

Growth and Physical Development of Primary Schoolchildren in Etimesğut, Turkey

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Observations on the rate of growth and development of children have been made by many authors in recent years. Greulich,¹ in 1958, investigated the growth of children of the same race under different environmental conditions; Mellbin,² in 1962, reported a study of the health, growth and development of the children of Swedish nomad Lapps; and Köksal and Yilmazsoy³ studied the growth rates of preschool children in Bursa, Turkey.

The aim of this investigation is to study the growth and physical development of children in the primary schools in the Etimesğut rural area and to evaluate the influence of nutritional and environmental factors.

Background

Etimesğut Health Center lies 22 km west of Ankara and is connected by several roads to Ankara, Istanbul and other large cities in the

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vicinity. The climate of this area is typical of Central Anatolia, hot in summer and cold in winter. The population is listed as 6,948 : 3,480 males and 3,468 females.

Health services are nationalized in Etimesğut. This is a pilot area including a population of about 50,000, the whole of which is divided into seven health districts; the headquarters of this organization is located in Etimesğut.

In Etimesğut there are two primary schools and one secondary school. The total number of students in the primary schools is 1163 (598 boys and 565 girls) the majority aged 7 to 14 years with a few children aged 6 and 15 years. The children of these schools receive a general medical examination periodically and each is vaccinated for tuberculosis, smallpox diphtheria, tetanus and typhoid.

Materials and Methods

This investigation was carried out from March through May, 1968. A total of 1,152 primary schoolchildren (592 boys and 560 girls) were examined clinically and height and weight were measured. Eleven children who did not attend school regularly during this period were excluded from the study. All children were weighed and measured without shoes and dressed only in underwear using balance scales which had an attached device for measuring height.

Findings and Results

The number of children per family varied between one and twelve, an average of 3.7 children per family (Figure 1).

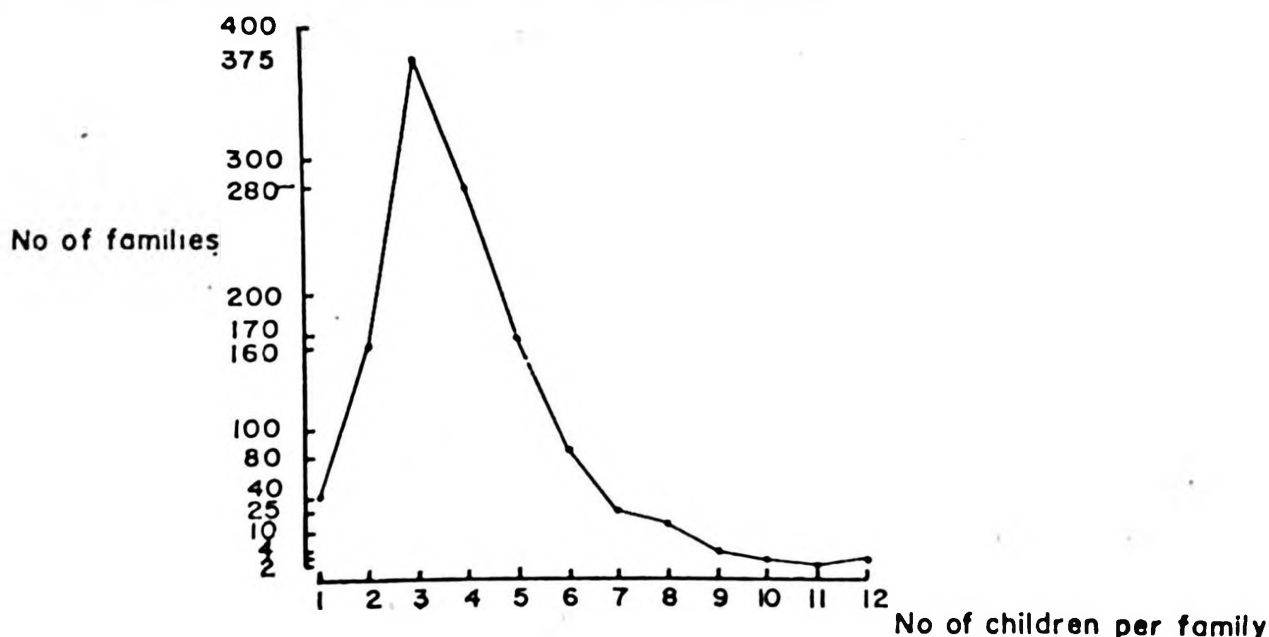


Figure 1. Distribution of families according to number of children per family

Illiteracy was found to be 15 per cent among the mothers. Fifty-five per cent of the fathers and 12 per cent of the mothers had had a secondary education. The occupations of the fathers were as follows: workers, 59 per cent; farmers, 5.5 per cent; professionals, 6 per cent; clerks, 25 per cent; unemployed, 4.5 per cent. Eleven of the children had no father. Seventy-nine per cent of the families had radios, 75 per cent carpets, 66 per cent butane gas, 54 per cent sewing machines and 23 per cent refrigerators.

Table 1 shows the mean height and mean weight standard deviation at one year intervals for boys and girls between 7 and 14 years of age in the Etimesğut primary schools. In this calculation we have considered all the fractions over 0.5 as one and the fractions under 0.5 as zero (152.7 cm is given as 153.0 cm and 25.4 kg as 25.0 kg).

