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Anthropometric measurements by ethnicity in Colombia, 1965–1990

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ABSTRACT

We analyzed the evolution of height in Colombia of cohorts born in the period 1965–1990 by ethnic groups. We found that Afro-Colombian men and women were the tallest: 6 cm taller than indigenous people and 2 cm taller than the rest of the population. We also found that the height gap between Afro-Colombians and others decreased during the period under study by 0.7 cm for both men and women. While improvements were noticeable among the Afro-Colombians and those who chose not to be classified by ethnicity, in the case of the indigenous population only female cohorts registered an average-height increase of 1.5 cm. Moreover, we found that indigenous Colombians were more likely than other ethnic groups to experience an increase in biological well-being as a consequence of an improvement in their socio-economic status, thereby reducing the average-stature gap between them and the rest of the population by 2.1 and 3.6 cm for men and women, respectively.

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1. Introduction

Stature, being a function of living conditions as well as genetic factors, is a reliable measure of material well-being.¹ While potential height is genetically determined healthful living conditions (including good nutrition) are required during the growing years if an individual is to attain that height (Steckel, 1995).

The first anthropometric study of Colombia's population was published in 1992. On the basis of 14,103 observations derived from national-ID-card statistics,

Ordoñez et al. (1992) found that between 1910 and 1970 there had been an average-height increase of 7.0 and 8.7 cm among men and women, respectively. Using a much larger database – over 9 million observations – derived from the national ID cards and from passports as well, Meisel and Vega found a sustained increase of about 9.0 cm among both male and female cohorts born between 1905 and 1985. In addition, there was a pronounced decrease in geographical variation; the average height of men and women increased throughout the country with one exception: San Andrés Island where the average height of women decreased slightly toward the end of the 20th century (Meisel and Vega, 2007a,b, 2010). A comparative analysis of the evolution of the heights of Colombia's various ethnic groups has never before been attempted. It is because the ENDS-ENSIN information collected in 2010 included self-identification according to ethnic group that we are able to undertake such an analysis.

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¹ For a survey of the anthropometric literature since 1994, see Steckel (2009). A collection of recent anthropometric research on Latin America is presented in Salvatore et al. (2010).

This paper examines the evolution of the height of Colombians born between 1946 and 1992. Our analysis comprises three categories: indigenous and Afro-Colombians because they constitute a significant percentage of the sample, and what we term *others*.² It should be noted that these categories are social constructions and are therefore to a certain extent arbitrary. In other words, they do not correspond to genetic or phenotypic categories, which would imply that they have a biological reality. Instead, we define them as a social reality. In line with the current anthropological argument that races do not exist as a biological fact, race-based taxonomies are arbitrary (Cartmill, 1998). This is not to cast doubt on the social reality of socially constructed categories, since they, too, have significant consequences, for better or for worse, in regard to the well-being of the individuals concerned.

2. Data

In order to obtain a representative sample of the country's main ethnic groups, we used data on 59,772 individuals from the National Survey of Demography and Health (ENDS, in Spanish) and the National Survey of Nutritional Situation (ENSIN, in Spanish),³ conducted in 2010.⁴ The surveys covered a total of 258 of Colombia's 1023 municipalities in 32 departments (provinces), and constitute a representative sample of the country's six geographic regions.⁵ This survey is particularly relevant to an anthropometric analysis of Colombia's socio-economic situation because, it is the first to provide data concerning the nutritional status of ethnics groups.⁶

Whereas the surveys include the entire age range from birth to 64 years (each individual being identified according to gender, ethnic group, and socio-economic status), we limit our analysis to adults between 20 and 45 years of age, because it is only during this 25-year span that an individual's height is constant (Monasterio et al., 2010).⁷

These age boundaries make for a sample of 59,774 individuals, consisting of 25,397 men and 34,377 women (Table 1). The ENDS-ENSIN surveyors gave each household member the opportunity to be identified as belonging to a

specific ethnic group.⁸ The options were: indigenous, gypsy (or Roma), *raizal*, *Palenquero* (from San Basilio), or black/mulatto/Afro-Descendant.⁹

The data collected were sufficiently numerous to provide a significant number of individuals who identified themselves as Afro-Colombians or as members of one of Colombia's indigenous groups. For this reason that we restrict our analysis to three ethnic classifications: indigenous, Afro-Colombians (including *raizals* and *Palenqueros* from San Basilio), and *others* (all those who did not identify themselves as belonging to the other two groups).

Afro-Colombians are concentrated in Chocó and San Andrés. However, they are also present throughout the Colombian Caribbean and along the rest of the Pacific Coast (Fig. 1).

Most of those who identify themselves as indigenous are located in the far north and the far south, on the Guajira peninsula, in the Amazonian region, and in Cauca (Map 2). In Colombia many ethnic groups remain minorities and, as such, are at a disadvantage relative to the rest of the Colombian population.¹⁰

3. Ethnic differences in stature

From 1965 to the early 1990s there was an increase in the average height of all of Colombia's ethnic groups, men and women alike, with the exception of indigenous men. The largest increase was in the group *others*: 2.0 and 1.9 cm for men and women, respectively (Table 1).

