of conscripts measured in the Second Republic in the town of Hellín in the draft of 1938 took two decades to recover: around 1957 in the town and 1960 in rural areas. Dietary deficiencies, poor sanitary conditions and famine must have influenced nutritional health during childhood and delayed growth in the adolescent phase, giving rise to a fall in adult height of almost two centimetres and even more in the rural areas. The decrease in rural heights is also documented in the Valencian territories (Puche-Gil, 2010). The fall in height during the 1940s and 1950s coincided with the fall in calorie and protein intake and an increase in deficiency diseases and malnutrition.[15] Autarchic policies had devastating effects on food consumption, health and standards of living (Barciela, 2013). Almost thirty studies published in *Anales de Bromatología* between 1958 and 1966 addessed the nutrition of the Spanish population. Surveys published in other journals highlighted deficiencies in energy and animal protein intake and deficits of Vitamins A, B1 (thiamine) B2 (riboflavin) and C, of calcium and nicotinic acid, and revealed nutritional inequality between social classes until the 1960s.[16] Results are consistent with recent research on adolescents who lived through civil wars, in whom the effects of deprivation and malnutrition can be observed in their adult height (Akresh *et al*, 2012 and Vecek *et al*, 2012).

Around 1957, nutritional status returned to the levels of the 1930s, beginning first in the town and then in rural areas, where emigration could have affected the stagnation of rural height which persisted until 1964. According to Quiroga (2010), taller people were more inclined to emigrate, which could explain the delayed recovery in rural areas where migration was intense from 1955 onwards (Figure 1). After the "great nutritional depression", the increase in rural height was remarkable: 4.2 cm

[15] Cussó (2005); Del Cura and Huertas (2007); Bernabeu-Mestre *et al* (2006); Trescastro-López *et al* (2014).
[16] Varela, Moreiras and Casado (1963); Varela, Moreiras and Vidal (1965); Casado (1967).

between 1963 and 1971 and 5.7 cm if we take 1946 as the starting year (161.8 cm), at which point the worst level of nutritional status was recorded. Urban height started to increase before that of the rural environment, increasing from 162.8 cm in 1953 to 163.1 cm in 1962 and reaching 167.5 cm in 1971.

The increase in the inequality of nutritional status was mirrored by the height from the mid-1950s onwards; it became worse in the 1960s and after a slight convergence at the end of the 1960s it persisted until the 1980s. The progress in nutrition is undeniable in the 1960s and 1970s, but the rural-urban divergence reveals an increase in the nutritional gap during the "developmentalism" phase (Table 3 and Figure 3). The rural-urban difference increased up to 2 cm. A comparison with the averages for Spain demonstrate the persistence of nutritional inequality in Hellín (Figure 4). Only urban heights are close to the averages of the nutritional values of Castilla-La Mancha, which was one of the regions with the lowest heights in the 1960s and 1970s.[17]

In contrast with the previous period, the improvement in child nutrition was, to some extent, related to the roles played by the institutions. Notwithstanding the increase in income per capita and a diet richer in quality proteins (meat, milk, and eggs), nutritional status improved because institutions promoted education and food hygiene. In 1956, a Centro de Higiene Rural (Rural Hygiene Centre) was created. Originally designed in 1947, it did not open until 1956 due to the lack of resources (Cañabate, 2015). The delivery of milk and dairy supplements to schoolchildren was one of the principal strategies of the SEAN, which began operating in 1954 through U.S. Aid distributed by Caritas and improved child eating habits. This work was particularly relevant in the rural environment where there was a low consumption of milk, as it was considered a kind of "medicine-food", reserved for vulnerable groups such as pregnant and nursing women, the elderly and the sick (Casado, 1967:154). Powdered milk was distributed in schools from 1959 onwards, and liquid milk from 1962. The Food and Nutrition Education Programme (EDALNU) was equally decisive. It was created in 1961 thanks to agreements between the Spanish government and the international organisations FAO and UNICEF, with the aim of improving the nutritional level of the population and consequently the level of health, "through the diffusion of knowledge in nutrition, promotion of better eating habits and encouragment of the consumption of local food products" (Trescastro-López *et al*, 2013: 6). In 1966, the state created the

[17] Martínez-Carrión and Puche (2010); Quiroga (2001); Quintana-Domeque, Bozzoli and Bosch (2012); Trescastro-López *et al* (2014).