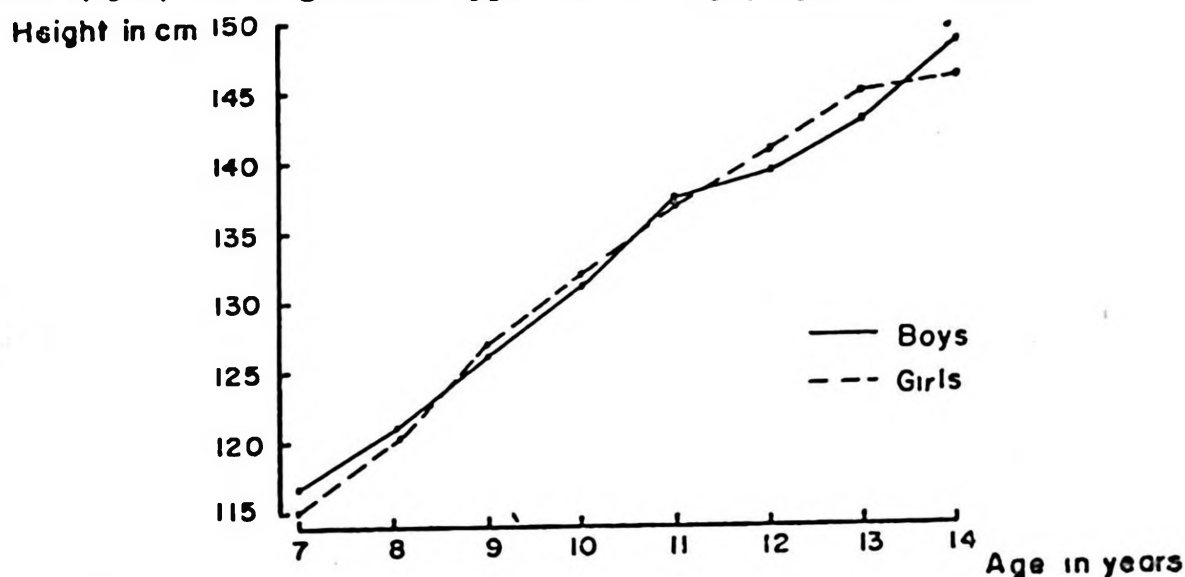


Figure 2. Body height in relation to age for Etimesğut boys and girls.

Figure 2 shows the curves for height development of the Etimesğut schoolchildren in relation to their age, weight in relation to age (Figure 3) and weight in relation to height (Figure 4).

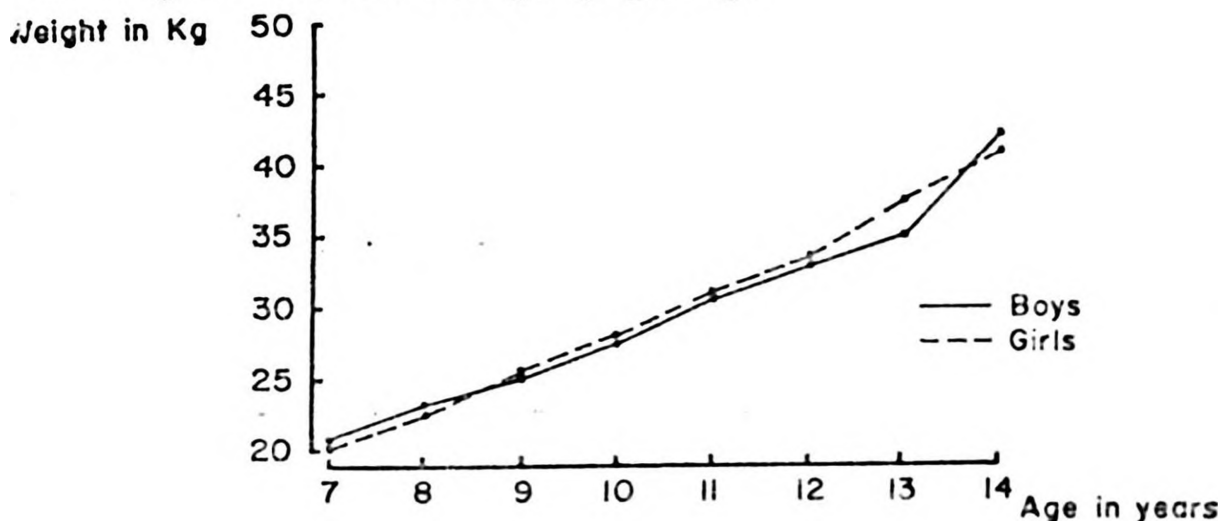


Figure 3. Body weight in relation to age for Etimesğut boys and girls.

TABLE I
MEAN HEIGHT AND WEIGHT OF ETİMESĞÜT
PRIMARY SCHOOLCHILDREN

Age (years)	Boys					Girls				
	No.	Mean- Height (cm)	S.D.	Mean Weight (Kg)	S.D.	No.	Mean Height (cm)	S.D.	Mean Weight (Kg)	S.D.
6-7	88	116.9	6.1	20.8	3.2	72	115.1	5.0	20.3	2.5
8	129	121.2	4.9	23.3	3.0	121	120.6	4.4	22.5	2.7
9	111	125.9	4.9	25.1	4.2	90	127.0	5.4	25.6	3.7
10	99	131.3	5.1	27.5	3.2	104	132.1	6.1	28.1	4.2
11	76	137.3	5.4	30.7	4.2	100	137.0	7.5	30.9	5.9
12	56	139.3	5.7	32.9	5.2	39	141.7	8.5	33.4	7.6
13	25	143.0	6.5	35.1	4.7	24	145.0	7.4	37.5	6.6
14	13	148.5	11.0	42.3	9.9	10	145.8	8.4	41.2	9.0