Although average Colombian height has increased, it still lags behind those of Europe and the US. The average height of the Colombian population is closer to that recorded in North America around 1850. Colombians born in 1990 are nearly 14 cm shorter than their Dutch counterparts – those men and women averaged 184 and 171 cm, respectively–, whose average height is approaching what is believed to be the human maximum (Cole, 2003; Fogel, 2004). Indigenous Colombians are on average as much as 19 cm shorter than their Dutch counterparts. Afro-Colombians are next with 171.5 and 158.8 cm for men and women, respectively (Figs. 2 and 3). Even though Americans are shorter than Europeans, they are taller than Colombian men and women, by 7.3 and 6.2 cm, respectively (Kuczarski et al., 2000; Cole, 2003).

Afro-Colombian men born between 1965 and 1990 are taller than both indigenous men and *others*, by 6.1 and 1.99 cm, respectively, with average height increasing across the most recent three of this group's birth cohorts,

² We exclude the category "gypsy" from our study because they represent only 0.1% of the total sample (Table 1).

³ The data are located in the Nutrition section of the Instituto Nacional del Bienestar Familiar (ICBF).

⁴ Although the first survey regarding Colombians' nutritional status was undertaken in 2005, we have chosen not to use it because it did not include what is, at least for our purposes, a key variable: ethnic origin. In addition, the 2010 ENDS-ENSIN features a much larger sample, of 50,670 households.

⁵ Amazonía and Orinoquía, Atlántica, Bogotá, Central, Oriental, and Pacífica.

⁶ National Survey of the Nutrition Situation in Colombia (ENSIN) report, 2010, p. 37.

⁷ While growth occurs up to about the age of 18, less well known is the fact that height tends to decrease after the age of 45 on account of compression of the vertebrae. For a detailed analysis of the growth process, see Ulijaszek et al., 1998, p. 195.

⁸ For more information about characteristics of the survey, see the National Survey of the Nutritional Situation in Colombia (ENSIN) report, 2010.

⁹ A *raizal* is a Colombian who is of African ancestry, was born in the Department of San Andrés and Providencia, and speaks the local, Caribbean, English. According to UNESCO (2005), "The Palenque de San Basilio was one of the fenced communities called palenques, which were founded by escaped slaves. Thus, Palenqueros are the members of this community and their descendents in the seventeenth century. Of the many palenques that existed in former times, only the one of San Basilio has survived until the present day and developed into a unique cultural space. The village of Palenque de San Basilio, with a population of about 3500 inhabitants, is located in the foothills of the Montes de María, southeast of the regional capital Cartagena (Colombia)."

¹⁰ For a study of the economic disadvantages faced by the indigenous group, see Romero (2010).

Table 1
Descriptive statistics of the sample of Colombian men and women.

	Men			Women		
	Indigenous	Afro-Colombian	Others	Indigenous	Afro-Colombian	Others
<i>N by birth cohort</i>						
1965–1970	675	675	4425	790	849	5893
1971–1975	560	560	4022	653	779	5695
1976–1980	498	498	3640	634	720	5099
1981–1985	467	467	3327	582	716	4730
1986–1990	514	514	4268	617	829	5772
Total	2714	2977	19,682	3276	3893	27,189
Average height	164.5	170.7	168.7	152.1	158.1	155.7
CI (95%)	(163.9–165)	(170.3–171)	(168.5–168.8)	(151.7–152.5)	(157.8–158.4)	(155.6–155.8)
Change in height (1965–1990)	–0.1	1.3	2.0	1.6	1.2	1.9
<i>p</i> value	0.855	0.006	0.000	0.004	0.002	0.000
<i>Distribution by wealth quintiles</i>						
Q1	49.8	32.0	16.5	48.6	29.0	14.4
Q2	23.1	21.2	20.2	21.7	20.5	20.2
Q3	15.3	18.6	22.4	15.8	20.3	22.3
Q4	7.4	15.7	21.2	8.5	17.8	22.0
Q5	4.3	12.5	19.8	5.4	12.4	21.1
Total	100	100	100	100	100	100

Notes: The number of observations for gypsies is 24 men and 17 women, and their average heights are 166.5 and 156.7 cm, respectively. CI: confidence interval. P-value pertains to change in height variable.

