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Idiopathic Scoliosis Prevalence Is 5 Times Less in Roma Than Greek Children and Adolescents

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Abstract

Study Design: Serial screening of Roma children for idiopathic scoliosis.
Objective: To confirm or reject the observation that the prevalence of scoliosis is reduced in the Roma population and possibly to explain it.
Materials and Methods: The authors conducted serial screening for idiopathic scoliosis of 1,034 indigenous Roma children (542 boys and 492 girls), aged 4–18 years (857 children were aged 8–18 years) from 1997 to 2011. Age, height, weight, body mass index, years of schooling, and menarche for girls were recorded. Children were clinically examined for body asymmetries and a standing posteroanterior spinal radiograph was obtained in selected cases.
Results: Sixty Roma children (6%) had clinical humps. Single humps, according to location, were mostly benign and not related to progressive scoliotic curves. In children with right thoracic humps a left lumbar component could be overlooked. Of 60 children, only 4 (3 girls and 1 boy) with right thoracic and left lumbar or thoracolumbar humps had true progressive scoliotic curves with greater than 10° Cobb angle (prevalence rate, 0.35%). This is 5 times less than the rate of 1.5% in Greek children. One of these 4 children was young and had possible congenital scoliosis; the other 3 were early adolescents.
Conclusions: A substantial difference in the prevalence of scoliosis between Roma and Greek children was documented. The usual percentage of adolescent scoliosis found in the Greek population (approximately 15–17 cases/1,000 children) was not seen in this sample of Roma children.

Keywords: Idiopathic scoliosis; Scoliosis screening; Scoliometer; Adams test

Introduction

During 15 years of work at a large state pediatric orthopedic hospital, the authors had the opportunity to treat a wide variety of orthopedic disorders, including trauma, in children aged 2 months to 18 years. Among various ethnic groups, they occasionally examined Roma children for various hip, knee, foot, upper extremity, or spine problems. None of the Roma children were diagnosed with idiopathic scoliosis. Later, this exception became more distinct within the authors' scoliosis units established in both a large pediatric hospital and a large general orthopedic and trauma state hospital.

The prevalence of idiopathic scoliosis in children aged 6–18 years, as derived from Greek and international screening programs, has been well documented and ranges from 1.5% to 2.5% for curves with 10° or greater Cobb angle when using the same basic generally accepted screening methods [1–13].

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This apparent discrepancy in scoliosis prevalence between 2 populations (native Greek and Roma) living side by side for over 5–6 centuries seemed unusual and has not been previously investigated.

A unique (to the current authors' knowledge), decisive difference in prevalence of idiopathic scoliosis was presented by Segil [14] in Johannesburg, South Africa between Caucasian subjects (2% to 3%) and Bantu African subject (0.3%), widely known in those days for their extremely low living standards. Far fewer variances in scoliosis prevalence have been published between people on the mainland and Greek islands [6,8,9] and internationally [15,16]. In the United States no such differences between black and white or other ethnicities have been mentioned [1,2,7].

It seemed challenging to study the hypothesis that Roma children are resistant to developing scoliosis; the existence of such a natural immunity first had to be substantiated thorough screening of the Roma children. This proved to be a difficult endeavor because of the primitive living conditions of these people in remote semi-rural areas.

The researchers' purpose was to screen Roma children for scoliosis and compare the incidence of scoliosis with that of Greek children as reported in the scoliosis screening literature [6,9,11]. Some of the authors of this research (P.S. and A.A.) were involved in previous screening of Greek children [3,5,8]. Based on previous experience and following the same methodology, the current study was initiated in April 1997 and was completed in 2011. The screening proceeded slowly and cautiously, gradually improving as the researchers became familiarized with unusual circumstances and problems. Approval for this research was requested from and granted by the authors' institutional review boards.

Background Data

The Gypsies, preferably called *Roma*, are a basically nomadic Caucasian race. They originally migrated from the border region between Iran and India to Europe around the 14th century (or earlier) and are now living mainly in Europe and the United States, speaking an Indic dialect in addition to the local language. Their total population in Greece is estimated to be around 55,000 according to the Ministry of Labor and Social Services. More than two-thirds of them live in middle and northern Greece, the part of the country annexed at the beginning of the previous century. These Roma of northern Greece are mixed with Roma of neighboring countries.

Approximately, 16000 Roma live in the south, the "Old Greece," and are considered indigenous because their ancestry goes back over four centuries. About 12,000 of these indigenous Roma are urbanized within large Greek cities; their children are not the object of this study. Besides, they refuse examination by foreigners. The remaining approximately 4,000 are officially categorized as "established" (about 3,000) and "epochal" (marginally over 1,000). The established population lives close to large cities in regions of flat fertile land, dispersed in semi-rural communities of 20–30 families, in simple barracks with low-quality, elementary facilities not substantially different from the homes of the epochal population.

Epochal Roma (about 1,100) and their approximately 700 children are the core interest of this study. They mainly live in mountainous rural areas in camps of 10–20 families. Their living conditions are harsh, lacking even the most basic home facilities, such as sitting chairs, toilets, and bathrooms for personal hygiene. They usually mate or marry at an early age within the tribe. Food is not a special problem. Parental care for youngsters could be described as primitive but good; children usually run around barefoot and lightly dressed all year long, and schooling is inefficient to nonexistent. Their home is a camp neighborhood similar to primitive or even contemporary remote tribal encampments.

