

DESCENDANT' STATURES AS DETERMINED BY SEX DIFFERENCES APPEARING IN PARENTS' STATURES?

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Abstract: The authors examined the above question in a relatively endogamous "small population" of a village in Northeastern Hungary, called Turrice. Altogether 155 adult males and 199 adult females (all above the age of 18 years) were involved in the analyses, which represented the 62.5 and 70.1 percents of adult population, respectively. Standardization according to age were accomplished by linear regression after a preliminary testing.

According to the results in father-sibling (son or daughter) correlation the greater was the sexual difference between the parents the smaller was the sibling's body height. Relating to the mother the direction of the above correlation was just the opposite. The influence of sexual difference is opposite in direction but balanced in dimension in both sexes. However, the question of to what extent the distribution of the siblings' statures depend on the distribution of the parents' sexual differences in samples differing from the examined in inbreeding is still open.

Key words: Inheritance of stature; Parents-siblings correlations; Sex difference.

Introduction

It was Galton (1889) who first published the results of his researches on the manifestation of stature in adult age and its genetic backgrounds.

The degree of the influence of environmental factors has not been fixed yet unambiguously in spite of the knowledge of a good few standard works of reference (Dahlberg, 1926; Lentz, 1935; Rieman, 1938; Werner, 1938; Ito, 1948; Vogel and Wendt, 1956).

Investigations related to the inheritance of stature can be assorted according to certain standpoints of approach (Knußmann, 1968). These cover partly twin-examinations (Verschuer, 1951; Csík and Apor, 1936; Osborn and de George, 1959; Kimura, 1956), partly analyses of stature-correlations of parents and siblings (Pearson and Lee, 1903; Finney, 1939; Tanner and Israelsohn, 1963; Bieliczki and Welon, 1966). Another respect of investigations like these was established by Gates' family-examinations (1949).

In the field of statistical comparative analyses Garn's basic experiments (1962) opened up new vistas in the history of researches.

The present paper attempts to analyse such a new aspect of the question, which, as far as we know, has no traditions in the history of the science. Namely, we attempt to analyse the question of whether the difference in parents' statures influences the body height of their descendants (sons and daughters).

Material and Method

We carried out our examinations on a small and relatively endogamous population on the basis of data measured in 1971. This settlement is sited in Northeastern-Hungary

(Szabolcs-Szatmár-Bereg county) and belongs to the category of the so-called "small populations". The distribution of population and sampling is shown in *Table 1*.

Table 1. Number of inhabitants in Turricse population (Census 1970) and sampling

	Total population in Turricse 863	
	Male 425	Female 438
Individuals above 18 years of the total sample:	248	284
Individuals (above 18 years) examined:	155 (62.5%)	199 (70.1%)

It is a fact of common knowledge that stature largely depends on the age of the individual. Consequently, first we tested the distributions of the total samples, then determined the linear regressions most characteristic of the distributions. In this way we could evaluate data comprehending two generations at least.

As a result of measuring the 155 males it could be established that body height above the age of 18 years decreased significantly according to the age on the level $p < 0.001$ ($y = -0.151x + 172.76$; $r = 0.398$). The same could be experienced in the case of the 199 examined females ($p < 0.001$; $y = -0.142x + 159.79$; $r = 0.398$).

Thus, according to the regression determined on the basis of the total sample it became obvious that for further examinations the statures of each individuals should be standardized with reference to an optional age. This was fixed at 18 years of age as this was the lowest age-limit for sampling. However, standardization was not accomplished in the case of each individual, instead those individuals above the age of 18 (that is, 33 sons and 35 daughters) were chosen from the total sample whose parents' body heights both were known.

In this way we were able to examine father-son, father-daughter, mother-son and mother-daughter stature-pairs taken as functions of the differences of the parents' statures owing to their sexual differences.

In order to standardize for the age of 18 years, linear regression was first corrected on the basis of stature-decrease characteristic of the whole population.

Males:

$$y = -0.151 X + 172.76$$

$$y^{18} = -2.72 + 172.76 = 170.04$$

-0.151×18

Females:

$$y = -0.142 X + 159.79$$

$$y^{18} = -2.56 + 159.79 = 157.23$$

-0.142×18

where X = years.