Gerencia de Productos Lácteos (Board of Dairy Products) – PROLAC – that reached agreements with dairy plants for the distribution of the liquid milk of the SEAN and other partners (Casado, 1967: 202; Langreo, 1995: 157-158). The increase in the consumption of dairy products in Spain between 1965 and 1980, mainly industrial milk (Collantes, 2014), contributed to improvements in nutrition and an increase in the heights of children and adolescents.

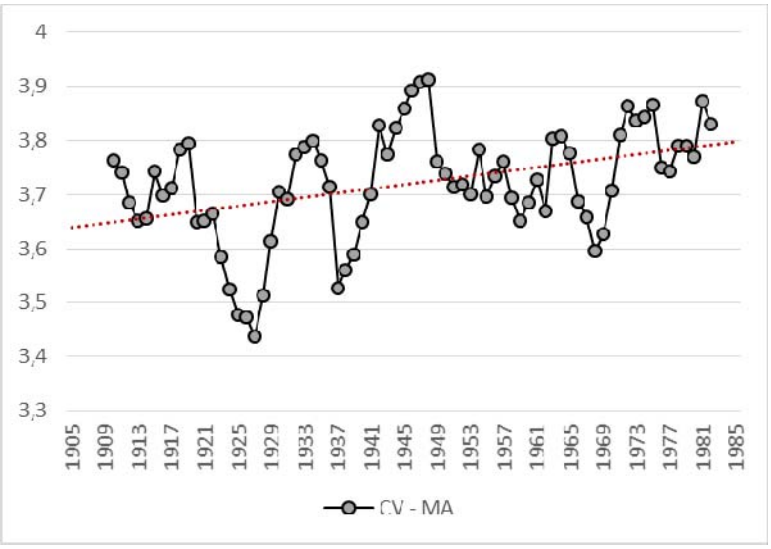
In other geographical territories, we can highlight the intervention of Auxilio Social (Social Assistance), las Cátedras Ambulantes de la Sección Femenina de la Falange Española de Acción Católica (the travelling professors of the Catholic Feminine Section of the Phalange) and other institutions created during the Franco regime to address the pressing needs of the most deprived social groups. They mainly acted in rural communities, though no information is available for the specific case of our study. It is also worth highlighting the role played by agricultural institutions. In the 1960s and 1970s, nutritional recommendations were exclusively issued by the Ministry of Agriculture that carried out important work, spreading the new diet culture related to agricultural policy guidelines. In this respect, the Agentes de Economía Doméstica del Servicio de Extensión Agraria (SEA) (Domestic Economics Agents of the Agricultural Extension Service) created in 1955, played a significant role (Díaz-Méndez and Gómez-Benito, 2008: 42). Health centres known as *ambulatorios*, which operated in Hellín from 1972, were established because they were vital for maternity care and also acted as emergency hospitals. Under the democratic government in May 1986, a contract was awarded for building a hospital which opened in 1990 (Cañabate, 2015). In this period, regional data reveal that heights in the poorest areas increased significantly and converged with those of the other regions with the greatest economic development.

3.2. Measuring inequality and malnutrition

Coefficients of variation (CV) express inequality better than other measures of dispersion, according to some authors (Baten and Blum 2012; Blum 2013). In estimating the CV, we have used the standard deviation (SD) of the five-year centred moving averages (MA5), and this evolution can be seen in Figure 5. Results indicate a slight upward trend in inequality in the long term. After falling in the 1920s and during the Civil War, its increase is notable in the following periods: during the First World War, at the beginning of the 1930s, with the autarchy (particularly in the 1940s) and the

beginning of the 1960s and 1970s. The slight upward trend in inequality was constricted in the 1950s, the second half of the 1960s, and the 1970s. The increase in inequality during the early years of the Franco regime is consistent with the increase in poverty and the deterioration of the main indicators of the standard of living (Prados de la Escosura, 2008). Data suggest that popular classes and large, impoverished, rural communities were those sectors worst hit by the deterioration of health conditions and nutritional deficiencies.

Figure 5. Coefficients of variation (CV, trend). Hellín, 1908-1985



Source: AMH. DDS&CCR. Based on fifth order moving averages (MA).

