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STATURE, LIVING STANDARDS,  
AND ECONOMIC DEVELOPMENT

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*Essays in Anthropometric History*

Edited by John Komlos

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To Robert W. Fogel and Emmanuel Le Roy Ladurie,  
two pioneers in the study of anthropometric history

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## Preface

The effort of anthropometric historians to unearth the broad patterns of human biological well-being during the course of the last two hundred years is well known.<sup>1</sup> It is perhaps less widely acknowledged, however, that French historians of the *Annales* tradition were among the first to experiment with methods from physical anthropology and from the biological sciences to illuminate historical issues.<sup>2</sup> Until then the topic of human height was of interest primarily to scholars in sister disciplines.<sup>3</sup> However, the real expansion of the field dates from Richard Steckel's exploratory essays (1979), which can be seen as the launching manifesto of the discipline on American soil.<sup>4</sup> Since then, many hundreds of thousands of records from nearly all continents of the globe have been examined, to a large extent by teams coordinated by Robert Fogel of the University of Chicago.<sup>5</sup> Despite all this research, and the contributions to this volume notwithstanding, many important issues remain unresolved.

Anthropometric history began as an effort to improve our knowledge of the secular trends in the standard of living or quality of life during the last two hundred years of rapid industrialization. In spite of a considerable amount of research, no consensus had emerged, for a variety of conceptual and empirical

1. Fogel, "Nutrition and the Decline in Mortality since 1700."

2. Le Roy Ladurie, Bernageau, and Pasquet, "Le conscrit et l'ordinateur"; Houdaille, "La taille des Français au début du XIXe siècle"; Le Roy Ladurie and Bernageau, "Étude sur un Contingent Militaire"; Aron, Dumont, and Le Roy Ladurie, *Anthropologie du conscrit français*; Houdaille, "La taille des Parisiens en 1793"; Houdaille, "Les femmes détenues dans les prisons parisiennes sous la Révolution"; van Meerten, "Développement économique et stature en France."

3. Tanner, *History of the Study of Human Growth*; Chamla, "L'accroissement de la stature en France."

4. Steckel, "Slave Height Profiles from Coastwise Manifests."

5. Komlos, *Nutrition and Economic Development*; Floud, Wachter, and Gregory, *Height, Health and History*.



## 5 Stature, Welfare, and Economic Growth in Nineteenth-Century Spain: The Case of Murcia

José M. Martínez Carrión

Variations in the standard of living in the extensive municipal district of Murcia in Southeastern Spain during the nineteenth century can be explored using data on the heights of young men called up to serve in the army.<sup>1</sup> The results allow us to make inferences about the important effect of economic transformations, in the short and long term, on the increase in human stature and about the implications for different social groups in areas of differing productive capacities.

The study of height in Murcia was carried out with a sample of 35,294 observations, divided into three regions: the urban area (the city), the *Huerta* (an irrigated zone with intensive agriculture surrounding the city), and the *Campo* (a vast outlying arid area with extensive agriculture). The distribution of heights by demographic groups is also explored. To analyze the extremes of the height distributions, the portion of the sample below 150 cm and that above 170 cm are discussed separately.

### THE TRANSFORMATION OF AGRICULTURE

The process of economic growth in Murcia during the nineteenth century has been studied in recent years. Development in this region was associated with an agrarian transformation which began at midcentury. After the disappearance of feudal structures and the introduction of liberal agricultural re-

I am particularly grateful to John Komlos for comments on earlier versions of this paper, and to M. A. Pérez de Perceval Verde for his assistance in carrying out all the calculations. This research was financed by the Dirección Regional de Educación y Universidad (PSH90/34).

1. A debate over the standard of living has been practically nonexistent in Spain, but see Gómez Mendoza and Pérez Moreda, "Estatura y nivel de vida en la España"; Maluquer de Motes, "Precios, salarios y beneficios"; and Simón Segura, "Aspectos del nivel de vida del campesinado español." A study of income and wealth in Spain during the last two centuries is found in Carreras, "Renta y riqueza." More recently, see the papers presented at the XV *Simposio de Análisis Económico. Seminario sobre la Evolución de los Niveles de Vida en España durante los siglos XIX y XX*.