In the course of this, besides the establishment of the constant values, we could determine, taking the age into consideration, the distance of the parents and their sons, daughters taking part in the present concrete analysis on the basis of the total sample, applying the following formulas:

$$D_y = y_r - y_o$$

where y_r = stature at a certain age estimated by the regression line of the total sample;
 y_o = original stature measured at a certain age.

$$y^x_{\text{stand}} = y^{18} - D_y$$

$$\text{Males: } y^x_{\text{stand}} = 170.04 \quad (-0.151 X + 172.76) - y_o$$

$$\text{Females: } y^x_{\text{stand}} = 157.23 \quad (-0.142 X + 159.79) - y_o$$

where X = years.

This standardization was therefore realized in each of the parent-sibling pairs.

Results

In the case of a father-son relation, the greater is sexual difference in stature between the two parents, the smaller is the son's body height, related to his father's stature. On the other hand, the less sexual difference in stature is, the more the son's stature will surpass the father's body height. This correlation looks very significant in the demonstrated linear regression (*Fig. 1*).

There seems to be a similar correlation in father-daughter relation, however, there are only a few cases known with values above 100 percent. The greater the sexual difference in stature is, the smaller the daughter's stature will be compared to her father's height. This correlation is also considerably significant (*Fig. 2*).

Relating to the mother the direction of the above correlation is just the opposite. In our sample the stature of the son surpasses that of the mother in each of the cases. The greater the sexual difference in stature is, the taller the sons relatively will be. Regression is significant in these cases, as well (*Fig. 3*).

The correlation of mother and daughter is also similar. The less the sexual difference in the parents' statures is, the smaller stature the daughter will have and the greater the sexual difference is, the more the daughter surpasses her mother's height. A significant correlation could be observed in this case, as well (*Fig. 4*).

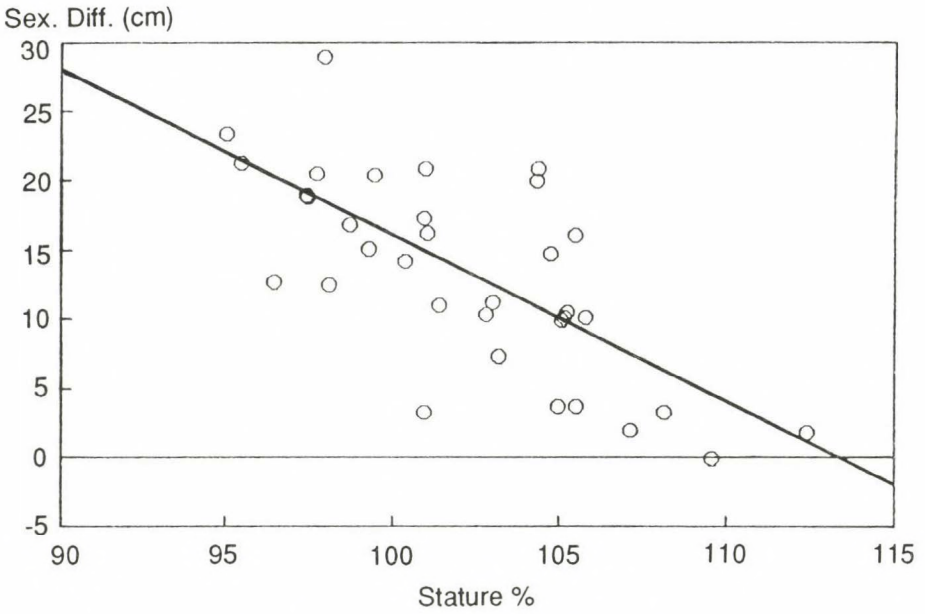


Fig. 1: Father—son correlation ($r = 0.685$; $P < 0.001$)

In all of our next figures the x-axis represents the descendants', sons' and daughters' standardized body height in the percentage of one of the parents' standardized statures. In Figure 2, for example the stature of the son is referred to that of the father. While the y-axis represents the difference between the standardized statures of the two parents, that is, the sexual difference in stature