The historical evaluation of the inequality of the nutritional status is also studied using percentiles.[18] The longitudinal and transversal growth studies using weight, height and body mass percentiles, and growth curves which demonstrate the expected growth speed for children according to their age and sex from the earliest years to 18-20 years of age, evaluate child development and the increase in height during the adolescent growth spurt. Comparing the anthropometric values of a population of the past with the values of modern or current populations that exhibit normal, healthy physiological development enables us to diagnose whether nutritional status in the past was optimum or conditioned by malnutrition and chronic diseases.

[18] Steckel (1996); Martínez-Carrión and Pérez Castejón (2002); Cámara (2009).

Table 4. Comparison of the values of height percentiles from 1910 in Hellín with those of the modern populations

Panel 1. Hellín (all conscripts)							
Year measured	**P_3**	**P_{10}**	**P_{25}**	**P_{50}**	**P_{75}**	**P_{90}**	**P_{97}**
1910	150.3	155.0	158.6	162.3	166.9	169.9	171.6
1930	150.8	155.1	158.1	162.6	167.9	171.2	174.6
1950	151.2	155.6	159.5	163.8	167.3	171.0	173.6
1965	153.4	157.7	162.0	166.1	170.6	174.0	177.7
1980	158.9	161.0	165.0	169.0	174.0	177.0	182.0
USA (20 yo, 2000)	163.3	167.6	172.0	176.8	181.6	185.9	190.2
Spain (Adult, 2000)	166.0	169.2	172.9	177.0	181.4	186.1	190.3
Spain (18 yo, 2004)	165.2	168.1	171.7	175.5	180.0	184.1	188.2
Panel 2. Rural							
Year measured	**P_3**	**P_{10}**	**P_{25}**	**P_{50}**	**P_{75}**	**P_{90}**	**P_{97}**
1910	154.5	156.6	159.5	162.2	163.5	169.2	174.2
1930	150.3	155.4	159.1	160.6	163.2	169.4	175.4
1950	151.9	155.6	158.3	163.2	166.8	170.0	173.4
1965	150.3	155.8	160.6	164.0	168.5	170.8	172.1
1980	159.2	161.5	165.0	168.0	171.2	176.5	181.7
Difference from USA	- 4.1	- 6.1	- 7.0	- 8.8	- 10.4	- 9.4	- 8.5
Dif, Spain (adults)	- 6.8	- 7.7	- 7.9	- 9.0	- 10.2	- 9.6	- 8.6
Dif, Spain (18 yo)	- 6.0	- 6.6	- 6.7	- 7.5	- 8.8	- 7.6	- 6.5
Panel 3. Urban							
Year measured	**P_3**	**P_{10}**	**P_{25}**	**P_{50}**	**P_{75}**	**P_{90}**	**P_{97}**
1910	149.1	155.0	158.6	162.2	166.9	170.8	170.8
1930	149.3	155.3	160.2	164.0	167.9	171.4	174.6
1950	150.1	155.3	160.7	164.2	167.9	172.4	175.4
1965	152.4	158.3	163.0	166.8	171.1	175.0	178.0
1980	156.9	160.0	165.0	169.0	174.0	177.8	182.2
Difference from USA	- 6.4	- 7.6	- 7.0	- 7.8	- 7.6	- 8.1	- 8.0
Dif, Spain (adults)	- 9.1	- 9.2	- 7.9	- 8.0	- 7.4	- 8.3	- 8.1
Dif, Spain (18 yo)	- 6.0	- 6.6	- 6.7	- 7.5	- 8.8	- 7.6	- 6.5

Source: AMH, DSS&CCR. For the masculine population of the USA at the age of 20, see Kuczmarski, Ogden and Guo *et al*, (2002); for the adult populations and of age 18 for Spain, see Carrascosa-Lezcano *et al,* (2008). The differences shown in panels 2 (Rural) and 3 (Urban) correspond to the difference in cm betwen the percentile values of Hellín in 1980 and those corresponding to the United States and Spain shown in Panel 1 for the years 2000-2004. (Abreviation for years old: yo).

