Growth & development of Indian children adopted in Sweden

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More than 6800 children from India have been adopted in Sweden over the last four decades. At arrival many were undernourished and suffered from infectious diseases. Catch-up growth was common. Unexpectedly, cases of early pubertal development were subsequently reported. In order to investigate the growth and development of adopted children more in detail we studied 114 children adopted from India prospectively during two years. The majority were stunted at arrival and caught up in height and weight after two years. Psychomotor retardation and common infections diminished fairly soon. Those that were stunted did not attain the higher catch-up levels of those not stunted at arrival. Low birth weight also limited the degree of catch-up growth. 107 girls were analysed retrospectively in another study. The median menarcheal age was 11.6 yr (range 7.3-14.6 yr) which is significantly earlier than the mean in Swedish and privileged Indian girls (13.0 and 12.4-12.9 yr, respectively). The pubertal linear growth component was normal in duration and magnitude but likewise started 1.5 yr earlier. The final height/age was 154 cm (-1.4 SDS) and the weight/age 46.9 kg (-1.1 SDS) 8 per cent were 145 cm or shorter. Stunting limited catch-up growth and final height. Those that were most stunted at arrival, and had the fastest catch-up growth, had the earliest menarche. Good maternal and child nutrition is necessary for full expression of a child’s growth potential. What is lost in growth early in life can only partially be recovered by catch-up growth. Such growth is associated with risk for early pubertal development which abbreviates the childhood growth period and limits final height. The mechanism underlying the early pubertal development, and the optimal management of nutrition rehabilitation after chronic malnutrition, need to be clarified by further studies.

Key words Adoption - children - growth - malnutrition - menarche - puberty - stunting

Introduction

Since the end of the 1960-ies, there have been around 1000 - 1500 international adoptions per year in Sweden. During the period 1969 - 2007 there have been 48094 children adopted in Sweden. Of these 6821 (14%) have come from India. During the peak years of adoption in the 1980-ies about 20-25 per cent of the arrivals each year came from India'. The adoptive parents lived all over Sweden. The children underwent an initial health examination on arrival in Sweden and were subsequently monitored regarding health and development in children’s health clinics. Many of the children were at arrival suffering from chronic malnutrition resulting in stunting, and were also afflicted with various infectious diseases. Psychomotor retardation was also observed. It was seen that most adopted children caught up well in height and weight, became cured of most of the infectious diseases and developed well. However, after
some years reports started to come that some adopted girls came into puberty very early.

The first report was from Gothenburg describing six girls adopted from India and one from Bangladesh who entered puberty very early and were short². Similar observations came from children’s clinics all over the country. Should these findings be regarded as normal variations or not? At Uppsala University Children’s Hospital, in the International Child Health Unit, we decided to investigate the growth and development of internationally adopted children more in detail.

We elected to study children from India, since (as mentioned above) India was at the time one of the major countries of origin for internationally adopted children in Sweden. Moreover, India had good national data about growth and development, both for privileged as well as for underprivileged child populations³-⁵. The growth data were analysed using Standard Deviation Scores (SDS) and the NCHS reference data as recommended by WHO for international comparisons⁶. We also compared with Indian national data, studies on the growth of affluent Indian children³-⁵ and Swedish national growth data⁷.

Health status and growth and two year follow-up

In a prospective study we contacted five main adoption organisations in Sweden and asked their help to contact all families going to adopt children from India. 114 children were included in the study⁸. We followed the health, growth and development of these children from arrival and during two years, with the help of the child health clinics. The mean age at arrival was 15.2 months. The children were examined monthly the first six months and thereafter every three months.

Health status: At arrival 29 per cent of the children had retarded psychomotor development, which had diminished to 4.7 per cent after two years. There was abnormal eating behaviour (voracious hunger or loss of appetite) in 30 per cent at arrival, declining to 8.3 per cent after three months. At arrival 54 per cent of the 114 children had a number of clinical conditions and common parasitic and bacterial infections. Some infections still remained after two years.

Growth: We found that they were characterised by chronic malnutrition expressed as stunting, with a mean of -2.25 SDS height/age at arrival, catching up to above -2 SDS after two months, and thereafter catching up steadily to level off at -0.7 SDS after the two years. There was a similar development for weight/age, which initially was - 2.23 SDS and eventually -1.0 SDS after two years. The mean weight/height at arrival was - 0.94 SDS and showed some catch up during the first months, thereafter levelling off and attained about – 0.5 SDS after two years. The mean head circumference was -1.98 SDS at arrival, and finally about -1.5 SDS after two years.

Birth weight: The birth weight was known for 37 children. 27 per cent had a birth weight <2000 g. This group attained a lower catch-up level of height/age after two years compared with the catch-up level of the group that had a birth weight >2000 g.

Menarcheal age and growth pattern

We also carried out a retrospective study¹⁰,¹¹ with the help of one of the main adoption organisations. We contacted the families of girls adopted from India born in 1971 or earlier and asked for their growth data and their menarcheal age. Data from the parents as well as from the child health and school health services were collected for 107 girls. Their mean age at arrival was 3.7 yr. We analysed their growth data at arrival, after two years in Sweden, at menarche and at attainment of final height. We used interpolation for the two-year values and the values at menarche⁸.⁹.

Menarcheal age: We found that their median menarcheal age was 11.6 yr which was significantly earlier compared with girls in Sweden (mean 13.0 yr), Indian well nourished girls (12.4-12.9 yr) and Indian less privileged girls (14.4 yr). The menarcheal ages were fairly normally distributed in our study population, with a range of 7.3 – 14.6 yr. 13 per cent had menarche before 10 yr of age.