They work in the fields, at local bazaars, and as scrap dealers or peddlers in the nearest town, often carrying the whole family in their trucks. Seasonal migration is customary. They obey a headman called a king or president, who is on good terms with local municipal authorities who provide basic health services in return for votes.

Materials and Methods

This study began by examining children of from whole epochal group (681 Roma children). In a second stage, the researchers successively examined 353 children within 3 random samples from the established group. Access to these communities was gained through the local mayors and community welfare staff.

Six alternating orthopedic surgeons participated in examining and recording the data derived from the children: 2 senior surgeons with long experience in school screening procedures, 2 senior surgeons with special interest in spinal problems, and 2 consultants. At least 1 expert orthopedic surgeon was always present during the examinations. To prepare and implement this program, the authors had the assistance of a social worker and 1 or 2 nurses. The occasional presence of interested local orthopedic surgeons was welcome.

General orthopedic and spinal screening was carried out by the authors' group in local rudimental medical facilities, schools, individual barracks, and outpatient clinics of local state hospitals. Screening included children aged 4–18 years so that no child who was age-prone to scoliosis would be neglected.

Until 2011, a total of 1,034 Roma children (542 boys and 492 girls) in good general health had been serially, randomly examined. Their age, gender, general demographics, body mass index (BMI), menarche for girls, and school attendance were recorded and compared with those recorded during similar Greek children's screenings [3,11].

After nurses completed the card with key demographic data, for first clinical assessment the child was examined in a private area, often with the parents or other siblings present.

Table 1
Curve classification, clinical and radiological, in 60 Roma children (37 girls and 23 boys).

	Girls (n = 37)							
	TL		T		L		T+L	
	R	l	r	l	r	l	r/l	
A	9	3	10	0	2	10	3	
B	6	1	7	0	2	4	3	
C	6	1	7	0	0	4	3	
D	0	0	1 rT=14° lL=9°	0	–	–	1* rT=10° lL=8°	1 rT=13° lTL=6°
E	0	–	rT=29° lL=15°	–	–	–	rT=20° lL=10°	rT=20° lTL=30°
	Boys (n = 23)							
A	9	2	5	4	2	0	1	
B	9	1	3	4	0	0	1	
C	9	1	3	4	0	0	1	
D	0	0	0	0	0	–	1 lTL=10°	
E	0	–	–	–	–	–	lTL=14° rT=7° lTL=20° rT=20°	

r, right; l, left; T, thoracic; L, lumbar; T+L, double thoracic and lumbar or thoracolumbar.
Notes: Rows A and B are the first and second clinical evaluations. Row C is radiography. Row D is scoliosis of ⩾10°. Row E is follow-up.
* Seven-year-old girl with possible congenital scoliosis. She was exempt from the sample compared with Greek children because she was younger than age 8 years.

Asymmetries of the body (neck, shoulders, thorax, waistline, and pelvis) and extremities were evaluated. The traditional Adams test from front and back in standing and sitting position followed. This test is simple, especially sensitive for detecting scoliosis in the lean Roma, and well accepted by children in general [12]. It requires a certain degree of expertise, preferably more than 1 examiner. Moiré topography was impractical under the circumstances; photographs of even partially nude girls would have been ill accepted by the Roma people. The researchers also had to consider that boys show an uncontrollable sexual aggressiveness toward girls. They were particularly excited during the screening of girls and often had to be forcefully controlled.

Trunk asymmetries were noted. Clinically observed humps were recorded for both boys and girls (Table 1, row A) according to the level, side, and horizontal inclination measured in degrees by the scoliometer. After a second clinical evaluation by a senior member of the group, a number of children were exempt owing to elusive clinical signs, age past growth spurt, and postmenarche for girls (Table 1, row B). A final decision was reached as to the need for a radiograph (Table 1, row C). When required, a radiograph of the spine (posteroanterior [PA] standing) was obtained on the same day and recorded if positive for a scoliotic curve of 10° or greater Cobb angle (Table 1, row D) The parents were informed and advised accordingly about any pathological findings; they were cooperative and grateful. This attitude greatly facilitated follow-up of the child at various intervals after the first examination, as was necessary in certain cases (Table 1, row E).

Statistical methodology

Age of menarche was reported for 138 girls; in 321, menstruation had not commenced. Data on the onset of menstrual cycle were not available for 33 girls. The researchers compared the mean onset of puberty (menstrual cycle) for the 138 Roma girls with that of Greek girls [6,17,18] using the 1-sample *t* test.

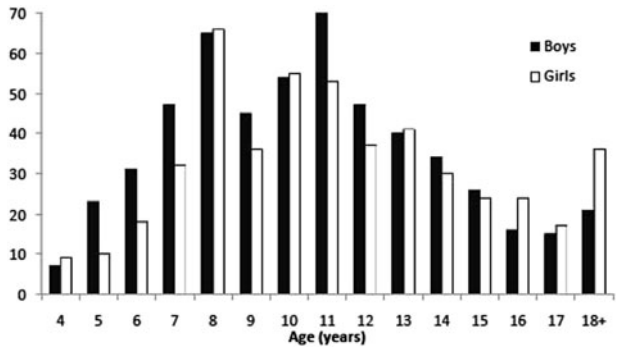

Fig. 1. Histogram presenting age distribution in the Roma sample of 542 boys and 492 girls (a total of 1,034 children aged 4–20 years).