In this study we have used 3rd, 10th, 25th, 50th, 90th and 97th percentiles of the height of the conscripts of Hellín corresponding to 1910, 1930, 1950, 1965 and 1980, which we have compared with the values of modern populations considered to be healthy and well nourished. Of these, we have used the percentile heights of 20-year old

males in the United States in 2000 (Kuczmarski, Ogden and Guo *et al*, 2002) and those of Spanish teenagers and adults between 2000 and 2004 (Carrascosa-Lezcano *et al*, 2008). We can observe that the 20-year old Americans are slightly shorter than the Spanish adult population in the same year until the 75th percentile, when there is a closer relationship between the 75th percentile of the United States and the 97th of Spain. However, the Americans are taller than the Spanish 18-year olds except in the 3rd and 10th percentiles. This finding would indicate greater inequality in the nutritional health of the United States than in Spain.

Table 4 reflects nutritional poverty for the whole municipality in the early decades of the twentieth century. Twenty-five per cent of the conscripts were shorter than 159 cm in 1910 and progress was insignificant until 1950: they grew less than one centimetre, except those in the 90th percentile and the 97th percentile who grew by 2 cm. The delay in adolescent growth in Hellín can be observed until 1980: in general, differences reached as high as 9 cm, mainly in rural areas, and are almost all over 6 cm. At the end of the period analysed, in 1980, only 10% of the tallest conscripts of the municipality reached the 50th percentile for height of Spanish adults in 2000. The contrast is abysmal if we compare the data with that of the beginning of the period: the tallest 10% of conscripts in Hellín were the same height as the shortest 10% of teenagers in Spain. This indicates the scope of nutritional poverty and biological well-being in interior rural Spain which existed until well into the nutritional transition.

Differences were even greater if we consider the different environmental contexts, namely rural or urban residences. Living in urban nuclei or small towns in interior Spain had more advantages than living in rural areas and villages. The rural penalty is clear in Hellín, but the heights of the shortest residents of the urban areas were shorter than those of rural areas, as we can observe in the 3rd and 10th percentiles of 1910, 1930, 1950 and even 1980. It should be noted that until the 25th percentile of rural populations, height was 1 centimetre greater than it was for those in urban settings. Even the 97th percentile between 1910 and 1930 was slightly greater in rural areas than in town. This relative rural advantage at the outer percentiles during the first third of the twentieth century is consistent with the growth in the height of rural conscripts during the 1920s, a period marked by the interior colonisation which went hand in hand with a growth of the rural population and relative improvements in the well-being of country dwellers. Data suggest that malnutrition was as widespread in the town as it was in rural areas and affected the poorest segments of the population in the urban nucleus most

intensly. Results should, however, be interpreted with caution given that the intermediate rural percentiles were smaller than those of the urban areas

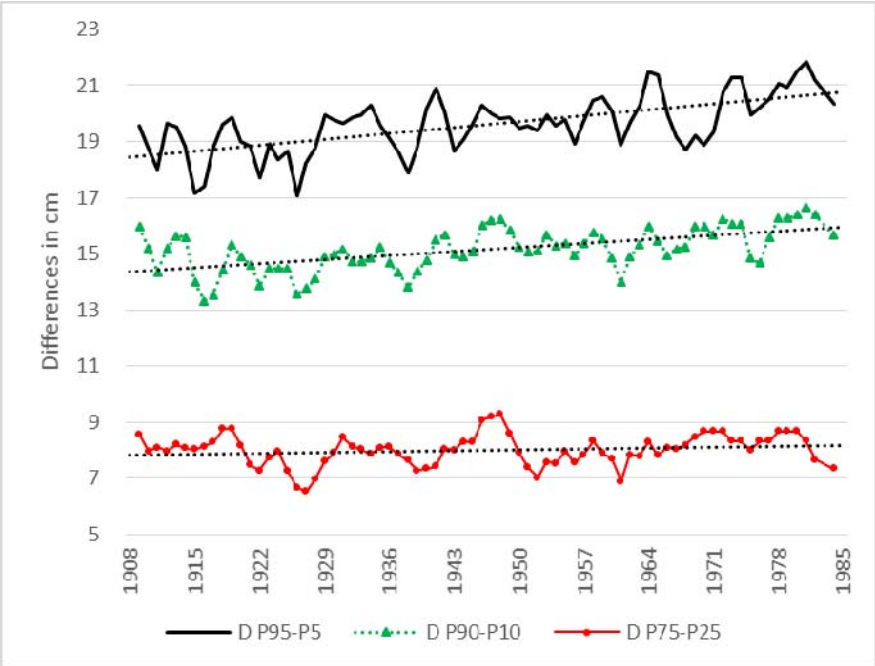
From 1930, in Hellín town, as the percentiles grew the advantages increased, particularly after 1950. From then on, the lowest percentile values corresponded to rural villages, hamlets and dwellings scattered far from the administrative centre of the municipality. On the whole, rural areas did not have schools or educational centres until 1960 and there was a notable absence of social assistance and health infrastructure. Results indicate that deficiencies were higher in the rural context, and despite the availability of food resources there was a high incidence of poverty and the quality of food sources was low, as this region was relatively poor. As a result, it can be inferred that deprivation had a greater impact on farm labourers and the peasant class. However, the poorest segments of the population in Hellín town and the groups marginalised from the formal economy were also hard hit, and they received very little education and very low income with which to provide the essential nutrients necessary for child and adolescent growth.

