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A longitudinal study on anthropometric and clinical development of Indian children adopted in Sweden

I. *Clinical and anthropometric condition at arrival*

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ABSTRACT

One hundred and fourteen children (60% girls) adopted from India through five major adoption organizations, were recruited consecutively. This paper describes the environment of the children in India and in Sweden, discusses the certainty of the ages and reports their condition at arrival in Sweden. The median age at arrival was 9.3 months, 62% being below one year of age (range 3-72 months). Infectious diseases similar in kind and frequency to those noted in child populations in developing countries, were found. Height/age and weight/age mean values were approximately -2 standard deviation scores (SDS) of the NCHS/WHO standard, which is similar to the anthropometric status of Indian average children. There were no significant sex differences. Thirty-seven birth weights were known, the majority below 2 500 g. Psychomotor retardation was found in 29% of the children. In the children with stunting and in those with weight/age $<$-3 SDS at arrival there were high percentages of psychomotor retardation, anaemia and combined wasting and stunting. Therefore these children should be regarded as a risk group and be followed up with special care.

INTRODUCTION

During the period 1969-87 more than 27 000 children were adopted from developing countries to Sweden, 4 800 of them from India. From 1975 onwards 1 300-1 700 children arrived yearly, an average of 300 from India.

Retrospective studies of the somatic development and social adaptation after arrival have been carried out (9, 11, 14). These studies have shown rapid initial catch-up growth and favourable development in general.

However, it has been found that Indian adopted girls undergo earlier sexual maturation and in some cases attain shorter final height than Indian and Swedish girls (1, 16, 17). Menarcheal age was positively correlated to the age at arrival and to the velocity of catch-up growth (16, 17).

Final height was positively related to menarcheal age and to height at arrival (17). The pubertal growth component was found to be normal, lower final height being associated with a shortened childhood growth phase due to early pubertal onset, as well as to lower height before onset of puberty (18).

These studies indicate that the later growth and development of adopted children is influenced by their conditions before adoption as well as during the initial period after arrival in Sweden. A longitudinal prospective study can add information not obtainable by retrospective investigations. Limitation of the study population to children adopted from one country enables comparison with national data.

The aim of the present study was to follow a group of adopted children from their arrival in Sweden and during the following 2 years, in order to record their growth, development and clinical condition, and to relate these parameters to sex, conditions before adoption, and to age, health and nutritional status at arrival.

This paper describes the environment of the adopted children in India and Sweden, discusses the certainty of the age data and describes the anthropometric and clinical condition at arrival in Sweden.

MATERIAL AND METHODS

The parents of 132 children were invited to take part in the study, upon the arrival of the children in Sweden. They were consecutively recruited through 5 adoption organizations: the Adoption Centre (AC), the Children Above All-Adoptions (BFA), the Indo-Swedish Association for Intercountry Adoptions (ISIA), the Family Association for International Adoptions (FFIA), and the Swedish Association for Adopted Children's Welfare (SAW). The parents of 114 children (86%) were willing to take part. The rest answered that they were unable to participate.

Due to the sensitivity of the issue of adoption experienced by many parents, the authors were advised by the adoption organizations neither to encourage enlistment in the study too insistently, nor to demand specification of the reason for non-participation.

The adoptive parents answered a questionnaire regarding their child's social and health conditions in India, and also about their own age and education and the number of their previous biological and/or adopted children. The doctor carrying out the first health examination was supplied with a standardized examination form. The subsequent examinations during the 2 years of follow up were also standardized, and will be described in detail in a subsequent paper. The data collection started in 1985.

Telephone contact with the parents was taken when necessary. The parents were offered medical advice regarding their children when needed. The parents' informed consent for data processing was obtained.

Anthropometric measurements were carried out according to routines used in Swedish child health practice.

The anthropometric data are expressed in standard deviation scores (SDS) according to the method recommended by WHO, using the reference data from the National Center for Health Statistics (NCHS) (15, 26, 27). The NCHS reference data are also applicable to Indian children (2, 25). When analyzing anthropometric data in relation to age at arrival, the age groups recommended by WHO were applied whenever possible. The calculation of standard deviation scores (SDS) for the anthropometric indices height/age, weight/age, weight/height and head circumference/age was done according to the procedure recommended by WHO (15, 26):

$$SDS = \frac{\text{Individual's value} - \text{median value of reference population}}{\text{Standard deviation value of reference population}}$$

The CDC Anthropometric Software Package (13) based on the NCHS reference population was used for the SDS calculations.

According to WHO recommendations malnutrition was classified as "stunting" for height/age <-2 SDS, and as "wasting" for weight/height <-2 SDS (15, 26, 27).