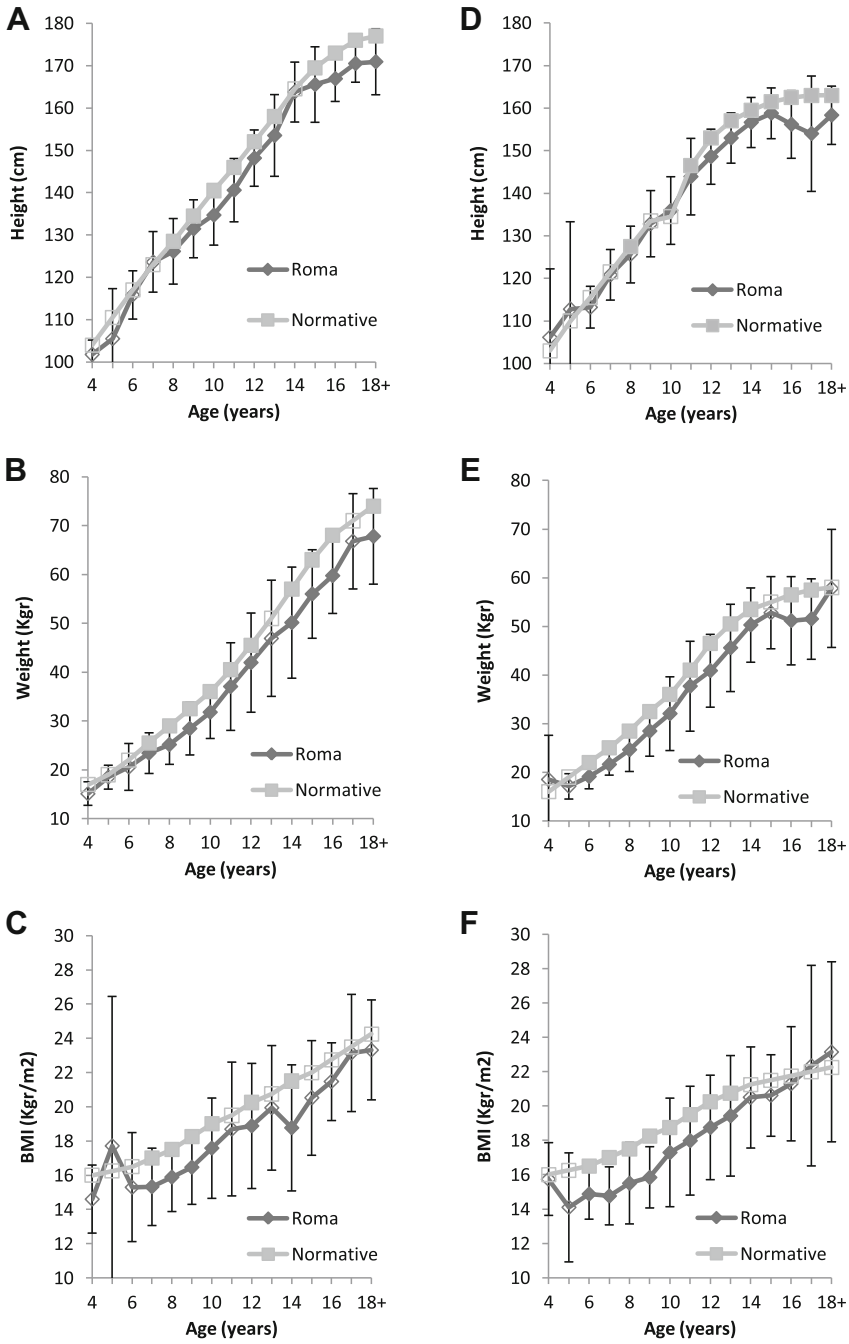

Fig. 2. (A–C) Mean height, weight, and body mass index (BMI) plus standard deviations (error bars) for Roma boys per age group shown as black lines and diamonds. Gray lines and squares represent the respective means for Greek children. Solid diamonds and squares represent Roma children whose means had statistically significant difference from the respective means of Greek children at p = .05 (using 1 sample *t* test). (D–F) The same plots for the Roma girls.

Table 2
Comparative screening for scoliosis of Roma and Greek children aged 8–18 years (mean, 12.5 years).

Children, n (mean; %)	Number examined	Clinically positive	Exempted at reexamination	Negative radiologically	Radiologic curve $<10^\circ$	Radiologic curve $\geqslant 10^\circ$
Roma	857	54 (6; 2)	20 (2; 3)	14 (1; 6)	17 (2)	3 (0; 35)
Greek [6]	82,901	5,803 (7)	1,618 (2)	1,402 (1; 6)	1,347 (1; 6)	1,436 (1; 6)
Greek [9]	2,700	156 (5; 77)	0	0	121 (4; 4)	32 (1; 18)

Note: Clinical findings were similar between Greek and Roma children but radiological findings revealed a lower rate of scoliosis $\geqslant 10^\circ$ in Roma children.

Boys and girls were separately classified according to age (Fig. 1). Mean height, weight, and BMI for each age group were compared with those of Greek children [19] using the 1-sample *t* test (Fig. 2).

To evaluate possible differences in school attendance between Roma and Greek children, the authors recorded the reported school attendance in years for 661 Roma children and then used the following measure: School difference in years = (Age−6 years−Reported school attendance in years. For individuals aged older than 18 years, age was corrected to be 18. The normal for this measure is 0, indicating that the student has attended all required years of schooling (12 years starting at age of 6). A positive difference indicates the loss of school years per individual. A mean school difference was thus recorded for the sample of 661 Roma children and was compared with the norm of 0 by the 1-sample *t* test.