Until the mid-twentieth century, almost half of the rural constripts did not exceed 160 cm (50th percentile), while in Hellín town this height corresponded to the 25th percentile from 1930. We can observe a pattern of low heights, which were associated with diets low in animal proteins and the low intake of quality foods. This low height may be associated with the low consumption of milk and diets based predominantly on vegetable products. In the 1920s, the province of Albacete had the lowest milk consumption per capita in Spain, together with other provinces of Castilla-La Mancha (Muñoz-Pradas, 2011), although meat consumption may have improved slightly after the expansion of pig and goat farming (Martínez-Carrión, 1984).

Until 1965, heights corresponding to the 10th percentile in the town and in the rural areas reveal moderate or mild levels of chronic malnutrition observed among the population analysed, which was more than 20 cm shorter than the 50th percentile of the aforementioned modern populations. The post-war nutritional crisis may have been as acute among the poor rural population as the urban population: the 10th percentile of rural conscripts in 1950 and 1965 had the same value as in 1910, and the 3rd percentile was even shorter. Nutritional deficiencies prevailing in the rural environment became less pronounced from 1980, when the 50th percentile matched levels of the 10th percentile of North American and Spanish populations who were considered healthy (Table 4, Panel 2). At the end of the period, differences widened at the extremes for the

whole of the population of the municipality. As shown in Figure 6, the results reveal that the inequality between the tallest and the shortest widened over time. This trend may suggest an increase in the inequality of income distribution.

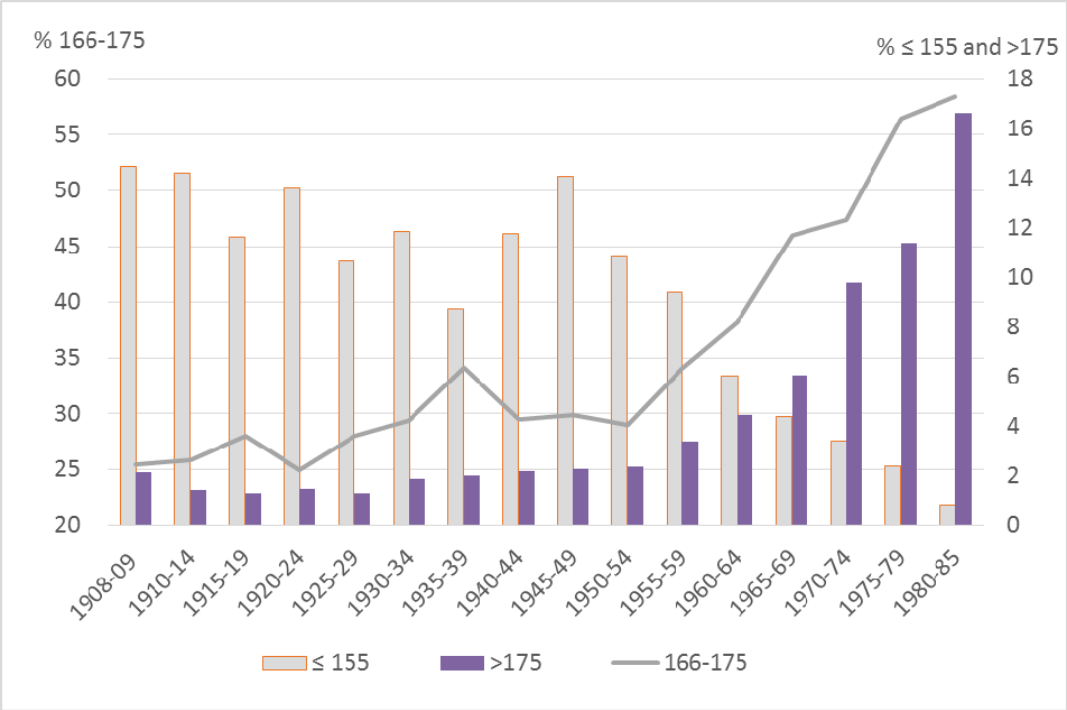
Figure 6. Differences in centimetres between percentile values (trend)
Hellín, 1908-1985