Psychomotor development was related to accepted standards (12).

Statistical analysis using Student's *t*-test, bivariate linear regression, calculation of Pearson's correlation coefficient and non-parametric analysis of variance (Kruskal-Wallis test) were carried out using the SAS System (19, 20 21).

When not otherwise stated, percentages are calculated on the total material of 114 children.

RESULTS

Environment in India and Sweden. The age at arrival and the sex distribution is seen in Table 1. The median age at arrival was 9.3 months, 62% being below 1 year and 81% below 2 years. The age ranged from 3-72 months. The girls dominated (60%).

Table 1. *Age at arrival*

Age at arrival (months)	Boys n	Girls n	Total n	Total %
- 11	31	40	71	62.2
12 - 23	8	13	21	18.4
24 - 35	2	9	11	9.7
36 -	5	6	11	9.7
Total n	46	68	114	100.0
%	40.4	59.6	100	
Mean age (months)	14.3	15.8	15.2	
Median age (months)	8.6	9.5	9.3	
Range (months)	3-62	3-72	3-72	

Most of the children were born in or near big cities (Calcutta 33%, Bombay 15%, Nagpur 15% and Madras 9%). The remaining came from all over India.

Information regarding one or both biological parents was available for 52 children. For 45 of these only the mother was known. Four of these 45 mothers had died and all the remaining lacked social support in various ways, e.g. they were unmarried, abandoned or widows. Six children had living married parents. In one case, only the father was known.

For the majority (62%) the first institutional contact eventually leading to adoption was with a children's home, to which the children were brought by parents or relatives. Eighteen percent were born or left in a hospital and later transferred to a foster home or children's home. Fourteen percent of the children were foundlings, e.g. abandoned in the street.

Most of the children (77%) were adopted from children's homes. Twenty-two percent came from foster homes, and 1% from a hospital.

For 36 children (32%) information regarding the previous medical history was available. This could refer to the period just before departure or earlier. The adoptive parents reported a summary of this information. Ten of the 36 children were reported to have had protein energy malnutrition, 11 acute respiratory infections, 9 diarrhoeal disease and 5 anaemia. A range of other diseases was also reported for a few or single cases: intestinal parasites, urinary, ear, eye and skin infections, hepatitis B, tuberculosis, vitamin A deficiency and rectal prolapse. Most children had more than one disease.

The adoptive families were located all over Sweden, in both rural and urban areas. There were 112 families in all, consisting of 108 couples and four single mothers. All the 108 adoptive couples were married. Two couples adopted 2 children each, the rest of the families adopted 1 child.

The mean age of the fathers (n=108) was 36 years (range 25-48 years) and that of the mothers (n=112) was 35 years (range 25-50 years). Eighteen mothers were 40 years or older. For 7 of these mothers the adopted child was the first child.

Forty-seven percent (51/108) of the fathers and 49% (55/112) of the mothers were first time parents. The 4 single mothers were among these. The mean age of the first time fathers was 34 years (range 25-48), and of the first time mothers 33 years (range 25-44).

Nine families had previous biological children (7 families had 1 child and 2 families had 2 children). Three of these families also had previously adopted children.

Fifty-one families had previously adopted children (48 families had one child and 3 families had 2 children). Eighty percent (43/54) of the previously adopted children came from India, the others from Sri Lanka, Indonesia, Thailand, Bolivia, Chile and Sweden.

Socio-economic classification of the adoptive parents has been carried out according to the method based on occupational categories developed by Statistics Sweden (23). Compared with Swedish figures for 1986 of classification of parents, the distribution of socio-economic classes was similar among the adoptive parents, except that no unemployed or unclassifiable parents were found among the adoptive parents (Table 2) (6).

Table 2. *Classification of adoptive families (n = 112)*

	Study population		Swedish families with children 1986 (6)
	n	%	%
HOMOGENEOUS FAMILIES[1]			
A. Workers or assistant non-manual employees	39	35	33
B. Intermediate non-manual employees, professionals or executives	35	31	29
C. Self-employed (other than professionals)	1	1	4
NON-HOMOGENEOUS FAMILIES			
One parent group A, the other group B	24	21	19
One parent group C, the other any other occupation	13	12	5
OTHER[2]	-	-	10
TOTAL	112	100	100

[1] i.e. both parents belong to the same occupational group

[2] unemployed or unclassifiable

Certainty of the children's age. The childrens' age was based on official documents issued by medical and civil authorities in India. Additional information was sometimes available from medical or other personnel at institutions where the children were cared for. The degree of certainty of the age was based on the information given to the adoptive parents as well as on the judgement of the doctor carrying out the first health examination after arrival. Based on this the age data of 54% were classified as "certain", 33% as "fairly certain" and 9% as "uncertain".