A separate sample of 857 Roma children (out of the 1,034 examined), 434 boys and 423 girls aged 8–18 years (mean, 12.5 years) was used to compare scoliosis occurrence between Roma and Greek populations of similar age (both for scoliosis $< 10^\circ$ and $> 10^\circ$) (Table 2) [6,9].

Results

Demographic characteristics

The ratio of boys (52.4%) and girls (47.6%) did not differ in the Roma sample ($p = .123$) [6]. Mean age at puberty onset for Roma girls (12.1 years; standard deviation [SD], ± 1.28 years) was not different from that of Greek girls (12 years; SD, ± 1.28 years) ($t_{137} = 1.13$; $p = .26$) [6,17,18].

On average, Roma children were shorter and weighed less than Greek children, as shown in Figure 2 [19]. This small mean difference in height and weight for the Roma was evident at age of 8–9 years and remained through late childhood and puberty, until adulthood. Girls' weight reached the mean of Greek girls after age 18 years [19]. Roma children also showed a small but significant decrease in mean BMI compared with that of Greek children [19]. It was evident at age of 6–7 years and remained so until age of 13–14 years, when the BMI reached the Greek average [19] and remained within this range until adulthood.

Roma children displayed marked deficiency of education (school). The mean school difference for this sample was 3.3 years (SD, 3.55 years), which was significantly higher than 0 ($t_{660} = 24.1$; $p < 10^{-6}$). That means that these children missed on average 3 years of school.

Prevalence of scoliosis

The radiographic prevalence of scoliosis 10° or greater for the 857 Roma children aged 8–18 years was 0.35% (2 girls and 1 boy). The rate of scoliosis 10° or greater for all Roma children examined (1,034), aged 4–18 years (including younger patients), was 0.39% (3 girls and 1 boy). Only 1 girl age 7 years with possible congenital scoliosis was found in the 4- to 7-year age group. This girl was exempt from the sample compared with Greek children because she was younger than age 8 years and the Greek sample in previous screenings consisted of children aged 8–18 years. The low cutoff for the prevalence of scoliosis in similar Greek populations is 1.5% [3,6,8,9,11]. Thus, the prevalence of this abnormality was significantly lower in the Roma population ($p = .0011$).

A total of 62 Roma children examined had a clinical hump of the back.

Two girls were excluded from this study: 1 with a 10° lumbar curve because of leg inequality and the other with a right shoulder elevation, trapezial muscle asymmetry, and a normal spine radiograph. The remaining 60 children (6% of the total), 37 girls and 23 boys, were recorded according to the hump level and side as right, left, thoracic, lumbar, thoracolumbar (TL), and double thoracic-lumbar or thoracic-thoracolumbar. Four children with 1-side extended humps were included in the right TL (rTL) type. The researchers obtained a radiograph from 39 children (18 boys and 21 girls) and curves with a Cobb angle 10° or greater were registered. Follow-up was conducted when possible (Table 1). The remaining 21 children (5 boys and 16 girls) had only clinical follow-up with no radiological assessment.

The most common clinical diagnosis in these series was an rTL hump in 18 children (9 girls and 9 boys), similar to other Greek studies [6]. Three girls (aged 14, 14, and 17 years) were exempt on second clinical evaluation. The remaining 15 children (6 girls and 9 boys) had atypical radiographic curves of less than 10° Cobb angle and neutral, opposite, or extended vertebral rotation [20].

The second most frequent clinical finding was the right thoracic (rT) hump in 15 children (10 girls and 5 boys). Three girls and 2 boys with single rT humps less than 3° by scoliometer) were exempt on second clinical evaluation. Three boys with humps less than 4° had negative radiographs. Of the remaining 7 girls, 6 aged 11–18 years had rT clinical humps of less than 4° by scoliometer and radiographic curves of 7° or less. The last girl (aged 11 years, no menses, Risser 0) with a 9° rT clinical hump had a typical rT 14° and a single left lumbar (lL) 9° Cobb angle scoliosis that progressed to 29° and 15° at follow-up. She ignored the researchers' instructions for interim follow-up (Fig. 3A, B).

An often elusive clinical hump was an lL hump seen in 10 girls. Six of these questionable cases were excluded from the study on second or other successive clinical examination, and 4 after radiography. Four children with rL humps, 2 girls and 2 boys, were exempt on the same basis without radiography.

A single left thoracolumbar (lTL) hump was found in 5 children (3 girls and 2 boys). After radiological assessment in 3 and repeated clinical evaluation in 2, none of these children had scoliosis.

Four boys with left thoracic (lT) humps had incomplete curves or no curves on radiographs.