Source: AMH, DSS&CCR. Estimate with 3rd order moving averages.

Finally, an analysis according to height groups in the tails of the distribution shows the extent of malnutrition (Figure 7). We believe that the percentage of conscripts who were shorter than the required height for military service (155 cm) was close to parametres which indicate protein-energy malnutrition and chronic undernourishment. Under this assumption, the prevalence of malnutrition may have been relevant until the end of the 1950s, and a small percentage of people with malnutrition existed until the late 1960s. This situation was likely due to nutritional restrictions and environmental diseases in early childhood, but could have accelerated during adolescence due to the nutritional deprivation caused by different *shocks* during the autarchy. Overall, the percentage of conscripts exempted in Castile-La Mancha, including those exempted because of short stature, was the highest in Spain, especially in the first third of the twentieth century (Bascuñán, 2010: 201).

Figure 7. Percentage of conscripts arranged by height groups in Hellín: "tall" and "short" conscripts corresponding to the drafts between 1908 and 1985



Source: AMH, DSS&CCR.

The impact of the Franco regime on the heights of the rural populations has been analysed in different studies.[19] Results reveal a fall in height and an increase in the percentage of short conscripts consistent with the situations of hunger and shortages experienced during the 1940s. Misguided agricultural policies may have led to this situation (Barciela, 2003). The increase in child labour for some tasks may also have delayed growth and influenced adolescent physiological development. An increase in energy expenditure combined with a decrease in energy intake accelerated the chain of physiological deterioration that led to adverse effects on labour productivity. The decline in the quality of human capital and the fall in labour productivity during the 1940s have been highlighted in several studies.[20] The problems may have been worse in the agricultural sector due to the black market, fall in real wages, poor harvests and, in general, the stagnation caused by the agricultural modernisation process.[21] Although the recovery began in the 1950s, the principal changes did not become visible until the

[19] Martínez-Carrión and Pérez-Castejón (2002); Quiroga (2002a) Puche-Gil (2010).
[20] See Prados de la Escosura (2003); Prados de la Escosura and Rosés (2010).
[21] Barciela (2003, 2013); Fernández Prieto (2007); Naredo (2004).

1960s. Calorie intake increased throughout the 1960s, and this contributed to the improvement of the nutritional status and the biological standard of living (Cussó, 2005). However, these improvements were accompanied by a slight increase in the rural-urban gap which lasted until the beginning of the 1980s. Despite the progress made during the decades of developmentalism, the '*rural penalty*' persisted until the beginning of democracy.

4. CONCLUSIONS

This study addresses the issue of poverty and the inequality of nutritional status according to place of residence using a case study in the southeast of Castile-La Mancha representative of the inner rural Spain. The population is made up of mostly low-income families who were engaged in more traditional agricultural activities until well into the twentieth century. One sector of the population lived in villages and farms, and were relatively isolated and without health and education coverage until the 1960s. Using the heights of enlisted conscripts for military recruitment, we explore the rural-urban gap and check the scope of rural penalty height and the stunting of growth. Anthropometric results illustrate the various stages during the process of the nutritional transition. In the first decades of the twentieth century, the prevalence of short heights were conditioned by a diet based on low-quality nutrients and vegetarian proteins and thus people were slightly shorter than the Spanish average and well below the patterns corresponding to the large urban and industrial centres.[22] Stunted growth was significant until the 1920s.