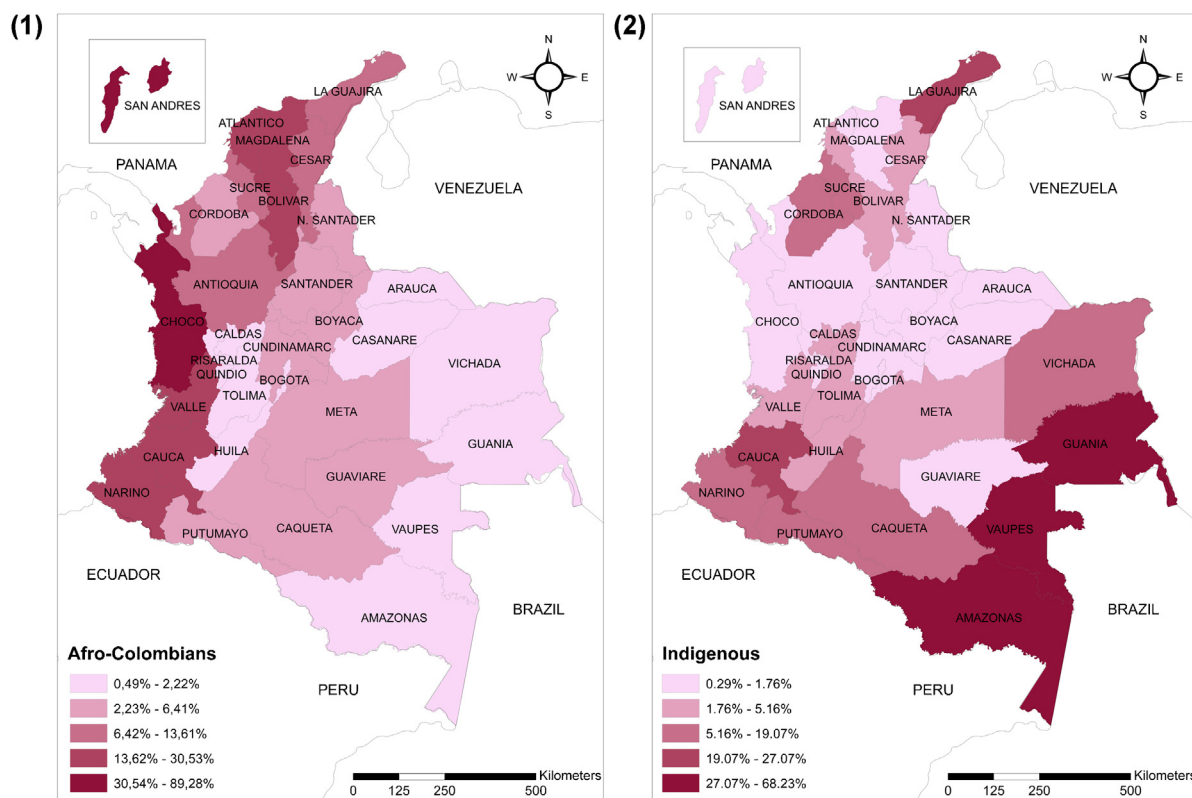


Fig. 1. (1) Proportion of Afro-Colombians men. (2) Proportion of indigenous men. Note: Maps for women are similar.

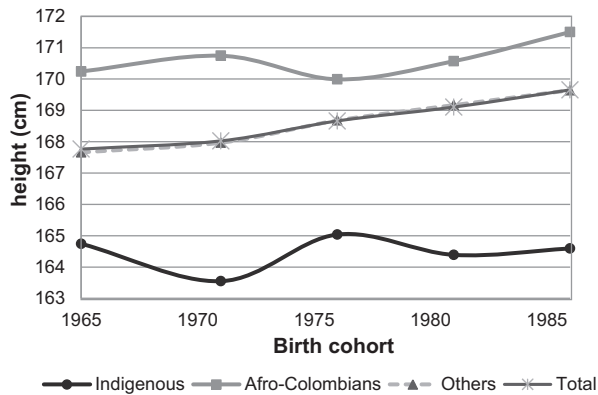


Fig. 2. Trend of male height by ethnicity in Colombia, 1965–1990.

from 170.2 to 171.5 cm (Fig. 2). Meanwhile, the average height of indigenous men did not change significantly, nor did the change endure: an increase of 0.3 cm in 1975, to 165 cm, was erased by 1990. Furthermore, the height difference between the Afro-Colombian and the indigenous groups ranged, over the course of the 25-year period under study, from 5.5 to 6.9 cm, the gap being widest for the 1971 cohorts: 7.2 cm.¹¹ In contrast, the height gap between Afro-Colombians and *others* has narrowed from 2.6 ($p=0.00$) to 1.9 cm in the late 1960s.

The women's results are notable for one striking difference from that of the men's: the indigenous group not only shows a significant height increase of 1.55 cm (from 151.4 to 152.9 cm), but even outpaces the Afro-Colombians and *others*. The increases made by these two groups are similar to those of their male counterparts, the height of the last cohort being 158.8 cm, 1.2 cm more than that of the first. The average height of *others* and its evolution over the period under study, from 154.8 to 156.7 cm, is roughly midway those of the other two groups.

The difference in the height of Afro-Colombian and indigenous women (6 cm ($p=0.00$)) remained more or less constant from 1976–1980 to 1986–1990 (Fig. 3). In the cohort 1971–1975, the gap between Afro-Colombians and indigenous women narrowed, to 5.5 cm ($p=0.00$) – whereas that of the men widened. Moreover, the dissimilarities in height between Afro-Colombians and *others* declined more gradually than for men during this period, remaining at less than half of that of the indigenous group, 2.3 cm ($p=0.00$). In fact, the ratio between women's and men's heights remained constant, at about 1.08, across ethnic groups and generations.

It should be noted that our average-height data differ from those reported in Meisel and Vega (2007a), derived from national ID cards; these exceed ours by 1.2 and 2.1 cm for men and women, respectively.