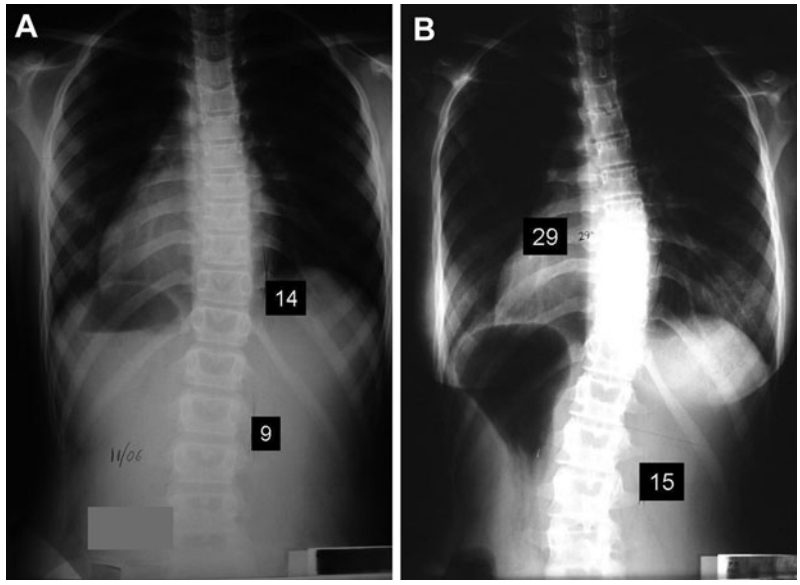

Fig. 3. (A) Roma girl, aged 11 years, with 7° right thoracic hump measured by scoliometer. Typical right thoracic 14° and left lumbar 9° Cobb angle scoliosis. (B) The girl is 5 years older and 22 cm higher with 29° right thoracic and 15° left lumbar Cobb angle.

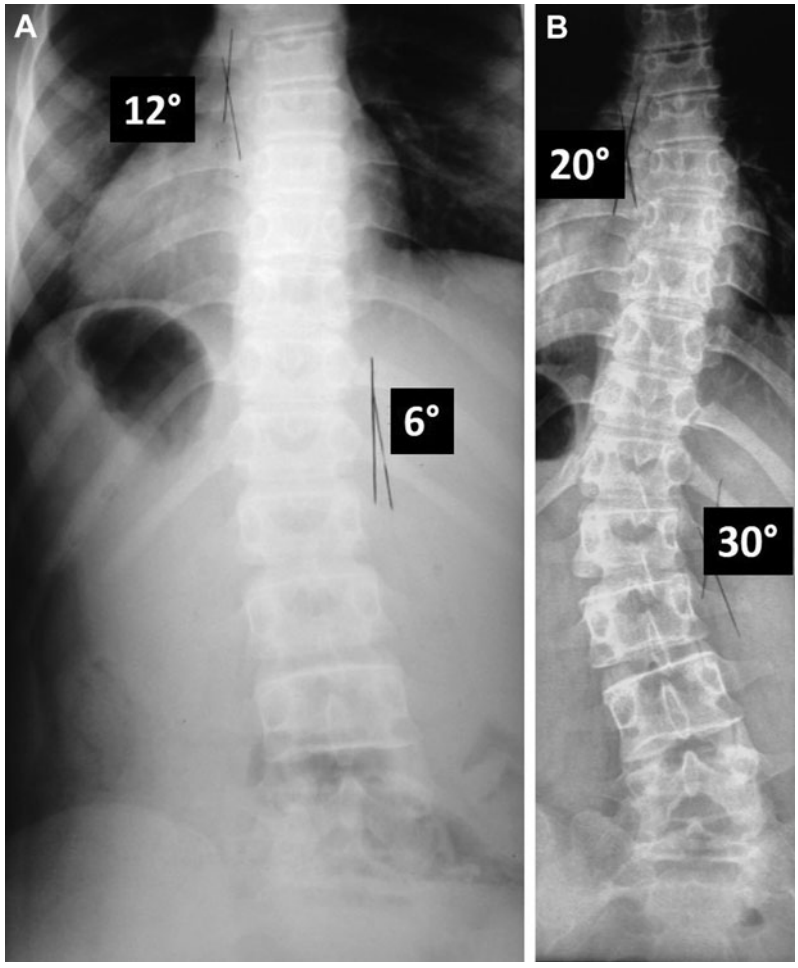

Fig. 4. (A) Roma girl, aged 11 years, with a 13° right thoracic and 6° left thoracolumbar curve. (B) The same girl at age 14 years, with 20° and 30° curves, respectively.