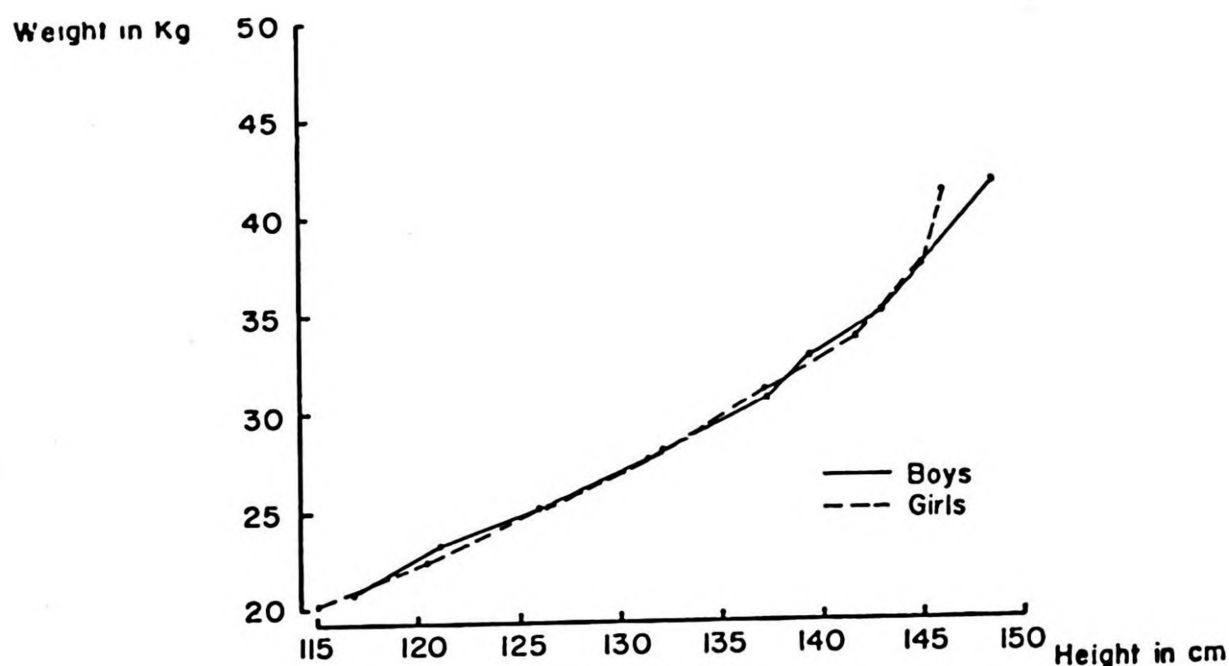


Figure 4. Body weight in relation to height for Etimesgut boys and girls.

TABLE 2

PATHOLOGIC FINDINGS ON PHYSICAL EXAMINATION
OF THE 1,152 SCHOOLCHILDREN

Finding	Number affected	Sex	Per cent
Congenital hip dislocation	3	female	0.26
Scoliosis	1	male	0.08
Congenital heart disease	1	female	0.08
Slight heart murmur	3	male	0.26
Pallor (anemia)	8	male	0.69
		female	
Stomatitis	66	male	5.70
		female	1
Dry skin	7	male	0.60
		female	
Acne	1	female	0.08
Inguinal hernia	1	male	0.08
Umbilical hernia	2	female	0.17
Paraplegia	2	male	0.17
		female	

Table 2 shows the pathologic findings on physical examination. The results of examination of the tonsils are shown in Table 3. Enlarged tonsils were found in 25.6 per cent of the boys and 25.5 per cent of the girls. The incidence of tonsillectomy was 3 per cent among boys and 4 per cent among girls.

TABLE 3
RESULTS OF TONSILLAR EXAMINATION

Condition of tonsils	Boys		Girls	
	Number	Per cent	Number	Per cent
Normal	422	71.4	394	70.5
Enlarged	152	25.6	143	25.5
Surgically removed	18	3.0	23	4.0
Total	592	100.0	560	100.0

Table 4 indicates the condition of the teeth of the schoolchildren examined. The percentage of children having dental caries was 37.3 in boys and 38.9 in girls. The average number of decayed, missing, filled (DMF) teeth per child was 2.1 in boys and 1.8 in girls.

TABLE 4
CONDITION OF TEETH

DMF. Teeth	Boys		Girls	
	Number	Per cent	Number	Per cent
DMF. —	371	62.7	342	61.1
DMF. +	221	37.3	218	38.9
Average per child	2.1	—	1.8	—
Total	592	100.0	560	100.0

During the investigation, refraction tests were carried out at a distance of five meters with an ordinary letter chart.⁴ All of the children were examined except 15 (13 girls and 2 boys) in the first and second class who did not co-operate. Table 5 shows the results of this examination.

