GROWTH IN GREENLAND: DEVELOPMENT OF BODY PROPORTIONS AND MENARCHEAL AGE IN GREENLANDIC CHILDREN.

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ABSTRACT

Introduction. No recent investigations of child growth in Greenland are available. Owing to the secular trend, earlier investigations are of limited clinical value.

Objectives. For this reason, we studied the most important anthropometric measurements of school children in Maniitsoq, Greenland.

Methods. We recorded weight, standing height, sitting height, armspan and menarcheal age. After the exclusion of ten children, who were either suffering from conditions known to influence growth, or for whom some of the anthropometric data were lacking, 299 boys and 290 girls remained in the study. The 589 children were between 5-19 years old.

Results. In comparison with a similar study in Maniitsoq undertaken a little more than 30 years ago, 14-year old children in Maniitsoq have increased standing height by 10 cms, or even more. Up to the age of 14, Greenlandic boys followed the Danish curve for standing height, then flattened out to reach a final mean height about 7 cms below the Danish level. The girls’ growth curve followed the Danish one only to the age of 11 years, then flattened out to a final height of 5 cms below the Danish level. A somewhat higher sitting height ratio was recorded for both sexes compared to Danish children. The mean menarcheal age was 12.64 years.

Conclusion. During the course of 100 years, menarcheal age in Greenland has diminished by three years, and is now 3 months below that in Denmark.

Keywords: Greenland, Growth, Secular trend, Menarcheal age, Height, Weight, Armspan.
INTRODUCTION

Growth curves are the most simple and cost-effective tools for routine health control of apparently healthy children, and may be very important in following disease during childhood. There is a further importance of growth curves as a consequence of the introduction of growth hormone treatment in Greenland.

Clinically useful Greenlandic standard growth charts are not available. This is a drawback in the screening of supposedly normal children. If disease, or growth abnormality, is suspected, or to be controlled, it is necessary to monitor growth, but, in such a situation, the individual child is its own control. It is important to assess whether the child follows its growth channel or deviates from it.

There are certain differences in children’s growth from one country to another. There are also differences from one generation to another, the so-called secular trend. The aim of the present investigation was to study growth of school children in Greenland.

The study was undertaken in Maniitsoq, a medium-sized municipality of 4000 inhabitants and presumed to be representative of the central part of the western coast, where the majority of Greenland’s population lives.

PREVIOUS STUDIES

Balslev Jørgensen (1) studied eskimo skeletal material mainly originating from various parts of Greenland and covering the period 1200-1700. Estimations from the humerus, femur, or tibia using Pearson’s method indicated an average adult male height of 159 cms and an adult female height of 148 cms.

Examining 439 schoolboys and girls in the school year of 1964/65 in Sukkertoppen (Maniitsoq), Jørgensen & Thomsen (2) found that Greenlandic children aged 14 years were approximately 10 cms shorter than their European peer group. Until now, unfortunately, it has not been possible to procure the original raw data. Measurements are estimated from the published growth curves.

Height differences, compared to Scandinavian children, were somewhat smaller in Zachau-Christiansen’s (3) 1971-72 study, which included 945 children aged 1-14 years from various districts. In the
age group of 14 years, Greenlandic boys were 3 cms shorter and girls 5 cms shorter. At a certain height, Greenlandic children were 0.2-5 kgs overweight compared to Scandinavian children.

MATERIALS AND METHODS

All investigations were carried out by the author and his staff at the health services of Maniitsoq, during the period of December 2nd 1996 – October 21st 1997, mainly in the morning, or in the late morning. Examinations were made in the health care nursery of the hospital and at the two schools of the town. Children of the three settlements of the municipality were examined locally as part of doctor’s visits for medical consultations.

All children were examined only once. The total number examined was 599 children, representing 78.2 % of the 766 school children of the municipality. 72 % of the 562 school children from the town participated in the investigation, while 95 % of the 204 school children from the settlements participated.

Ten of the examined children were excluded from the data analysis, due to a lack of certain anthropometric measures, or treatment of disease, i.e. ongoing, or previous treatment with growth hormone.

In determining nationality, 537 children had both a father and a mother, who were Greenlanders. We defined a Greenlander as a person having Greenlandic as his, or her, maternal language. 52 children had at least one parent who was not a Greenlander. All 589 children, however, are included in the present data analysis, with 299 boys and 290 girls. The boys were born between 1979 and 1991, and were aged 5-18 years at the time of examination. The girls were born between 1978-1990, and were aged 5-19 years at the time of examination. Except in the youngest age-groups, girls were asked about menarche.