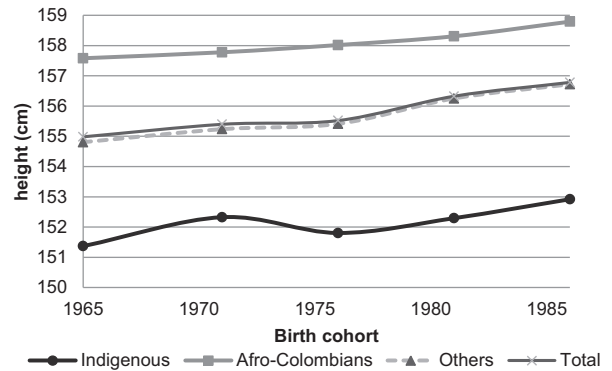


Fig. 3. Trend of female height by ethnicity in Colombia, 1965–1990.

3.1. Wealth and height

The ENDS-ENSIN survey does not include household income and expenditures. For evaluating socio-economic status, an index of wealth calculated by the method of principal components and classified by quintiles was included (Table 2). This index enables us to extrapolate household income from observable living conditions.¹² Quintile 5 is the richest while quintile 1 is the poorest.

Across categories, for men and women alike, height increases with quintiles. Between the first quintile and the last, the height of indigenous men increases by 5.6 cm, that of Afro-Colombians by 1.7 cm, and that of *others* by 3.5 cm. The widest gaps are found in quintile 1: 6.9 cm between indigenous and Afro-Colombian men, for instance. As living conditions improve this gap narrows, until, in quintile 5, it is only 3.1 cm (Fig. 4).

For men the greatest difference, by ethnic origin and quintile, is between Afro-Colombians of quintile 5 and the indigenous of quintile 1: 8.7 cm ($p=0.000$). This gap is a function of characteristics specific to the two ethnic groups, and to their living conditions as well.

For women, the height differences are less significant except for the indigenous category (Table 2). For example, among indigenous woman the difference in height among quintile 5 and 1 is 6.1 cm, whereas in the case of *others* and Afro-Colombians the difference is just 2.5 and 1.5 cm, respectively. It should be noted that the increase in indigenous women's height is such that in quintile 5 their average height is almost the same as that of *others*. Moreover, just as in the case of men, the largest differences according to these classifications is 8.5 cm ($p=0.000$), between indigenous women in quintile 1 and Afro-Colombian women in quintile 5 (Fig. 5).

These observations are consistent with the findings of Komlos (2010) in his analysis of ethnicity and gender for

¹¹ All of the estimations and their p values presented in this study were calculated on the basis of three sample characteristics: sampling weight, clustering, and survey strata. As for the differences reported in this paragraph, all of them are significant, and their p values are 0.000.

¹² Thus the wealth variable refers to the household, not the individual. To measure the Wealth Index, the international standard measure of Demographic and Health Survey is used. The DHS follows Filmer and Pritchett (2001) procedure. Some household assets and materials included are: presence of television, radio, car, motorcycle, refrigerator, electricity, persons per sleeping room, water supply, type of wall and of floors (Rutstein and Johnson, 2004).

Table 2
Average height by wealth quintiles (centimeters).

Ethnicity	Q1	Q2	Q3	Q4	Q5	Q5 – Q1	P value
Men							
(1) Indigenous	162.8	164.9	166.6	167.3	168.4	5.6	0.000
(2) Afro-Colombians	169.8	170.2	171.3	171.5	171.5	1.7	0.029
(3) Others	167.1	167.5	168.6	169.3	170.6	3.5	0.000
Differences in height							
(2) – (1)	6.9	5.3	4.7	4.2	3.1		
p value	0.00	0.00	0.00	0.00	0.024		
(2) – (3)	2.7	2.7	2.7	2.3	0.9		
p value	0.00	0.00	0.00	0.00	0.22		
Women							
(1) Indigenous	150.7	152.4	153.3	154.9	156.7	6.1	0.000
(2) Afro-Colombians	157.7	157.5	158.2	158.6	159.2	1.5	0.001
(3) Others	154.4	155.0	155.7	156.1	156.9	2.5	0.000
Differences in height							
(2) – (1)	7.0	5.1	4.9	3.7	2.4		
p value	0.00	0.00	0.00	0.00	0.005		
(2) – (3)	3.3	2.5	2.6	2.4	2.3		
p value	0.00	0.00	0.00	0.00	0.00		

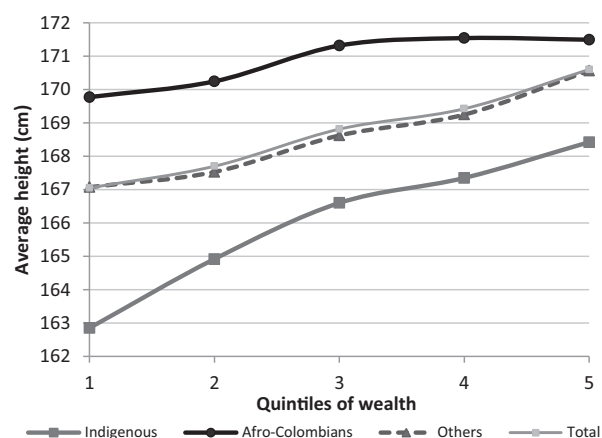


Fig. 4. Male height by ethnicity and wealth quintiles.