Discussion

Growth and physical development are the results of a combination of four factors: genetic, hormonal, nutritional and environmental. We have tried to ascertain the influence of nutritional and environmental factors on the growth and development of the primary schoolchildren in the Etimesgut area. Protein is essential for body growth, while fat and carbohydrates are the main source of energy.^{5 6} Holt and Fales⁷ have recommended that two thirds of the protein intake in children be given in the form of animal protein. It is known that the deficiency of this nutritional factor leads to retardation of body weight and height.⁸

TABLE 5
RESULTS OF EYE-SIGHT TEST

	Boys	Girls	Boys and Girls
Vision of children aged 7-10 years:			
Normal	377	326	703
Diminished in one eye	27	22	49
Diminished in both eyes	16	26	42
Total (7-10)	420	374	794
Vision of children aged 11-14 years			
Normal	146	140	286
Diminished in one eye	15	15	30
Diminished in both eyes	9	18	27
Total (7-14)	590	547	1,137

There is dispute as to whether geographic variations have an effect on growth. Mills⁹ has stated that children living in tropical regions show retarded growth and consequently an inferior adult size. The observations of Ellis¹⁰ and Tanner¹¹ support the fact that climate has little effect on adolescent development and on height and weight. Socio-economic factors are of great importance in determining the physical status of children. The rate of growth of children whose parents were unemployed was found to be inferior to that of the children with one employed parent.¹² Recent studies have shown a general trend toward increase in the height and weight of people in all civilized countries, this trend being most striking in schoolchildren.⁵

Nutritional conditions in Etimesğut have been investigated by several authors. The percentage of infants receiving supplementary food in the form of cow's milk and solid food in the villages around Ankara, including Etimesğut, was as follows:¹³ in the first month, 10 per cent; 3 to 4 months, 4 per cent; 5 to 7 months, 41 per cent; 8 to 10 months, 23 per cent; and 11 to 12 months, 22 per cent. Köksal,¹⁴ in 1968, reported calorie deficiency in up to 18 per cent; animal protein deficiency in approximately 37 per cent, vitamin A deficiency in 24 per cent; vitamin C deficiency in 6 per

cent; less than the required amount of riboflavin in 39 per cent and less than the required amount of calcium in 6 per cent.

The socio-economic level in Etimesğut was reflected by the average family size (Figure 1), the father's occupation and the presence of some modern facilities in the home.

Our study has shown that the 7-to 9-year-old Etimesğut boys were taller than the girls of the same age (Figure 2). The difference was about 1.8 cm at age 7, dropping to 0.6 cm at age 8. After that, the height of the girls slightly exceeded that of the boys (1.1 cm at age 9 and 0.8 cm at age 10) until boys and girls reached the same level at age 11. Between 11 and 13 the height development of the girls was accelerated and was ahead of that of the boys, this acceleration being attributed to the earlier puberty in girls.² At age 14 the boys again exceeded the girls in height.

Comparison of the weight development of the Etimesğut schoolboys and schoolgirls (Figure 3) showed the boys to be heavier than the girls until age 8 1/2 years. After that the girls weighed slightly more, reaching a maximum variation between the sexes at age 13 (2.4 kg). At age 14 the boys were again heavier, coinciding with the height development (Figure 4).

Unfortunately there are no tables of normal height and weight for Turkish children with which to compare our results. However, Köksal,^{3 14} reported standard heights and weights for Turkish children up to the age of 11 from a survey he made in Bursa on the growth rate of children from 0 to 4 years of age. He obtained a mean height and weight for children aged 6 to 11 years by adding 5 cm to the height and 10 per cent to the weight for every year of age. In Figures 5 and 6, the height of Etimesğut children is compared with the Turkish Standard for boys and girls up to 11 years of age¹¹ and with rural Haitian, Iowan and Egyptian school-children.¹⁵⁻¹⁷ It is interesting to note that the average height of the Etimesğut children exceeded the Turkish Standard at every age. This clearly indicates that to obtain a standard measurement of height and weight one must survey different parts of the country using the same method and scale. The Etimesğut children were taller than Haitian children (except Haitian girls aged 12 to 14 years, who exceeded Etimesğut girls in height), but shorter than American children. This suggests a growth retardation in the Etimesğut children, which may be to a great extent the result of poor nutrition and the lower socio-economic level. It also reflects the lower protein intake and calorie deficiency found in this area.¹⁴ The height curve for Etimesğut boys and girls coincided approximately with that for Egyptian boys and girls up to the age of 12 years for boys and 13 years for girls, possibly reflecting similar nutritional and socio-economic