The children were examined in their clothes, but without shoes. Weight, standing height, sitting height and armspan, from the tip of one third finger to the tip of the other third finger, were examined in all cases. Weight was recorded in all children using the same electronic scales. The youngest children in Maniitsoq had their standing height and sitting height measured with a karrymetre MkI-
II, supplied by Raven Equipment Limited, England, and their armspan was determined with a metal measuring band. All other children in the town, and all those in the settlements, were measured by a special metal rod designed for anthropological research (Fig. 1, Fig. 2).

The same equipment was used in the schools of both the town and the settlements and in nurseries in the settlements. We did not have a golden standard for height measurements, but we have com-

Figure 1. Sitting height.
pared the different equipments used. For standing height, we found a good degree of correspondence between the karrymetre instrument and the metal rod. In 15 double measurements, standing height was 0.27 cms greater with the karrymetre than with the metal rod.

In more than 80% of the measurements, results were immediately recorded on a portable Macintosh.

The study was approved by The Commission for Scientific Research in Greenland. Prior to the examinations, children and parents were informed by the distribution of a bilingual, written description of the study.

RESULTS

Tables 1a-b show mean values and standard deviations of four classic body proportions and of two derived proportions. Supplementary diagrams show standing height, sitting height ratio, weight for age, and weight for height (Fig.3a-b, Fig.4a-b, Fig.5a-b and Fig 6a-b). In the diagrams, only mean values are given.

Menarche: At the time of investigation, 95 girls born between 1978-1986 had had menarche and remembered the time. The majority remembered the exact date. Median age for menarche was 12.85 years and mean age was 12.66 years (SD 1.23). In a few other cases menarche had occurred, but the time could not be stated.
**Table 1a.** Mean and standard deviations (SD) for weight, standing height, sitting height, armspan, sitting height ratio (sitting height/standing height) and subischial leg length (SILL = standing height - sitting height) of boys in Maniitsoq, Greenland.

| Age (years) | Weight (kg) | Standing Height (cm) | Sitting Height (cm) | Armspan (cm) | Sitting Height Ratio | SILL (cm) | N |
|-------------|-------------|----------------------|--------------------|--------------|---------------------|-----------|---|
| 6.2         | 23.7 ± 3.0  | 118.4 ± 4.7          | 64.2 ± 3.2         | 117.0 ± 4.9  | 0.54 ± 0.02         | 54.2 ± 3.4  | 17 |
| 7.0         | 25.1 ± 3.7  | 122.4 ± 6.2          | 65.9 ± 3.5         | 120.8 ± 5.6  | 0.54 ± 0.02         | 56.5 ± 3.8  | 25 |
| 8.0         | 29.2 ± 7.5  | 128.3 ± 5.5          | 69.6 ± 2.9         | 128.4 ± 5.9  | 0.54 ± 0.02         | 58.7 ± 4.1  | 41 |
| 9.0         | 31.0 ± 3.6  | 133.3 ± 5.4          | 71.9 ± 3.1         | 133.3 ± 6.2  | 0.54 ± 0.01         | 61.4 ± 3.1  | 29 |
| 10.0        | 35.1 ± 4.0  | 138.4 ± 4.4          | 73.6 ± 2.3         | 138.7 ± 5.2  | 0.53 ± 0.01         | 68.8 ± 3.1  | 28 |
| 11.0        | 40.0 ± 7.0  | 143.8 ± 5.0          | 75.5 ± 2.8         | 146.1 ± 5.7  | 0.53 ± 0.01         | 68.3 ± 3.4  | 20 |
| 11.9        | 43.3 ± 6.7  | 148.3 ± 6.5          | 78.4 ± 2.9         | 148.1 ± 7.3  | 0.53 ± 0.02         | 69.9 ± 4.7  | 18 |
| 13.0        | 48.7 ± 7.5  | 155.9 ± 7.9          | 81.0 ± 3.9         | 157.8 ± 9.7  | 0.52 ± 0.01         | 74.9 ± 4.3  | 20 |
| 14.0        | 56.4 ± 11.9 | 161.2 ± 8.4          | 83.8 ± 4.2         | 164.0 ± 10.3 | 0.52 ± 0.01         | 77.5 ± 5.1  | 29 |
| 15.0        | 54.9 ± 8.7  | 163.4 ± 7.3          | 84.7 ± 3.8         | 166.7 ± 8.7  | 0.52 ± 0.01         | 78.7 ± 4.8  | 30 |
| 16.0        | 61.5 ± 6.5  | 168.3 ± 5.2          | 88.9 ± 3.8         | 172.6 ± 5.3  | 0.53 ± 0.02         | 79.5 ± 3.5  | 23 |
| 16.9        | 64.3 ± 9.3  | 169.9 ± 6.5          | 90.0 ± 3.6         | 175.2 ± 6.3  | 0.53 ± 0.01         | 79.9 ± 3.5  | 18 |
| 18.3        | 83.4        | 172.8                | 95.6               | 179.2        | 0.55                | 77.2       | 1  |