the population of the United States in the long-run (1915–1986). He argues that among women born 1975–1986, the height gap between low- and upper-income whites and blacks was 2.3 and 0.6 cm, respectively. In addition, Komlos found that at every income level the height gap between black and white American women increased over time – from 1955 to 1986. In this respect Komlos’s findings for the United States differ from ours for Colombia: we find that the height gaps among ethnic groups, and most notably the gap between Afro-Colombians and *others*, narrowed over time.

4. Econometric analysis

4.1. Differences in stature by generation, ethnicity, and living conditions

Numerous studies stress the impact of living conditions on children’s health and therefore on their anthropometric development as well (Alderman et al., 2006; Linnemayr et al., 2008; Hohmann and Garenne, 2010). The poverty

that prevails in rural Colombia is such that living conditions constitute both a short- and a long-term health risk for the region’s children (Attanasio et al., 2004). Malnutrition translates into stunting, which shows up in height data.

In our linear-regression model the dependent variable is the height in centimeters of men and women born between 1965 and 1990. Among the independent variables we include: generational groups, since during the past century Colombia’s secular height trend has been upward (Meisel and Vega, 2007a)¹³; interactions between the wealth index and generational groups; and both a wealth index and, as an alternative, the variable House Food Security (HFS)¹⁴.

The purpose of the survey’s questions is to determine whether, on account of budget constraints, there has been a decline in the quantity and/or the quality of the food purchased, and whether, as a consequence, any members of the household have suffered malnutrition. Given this information, we distinguish four categories of food security: security, mild insecurity, moderate insecurity, and severe insecurity.

Regressions were estimated for each ethnic group and *others* in order to determine whether the explanatory variables have the same effect in all three groups. There are two models: model (1) uses the wealth index as a continuous variable and model (2) uses quintiles of wealth (Table 3).

¹³ Generations are grouped using four dummies: 1965–1970, 1971–1975, 1976–1980, and 1981–1985.

¹⁴ We use this variable in order to show that in a country such as Colombia, where a vast number of the population is undernourished, the issue of household food security is crucial to any height analysis. The results generated by the wealth index are not significantly different: height increases with quintiles. See Appendix, panels A and B. In other words, the wealth index is almost the same as a nutrition index, since presumably the wealth of a given person/family is a reliable predictor of the nutritiousness of the diet of that person/family – if also of the quality of lots of other commodities.

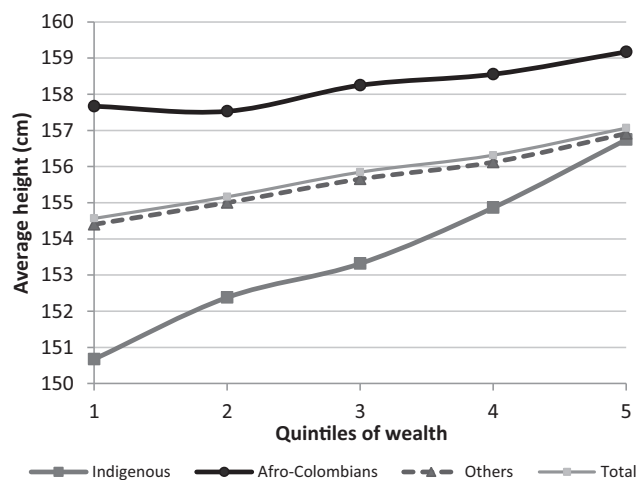


Fig. 5. Female height by ethnic group and wealth quintile.

Two results are robust: the latest generations are the tallest, and Afro-Colombians are taller than Indigenous and *others* by about 5.5 cm and 2.6 cm, respectively. In the case of men, only Afro-Colombians and *others* have negative and significant signs for generation g1 (1965–1970), g2 (1971–1975), g3 (1976–1980), and g4 (1981–1985) (model 1). As was shown in Figs. 1 and 2, the tallest generations are the most recent ones. The latest generation of *others* is 1.9 cm taller than the earliest, while the gap for Afro-Colombians is 1.9 cm.

Whereas the indigenous group experiences no such height increases over time. For women in the Afro-Colombian and *others* categories, too, there is a similar, significant difference, whereas the only increase experienced by the indigenous group, 1.7 cm, occurs in g1. To summarize: the *others* group experienced the largest height increase over the period 1965–1990 and the indigenous group the smallest.

The results also suggest that the wealth index, a continuous variable, is an important determinant of height for the men in all three groups (model 1), whereas it is not statistically significant for women in the Afro-Colombian group. This may be because the wealth index is not an accurate gauge of the living conditions from birth to three years, which is the best predictor of an individual's maximum height. It is because the survey does not provide information on this period of the participants' lives that we are obliged to use the wealth index as well. In this regard, Galvis and Meisel (2010) concluded that upward social mobility in Colombia to be minimal, having found that the 1985 edition of the Index of Unsatisfied Basic Needs (NBI) is virtually identical to that of the 2005 edition. A lack of geographical mobility over time reflects the persistence of "spatial poverty traps": another way of describing the regional persistence of poverty.