Anthropometric evaluation. The majority (75%) of the first examinations after arrival were carried out within 1 week, and 86% within 2 weeks. Sixty-four percent of the examinations were carried out at pediatric clinics, 26% at infectious diseases clinics, and 10% at other clinics.

Figure 1 and Table 3 show the distribution and the means of the weight/age, height/age and the head circumference/age.

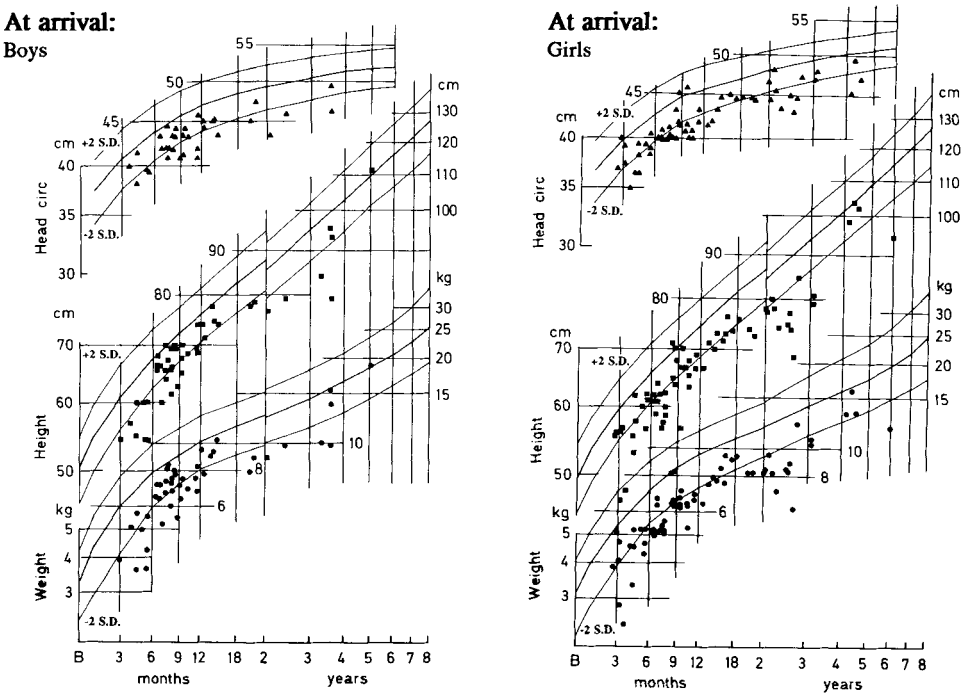

Figure 1. Head circumference (triangles), height (squares) and weight (dots) at arrival for the adopted boys and girls, in relation to the NCHS reference (median and +/- 2 SD indicated).

The mean values for weight/age, height/age and head circumference/age were about -2 SDS, but with great variation. The mean weight/height was approximately -1 SDS. Many children showed extremely low values, particularly among the young infants and the older children.

Table 4 shows the rate of stunting and wasting according to the definitions used; 47% were stunted, 1.8% wasted and 6.4% showed a combination of both conditions. There were no significant sex differences.

The age distribution of the anthropometric variables and the nutritional status are seen in Tables 5 and 6. The children in the age groups 0-5 months and ≥18 months had the lowest weight/age and height/age. Analysis of variance (Kruskal-Wallis test) showed significant differences between the means of the age groups for height/age and for weight/age, while for weight/height and head circumference/age there were no significant variations. Six of the 7 children with both stunting and wasting were found in the oldest age group.

Table 3. *Anthropometry at arrival*

	Boys (n=46)	Girls (n=68)	Total (n=114)
WEIGHT/age			
mean SDS	-2.06	-2.38	-2.25
range SDS	(-4.02)- (-0.26)	(-5.21)- (-0.14)	(-5.21)- (-0.14)
n	45	66	111
% <-2 SDS	49	67	60
% <-3 SDS	27	24	25
HEIGHT/age			
mean SDS	-2.08	-2.33	-2.23
range SDS	(-5.26)-(+0.14)	(-6.20)-(+0.90)	(-6.20)-(+0.90)
n	45	66	111
% <-2 SDS	51	56	54
% <-3 SDS	22	27	25
WEIGHT/HEIGHT			
mean SDS	-0.84	-1.02	-0.94
range SDS	(-2.82)-(+0.90)	(-2.27)-(+0.91)	(-2.82)-(+0.91)
n	45	64	109
% <-2 SDS	9	8	8
% <-3 SDS	0	0	0
HEAD CIRCUMFERENCE/age			
mean SDS	-1.83	-2.07	-1.98
range SDS	(-3.91)- (-0.17)	(-4.62)-(+0.84)	(-4.62)-(+0.84)
n	34	59	93
% <-2 SDS	44	54	51
% <-3 SDS	9	15	13