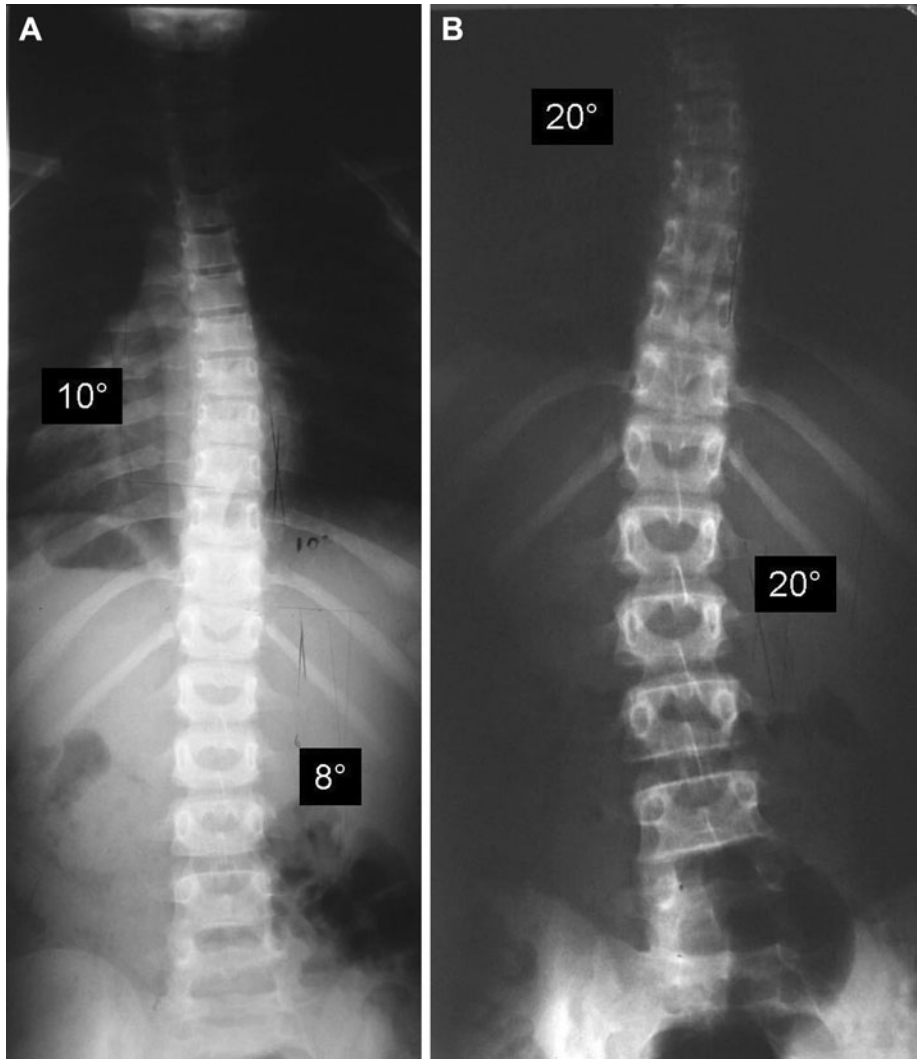

Fig. 5. (A) Roma girl, aged 7 years, with a 5° right thoracic and 4° left lumbar hump measured by scoliometer and 10° right thoracic and 8° left lumbar Cobb angle curves. (B) The same girl at age 11 years, 21 cm higher with 20° right thoracic and 20° left lumbar Cobb angle scoliosis.

The double right thoracic-left lumbar or thoracolumbar (rT-lL or TL) clinical hump type was the least common, with 4 cases in this study; when present, it may indicate an underlying significant scoliosis. Indeed, in 3 subjects a progressive scoliosis evolved. In particular, a girl (no menses, Risser 0) had a double hump of 4° by scoliometer. Radiographically, she had a double curve rT 12° to lTL 7° at age 11 years and an rT 20° to lTL or lumbar 30° scoliosis at age 14 years (Fig. 4A, B). Another 7-year-old girl with a 7° rT to 4° lL hump by scoliometer had a double curve with an rT 10° and lL 8° Cobb angle. Both curves, rT and LL, increased at age 11 years to a 20° Cobb angle and were treated with a Boston brace (Fig. 5A, B). This girl had originally a 5° left horizontal inclination of the L5 vertebra on X-ray (vertebral body deformity), which at age 11 years increased to 11° and could possibly be considered a contributing factor to the scoliosis, which was possibly congenital [21,22]. Her mother had precisely the same inclination without scoliosis. The last subject, an 11-year-old boy with a lTL clinical hump of 4° and an 8° Cobb angle lTL curve on first examination, presented after 1 year with a double clinical hump and a 14° Cobb angle lTL curve combined with a high 7° Cobb angle rT curve. At the age 14 years he developed a 20° lTL and a 20° rT scoliosis, Risser 4, and a 24-cm increase in height (Fig. 6A–C).

Comparative prevalence of clinical and radiological signs of scoliosis in Roma and Greek children

A dorsal hump is the first sign of a possible underlying scoliosis. Figure 7 shows the incidence of dorsal humps in Roma children of different age groups: a) 4–9 years, b) 10–12 years, and c) persisting until age 18. Humps are attributed to lateral spine displacement or rotation, usually both [20].