Among men in the indigenous and *others* categories, there are significant differences between quintile-of-wealth 1 and the other four quintiles,¹⁵ whereas for

Afro-Colombian men the significant differences are between quintiles 1 and 3 and quintiles 1 and 4 (2 and 3 cm, respectively). The most important result here is the huge, 9-cm, height increase among indigenous persons between quintile 1 and quintile 5.

The women's results are quite similar; the greatest difference, 6.8 cm, is between quintiles 1 and 5 of the indigenous group; only quintiles 4 and 5 differ significantly from quintile 1. As for the Afro-Colombians, there are statistically significant differences between quintile 1 and both quintile 2 and quintile 5, especially the latter (2.1 cm). For *others*, the women's results are like the men's: height varies in direct proportion to wealth. Likewise, the interaction terms are insignificant for the indigenous and Afro-Colombian groups. As for *others*, those who are wealthier in the earlier generations are shorter than those who are wealthier in later generations.

As mentioned above, we also use the variable access to adequate food as an approximation for general living conditions (Appendix).¹⁶ The reference group is the one facing severe food insecurity. The coefficient points to a significant and positive effect of adequate nutrition on height.

The food-security coefficients were not significant for the Afro-Colombian group (Appendix, model 1). In other words, there are no significant differences in stature between Afro-Colombians who report an adequate level of nutrition and those who do not. The same pattern is observed for indigenous women, the only significant height difference, 2.4 cm, being between those at the two ends of the food-security spectrum: those with security and those with severe insecurity.

In contrast, for indigenous men and *others*, there are significant differences in the food-security status of the family. In the case of indigenous men, belonging to a family with food security is associated with a height superiority of 4.7 cm over those who belong to families suffering from severe food insecurity. In the *others* category, height is in

¹⁵ The results for model 2 without interactions were not significantly different and are included in Appendix, model 3.

¹⁶ Here we interpreted Appendix, model 1, we also estimated the HFS model with interactions, but the results were not statistically significant.

Table 3
Regression analysis of the height of Colombian men and women.

	Ethnic classifications							
	Indigenous		Afrocolombian		Others		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Panel A: men								
Generations								
1965–1970 (g1)	–0.9	0.7	–1.5	–1.0	–1.9	–1.3	–1.8	–1.1
1971–1975 (g2)	–1.1	–1.3	–0.9	–0.5	–1.6	–0.6	–1.5	–0.7
1976–1980 (g3)	0.2	0.7	–1.7	–1.1	–0.9	–0.4	–0.9	–0.4
1981–1985 (g4)	–0.5	0.3	–0.9	–1.2	–0.4	0.1	–0.5	–0.2
1986–1990 (g5)	–	–	Reference	–	–	–	–	–
Quintiles of wealth								
Q1	–	–	Reference	–	–	–	–	–
Q2		2.5		0.2		0.8		0.9
Q3		4.6		2.0		2.3		2.4
Q4		4.1		3.0		2.7		2.9
Q5		8.9		1.2		4.1		4.0
Wealth index (WI)	2.2		0.9		1.5		1.4	
G1*WI	–1.0		–0.5		–0.3		–0.4	
G2*WI	0.2		–0.3		–0.4		–0.4	
G3*WI	–0.2		–0.5		–0.3		–0.3	
G4*WI	–0.4		0.2		–0.4		–0.2	
Afro-Colombians							Reference	–
Indigenous							–5.6	–5.5
Others							–2.5	–2.4
Constant	166.4	162.7	171.9	170.5	169.4	167.5	171.9	169.9
R ²	0.07	0.07	0.02	0.03	0.04	0.05	0.06	
Observations	2714		2977		19682		25373	
Panel B: women								
Generations								
1965–1970 (g1)	–1.7	–2.0	–1.3	–1.7	–1.9	–1.1	–1.9	–1.3
1971–1975 (g2)	–0.5	–0.5	–1.0	–1.4	–1.4	–0.6	–1.4	–0.7
1976–1980 (g3)	–0.8	–1.8	–0.8	–1.2	–1.3	–1.0	–1.3	–1.2
1981–1985 (g4)	–0.4	–0.8	–0.3	–1.2	–0.4	0.1	–0.4	–0.2
1986–1990 (g5)	–	–	Reference	–	–	–	–	–
Quintiles of wealth								
Q1	–	–	Reference	–	–	–	–	–
Q2		1.6		–1.2		1.0		0.7
Q3		1.6		–0.3		1.8		1.5
Q4		3.9		0.7		2.6		2.4
Q5		6.8		2.1		3.3		3.1
Wealth index (WI)	1.3		0.3		1.2		1.1	
G1*WI	0.2		0.0		–0.4		–0.3	
G2*WI	0.2		0.0		–0.5		–0.4	
G3*WI	0.5		0.2		–0.1		–0.1	
G4*WI	0.3		0.4		–0.3		–0.2	
Afro-Colombians							Reference	–
Indigenous							–5.5	–5.6
Others							–2.8	–2.7
Constant	154.0	151.7	158.9	158.7	156.5	154.9	159.3	157.8
R ²	0.08	0.10	0.01	0.02	0.03	0.04	0.06	0.06
Observations	3280		3891		27189		34360	

Note: (1) Significant coefficients at the 5% level in bold. (2) Most of the interactions in model 2 were not significant.

direct proportion to security, making for maximum height gaps of 2 and 1.5 cm for men and women, respectively (Appendix, model 1). In other words, for the indigenous group an improvement in nutrition is a predictor of a significant height increase.