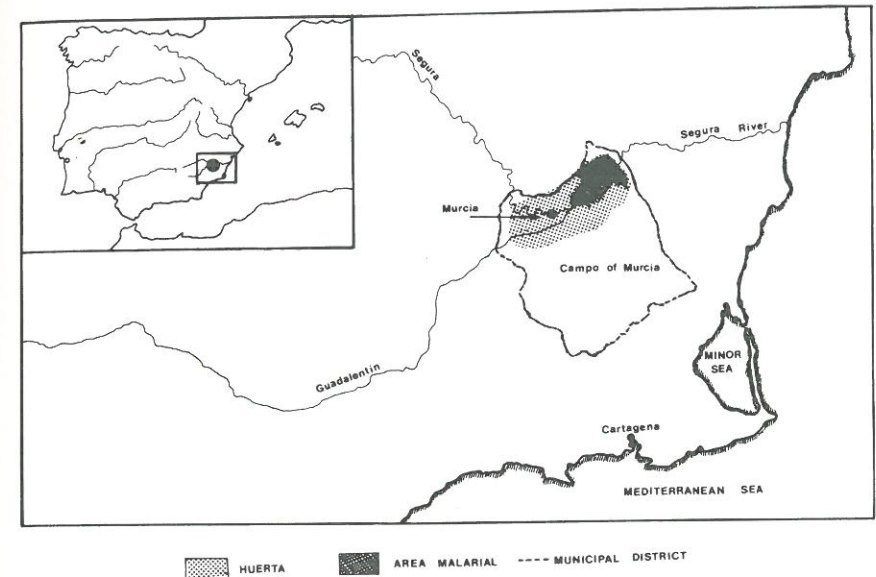


FIG. 5.1 Southeastern Spain

forms, the decades around midcentury enjoyed a period of growth in agricultural production owing to the extension of the cultivated area of the *Campo* and to increasing cash-crop specialization in the *Huerta*. The intensive use of the soil and the diversification of production in the irrigated zone are the developments which affected Murcian agriculture most significantly during the nineteenth century.

Production and trade statistics allow us to gauge the progress made by Murcian farmers. In the arid *Campo*, the acreage dedicated to fodder crops (barley and oats) increased enormously. Output entered regional and national markets through coastal trade. In the *Huerta*, with more productive irrigated farmland, self-sufficiency was achieved through crop rotation (corn, garden produce, and fodder). The introduction and diffusion of new cash crops, particularly potatoes, became important, and their consumption spread among the peasant population in the first half of the nineteenth century. By the 1870s and 1880s, after the construction of railroads, production was destined primarily for the peninsular urban markets. In addition to the potato, the output of garden produce and citrus and other fruits also rose.<sup>2</sup>

2. Martínez Carrión, *Desarrollo agrario y crecimiento económico*. For other regions of Spain, see Garrabou and Sanz Fernández, *Historia agraria de la España contemporánea*.



Among the new crops, the production of red peppers (for the manufacture of paprika) spread rapidly in the *Huerta* and became one of the principal sources of income for small farmers. During this period, a number of other food-processing industries, notably those producing flour and olive oil, made significant advances. Moreover, the textile industry was stimulated by an increase in local consumption and the demand for silk in France. Sericulture was, in fact, one of the traditional staples of the peasant economy.<sup>3</sup> In short, there is plenty of evidence in the middle of the nineteenth century of the development of agriculture and the progress of the manufacturing sector in the *Huerta*.<sup>4</sup>

During the last third of the nineteenth century, the process of intensification and specialization continued. In the *Huerta*, attention was increasingly focused on the production of fruit, particularly citrus, for sale in foreign markets. In contrast, dry farming tended toward greater specialization in cereals for fodder and the planting of almond trees. The food industry expanded considerably. Paprika-processing factories grew to considerable size and importance, and the first canning industries were founded. The introduction of improved technology and farm organization increased in the 1880s and 1890s in connection with the development of the food industry and the marketing of farm produce. The rise in paprika exports, sparked by the heavy foreign demand after 1880, constituted an important source of capital accumulation. Most of the profits derived from the agricultural sector were reinvested, making it possible for technical improvements to be introduced which in turn led to higher yields.<sup>5</sup>

#### LIVING STANDARDS

Having outlined the principal characteristics of the process of economic growth in Murcia during the nineteenth century, we now consider its effect on living standards.