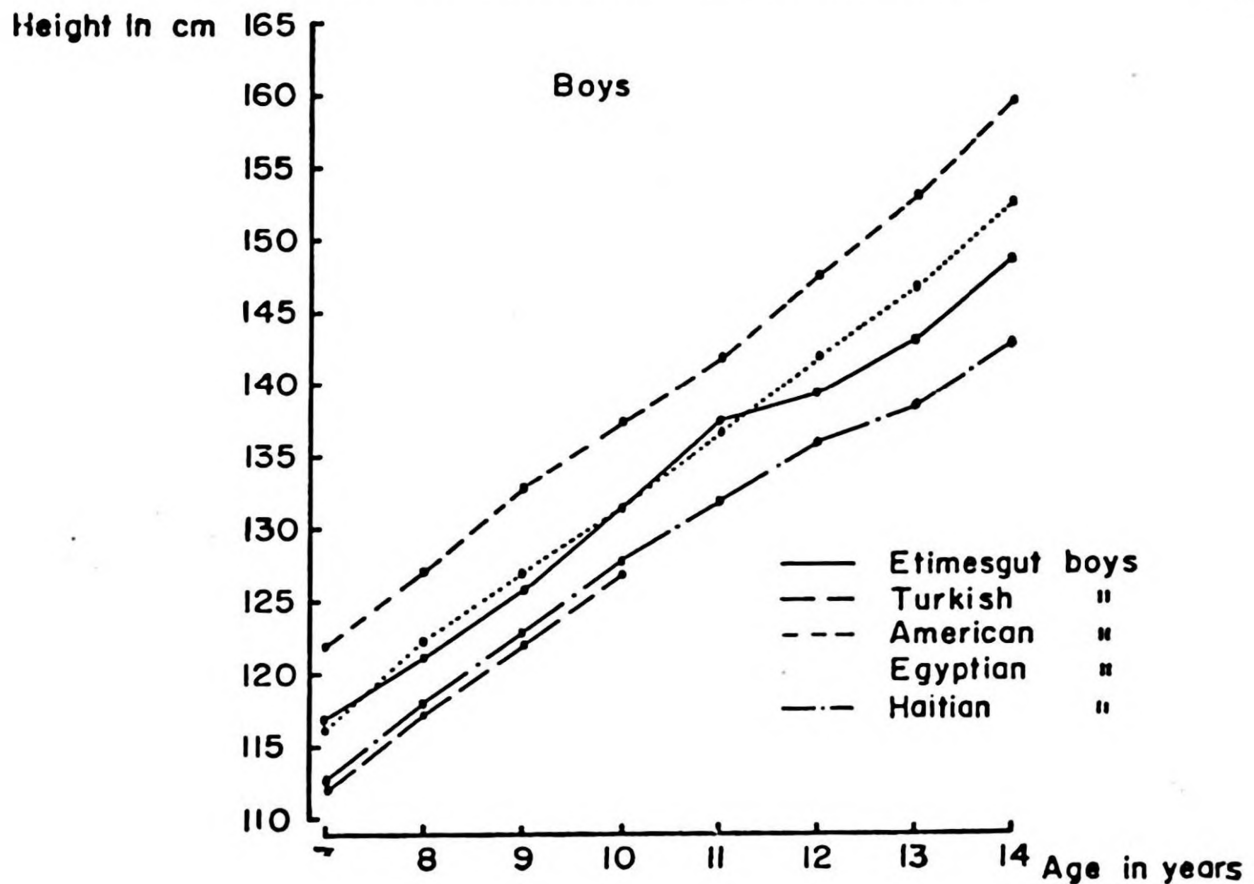


Figure 5. Comparison of height development of Etimesgut boys with Turkish, American, Egyptian and Haitian boys.

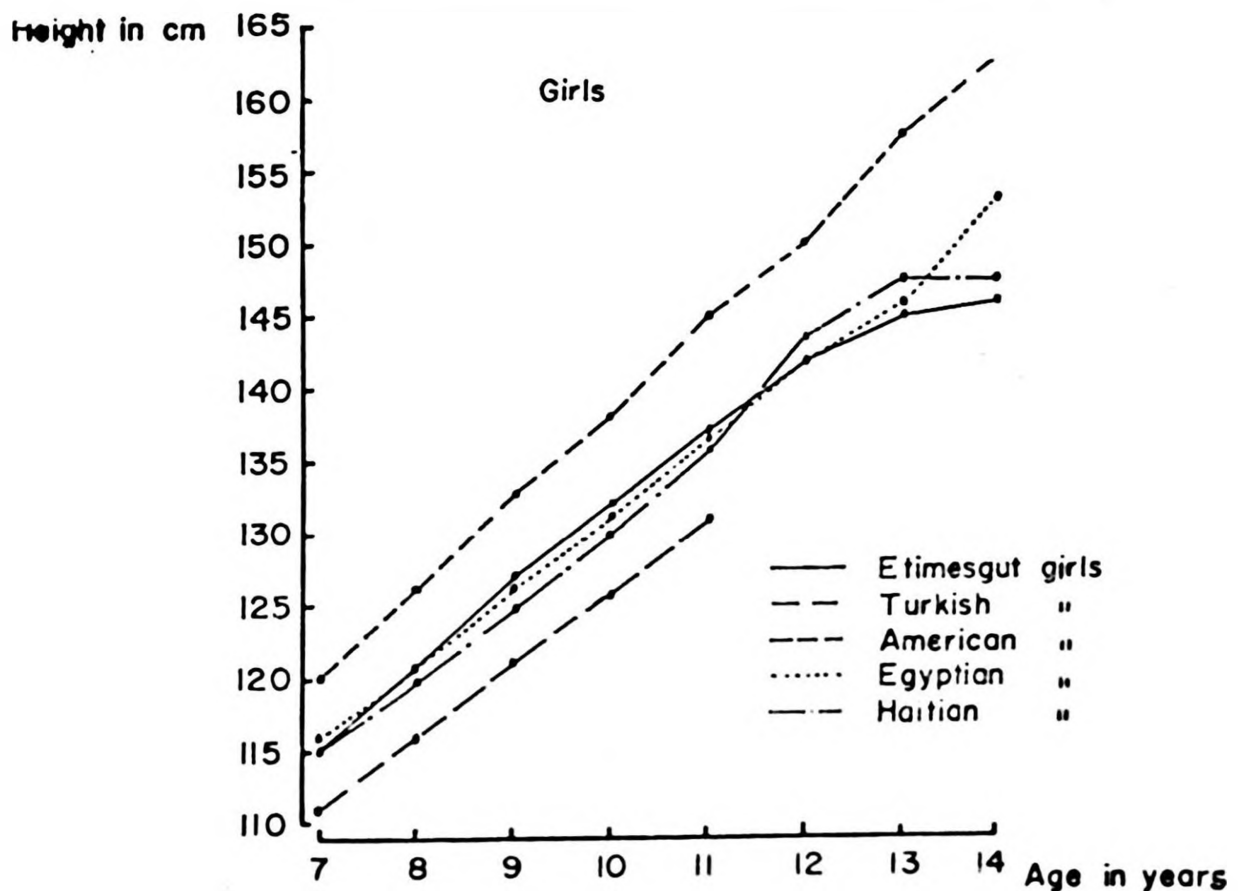


Figure 6. Comparison of height development of Etimesgut girls with Turkish, American, Egyptian and Haitian girls.

conditions until puberty when the influence of genetics and hormones starts to appear.

