COMPARISON OF GROWTH CHARTS OF 1-36 MONTH OLD TEHRANI CHILDREN WITH THE N.C.H.S.[1] CURVE

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ABSTRACT

During a historic prospective study, measurements of weight, height and head circumferences were carried out in a group of 393 Tehrani boys and girls between the first and 36th month of life and measurements were plotted over the N.C.H.S. curves. These children belonged to middle and high-class literate families who were able to understand and follow the medical advice given by their private pediatricians.

Results of this study (Table I and Figs. 1-6) indicate that the trend of growth of this sample of middle and high-class Tehrani children does not differ from N.C.H.S. standards, provided that the parents understand and follow the instructions given with regards to diet, timing, and type of introduction of foods as well as hygienic and preventive measures to be taken.

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INTRODUCTION

Nutrition plays a major and central role in growth and the changing body composition. Growth and maturation begin at the moment of conception and cease with the end of puberty.[1]

All health personnel who are responsible for the care of children must be familiar with their normal pattern of growth and development. They should be alert enough to recognize even minor changes from the norm early and to give appropriate attention to these changes.[2]

To recognize growth variation from the norm quickly, one must measure weight, length and head circumference regularly in children and plot them on standard curves.[2,3]

When local standard curves are not available, N.C.H.S. curves and tables can be used,[2,4,5] especially since these are accepted by the WHO and other international organizations.[6,7]

As growth is under the influence of nutrition, genetics, ethnic and socioeconomic factors,[8,9] the question in this study is could an internationally accepted growth chart such as that of the N.C.H.S. be used for Iranian children?

We are aware of several cross-sectional studies carried out in various groups of rural as well as urban Iranian children from birth to adolescence. These studies indicate that although they grow well and follow the standard curves during the first six months of life especially when breast-fed, they will stay behind in the later stages of life[10,11,12] unless fed properly and good environmental sanitation and care is provided for them by their parents.

Pre-school and school children who belonged to the upper socioeconomic groups of Tehran and Shiraz, demonstrated a growth rate similar and comparable to N.C.H.S. curves.[13,14,15,16]

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One longitudinal study carried out in rich urban and poor rural Shirazi children from birth to two years of age, when compared with Boston and London standards (Jan 1969- Jan 1972) showed that in high socioeconomic groups, growth was similar to standards, but in low-income urban and village children, growth patterns gradually fell below the level of well-to-do children, demonstrating that the differences likely to be due to ecological rather than genetic factors.[17]

As various experts have different views about using western standards for countries like Iran, it was decided to examine the growth indices in a group of Tehrani children from birth to 36 months of age and compare them with N.C.H.S. standards.

MATERIALS AND METHODS

In this historical prospective study, which began in July 1971 and continued for twenty years in the private office of the first author, all children born in Tehran were included in this study. However, out of more than two thousand cases, only 393 who were born full-term and had no congenital anomalies and/or chronic problems and who had followed the instructions (see below) properly and who had the inclusion criteria were selected and data related to them was analyzed. The group included 200 girls and 193 boys. The criteria used in this study were as follows:

A healthy child was defined as one who had been well at least for the past two weeks and did not suffer from any chronic diseases. If the child had had an acute illness such as diarrhea, his/her weight would be disregarded.

Since children were not brought in on a set time and on a regular anticipated schedule, we took into account age ranges and grouped them as:

1 month = 29-31 days old (30±1 day)
3 months = 87-93 days old (90±3 days)
6 months= 175-185 days old (180±5 days)
9 months = 265-275 days old (270±5 days)
12 months = 355-365 days old (360±5 days)
15-24 months = chronological age ± 15 days
25-36 months = chronological age ± 30 days

As for nutrition, all of these children were fed according to a set diet which had been arranged by a pediatrician and were monitored on follow-up visits. Although over 95% of the mothers initiated breast-feeding, the duration of this varied from several days to two years and above, and the majority of infants were formula-fed (mixed feeding). Weaning food and vitamins were usually added from 2-3 months of age, beginning with rice and then with other cereals plus juice. From 4-5 months on, soup, egg yolk, greens, and other vegetables were gradually added to their diet. Family foods and whole egg were introduced during the second year of life together with 1/2 litre of milk.