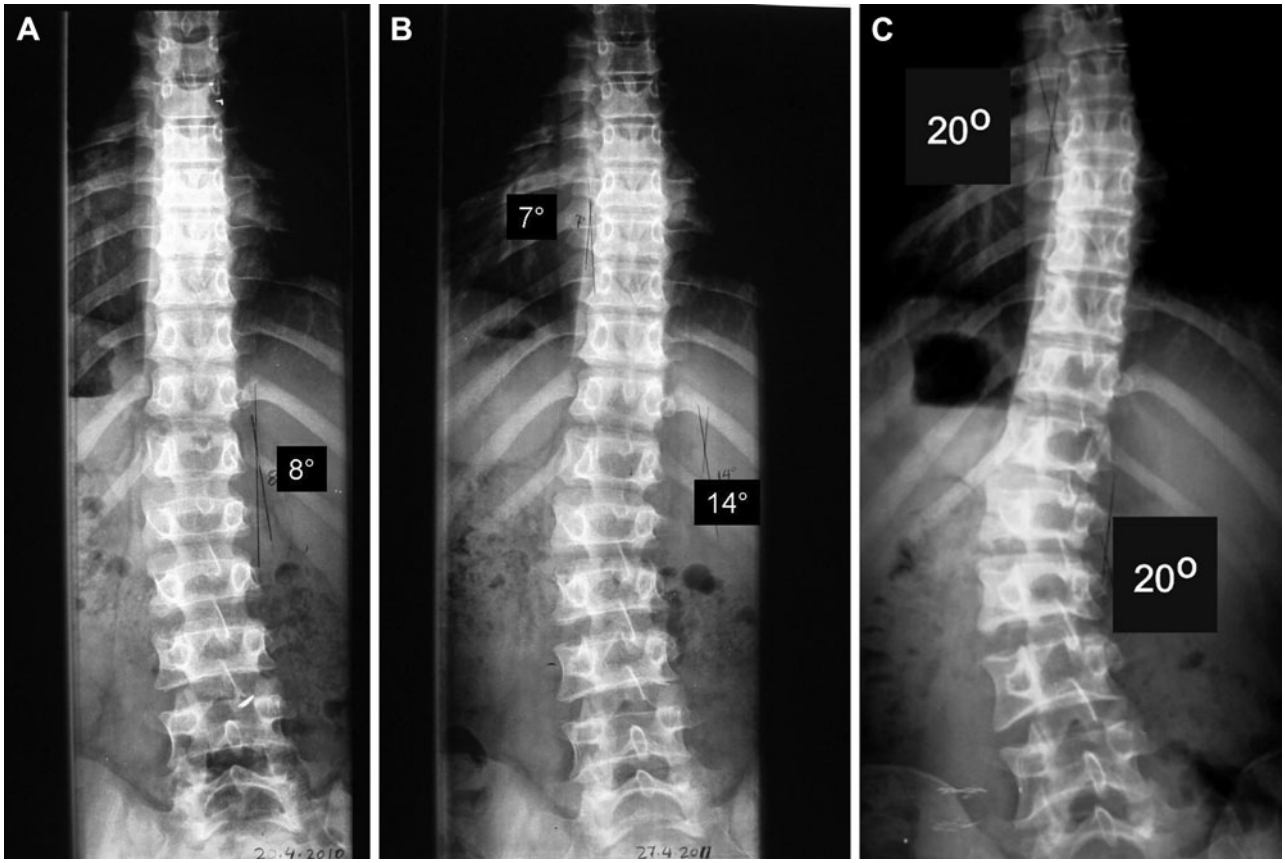

Fig. 6. (A) A Roma boy, aged 11 years, a 4° left lumbar hump measured by scoliometer. The radiograph revealed a left thoracolumbar 8° Cobb angle scoliotic curve. (B) The same boy at age 12 years, 7 cm taller with left thoracolumbar 14° and right thoracic 7° Cobb angle curves. (C) The same boy at age 14 years, 24 cm taller with left thoracolumbar 20° and right thoracic 20° scoliosis (Risser 4).

Table 2 presents the comparative prevalence of scoliosis according to clinical findings and scoliosis degrees (<less than 10° and 10° or greater) between Roma and Greek children aged 8–18 years. The clinical hump rate for both Roma and Greek children is almost equal (6% to 7%) [9,11]. After radiological examination, the rate of curves 10° or greater is 1.5% for Greek and only 0.35% for Roma children.

Figure 8 compares the prevalence of scoliosis 10° or greater according to age in Roma and Greek children. The rates are low for both populations before age 9 years. Roma children display a peak rate at age 11 years and level down at 12 years. However, the process in Greek children extends before age 10 years and mainly after age 11 years, with several additional new cases and an increasing tendency up to 14 years, whereas the Roma remain immune to this development after age of 11 years [6].

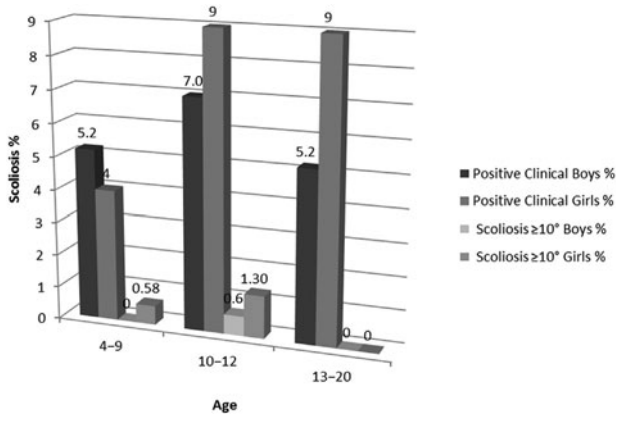

Fig. 7. Comparative prevalence of dorsal humps and scoliosis of 10° or greater in Roma children of different sex and age groups: a) 4–9 years, b) 10–12 years, and c) persisting until age 20 years.

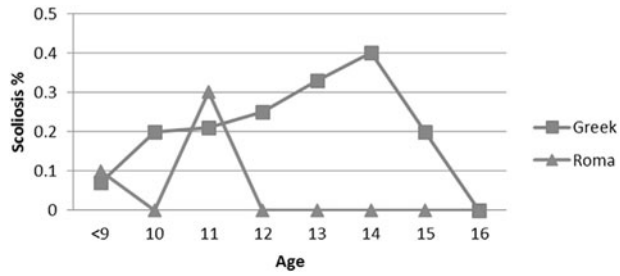

Fig. 8. Comparative prevalence of scoliosis greater than 10° in Roma and Greek children, according to age.

Discussion

The current study included many skeletally immature children aged 4 years and older. That was done to acquire a complete picture of the development of scoliosis in the Roma population. The authors mainly relied on clinical methodology as in previous screenings of Greek children [6,9,11]. Some of these screenings were also performed by the current authors [3,5,11]. The researchers compared a separate sample of 857 Roma children (out of the 1,034 examined) aged 8–18 years, to match the samples of previous screenings of Greek children similar in age so as to establish the validity of the sample of the Roma children (Table 2).