In several regions of Colombia, the lives of indigenous people are marked by severe food insecurity, which is reflected in high levels of malnutrition, stunting, and obesity. Not surprisingly, the stunting rate is closely correlated with the concentration of the indigenous

population in a given region (Acosta, 2012). For example, over the past two decades the territorial consequences of the colonization process and the armed conflict affecting not just Chocó but the rest of Colombia as well have had devastating consequences for the Embera indigenous; a recent report puts their average energy consumption at only 1579 calories per day. Anthropometric data show that 77% of those 10–19 years of age, 83% of the men, and 69% of the women are of below-average height for their age group (Rosique et al., 2010).

Table 4
Regression models of the height of Colombian men and women.

	Men				Women			
	Indigenous	Afrocolombian	Others	Total	Indigenous	Afrocolombian	Others	Total
Mother's height	0.6	0.5	0.4	0.5	0.4	0.5	0.4	0.4
Father's height	0.3	0.5	0.4	0.4	0.4	0.5	0.3	0.3
Afro-Colombians	–	Reference	–	–	–	–	–	–
Indigenous				–1.1				–1.3
Others				0.9				0.3
Constant	24.2	12.1	38.7	34.7	28.9	–3.4	38.1	33.2
R ²	0.51	0.36	0.33	0.36	0.55	0.50	0.34	0.39
Observations	309	228	1692	2229	230	217	1628	2075

Note: Significant coefficients at the 5% level in bold.

Our results are in line with the findings of [Eveleth and Tanner \(1990\)](#), who, referring to the interaction between genes and environmental influences, arrive at the following conclusion: “Two geno-types which produce the same adult height under optimal environmental circumstances may produce different heights under circumstances of privation.”¹⁷ While it has yet to be determined whether there is a genetic basis to the height differences of indigenous people and those in the *others* category, it is safe to say that when the living conditions of those self-classified as indigenous improve, their average height also increases.

4.2. Econometric analysis of differences in stature using anthropometric information on parents

In the previous section we presented estimations that relate the living conditions of individuals in the five-year birth cohorts between 1965 and 1990 to the average heights of those cohorts. Given the significant impact on height of both genetic endowment and the socio-economic status of the household, we supplement those estimations by regressions that include the father's and mother's height as independent variables for the different ethnic groups ([Sahn and Alderman, 1997](#)).

As expected, potential growth is a function of inter-generational factors: not only the genes transmitted over the generations but also the living conditions of parents affect the growth of their children.

For technical reasons related to certain constraints at the survey level,¹⁸ the inclusion of parents' heights led to such a drastic reduction in the number of observations in the sample that we did not have a number sufficient for an over-30-years-of-age group.¹⁹

When the heights of both parents are included in the calculation, the R² of the regression increases to 0.4 for the population as a whole ([Table 4](#)). In other words, the origin and both the genetic background and the current quality of

life (the genotypes and the socio-economic conditions) of the parents are closely correlated with the biological quality of life of their children.

We compared the coefficients of the heights of both parents in each of the ethnic groups. In the *others* group an additional centimeter in the mother's height is correlated with an additional 0.4 cm for her offspring; in the indigenous and Afro-Colombian groups, the increase is 0.5 cm. As for the fathers, in the *others* and the indigenous groups one additional centimeter is correlated with 0.3 cm, in the Afro-Colombian group with 0.5 cm.²⁰

5. Conclusions

We analyzed the recent evolution of height among Colombia's three main ethnic groups. The average height of Colombians born between 1965 and 1990 increased steadily; the most recent cohort (1986–1990) is 2 cm taller than those born in 1965–1970. However, the height of each of the ethnic groups differs somewhat from this overall trend, with the group *others* enjoying greater than average-height increases than the other two groups (2 cm for men, and 1.9 cm for women) ([Table 1](#)).

Afro-Colombians were the tallest group and indigenous the shortest. While the height gap between Afro-Colombians and *Others* narrowed over the course of the period under study (to 2.7 cm and 1.9 cm for men and women, respectively), the one between Afro-Colombians and the indigenous group remained close to 6 cm.

The results also indicate that wealth (and, by extension, nutrition) is positively correlated with height: men and women at the top of the socio-economic pyramid were 3.6 and 2.5 cm taller, respectively, than those at the bottom. Although this situation can be generalized to all three ethnic groups, those in the indigenous group profited most from an improvement in their living conditions, and by extension their nutrition. Their upper-low income gap is 6.1 and 5.6 cm for women and men, respectively.