**Table 1b.** Mean and standard deviations (SD) for weight, standing height, sitting height, armspan, sitting height ratio (sitting height/standing height) and subischial leg length (SILL = standing height - sitting height) of girls in Maniitsoq, Greenland.

| Age (years) | Weight (kg) | Standing Height (cm) | Sitting Height (cm) | Armspan (cm) | Sitting Height Ratio | SILL (cm) | N |
|-------------|-------------|----------------------|--------------------|--------------|---------------------|-----------|---|
| 6.2         | 22.6 ± 2.9  | 116.2 ± 5.1          | 63.0 ± 2.5         | 114.8 ± 4.6  | 0.54 ± 0.01         | 53.1 ± 3.4  | 15 |
| 6.9         | 24.6 ± 3.1  | 120.4 ± 5.1          | 65.4 ± 3.5         | 117.8 ± 5.8  | 0.54 ± 0.02         | 55.1 ± 2.8  | 24 |
| 8.0         | 28.2 ± 4.8  | 127.2 ± 5.4          | 68.6 ± 2.9         | 125.3 ± 5.8  | 0.54 ± 0.02         | 58.6 ± 3.7  | 34 |
| 9.0         | 30.8 ± 4.4  | 132.6 ± 5.2          | 71.6 ± 3.6         | 131.7 ± 5.9  | 0.54 ± 0.02         | 61.1 ± 3.1  | 29 |
| 10.0        | 35.0 ± 6.3  | 137.7 ± 6.1          | 73.4 ± 3.2         | 133.5 ± 22.1 | 0.53 ± 0.01         | 64.2 ± 3.8  | 32 |
| 10.9        | 40.2 ± 9.5  | 144.2 ± 8.1          | 76.8 ± 4.6         | 144.4 ± 8.1  | 0.53 ± 0.01         | 67.4 ± 4.3  | 27 |
| 11.9        | 42.4 ± 7.8  | 147.0 ± 7.3          | 77.4 ± 4.1         | 147.2 ± 8.9  | 0.53 ± 0.01         | 69.5 ± 4.3  | 20 |
| 13.0        | 50.8 ± 17.5 | 153.3 ± 7.1          | 80.9 ± 4.5         | 154.6 ± 8.2  | 0.53 ± 0.01         | 72.4 ± 3.6  | 11 |
| 14.0        | 54.1 ± 14.5 | 157.4 ± 5.0          | 83.7 ± 3.3         | 157.8 ± 6.9  | 0.53 ± 0.01         | 73.8 ± 2.7  | 31 |
| 15.0        | 58.7 ± 10.3 | 159.7 ± 5.2          | 85.7 ± 2.9         | 160.3 ± 5.5  | 0.54 ± 0.01         | 73.9 ± 3.5  | 33 |
| 16.0        | 60.5 ± 3.7  | 158.1 ± 4.0          | 86.5 ± 1.7         | 160.7 ± 4.5  | 0.54 ± 0.01         | 72.5 ± 3.2  | 15 |
| 17.1        | 61.0 ± 5.8  | 163.4 ± 5.6          | 88.3 ± 2.4         | 164.4 ± 5.0  | 0.54 ± 0.01         | 75.2 ± 3.9  | 15 |
| 18.1        | 57.0 ± 2.6  | 160.1 ± 1.8          | 85.9 ± 0.9         | 164.9 ± 6.5  | 0.54 ± 0.00         | 74.3 ± 0.9  | 2  |
| 19.0        | 57.0 ± 6.4  | 160.1 ± 7.2          | 85.9 ± 2.8         | 164.9 ± 4.3  | 0.54 ± 0.01         | 74.3 ± 4.5  | 2  |
DISCUSSION

The material is small, as is often the case in population-based studies in sparsely populated arctic countries. On the other hand it is examined, and described in detail. I found the interest and participation of local people to be satisfactory. More districts must be involved if clinically useful Greenlandic standard growth charts are to be compiled. Our study, however, gives a hint to what extent foreign, for example Danish, growth charts may be of use in Greenland.