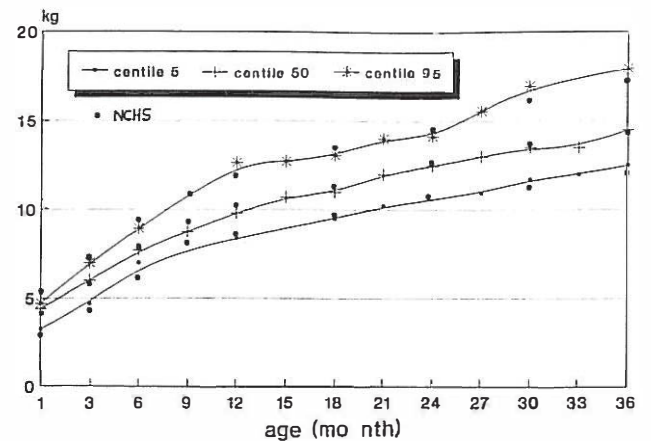All children were immunized against at least six diseases

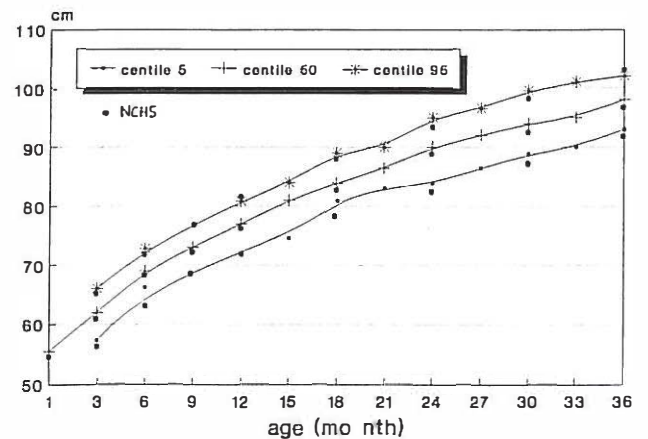**Fig.1.** Comparison of growth charts of 1-36 month old Tehrani children with N.C.H.S. curves.

Fig. 2. Comparison of growth charts of 1-36 month old Tehrani children with N.C.H.S. curves.

Fig. 3. Comparison of growth charts of 1-36 month old Tehrani children with N.C.H.S. curves.

238

Fig. 4. Comparison of growth charts of 1-36 month old Tehrani children with N.C.H.S. curves.

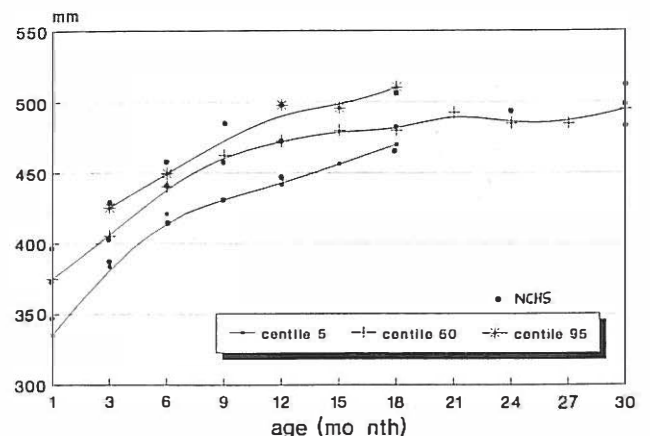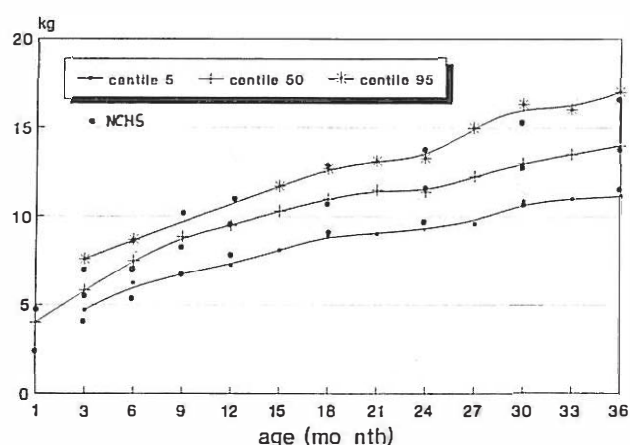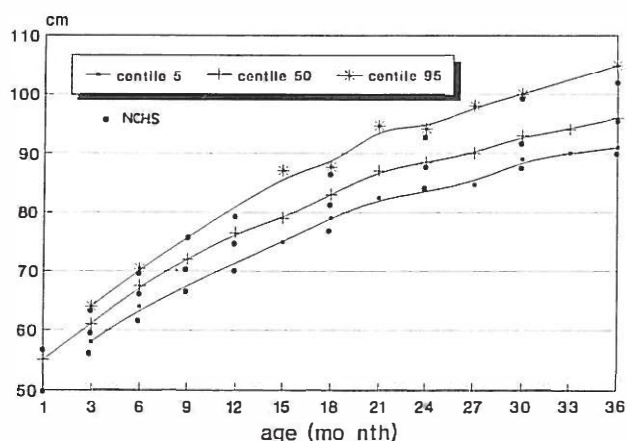**Fig. 5.** Comparison of growth charts of 1-36 month old Tehrani children with N.C.H.S. curves.
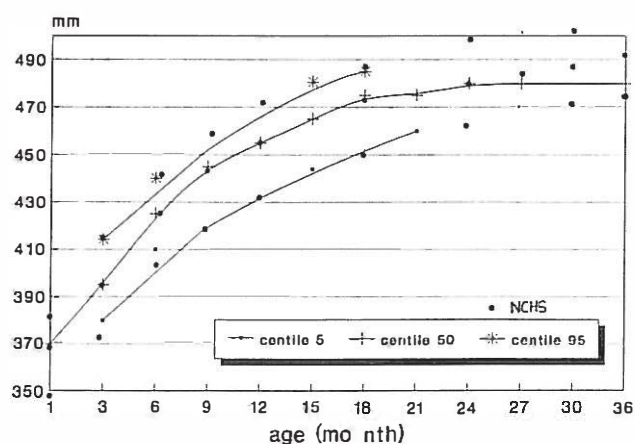