Earlier research found both economic stagnation and the absence of relevant agrarian transformations at the end of the nineteenth century, but recently the validity of these assertions have been questioned, even by the original pro-

3. Pérez Picazo and Lemeunier, *El proceso de modernización*.

4. Nadal and Carreras, *Pautas regionales de la industrialización española*.

5. Martínez Carrión, *Desarrollo agrario y crecimiento económico*. For a discussion of the role of agriculture in economic growth in Spain during the second half of the nineteenth century, see Garrabou and Sanz Fernández, *Historia agraria de la España contemporánea*; Prados de la Escosura, *De imperio a nación*; Simpson, "Los límites del crecimiento agrario."

TABLE 5.1 Height of Men by Area of Residence in the Municipal District of Murcia

Year of Birth	Urban	Rural		Total Murcia	N
		<i>Huerta</i>	<i>Campo</i>		
Age 20					
1840-44	163.1	159.4	159.8	160.0	2,766
1845-49	162.5	160.3	159.6	160.6	2,118
1850-54	163.7	159.8	160.4	160.6	596
1855-59	163.1	159.2	160.7	160.1	3,034
1860-64	162.5	159.8	160.5	160.4	4,076
Age 19					
1866-70	162.6	159.7	159.2	160.3	5,188
1871-75	162.3	159.0	157.6	159.7	4,622
1876-80	163.3	159.2	159.2	160.1	4,905
Age 20					
1882-86	164.2	161.9	161.6	162.7	4,145
Age 21					
1888-92	164.8	162.6	162.0	163.1	3,844
1892-99	164.6	—	164.2	—	1,360
1900-1909	164.3	—	—	—	462

SOURCE: Archivo Municipal de Murcia (AMM), *Expedientes de reemplazos*.

pounder of the thesis.<sup>6</sup> Despite the fact that the circumstances that prevailed during the middle decades of the century, characterized by a period of economic prosperity, were already better understood,<sup>7</sup> these early studies pointed to a decline in the material living conditions of the population at the end of the nineteenth century. However, new evidence on the physical stature of the population casts doubt on this hypothesis.<sup>8</sup>

The physical stature of young Murcian men born between 1840 and 1880 stagnated (table 5.1, figure 5.2). The height evidence indicates that economic

6. For the thesis on economic stagnation in late-nineteenth-century Murcia, see Pérez Picazo, *Oligarquía urbana y campesinado en Murcia*. For a more optimistic interpretation of the role of Murcian agriculture during this period, see Martínez Carrión, "Cambio agrícola y desarrollo capitalista."

7. Pérez Picazo and Lemeunier, *El proceso de modernización*, 307. On economic development in Spain during the middle decades of the nineteenth century, see Albert Carreras, *Industrialización española: estudios de historia cuantitativa*.

8. Martínez Carrión, "Estatura, nutrición y nivel de vida en Murcia." This study was based on a small sample of the available evidence. Other authors found a similar trend in the United States and United Kingdom. See Fogel, Engerman, Floud et al., "Secular Changes in American and British Stature and Nutrition"; Fogel, "Nutrition and the Decline in Mortality since 1700"; Floud, Wachter, and Gregory, *Height, Health and History*, 152.