A discrepancy initially apparent to clinicians regarding the rate of idiopathic scoliosis between Greek and Roma children living in Greece is clearly established. A substantial difference in the prevalence of scoliosis in Greek (1.5%) and Roma children (0.35%) was statistically confirmed. In other words, in this study including 857 Roma children, the authors found 4 children with scoliosis of 10° or greater, as opposed to 15–20 children as seen in scoliosis screenings of Greeks performed with the same methodology [3,6,8]. Follow-up of these 4 Roma children revealed an increase in scoliosis up to 20° in 2 and 30° in the other 2.

In these Roma children with scoliosis, 1 was a young girl with a possible congenital scoliosis, 2 were premenarchal girls, and 1 was a boy with an early adolescent type of scoliosis. In Greek children above age 10 years and until age 15 years, there has been a substantial increase in the rate of scoliosis, from 15 to 17 per 1,000 children [6,13]; this includes cases of adolescent scoliosis, the most common and devastating type of the deformity, with curves that may exceed 40°. These approximately 15–17 adolescents with curves of 10° or greater after age 11 years were not seen in the Roma sample (Fig. 8).

In the current study, the authors noticed that some clinical hump types are benign and some risky in terms of their correlation with an underlying scoliosis. This is not statistically confirmed but it is reported in the literature [6,12,13,20].

The rTL hump, which is the most common type [6] (18 children), usually did not correlate with scoliosis, as confirmed by follow-up. Six of these patients with unilateral extended humps, a recognized benign asymmetry [20], were exempt from radiographic examination.

Elusive single lumbar humps (3° or less by scoliometer) may easily hide an actual progressive curve [9] and require special attention. From the 10 children with left lumbar humps, 4 were radiographically normal and 6 were exempt from radiographic assessment after a clinical reevaluation. Four children with right lumbar humps (2 boys and 2 girls) were also exempt from radiographic examination on a clinical basis.

A right thoracic hump was noted in 11 girls and 5 boys. Children with single right thoracic humps $<3°$ by scoliometer (5 in our study) were exempt from radiographic examination. However, an often coexisting left lumbar or thoracolumbar hump should initially be cautiously ruled out, because this difference (single–double) apparently changes the status from benign to risky and may prove a useful indication (Figs. 3, 6) [12]. An interesting observation of this study is that all 4 Roma children (3 girls and 1 boy) with true progressive scoliosis had the double risky hump type.

In general, benign humps are almost equally found in girls and boys whereas risky humps and curves are found in two-thirds of girls examined for them (Fig. 8) [6,12,13].

This study may be criticized for relying mainly on the Adams bending test and the scoliometer to select possible scoliosis patients [6,12]. Of the 60 children clinically positive for scoliosis, 21 were exempt from radiological examination on a clinical basis (state of maturity and known benign type of hump [12,20]). No further deterioration of the deformity was detected on follow-up (Table 1). In the generally lean Roma, this process was easy and more accurate. To minimize the main concern of over-referring and nullify the risk of a false-negative case, the authors followed the suggestion to double- and triple-test clinically by different examiners [12,13]. The alternative would be a PA radiograph for all clinically positive children, as in a 1999 Greek scoliosis screening of 2,700 children on the island of Samos [9]. In that screening, all clinically positive children were subjected to a PA radiographic examination that revealed that 32 children had curves of 10° or greater, a rate of 1.18% that was slightly less than the usual 1.5% for children on the Greek islands and 1.7% for children on the mainland [6]. Therefore, even checking radiographically all clinically positive children did not result in a different incidence of scoliosis.

The cause of idiopathic scoliosis remains unknown but different theories concerning its etiology have been proposed, including genetic [23–28] and hormonal factors [29–31], growth abnormalities [32–35], and biomechanical and neuromuscular etiologies [36–38].

Certainly, a genetic resistance to the development of scoliosis could be considered in this isolated Roma community. In addition, considering that the inheritance pattern of scoliosis is most likely multifactorial [23,26], the different way of life of the Roma could have a protective role in the development of scoliosis. As already stressed, Roma children have a markedly different way of life compared with that of modern Western societies or at least compared with Greek children's life. They lack even the simplest conveniences of a home. Young girls from age 5–6 years and up must assume several family responsibilities such as caring for their younger sibling, as well as strenuous kitchen and outdoor labor. There is little time for leisure and relaxation and no privacy, comfort, or even a couch is available. Could this harsh way of life and inevitable hyperactivity fortify the protective mechanisms of the spine against growth instability in early adolescence?

Regarding growth abnormalities, in the current study the researchers noted that both Roma boys and girls have a delay in reaching Greek children's standards for height and BMI (Fig. 2). Could this small aberration favor spinal stability [32,34,35]? A comparison of the prevalence of scoliosis of 10° or more between Roma and Greek children according to age shows substantially diverting courses, reaching a peak at age 11 years for Roma and 14 years for Greek children (Fig. 8) [6].

In this study on Roma children, a substantially lower prevalence of scoliosis was noted compared with Greek children of similar age. The usual percentage (1.5%) of adolescent scoliosis found in the Greek population (approximately 15–17 cases/1,000 children) was not seen in the Roma children sample (0.35%). Further studies on the etiology have to be done to explain the resistance of this population to scoliosis.

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