Table 4. *Distribution of stunting and wasting (n=109)*

	Normal		Stunted		Wasted		Stunted & wasted		Total	
	n	%	n	%	n	%	n	%	n	%
Boys	21	46.7	20	44.4	1	2.2	3	6.7	45	100.0
Girls	28	43.7	31	48.4	1	1.6	4	6.3	64	100.0
All children	49	45.0	51	46.8	2	1.8	7	6.4	109	100.0

Table 5. *Mean SDS values on arrival for all children for the various age groups, for weight/age, height/age, weight/height and head circumference/age.*

	Weight/age		Height/age		Weight/height		Head circ/age	
	n	SDS	n	SDS	n	SDS	n	SDS
0-5	22	-2.39	22	-2.61	20	-0.62	18	-1.88
6-11	48	-2.13	48	-1.83	48	-0.91	41	-1.85
12-17	13	-1.74	13	-1.75	13	-0.86	11	-1.88
18-	28	-2.58	28	-2.84	28	-1.26	23	-2.35
KRUSKAL-WALLIS TEST[1]		$p<0.05$		$p<0.01$		NS		NS

[1] non-parametric analysis of variance (20), 5% significance level

Table 6. *Age distribution of nutritional status (n=109)*

Age (months)	Normal		Stunted		Wasted		Stunted & wasted		Total	
	n	%	n	%	n	%	n	%	n	%
0-5	7	35.0	12	60.0	1	5.0	0	0	20	100.0
6-11	25	52.0	21	43.8	1	2.1	1	2.1	48	100.0
12-17	8	61.5	5	38.5	0	0	0	0	13	100.0
≥ 18	9	32.1	13	46.5	0	0	6	21.4	28	100.0

There were birth weight data for 37 children (19 boys and 18 girls). Eighty-one percent (30/37) had a birth weight below 2 500 g. At arrival in Sweden 17 were <6 months of age, 19 were 6-17 months of age and 1 ≥18 months of age. Sixty-five percent (24/37) were stunted and 8.6% (3/35) were wasted. There was no sex difference regarding weight/age, height/age and weight/height at arrival, and therefore the sexes were combined into one group. Linear regression analysis showed that birth weight correlated significantly with weight/age at arrival ($p<0.001$, $r=0.38$) and height/age at arrival ($p<0.001$, $r=0.36$), but not significantly with weight/height at arrival).

Clinical examination. The clinical assessment after arrival showed that 54% had pathological findings, most commonly malnutrition (as judged clinically) (45%), acute respiratory infections (8.8%), diarrhoea (4.4%), molluscum contagiosum (8.3%), scabies (9.7%), otitis media or otosalpingitis (15%), external otitis (3.7%) and throat infections (4,4%). Frequently the same child had several pathological findings.

Anaemia (B-haemoglobin <100 g/L) (5) was found in 15%, elevated ESR (≥20 mm/h) in 26%, leucocytosis (≥15 x 10^9/l) in 40%, abnormal differential count (mainly lymphocytosis and eosinophilia) in 60%. HBsAg was positive in 8.3%. The stools were abnormal in 44%, with bacterial, parasitic or combined infections (Table 7).

Table 7. *Results of the stool examination of the children in "the 2-year study" (n=112-113), at arrival in Sweden.*

Diagnosis[1]	%
Salmonella	15.9
Giardia lamblia	13.3
Trichuris trichiura	9.7
Campylobacter	7.1
Ascaris	6.2
Strongyloides stercoralis	4.4
Ancylostoma duodenale	3.5
Hymenolepis nana	3.5
Shigella	1.8
E. histolytica	1.8

[1] one child may have several infections

Of 108 children assessed regarding their psychomotor development, 29% were found to be retarded according to accepted development standards (12).

Psychomotor retardation occurred mainly among the stunted children (47%), compared with 7.8% in the non-stunted group. Corresponding figures for anaemia were 23% and 4.0%, respectively.