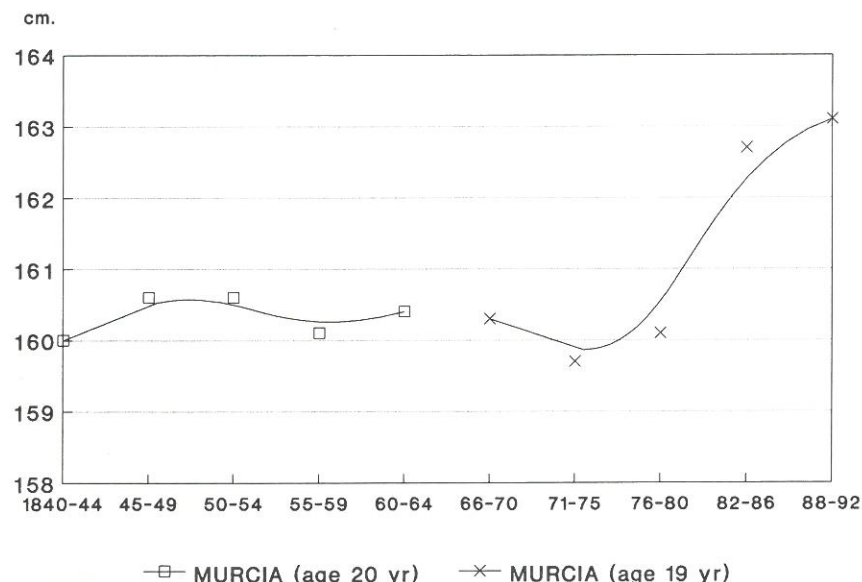


FIG. 5.2 Height by year of birth in Murcia

prosperity did not lead to a general improvement in living standards. Furthermore, it might reasonably be deduced that the processes of intensification and diversification of production and the improvements in agricultural techniques introduced at mid-century did not have a particularly significant impact on the nutritional status of the population.

The consequences of population growth, urbanization, incidence of disease, and environmental conditions associated with demographic pressure may explain, in part, the stagnation of heights in the middle of the century. However, a more detailed analysis that distinguishes urban from rural heights points to a somewhat different pattern (see Table 5.1). The average height in the rural areas of Murcia was consistently lower than that found for the urban population. This is because of the greater relative wealth of some social groups in the city.

#### CITY-DWELLERS

In the city of Murcia, an increase in stature of the cohorts born in the early 1850s was followed by a decline. This slight fall in urban heights through 1871-75 can be attributed largely to three factors: demographic pressures, a probable deterioration in nutrition because of inflation, and an increase in pov-

erty in the poorest quarters of the city. There is no reason to believe that food consumption improved, especially if we bear in mind the rise in the prices of farm products. The rise in grain prices between 1855 and 1870 doubtlessly had a negative effect on the purchasing power of the urban population.<sup>9</sup> It seems likely that the real income of nonagricultural workers fell, caused by an increase in the price of grain that was accompanied by a surge in meat prices. The extension of the arable land brought with it a reduction in pasture available for grazing and led to a rise in the price of meat. As a result, demand must have shifted increasingly to vegetables, mainly potatoes. The deterioration of grain consumption and the replacement of meat with salted fish and especially with potatoes are clear indications of dietary change and a deterioration in living standards.

The spread of epidemic diseases must also have contributed to the decline of stature in urban areas and in some rural areas. The generations born between 1855 and 1870 were subjected during childhood to some of the most terrible epidemics: cholera, measles, smallpox, and typhus. The epidemics were particularly virulent in 1855, 1859, and 1861, and typhus and typhoid fever struck hard during the subsistence crisis of 1868.<sup>10</sup> The concentration of the population in the city undoubtedly contributed to the propagation of these diseases. Although the number of deaths caused by the epidemics was not very high, the level of morbidity certainly was, leaving aftereffects in a large portion of the population. A similar increase can be detected in the incidence of common illnesses during the same period: dysentery, enteritis, tuberculosis, bronchitis, and pneumonia. These illnesses in fact had a greater impact on the rate of mortality than did the epidemic diseases. The general rise in morbidity may also have been associated with the deterioration of environmental conditions and health in the city as a consequence of population growth.

#### RURAL POPULATIONS

In rural areas, stature shows different patterns of change. The decline in stature detected in the city is also registered in the *Huerta* during the 1850s; thereafter, average heights stabilized at just over 159 cm until 1880. Nevertheless, figures corresponding to the diverse areas of the *Huerta* (see table 5.2 below) accentuate the heterogeneity of the results. In the *Campo*, it is precisely

9. Pérez Picazo and Lemeunier, *El proceso de modernización*; Martínez Carrión, *Desarrollo agrario y crecimiento económico*, 221.

10. Maset, "Aspectos sociosanitarios de Murcia."



TABLE 5.2 Heights by Area of Residence in the *Huerta* of Murcia

Year of Birth	Area 1	Area 2	Area 3	Area 4	Area 5
Age 20					
1840–44	161.2	159.7	158.1	159.5	159.2
1845–49	161.7	160.0	159.1	160.9	160.2
1850–54	160.6	161.3	157.8	159.7	161.3
1855–59	161.0	159.2	158.5	159.0	159.4
1860–64	160.7	159.3	158.9	159.4	159.6
Age 19					
1866–70	160.6	160.3	158.5	159.4	159.6
1871–75	159.9	159.7	158.4	159.3	157.0
1876–80	160.4	160.0	158.0	159.3	158.9
Age 20					
1882–86	162.7	161.9	161.0	161.0	—
Age 21					
1888–92	163.1	163.2	161.8	162.6	—
1892–99	163.4	163.4	—	—	—