When the average weight of Etimesğut boys and girls was compared with the Turkish Standard and the Iowan, Egyptian and Haitian school-children (Figures 7 and 8), the weight of Etimesğut boys completely

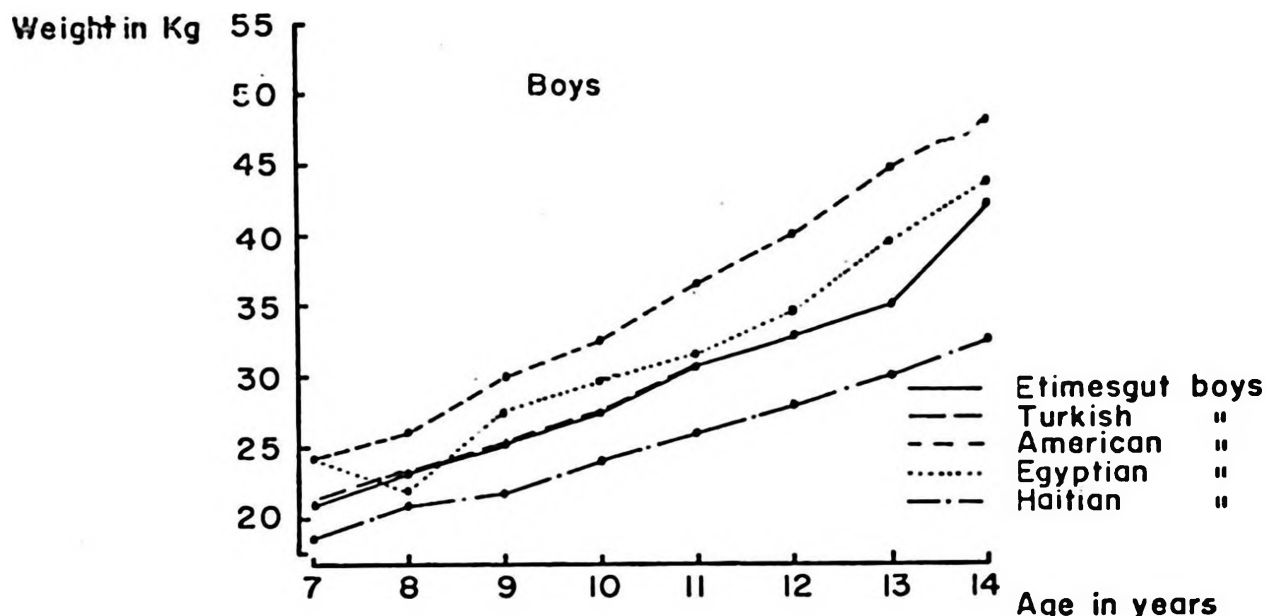


Figure 7. Comparison of weight development of Etimesğut boys with Turkish, American, Egyptian and Haitian boys.

coincided with the Turkish Standard and was higher than that of the Haitian boys, while the weight of the Etimesğut girls was slightly higher than that of both the Turkish Standard and Haitian girls. The American boys and

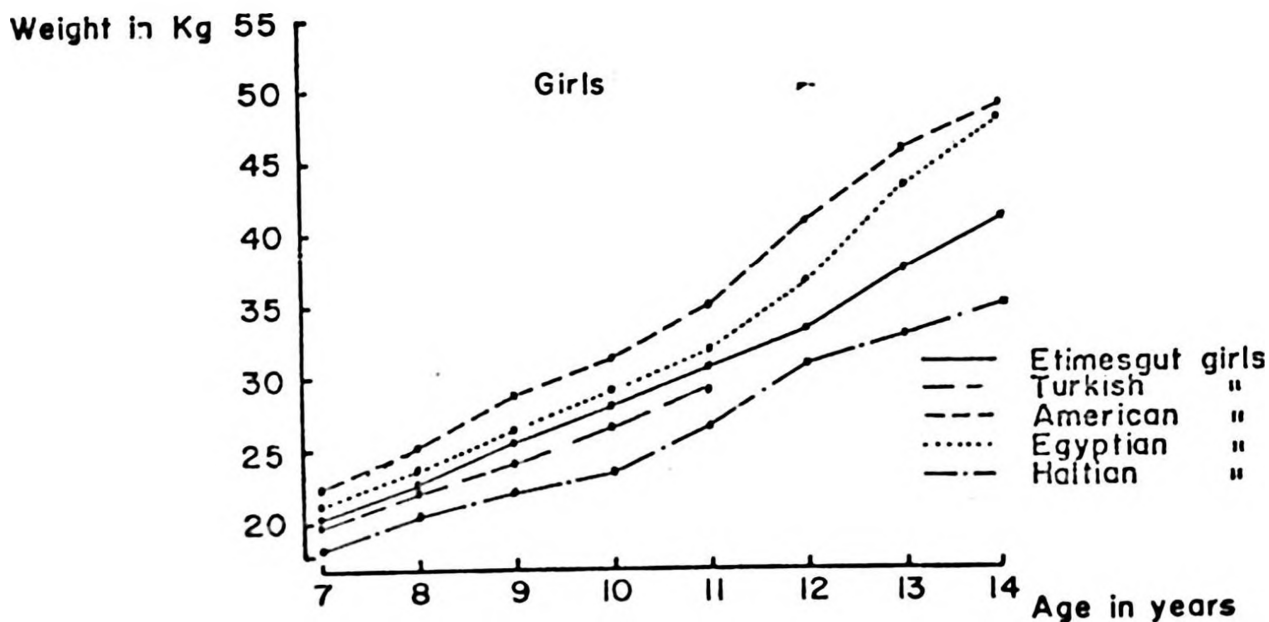


Figure 8. Comparison of weight development of Etimesğut girls with Turkish, American, Egyptian and Haitian girls.

girls were heavier than the Etimesğut boys and girls at every age. Also, the Egyptian children weighed a little more than the Etimesğut children, with the exception of 8-year-old Egyptian boys who weighed less than Etimesğut boys of the same age.