Fig. 6. Comparison of growth charts of 1-36 month old Tehrani children with N.C.H.S. curves.

according to the national expanded program of immunization, namely tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis and measles.

Each child was weighed and his/her height measured by the first author. Weighing was carried out with minimum clothing or naked to the nearest 50 grams with a standard infant scale (Seca) which was calibrated every time used with standard weights on a regular basis.

The recumbent body length was measured as the distance between a moveable upright board applied to the foot soles and a fixed upright board applied to the vertex.

Head circumference was measured by applying a plastic tape firmly over the glabella and supraorbital ridges anteriorly and the maximal occipital protuberance posteriorly to the last completed millimeter. This last measurement was not performed beyond 30 months of age. All figures were plotted on the respective curves.

Description and Analysis of Data

Collected data was analysed by a computer package and processed information given for 5, 10, 25, 50, 75, 90 and 95th percentiles from 1 month to 36 months of age at three month intervals. Graphic presentation of weight, height and head circumference relative to age and comparison with N.C.H.S. standards are shown in Figs. 1-3 for boys and 4-6 for girls. For simplification, only curves for 5th, 50th and 95th percentiles are given. Exact figures for the latter three percentiles are given in Table I for both sexes. Figures in parentheses are the N.C.H.S standards.

It is important to note that after 12 months of age figures are given every 6 months, because the reference data for 3 month intervals were not available.[2] In spite of availability of birth indices, the measurements were carried out in different maternity units and these figures were disregarded.

All of the mothers had had prenatal care and had delivered in hospitals. 97% of infants were their parents' first to third children (42% first, 43% second and 12% third born). Although many of these children were followed-up to their adolescence, this study deals only with their first three years of life. Follow-ups on these children and others will be the subject of another report.

The parents were of middle and high socioeconomic classes of the Tehrani population who were able to understand and follow the medical advice given by private pediatricians and afford to pay for the medical expenses to some extent. The mother's age was 20-35 years in 96% of cases and higher in the remaining 4%. 90% of mothers had completed high school and a few of them were university graduates. Those who were less educated could understand and follow orders.

Only 31% of the mothers were employed (about two-thirds were government employees). A statistical sign test showed that given this sample as a representative sample of

239

Table I. Weight, length and head circumference by age and sex in children 1 - 36 months old*