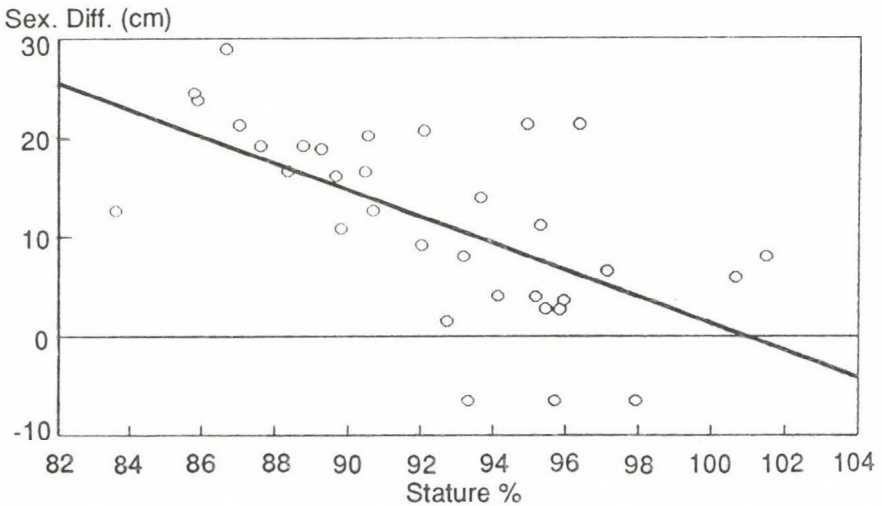


Fig. 2: Father—daughter correlation ($r = 0.624$; $P < 0.001$)

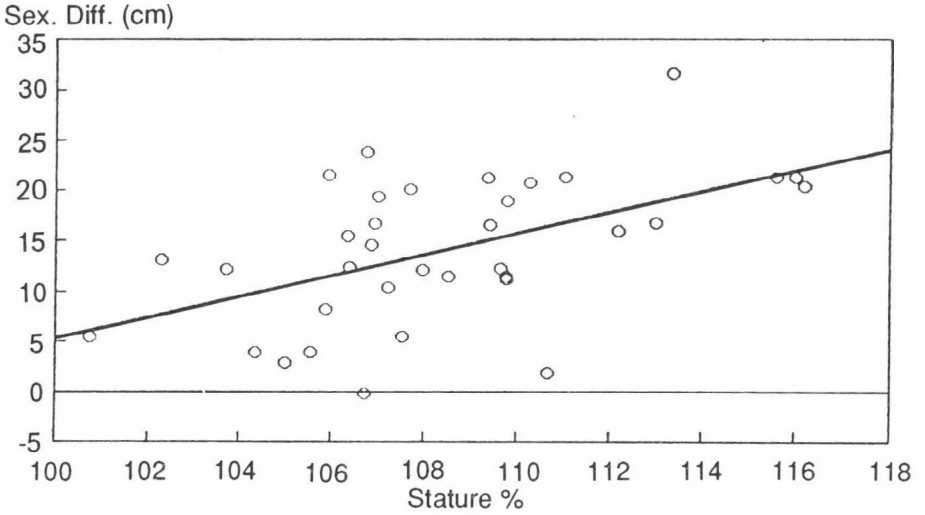


Fig. 3: Mother-son correlation ($r = 0.519$; $P < 0.001$)

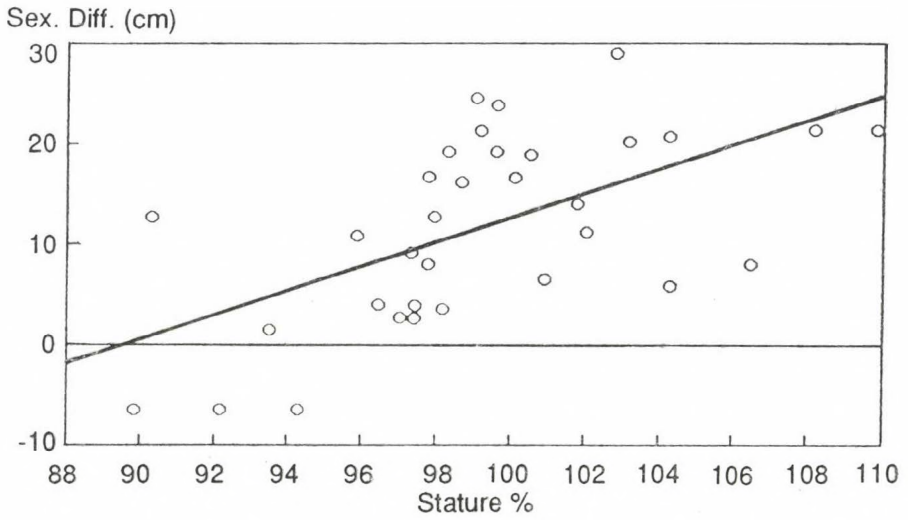
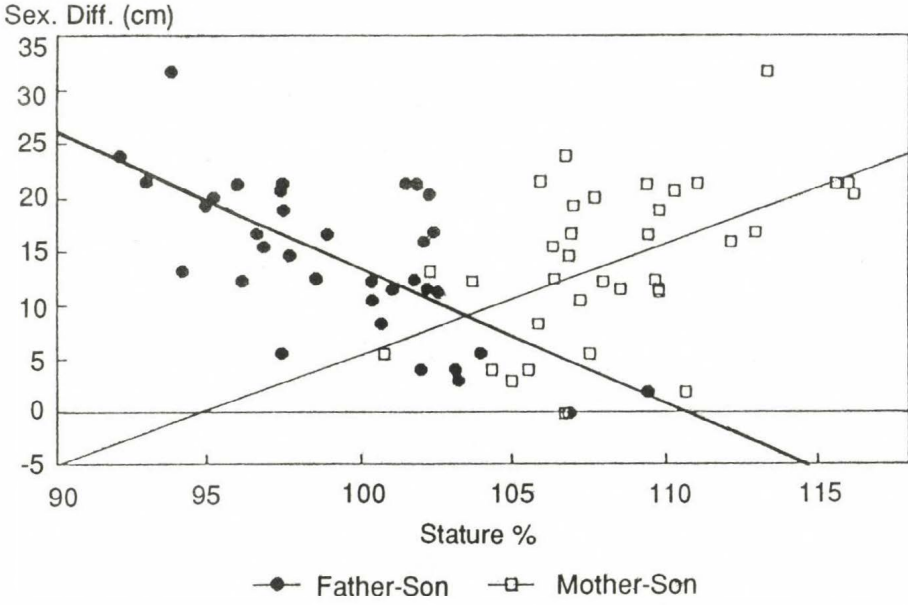