It is regrettable and incomprehensible that no recent Danish material is available. Concerning standing height and weight, the Danish standard growth curves usually referred to were published 20 years
ago, but using material now 30 years old (4). Concerning sitting height, sitting height ratio and armspan, a more recent Danish study has been published (5).

It appears that, Greenlandic boys today follow the latest Danish curves for standing height up to the age of 14. After that, the Greenlandic curves flatten out reaching a mean final height of 7 cms below that of Danish boys (Fig.3a). Greenlandic girls up to the age of 11 years follow the Danish curves; the Greenlandic curves then flatten out to attain a final height of 5 cms below the Danish final height (Fig.3b).

The material from Maniitsoq presented in this article includes a small number of children not of pure Greenlandic descent. In a pre-
Previous publication (6), 52 individuals were excluded, leaving only 537 children for analysis. The remaining subjects, and the data derived from them, were described as genuinely Greenlandic, if such a designation may be used. The curves compiled in the previous analysis were only slightly different from those presented here.

It is interesting that a 37-year-old study of Greenlandic school children was made in Maniitsoq alone (2). This study only included children up to the age of 14 years, presumably because children in those days had left school by that age. It appears that, in Maniitsoq, both boys and girls aged 14 years have increased their standing height by at least 10 cms. That does not imply that their final height is similarly increased. The secular trend implies a modification of the shape of
Figure 6a-b. Boys' and girls' weight for height.

a child’s growth curve, the pubertal growth spurt nowadays typically occurring at a younger age.

Greenlandic children seem to have a final armspan a few cms greater than their final standing height, the former measurement not reaching it’s maximum until one year after the final height is obtained. It is unknown whether this is also true of Danish children. Simultaneous recordings of these body proportions in Danes have not been published.

It is a longstanding, but maybe forgotten, observation that Greenlanders’ bodies are somewhat longer than those of Europeans, the latter having longer legs (7).

In some countries, such as Holland, it is reported that the secular
The secular trend of increased standing height is due to increased leg length (8). Therefore, the secular trend in growth implies a decreasing sitting height ratio, as indeed is seen when comparing the two sets of data from Maniitsoq. (Fig. 4a and b). Differences of body proportions may give the erroneous impression of morbidity, especially skeletal dysplasia.

It is well known that Greenlanders’, or Inuits’, height for age is smaller than that of Europeans. Weight for height, however, is higher (2,3,9). This is apparent from the previous study in Maniitsoq and is confirmed in the new study (Fig. 6a and b).

Menarche is an important marker and milestone of growth, development and final height. Mean menarcheal age in Greenland has formerly been mentioned by Alfred Berthelsen (10). He stated it to be 15 years and 6 months in eskimo women in 1900, probably at the beginning of the previous century. In Danish birth cohorts from 1923-69, menarcheal age fell from 14.15 years to 13.09 years (11). Menarche in Maniitsoq now occurs at an age three months younger than in Denmark.

The positive secular trend in Greenland may be due to both better nutrition and less morbidity than previously. The trend may perhaps be seen as an indicator of the population’s good state of health. Increasing interbreeding between Inuit (Greenlanders) and Europeans (Danes) cannot be ruled out as a factor influencing the secular trend.

CONCLUSION

Over a little more than 30 years, 14-year-old children in Maniitsoq increased standing height by 10 cms, or more. Up to the age of 14 years, boys in Maniitsoq seemed to reach the same standing height as Danish boys, while girls were still a bit shorter than Danish girls, although only by a few cms. Greenlandic children’s mean final height, however, was 5-7 cms below that of Danes. Being a part of the secular trend the spurt of puberty is moving towards younger age groups.

From puberty onwards, the Greenlandic growth curves for standing height flattened out, reaching a final height 5-7 cms lower than the Danish curves. Adult sitting height almost reached the Danish level. Until puberty, Greenlandic children seemed to follow the Danish curves for standing height. Then their curves levelled out. That means that the adult sitting height ratio was higher in Greenlanders than in Danes.

The secular trend in Greenland, with a pubertal growth spurt earlier
than previously, implies that menarcheal age in Greenland is now a little, although not much, lower than in the corresponding Danish birth groups. Over the space of 100 years, menarcheal age in Greenland has been reduced by three years, and is now 12.66 years.

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