SOURCE: See table 5.1.

in the 1850s and early 1860s that average heights increased, in contrast with the findings for the city and *Huerta*. The reasons for this divergence are unclear. It is true that the *Campo* had become specialized in the production of cereals and might have benefited from the rise in cereal prices between 1855 and 1870. The grain farmers' incomes also rose as a consequence of the increase in the sales of surpluses. Considerable volumes of corn and barley were exported from Murcia to other regions of Spain at this time.<sup>11</sup> In the case of the *Campo*, it is tempting to relate the changes in stature to economic indicators. However, in the *Huerta*, other factors exist which explain the stagnation of human height prior to 1870, lessening the importance of the improvements in agricultural production.

First of all, the social consequences of the processes of demographic growth and agricultural expansion, along with the development of capitalist relations of production, must be stressed. Although the inflationary process was theoretically favorable to farmers, the uneven distribution of land ownership and the proletarianization of the peasantry tended to neutralize its beneficial effects. Thus, the increase in the number of day laborers among the peasants of the *Huerta* during the nineteenth century is a strong argument in support of the pessimistic hypotheses about the period. In addition, the surge in

emigration around the middle of the century points to underlying social tensions at a time when agricultural development was just getting started.<sup>12</sup>

Demographic pressure and liberal reforms on the land had a positive effect on the dynamism of agricultural production, but also led to significant changes in the organization of farmsteads which affected the welfare of certain sectors of the peasant population. Such changes included the tendency for property to concentrate in the hands of a minority, with the expulsion of peasant families from their small-holdings when they were unable to pay off debts and cash-flow difficulties related to sectoral restructuring. On the other hand, the increase in the peasant population aggravated the fragmentation of holdings, probably resulting in a fall in income and the deterioration of household consumption. The price increases benefited landowning peasants, but were detrimental to the interests of laborers in the *Huerta*—whose numbers were constantly on the increase after the mid-nineteenth century—as well as of the poor, observable in the ever-increasing number of the truly destitute.<sup>13</sup>

The advances in cereal production achieved in the 1850s and 1860s were halted in the *Campo* with the appearance of shortages and high prices around 1870. The impact was most severely felt during the subsistence crisis of 1867–68, during which the dry-farming areas suffered heavy losses because of their monoculture and specialization in cereal production. The *Huerta* weathered the crisis better because of the diversification of its crops. Nevertheless, day laborers of both areas were affected by the overall rise in food prices. The greater proletarianization of the *Campo* meant that the crisis reached more serious proportions in the dry-farming zone. Between 1867 and 1875, local grain production fell by more than 50 percent. The subsistence crisis was accompanied by peasant indebtedness, a consequence of proportionally higher costs from having to work lower-quality marginal land. Many peasants with small-holdings and a part of the day-laborer population were no doubt driven into poverty.

#### DISEASE AND HEIGHT

Since beggars and paupers had no place in small village communities, the marginal population concentrated in the city and strayed about the

12. Martínez Carrión, "Cambio agrícola y desarrollo capitalista," 93–94. For a fuller account, see Vilar, *Los españoles en la Argelia francesa*.