Twenty five percent (28/111) of the children (27% of the boys and 24% of the girls) had weight/age <-3 SDS. This indicator was selected since it reflects both height for age and weight for height (27). The majority of those with height for age <-3 SDS and 5 of the 9 with weight for height<-2 SDS, were found in this group. Retarded psychomotor development was more common (54% compared to 21% among the rest). Anaemia was also more frequent. Otherwise there were no clear differences regarding disease frequencies (Table 8).

Table 8. *Characteristics of children with weight/age <-3 SDS compared with those ≥-3 SDS*

	weight/age <-3 SDS (n=24-28)		weight/age ≥-3 SDS (n=72-83)	
	n	%	n	%
Height/age <-3 SDS	21	75	7	8
Weight/height <-2 SDS	5	19	4	5
Anaemia (B-Hb <100 g/L)	6	21	10	12
HBsAg positives	3	12	5	6
Salmonella	5	18	13	16
Shigella	2	7	0	0
Campylobacter	2	7	6	7
E.histolytica	0	0	2	2
Giardia lamblia	4	14	10	12
Ascaris	2	7	5	6
Trichuris trichiura	4	14	7	9
Acute respiratory infection	0	0	11	13
Diarrhoeal disease	2	7	3	4
Urinary tract infection	1	4	1	1
Scabies	3	11	8	10
Conjunctivitis	0	0	2	2
Throat infections	0	0	4	5
Otitis	4	14	13	16
Tuberculosis	1	3	0	0
Retarded psychomotor development	14	54	17	21

DISCUSSION

The study population was recruited consecutively during a certain period. The age and sex distributions in the studied population were very similar to those of all Indian children adopted in Sweden during the recruitment period. The 5 major Swedish adoption organizations undertaking adoptions of children from India were included. Therefore the study population could be considered as representative for Indian children adopted in Sweden during the period mentioned.

There is no reason to believe that the defaulting 18 children were different from those in the study population.

As many as 87% of the children were estimated as having a "certain" or "fairly certain" age. This seems reasonable since the majority of the children were very young at arrival, and it is easier to obtain reliable birth data for younger children. Furthermore, the margin of error in age estimation is naturally less the younger the child.

The adoptive families were selected to provide a good emotional and social environment to the children.

The majority of the children with known background came initially from socially deprived situations. The children's homes and foster homes, from which most of the children were adopted, were as a rule well-ordered but certainly not affluent. It is therefore not surprising to find that the diseases in India, as well as at arrival, corresponded to those usually found in developing countries. Moreover the anthropometric indices were similar to those of an average Indian population, characterized by chronic malnutrition among a considerable proportion of the children (3, 8, 22). Similar findings are reported also from earlier studies of children adopted from developing countries. The relatively high prevalence of psychomotor retardation has likewise been noted earlier. (9, 14).

The mean weight and height for age at arrival were approximately 2 SDS lower than for affluent Indian children (2, 25) but were similar to Indian national average data which included also less privileged children (8). The distribution of wasting and stunting was similar to that found in India except for a higher percentage of combined wasting and stunting (Table 4) (22).

No significant differences regarding anthropometry were found between the sexes, which is in accordance with the findings of Sastry et al. (22).

In our study population there were data on birth weight for only 37 children. The sub-sample is naturally limited to children delivered in an institution where birth weight is recorded. As many as 30 (81%) had low birth weight (<2 500 g). The Indian low birth weight average is 30% (24), with a wide range depending on socio-economic conditions (7). Our sub-sample is probably biased, including many socially deprived mothers. Malnutrition and pregnancy complications may

have caused these mothers to deliver in a hospital or similar health service, thereby enabling the birth weight to be recorded.

Birth weight has been found to predict weight and height in early childhood (4, 10). The high proportion of stunting seen already in the children who were youngest at arrival (0-5 months) fits with the high percentage of low birth weight in this group (Table 6). Our study sample of 37 children showed significant positive correlations between birth weight, and height as well as weight at arrival, confirming the studies mentioned above.

The low height/age in the youngest age group (Table 5) indicates that stunting may have been present already before birth. The lower rate of stunting in the age group 6-17 months may be due to mortality selection of the weakest and to nutritional catch-up in the survivors. The high rate of stunting seen in the oldest children conforms to rates found in India (22).

The wide ranges of the anthropometric indices at arrival (Table 3) probably reflect the differences in the children's pre-adoptive environment, of which we only have limited knowledge.

The stunted children showed a high rate of anaemia and psychomotor retardation. The children with very low weight for age (a group which contained many of the most severely stunted and/or wasted) also included a high proportion of children with psychomotor retardation and anaemia.

Stunted and very low weight children should be regarded as risk groups and routinely be given a more prolonged and intensive follow up after arrival.

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