The process altered during the Civil War and the post-war period due to autarchic policies, which increased malnutrition to early twentieth-century levels; these persisted until as late as the beginning of the 1960s in rural areas. Deprivation and nutritional poverty may have increased the prevalence of deficiency diseases and aggravated health status from the beginning of the 1940s. Until the 1960s the environment was not conducive for healthy adolescent growth, and this can be noted in the reduction in adult heights during the early years of the Franco regime. The reduction in calorie intake may have been significant in the context of low salaries, economic depression and deprivation. The recovery of height occurred later than in other parts, including the rural areas of Mediterranean Spain. In the urban areas, recovery began in around 1953 but was not manifest until 1962, whereas in the rural areas height recovery

[22] Pujol and Cussó (2014); González de Molina *et al* (2014).

was not visible until 1968. At the time, this phenomenon came to be known as the "great food depression" (Casado, 1967). Overall, the increase in height was substantial during the 1960s and 1970s and suggests that adequate levels of protein intake were being obtained, although vegetable calories and fats were predominant. The growth stature was considerable in the rural areas, despite the divergence with the urban areas which lasted until 1980. Results are consistent with the regional and local diversity observed in Spain's nutritional transition pattern, which, in turn, was different to the pattern of Western Europe, suggesting that it was less linear, homogeneous, and income-dependent than the model initially proposed by Popkin (1993), as observed by Pujol and Cussó (2014). Further research is required on the growth and variability of rural and urban contexts which were differentiated into socio-economic groups and contextualised environments.

Results reveal the unequal impact of economic and nutritional change processes, the effects of the food crises accompanied by deficiency diseases, the influence of economic policy, and, as to be expected, the institutional role of the provision of healthcare services and nutritional education. In the case of the latter, we should highlight the distribution of food supplements by the state and other institutions. The role of the state may have been as decisive as per-capita income in the improvement of standards of living and nutrient intake during the 1960s and 1970s. The different nutritional education and assistance programmes, which mainly affected schoolchildren, may have had a positive impact on cognitive development and, most of all, growth in childhood and adolescence. We observed that the heights of adult males increased dramatically in just one decade (conscripts measured in the 1960s). Amid the economic developmentalism phase, the increase in nutritional inequality between rural and urban areas became particularly acute, probably due to the impact of rural emigration, which was more intense than urban emigration. Inequality increased during the phase of greatest economic growth at the end of the 1960s and again with the economic crises of the 1970s. As this is a local case study, more evidence is required in this line of research.

Our study suggests that the rural-urban gap was subject to the unequal provision of resources, which depended on the different environments and the framework of institutional action. Living in rural areas far from the urban nucleus, deprived of medical and health care facilities, schools, care and social facilities naturally affected biological well-being and nutritional health. The rural penalty can also be explained by

inappropriate policies in the provision of public welfare goods for the rural areas, which lacked resources and infrastructures; also, much of the population was not supported by social services, particularly healthcare, until the late twentieth century (Vilar and Pons, 2015). However, the gap was also due to the composition and nature of the social groups characterised by poverty and shortages and inequality in terms of availability and access to sources of nutrients. A greater penalty may have arisen from belonging to a particular social group or class. Therefore, more studies that analyse inequality in relation to economic and education resources by social groups and classes and even professions are required.

Finally, from a methodological point of view, this study focuses on the adolescent age as a decisive period of physiological growth and cognitive development in the same way as other recent studies which are based on longitudinal data. It is important to recognise the importance of the environment during childhood, as has been highlighted in the abundance of literature on human growth, and the data from our study suggest that early adolescent years seem sensitive to those factors that stimulate, stifle or stunt growth. The nutritional health status during puberty can define the differences observed in adulthood.[23] Focusing on the conditions during puberty may shed light on the way in which restrictions of resources and environmental conflict, or deficiency diseases, food crises and nutritional shocks affect the results in adulthood. This aspect may be helpful in defining nutritional education policies and developing healthcare programmes for pre-adolescents and adolescents, and therefore offer a window of opportunity for catch-up growth during the pubertal phase in poor and developing countries.

[23] See the recent contributions of Van den Berg *et al* (2014), Hõrak and Valge (2015); Qi and Niu (2015).

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