When weight development was calculated in relation to body height (Figures 9 and 10), Etimesğut children were heavier than the Haitian children at every age, perhaps due to the low nutrition and socio-economic levels in the Haitian rural area. Our group weighed slightly less than American and Egyptian children at some ages and slightly more than them at other ages. This shows that factors which influence body growth affect height and weight development to approximately the same degree.

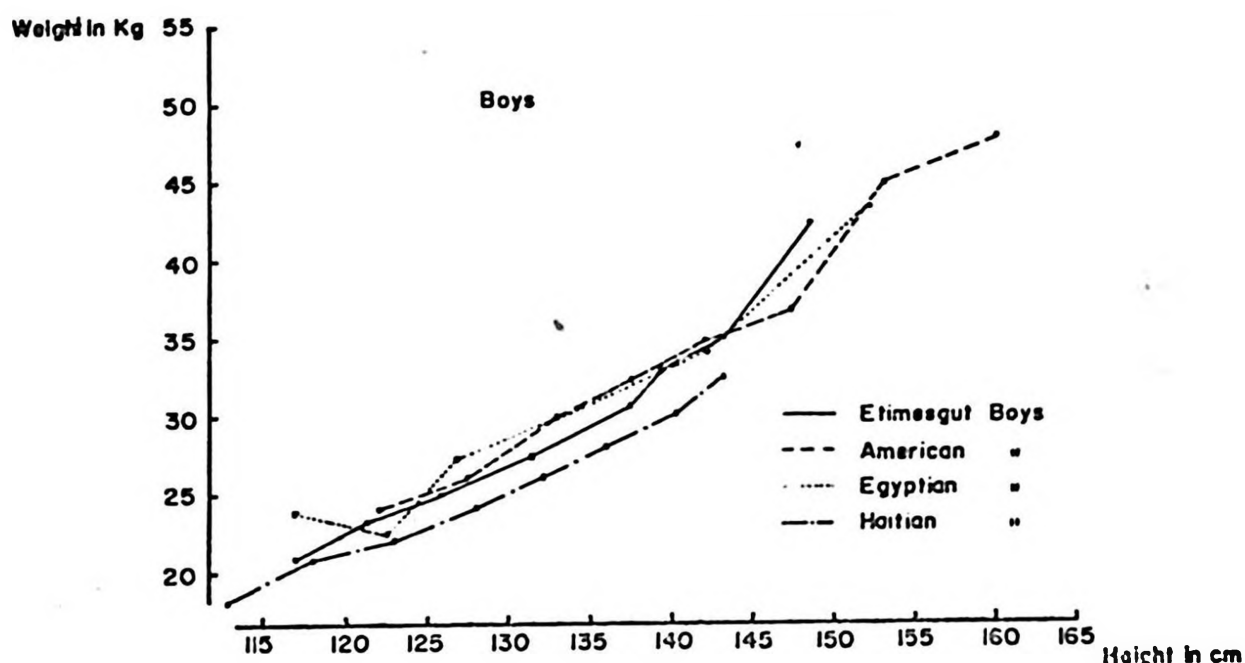


Figure 9. Comparison of weight in relation to height of Etimesğut boys with American, Egyptian and Haitian boys.

The incidence of angular stomatitis was high, 5.7 per cent, reflecting the previously reported inadequate intake of riboflavin.¹⁴ Enlarged tonsils were present to a relatively high degree in both sexes, 25.6 per cent in boys and 25.5 per cent in girls (Table 3). Enlarged tonsils are not unusual in children, as hypertrophy of the tonsils may be physiologic in character and not necessarily the result of chronic inflammation.¹⁸ Such hypertrophy also may be hereditary and often occurs at 4 to 5 years of age with subsequent regression at the time of puberty.¹⁸

The rate of dental caries in the Etimesğut schoolchildren aged 7 to 14 years (Table 4) was 37.3 per cent for boys and 38.9 per cent for girls, less than that of British schoolchildren.¹⁹ The percentage of British schoolchildren showing DMF was 87.8 in the 5-year-old age group and 95 in

the 12-year-old group, and the average number of decayed teeth 5.7 for the 5-year-olds and 5.5 for the 12-year-olds. In Etimesğut the average number of decayed teeth was 1.2 for the boys and 1.8 for girls aged 7 to 14. This difference may be due to the diet of the British children; however, dental caries are still rampant in children of all ages. The reported percentage of school-age children showing evidence of caries varied from 20 to 100 per cent.²⁰ Dental caries are generally regarded as an indication of a poor nutritional status²⁰ and the biggest factor contributing to tooth decay is excessive ingestion of sticky, refined carbohydrates between meals.