Catch-up growth and final height: At arrival in Sweden the mean starting height/age of the girls was -2 SDS, similarly to a general child population in India compared with the NCHS curves. After two years in Sweden most of the girls had caught up in height and weight within normal range for well-nourished children, and remained so at menarche. Obesity did not develop. The mean final height attained was 154.0 cm (-1.4 SDS), and weight 46.9 kg (-1.1 SDS). The range for final height was 134.0 cm – 165.0 cm, and 8 per cent of the girls were 145 cm or shorter.

Those that were stunted did catch up in height and weight, but did not attain the higher catch-up and the final height levels of those that were not stunted at arrival.

Stunting, rate of catch-up growth and the timing of puberty: Furthermore, we found that the degree of stunting and the rate of catch-up growth were associated
with the timing of puberty. Analysis by stepwise multiple linear regression showed that the girls that had the most pronounced stunting and thereafter the most accelerated catch-up growth were those who had the earliest menarcheal age\textsuperscript{12}.

The onset and duration of pubertal linear growth: In a further analysis\textsuperscript{13} we examined the onset of puberty and the pubertal linear growth component using the Infancy-Childhood-Puberty (ICP) model of Karlberg\textsuperscript{14}. This method subdivides linear growth into an Infancy phase, a Childhood phase and a Pubertal growth phase and describes the duration and magnitude of each component.

We found that their childhood phase was shortened by 1.5 yr by the earlier onset of the pubertal growth component, which in itself was of normal duration and magnitude.

Discussion

The Indian adopted children analysed in these studies are fairly representative of Indian less privileged children, with a high proportion of stunting and common infections at arrival in Sweden. Other studies show the same picture\textsuperscript{15}. Thus studies of their growth and development after adoption may be of interest in the country of origin as well as in the recipient country, offering the possibility to observe the effect of permanent transition to, in many ways, optimal living conditions.

It appeared that most of the chronically malnourished children, many suffering from infections, had a good potential for recuperation. They got rid of their diseases and caught up well regarding psychomotor development and height and weight for age in their new environment. Head circumference showed only limited catch-up.

It is interesting to note that obesity did not develop, neither during catch-up growth the first two years after arrival, nor during later growth. However, these studies also show that the catch-up growth was limited by factors probably associated with previous undernutrition in utero expressing itself as low birth weight. Stunting at arrival in Sweden may in many cases be due to the combined effects of intrauterine and postnatal chronic undernutrition.

A further limiting factor for the linear growth of the girls in the retrospective study was the much earlier onset of the pubertal development. This cut short the childhood growth period with around 1.5 yr, compared with girls in Sweden. The extent and magnitude of the pubertal growth component was normal but started earlier. This is in accordance with the studies of Satyanarayan \textit{et al} of the adolescent growth of privileged and underprivileged boys\textsuperscript{16}.

A number of studies on adopted girls in various European countries and also in the USA have subsequently reported early pubertal development in adopted girls\textsuperscript{17,22}. The fact that many countries of origin are represented in these reports indicate that the early pubertal development may be mainly due to environmental factors. The reason for the development of early puberty remains as yet unknown, but there are some relevant observations:

As mentioned above, in our studies we found that the lower the stunting and the faster the catch-up growth, the earlier the menarche occurred\textsuperscript{11,12}. Bourguignon \textit{et al} found in experimental studies in male rats that an increased growth rate resulting from unrestricted feeding after nutritional deprivation was associated with accelerated hypothalamic and testicular maturation. The authors discussed early pubertal maturation associated with catch-up growth in adopted girls in relation to these findings\textsuperscript{17}. Teilmann \textit{et al} found that prepubertal adopted girls in Denmark showed signs of increased pituitary and gonadal activity\textsuperscript{23}.

Persson \textit{et al} have also shown that girls born small for gestational age came into puberty about 5 months earlier compared with the normal population\textsuperscript{24}. Connections between prenatal growth and pubertal development have been discussed\textsuperscript{25}, as has the possible effects of growth retardation in early childhood\textsuperscript{26}.

Precocious puberty can effectively be treated with GnRH analogues. With this treatment the pubertal signs recede and also psychologically the girl remains in childhood until the medication is withdrawn. This withdrawal is planned together with the child and the parents to take place at the appropriate time for normal puberty. There is no certain gain in height by this medication; in fact GH-secretion may be decreased by the GnRH-analogue.

Treatment with GH added to GnRH-analogue has been shown to improve final height, in a multicentre study of adopted girls with early puberty\textsuperscript{27}. However, this combined treatment is only justified in selected subgroups, consisting of those most stunted at onset of GnRH-analogue treatment and with the lowest predicted adult height. Such prediction is done using bone age determination. We have studied the value of different bone age determination methods for this
purpose and recommend one method as the most useful in selecting patients for combination treatment.28,29

Conclusions

These studies on Indian children adopted in Sweden underline that good maternal and child nutrition is necessary for full expression of a child’s growth potential. What is lost in growth early in life can only partially be compensated for by catch-up growth.

Such growth is associated with risk for early pubertal development which abbreviates the childhood growth period and limits final height. Parents and personnel in child health and school health services should be aware of this so that clinical evaluation of the child at risk can be done speedily, and medication started, if necessary.

The early pubertal development would seem to be associated with intrauterine factors as well as with the severity of stunting postnatally and the rate of prepubertal catch-up growth. The mechanism underlying the early pubertal development, the metabolic changes during catch-up growth and the optimal management of nutrition rehabilitation after chronic undernutrition in children, need to be clarified by further research.

References


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