Fig. 4: Mother-daughter correlation ($r = 0.585$; $P < 0.001$)

Males



Females

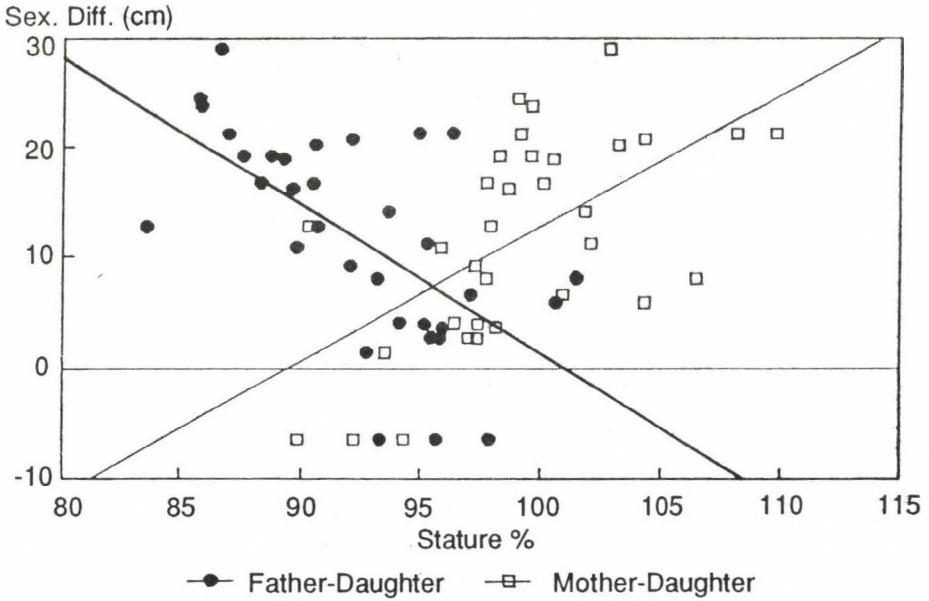


Fig. 5: A summary of tendencies comparing the two sexes

The correlations discovered above represent (through some sort of inside-machinery) the manifestations of the siblings' generational stature, taken as functions of sexual difference, which can be interpreted within a relatively endogamous population. This inside-machinery can be illustrated better in the summary of *Figure 5*. In the figure the points of intersection of the two lines in the case of the two sexes differ proportionally. Projecting these onto the x-axis, they show about 104 percent in males and about 96 percent in females. As the distances from the 100 percent in the cases of the two sexes are similar in measure but opposite in direction it seems that the factors behind this sexual difference become balanced.

Furthermore it is suggested that the distribution of the parents' sexual differences in stature may considerably influence the siblings' stature-distribution.

On the basis of this discovery quite a few further series of research work can be initiated. First that should be examined to what extent the regularities we have newly realized can be confirmed in populations of different inbreedings. Furthermore in selective (extreme) samples it should be analysed how these newly discovered tendencies work.

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