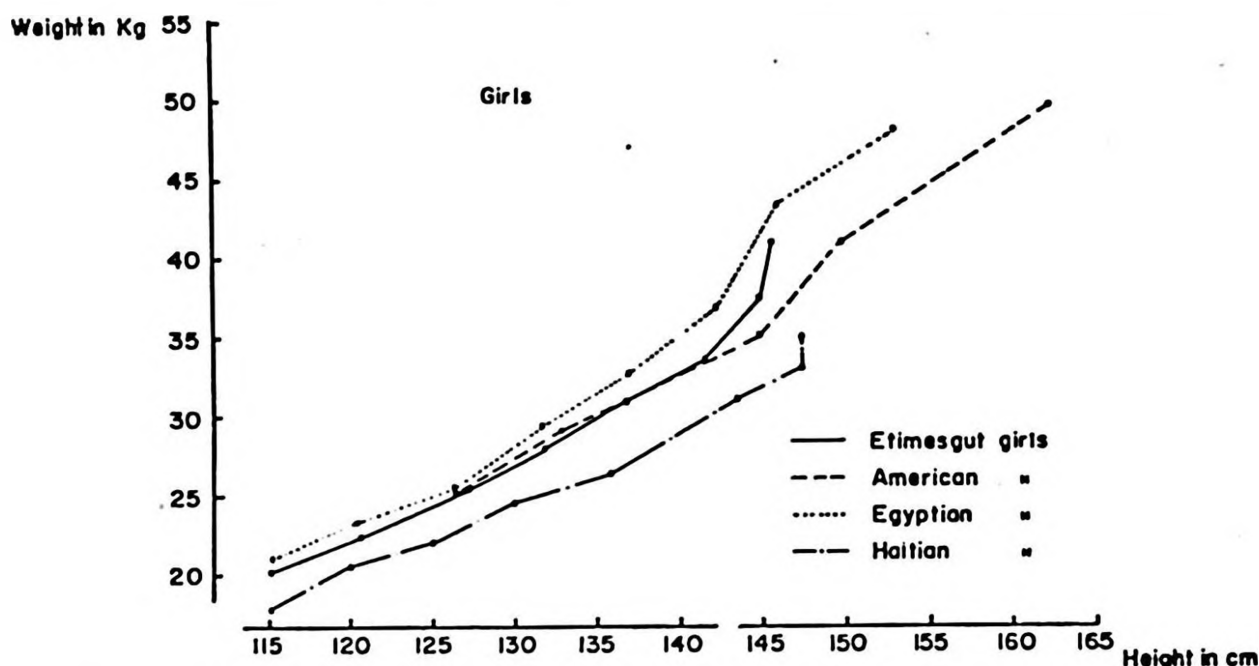


Figure 10. Comparison of weight in relation to height of Etimesğut girls with American, Egyptian and Haitian girls.

It has been noted that there was little or no increase in caries if extra sugar was consumed in liquid form, i.e. in tea. When sugar was consumed as chocolate between meals, there was a moderate increase in caries. The greatest increase occurred in those patients who received caramels and toffees between meals.¹⁹ There is ample evidence that a reduction in dental caries of up to 60 per cent can be achieved in communities with fluoride-deficient water supplies by adjusting the fluoride concentration to one part per million. Analysis of Etimesğut water revealed about 0.65 mg per liter of fluoride, which may have had some effect on the low prevalence of dental caries in this area.

Table 5 shows that the incidence of impaired vision in one or both eyes in the 11 to 14-year-old Etimesğut children is higher than that of the 7 to 10-year olds (10.2 per cent in boys aged 7 to 10 rose to 14 per cent at age 11 to 14). A difference was noted also between the sexes, 2.8 per cent in the younger group increasing to 5 per cent in the older group.

A comparison of this result with the impaired vision of Swedish nomad Lapp children² shows that the latter are greater in number in the two age groups (17 per cent at 6 to 11 years in Swedish nomad Lapps rising to 28 per cent at age 12 to 15). Since there is no ophthalmic department in the regional hospital in Etimesğut, the causes of vision disturbance were not investigated, except that two children had clinically diagnosed cataracts. If we consider most of the cases of impaired vision to be caused by refraction error, especially myopia, our study group corresponds with those in the literature, since all studies of refraction in children show a difference between girls and boys, both groups having similar changes, but the changes tending to occur two to three years earlier in girls. This phenomenon was observed by Hirsch,²² who, when considering the percentage of boys and girls who had myopia at each age, found that the incidence of myopia is roughly similar in girls of ten years old and boys of 13. There was a marked increase in the number of myopic girls, while the boys showed only a slight increase. He suggested some relationship between the onset of puberty and the development of myopia.

Summary

The growth and physical development of primary schoolchildren in Etimesğut, Turkey, were investigated through physical examination and measurement of height and weight. The mean height and weight of the Etimesğut children are compared with the Turkish Standard, American, Egyptian and Haitian schoolchildren. The Etimesğut boys and girls were found to be taller than the Turkish Standard and the Haitian children, except for Haitian girls aged 12 to 14. The Etimesğut children were similar in height to Egyptian children until the age of 12 for boys and 13 for girls and shorter than American children. Etimesğut children were found to be heavier than Haitian children and lighter than American children. When the weight was calculated in relation to the age, Etimesğut children were heavier than Haitian children at every age and American and Egyptian children at some ages, indicating that the factors which affect body growth influence both height and weight development. The incidence of angular stomatitis among Etimesğut primary schoolchildren corresponded with the deficiency of riboflavin reported in 39 per cent of the families in this area. The incidence of enlarged tonsils was high in both sexes. Dental caries were found to be lower than in British schoolchildren, possibly owing to the amount of fluoride in Etimesğut's water. Impaired vision was higher in the 7 to 10 year age group than in the

11 to 14 year group, higher in girls than in boys, but lower than that of Swedish nomad Lapp children. Hip dislocation was diagnosed in three girls and congenital heart disease in one girl.

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