13. Vilar, *El sexenio democrático y el cantón murciano*, 29.

11. Martínez Carrión, *Desarrollo agrario y crecimiento económico*, 238.



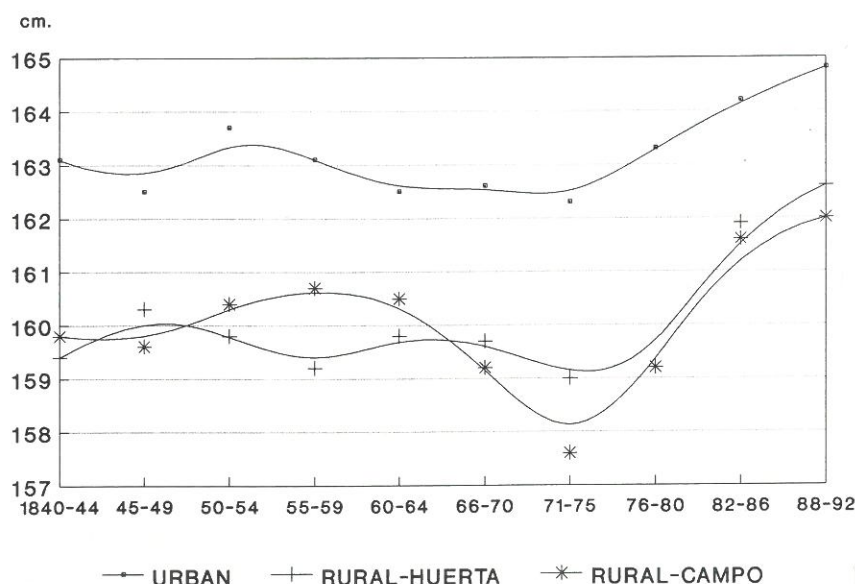


FIG. 5.3 Height by year of birth in urban and rural areas

*Huerta*.<sup>14</sup> Hunger was followed by illness and disease. Around this time, a host of sicknesses and epidemics fell upon a weakened and undernourished population. Although the reduction in physical stature observed among those born at the beginning of the 1870s was general, the sharpest decline is registered among the population of the *Campo*, where the subsistence crisis had its greatest impact (see table 5.2, figure 5.3).

The relationship between illness and height is most clearly seen in the *Huerta*. The zones where malaria was endemic are the ones in which the recruits were the shortest (table 5.2, areas 3 and 4). The level of malarial infection in the intensively irrigated area is directly related to the excess humidity in the atmosphere. In the *Huerta*, high humidity can be attributed to several factors: the presence of a dense network of water channels, particularly the drainage ditches known as *azarbes*; the low-lying nature of the land; and the presence of clays which prevent water from filtering through the subsoil. Since the *Huerta* stretches from east to west and these characteristics are concentrated in the eastern sector (area 3), it is not surprising that this area is the one which had the shortest population.

14. *Ibid.*, 62-72.

The evolution of height in areas 1 and 3 deserves special attention. Area 1 includes that part of the population that lives at the foot of the mountains at the southern limit of the irrigated area. The altitude of the land prevents the formation of ponds and marshes. This area had the tallest population. Area 3, on the other hand, contains the villages situated in the low-lying valley. Occupying the northeastern and eastern sectors, this area was a continual site of malaria, because of the presence of tracts of boggy marshland and stagnant pools. Malaria was the predominant illness throughout area 3. The negative consequences for the human organism of this disease's extraordinary development and endemic nature are evident in the human growth statistics (see table 5.3). The heights of young men born in area 3 were the lowest for the whole of the *Huerta*.

It is well known that malaria is a greater source of morbidity than of mortality. The state of physical weakness brought on by malarial fever facilitates the development of complications from other diseases. Few illnesses are not worsened when complicated with malaria, whether at the onset, during the decline, or even in convalescence. In this way, malaria tended to augment the risk of sickness and mortality. It persisted in the *Huerta* up to the 1880s.<sup>15</sup> Thereafter its effect concentrated on the villages of area 3, although with decreasing intensity because of improved irrigation and drainage systems and a better level of health, thanks to the efforts of various public and private organizations.

The large number of short men born between 1855 and 1870 not only reflects women's low average calorie intake during pregnancy and lactation but also underlines the importance of the incidence of illness during youth (tables 5.3 and 5.4). Malaria, complicated by the series of chronic and infectious diseases which characterize the period, must have been responsible for the large number of sickly, stunted youth. Furthermore, it is more than likely that the short stature of those born in the 1860s and 1870s is also associated with the intensity with which malaria, in conjunction with other diseases, persisted during the 1880s. Thus, the increase in the number of young men recruited from rural areas between 1850 and 1875 who were shorter than 150 cm must be related both to a decline in nutritional intake and to the deterioration in the epidemiological environment which lasted well into the 1880s.