¹⁷ Cited by [Steckel \(1995\)](#).

¹⁸ It is only if both parents are present in the household – what was all too often not the case – that the heights of both of them can be established.

¹⁹ Because we were obliged to omit those variables for which we lacked observations, these results may be biased.

²⁰ These results are homogeneous for both men and women.

As expected, we found that the height of parents is the best predictors of their children's height: it accounts for 40% of the variation in height. Thus, there is no doubt that genes and living conditions directly affect human growth pattern.

The remarkable importance of our findings is the positive practical impact that it would have on public-health policy. Colombia should narrow the huge differences between the ethnic groups not only in height but also in wealth and income. The country's policy makers should implement a public health and nutrition-education programs and outreach programs adapted to the needs of each of the ethnic group. The evidence is sufficient to indicate that if Colombia does not have such focus policies

indigenous minorities would continue to lag behind others in the population.

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Appendix

	Ethnic classifications											
	Indigenous			Afrocolombian			Others			Total		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Panel A: regression analysis of the height of Colombian men												
Generations												
1965–1970 (g1)	0.0	–0.4	–0.1	–1.3	–1.1	–1.3	–2.0	–0.7	–2.0	–1.9	–0.8	–1.8
1971–1975 (g2)	–1.2	–5.1	–1.2	–0.8	0.4	–0.8	–1.7	–1.2	–1.6	–1.6	–1.1	–1.5
1976–1980 (g3)	0.3	0.5	0.3	–1.6	–1.6	–1.5	–1.0	1.5	–0.9	–1.0	0.8	–0.9
1981–1985 (g4)	–0.5	–1.8	–0.3	–1.0	–1.7	–1.0	–0.5	0.8	–0.4	–0.6	0.0	–0.5
1985–1990 (g5)	–	–	–	–	–	Reference	–	–	–	–	–	–
Quintiles of wealth												
Q1						Reference						
Q2				2.0		0.5			0.5			0.6
Q3				3.7		1.6			1.5			1.7
Q4				4.5		1.7			2.2			2.3
Q5				5.5		1.7			3.5			3.5
HSF												
Security (S1)	4.7	4.2		0.6	0.5		2.0	3.0		2.0	2.7	
Mild insecurity (S2)	3.2	1.4		0.1	0.8		0.8	1.8		0.9	1.6	
Moderate insecurity (S3)	3.4	2.7		–0.3	–0.7		0.6	2.1		0.7	1.6	
Severe insecurity (S4)	–	–		–	–		–	–		Reference	–	–
Afro-Colombians												
Indigenous										Reference	–	–
Others										–5.9	–5.9	–5.5
Constant	161.2	162.1	163.1	171.3	171.2	170.7	168.2	167.2	168.0	170.3	169.5	170.2
Interactions	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No
R ²	0.03	0.03	0.06	0.01	0.02	0.02	0.02	0.02	0.05	0.04	0.04	0.07
Observations		2714			2977			19682		25373		
Panel B. Regression analysis of the height of Colombian women												
Generations												
1965–1970 (G1)	–1.4	0.7	–1.8	–1.2	1.0	–1.3	–1.9	–1.5	–2.0	–1.8	–0.7	–1.9
1971–1975 (G2)	–0.4	0.2	–0.6	–1.0	–1.6	–1.0	–1.5	–3.3	–1.5	–1.4	–2.5	–1.4
1976–1980 (G3)	–0.9	–0.7	–1.2	–0.8	1.7	–0.8	–1.3	–2.7	–1.3	–1.2	–1.6	–1.3
1981–1985 (G4)	–0.5	0.3	–0.6	–0.5	0.6	–0.4	–0.5	0.3	–0.4	–0.5	0.4	–0.5
1985–1990 (G5)	–	–	–	–	–	Reference	–	–	–	–	–	–
Quintiles of wealth												
Q1						Reference						
Q2				1.8		–0.1			0.6			0.6
Q3				2.7		0.6			1.3			1.3
Q4				4.2		1.0			1.8			1.8
Q5				6.2		1.6			2.6			2.6
HSF												
Security (S1)	2.4	3.4		0.8	2.0		1.5	1.2		1.4	1.7	
Mild insecurity (S2)	0.9	2.1		0.7	2.0		0.8	0.3		0.8	0.9	
Moderate insecurity (S3)	0.5	0.9		0.8	1.1		0.7	0.0		0.7	0.4	
Severe insecurity (S4)	–	–		–	–		–	–		Reference	–	–
Afro-Colombians												
Indigenous										Reference	–	–
Others										–5.9	–5.9	–5.6
Constant	151.5	150.6	151.5	158.1	157.1	158.3	155.6	155.9	155.4	158.1	157.9	158.1

Appendix (Continued)

	Ethnic classifications											
	Indigenous			Afrocolombian			Others			Total		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Interactions	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No
R^2	0.02	0.03	0.08	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.05	0.06
Observations		3280			3891			27189				

Notes: Significant coefficients at the 5% level in bold.

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