The change in height during the 1880s shows the importance of the economic transformations which occurred at the end of the century. The fact that

15. Martínez Espinosa, *Apuntes de climatología, saneamiento e higiene en Murcia y su huerta*.



TABLE 5.3 Distributions (%) of Heights by Year of Birth

Year of Birth	Under 145 cm	146–50 cm	151–55 cm	156–60 cm	161–65 cm	166–70 cm	171–75 cm	176+ cm
Age 20								
1840–44	1.9	4.6	16.0	29.7	27.4	14.3	5.1	0.9
1845–49	1.7	5.1	12.9	29.1	27.9	16.9	5.3	1.1
1850–54	2.8	3.5	13.4	28.7	28.0	17.1	5.7	0.7
1855–59	2.8	5.1	15.6	26.9	27.8	16.1	4.6	1.1
1860–64	2.6	5.4	14.5	26.9	29.1	16.7	3.8	1.0
Age 19								
1866–70	2.6	6.3	13.6	26.4	28.5	17.0	4.6	1.0
1871–75	3.3	9.9	13.5	24.5	27.3	16.0	4.5	1.0
1876–80	3.4	8.4	12.7	22.8	29.1	16.7	5.3	1.5
Age 20								
1882–86	1.0	3.7	8.9	23.5	31.1	21.2	8.1	2.5
Age 21								
1888–92	0.6	2.8	7.4	20.7	32.9	23.1	10.2	2.3

SOURCE: See table 5.1.

malaria was still ravaging the countryside at the same time is apparent in contemporary medical reports and is reflected in the height of contemporary army recruits. Yet this should not lead us to question the improvements in food consumption and perhaps even in the levels of child mortality achieved in the course of these two decades.

TABLE 5.4 Percentages of Heights under 151 cm and over 170 cm in Urban and Rural Areas

Year of Birth	Under 151 cm			Over 170 cm		
	Urban	Rural	Total	Urban	Rural	Total
Age 20						
1840–44	1.0	7.7	6.5	12.8	4.6	6.0
1845–49	2.3	7.6	6.7	9.3	5.9	6.4
1850–54	5.6	7.1	6.4	14.8	4.9	6.4
1855–59	2.1	9.4	7.9	8.1	5.0	5.6
1860–64	2.9	9.4	8.0	8.0	3.9	4.8
Age 19						
1866–70	3.9	10.4	8.8	9.3	4.5	5.6
1871–75	6.8	15.4	13.3	10.2	3.9	5.5
1876–80	4.8	13.9	11.8	12.3	5.1	6.8
Age 20						
1882–86	1.0	5.9	4.6	14.7	9.1	10.6
Age 21						
1888–92	1.4	4.2	3.4	18.3	10.0	12.5

SOURCE: See table 5.1.

## NEW MARKET CONDITIONS

The increase in stature in the 1880s and 1890s was caused by improvements in material and environmental conditions favorable to the development of the human organism. Contrary to current historiographical theories about the harmful effects of the "great agricultural depression" in Murcia and other Spanish regions,<sup>16</sup> the data regarding stature suggest that the situation at the end of the century was broadly favorable for a large segment of the lower classes.

Without wishing to underrate the impact which the end-of-the-century crisis had on extensive agriculture and on certain traditional crops in the irrigated zone, we now know that the introduction of new cash crops helped to compensate for the losses suffered in other zones. The situation was not so much one of crisis as of an adjustment to new market conditions. This also explains why both men and women were marrying at younger ages in the 1880s and 1890s, as a response to market opportunities.<sup>17</sup>

The process of agricultural intensification and specialization which gained momentum during the final decades of the last century was accompanied by a slight fall in food prices. This meant a serious setback for those farms specializing in grain production. However, crop diversification at the expense of cereal production in the irrigated area saved growers in the *Huerta* from incurring the same losses as their dry-farm counterparts. The prices not only of corn but also of meat fell, as can be deduced from the increasing number of cattle shipped through Cartagena between 1876 and 1895.<sup>18</sup> The diversification of the peasant diet (vegetables, beans, potatoes, dried cod) and the opportunity to buy the highest-quality cereals, wheat bread, and meat, brought about a tangible improvement in food consumption for a considerable share of the population.

The common people were no doubt the principal beneficiaries of the fall in food prices. The drop in the price of cereals need not have been accompanied by reductions in nominal incomes, as has been speculated.<sup>19</sup> The existence of alternative crops that required an abundant and often specialized workforce, both in the irrigated and unirrigated areas, does not seem to bear out the hy-

16. For a different view of the question in Spain, see Garrabou (ed.), *La crisis agraria*.17. Data on age at marriage of the population of the *Huerta* of Murcia are found in Martínez Carrión and Hernández Moreno, "Cambio agrario y organización familiar en la Huerta de Murcia," 70; Martínez Carrión, "Peasant household formation."18. Martínez Carrión, *La ganadería en la economía murciana contemporánea*.19. Pérez Picazo and Lemeunier, *El proceso de modernización*, 402.



pothesis of a fall in income. Even in the unirrigated zones of Murcia, the cereal crisis did not strike with as extreme severity as it did in the farms of the Castilian interior;<sup>20</sup> the Murcian *Campo* was opting decidedly for barley, the prices of which were holding up much better on the national market due to its high quality; and cereals were being replaced in Murcia by almonds and other tree crops.

#### HEIGHTS INCREASE AS THE CENTURY CLOSES

The response to the environmental improvements which took place at the end of the nineteenth century was immediate. From the early 1880s on, stature increased both in the urban and rural areas. The height of the generations born between 1882 and 1892 increased by more than 3 cm compared with those born between 1876 and 1880 in some areas of the *Huerta*. The most spectacular rise in height found during the second half of the nineteenth century among young men recruited from the *Huerta* was in area 3, the traditional stronghold of malaria. The number of cases of stunted men decreased sharply (see tables 5.3 and 5.4); this must have been related both to the improved dietary conditions and to reduced morbidity. The gradual eradication of malaria from villages situated in the irrigated zone was particularly important.

#### CONCLUSION

The height statistics indicate that an improvement in living standards does not depend only on prices and incomes measuring purchasing capacity. Furthermore, the lack of reliable evidence on real incomes relevant to the population under consideration raises difficulties for an attempt to identify welfare trends with conventional measures. Trade and production statistics can demonstrate an improvement in output, but do not constitute effective indicators of local consumption. It is necessary to use other variables in order to measure more accurately variations in sickness and health. Unfortunately, for Spain we only have at our disposal death statistics, with no data on levels of morbidity. The problem becomes even more acute in Murcia if we bear in mind that malaria, one of the most widespread illnesses among the population under study until the end of the nineteenth century, is characterized more by its effect on morbidity than on mortality. In such circumstances, anthropometric statistics provide an excellent measure of welfare.

The economic growth of the second half of the nineteenth century did not

lead to an immediate improvement in living conditions. The stagnation and subsequent decline in height in the 1860s and 1870s is evidence that nutritional status fell during the early stages of economic growth. The growing proletarianization, together with the increase in demographic pressure and spread of diseases, were the principal factors which caused this fall in welfare during an inflationary period. The expansion of agriculture after the liberal land reforms, together with the processes of specialization, produced changes in farm organization and in the property system which had significant consequences for the social structure. Demographic growth and the capital accumulation derived from agricultural expansion must have accentuated the social polarization in Spanish peasant society. This polarization is responsible for the large differences between the heights of youth of different social status, and from the urban and rural sectors, found among those born up to the 1880s.<sup>21</sup>

The trends in height can also cast light on the modifications which disease patterns underwent in the context of environmental transformation. It is very likely that the agricultural transformations of the mid-nineteenth century also induced changes in the nature of the prevalent diseases. In any case, the data suggest the existence of a relationship between malaria, irrigated agriculture, and low stature, and also between the periods of scarcity, morbidity, and the decline in height found in the late 1860s and early 1870s.

The changes in height in the closing decades of the nineteenth century was related to the improvement in nutritional status and conditions of health. The deflation at the end of the century must have contributed to the increased purchasing power of the working classes, and improvements in agriculture and in the irrigation and drainage systems diminished the effects of malaria and other diseases connected with the environment. It is significant that the increase in stature occurred precisely when measures were being taken to improve endemic diseases in the *Huerta* of Murcia. Neither can it be a coincidence that the greatest increases in height were registered in the rural areas, especially in the *Huerta*. At the end of the period under study, the increase in stature of the generation born during the 1880s reduced the height differences which had prevailed throughout the century. The gradual diminution of statural differences between the urban and rural populations indicates that the consequences of economic development and demographic change were broadly beneficial to the plight of the common people.

21. For data on height and social status at the end of the nineteenth century in Murcia, see Martínez Carrión, "Estatura, nutrición y nivel de vida en Murcia." For a study of the German evidence, see Komlos, "Height and Social Status in Eighteenth-Century Germany."

20. Garrabou and Sanz Fernández, *Historia agraria de la España contemporánea*.