Age (Mo)	Age Variation (Days)	Sex	Weight for Age (kg) No. of Valid Case	Percentiles 5th	50th	95th	Length for Age (cm) No.of Valid Case	Percentiles 5th	50th	95th	Head Circumference for Age (cm) No.of Valid Case	Percentiles 5th	50th	95th
1	30 ± 1	Boy	25	3.265 (3.16)	4.40 (4.29)	4.70 (5.38)	18	- (50.4)	55.5 (54.6)	- (58.6)	19	35.5 (34.9)	37.5 (37.2)	- (39.6)
		Girl	17	- (2.97)	4 (3.98)	- (4.92)	16	- (49.2)	55 (53.5)	- (56.9)	15	- (34.2)	37 (36.4)	- (38.3)
3	90 ± 3	Boy	65	4.70 (4.43)	6 (5.98)	7 (7.37)	55	57.3 (56.7)	62 (61.1)	66 (65.4)	54	38.3 (38.4)	40.5 (40.6)	42.5 (43.1)
		Girl	51	4.70 (4.18)	5.80 (5.40)	7.58 (6.74)	44	58 (55.4)	61 (59.5)	64 (63.4)	44	38 (37.3)	39.5 (39.5)	41.4 (41.70)
6	180 ± 5	Boy	48	7 (6.20)	7.70 (7.85)	8.93 (9.46)	44	66.25 (63.40)	69 (67.80)	72.75 (72.30)	44	42.75 (41.50)	44 (43.80)	44.92 (46.20)
		Girl	49	6.22 (5.79)	7.5 (7.21)	8.7 (8.73)	51	64 (61.8)	67.5 (65.9)	70.4 (70.2)	51	41 (40.3)	42.5 (42.4)	44 (44.6)
9	270 ± 5	Boy	7	- (7.52)	8.75 (9.8)	- (10.93)	6	- (68)	73 (72.3)	- (77.1)	6	- (43.5)	46.2 (45.8)	- (48.1)
		Girl	11	- (7)	8.85 (8.56)	- (10.17)	7	- (66.1)	72 (70.4)	- (75)	7	- (42.3)	44.5 (44.3)	- (46.4)
12	360 ± 5	Boy	22	8.40 (8.43)	9.80 (10.15)	12.63 (11.99)	25	72.9 (71.7)	77 (76.1)	80.85 (81.2)	22	44.15 (44.8)	47.25 (47)	49.77 (49.3)
		Girl	19	7.25 (7.84)	9.5 (9.53)	- (11.24)	15	- (69.8)	76.5 (74.3)	- (79.1)	16	- (43.5)	45.5 (45.6)	- (47.6)
18	540 ± 15	Boy	71	9.5 (9.59)	11 (11.47)	13.08 (13.44)	61	81 (77.5)	84 (82.4)	89 (88)	52	47 (46.3)	48 (48.3)	51 (50.6)
		Girl	70	8.91 (8.92)	11 (10.82)	12.69 (12.76)	66	79 (76)	83 (80.9)	87.65 (86.1)	60	45.7 (45)	47.5 (47.1)	48.5 (49.1)
24	720 ± 15	Boy	43	10.07 (10.54)	12.50 (12.59)	14.16 (14.70)	40	84 (82.3)	90 (87.6)	94.95 (93.8)	10	- (47.3)	48.5 (49.2)	- (51.4)
		Girl	28	8.63 (9.87)	11.37 (11.90)	13.27 (14.08)	28	80.35 (81.3)	88.5 (86.5)	94.1 (92)	7	- (46.1)	48 (48.1)	- (50.1)
30	900 ± 30	Boy	80	11.71 (11.44)	13.5 (13.67)	16.97 (15.97)	68	88.9 (87)	94 (92.3)	99.55 (98.7)	9	- (48)	49.5 (49.9)	- (52.2)
		Girl	67	10.85 (10.78)	13 (12.93)	16.3 (15.9)	61	89 (86)	93 (91.3)	100 (96.6)	6	- (47)	47.5 (48.8)	- (50.8)
36	1080 ± 30	Boy	62	12.5 (12.26)	14.5 (14.69)	17.92 (17.28)	59	93 (91.2)	98 (96.5)	102 (103.1)	1	- (48.6)	- (50.5)	- (52.8)
		Girl	65	11.15 (11.60)	14 (13.93)	17 (16.54)	58	90.95 (90)	96 (95.6)	105 (101.5)	3	- (47.6)	48 (49.3)	- (51.4)

*numbers in parentheses are relevant N.C.H.S. figures.

240

the middle and high-class population, it appears that Tehrani middle and high-class children grow as well as their western counterparts, provided that good care and nutrition is available. In other words, the null hypothesis was accepted.

DISCUSSION

Growth monitoring is one of the most important methods for assessment of children's health status. When growth parameters are obtained, they must be compared with and plotted over standard figures and curves.

N.C.H.S. standards have been accepted and found useful by the World Health Organization and many other international institutions and authorities.[3,4,6,7] These standards have been used for the past two decades and therefore all health professionals are instructed and advised to follow children's growth carefully by drawing their growth curves so that variations from the norm can be detected soon and prompt corrective measures be taken.[2,3,4,18]

Still some authorities believe that this technique is not very sensitive and is of little value in comparing the magnitude of the gain in weight or height of a child with those of a reference population, and argue that reference data for increments in height and weight are necessary if one is to make a quantitative assessment of a child in relation to that of the reference population. Yet, due to the difficulty in use of reference tables of increment data, they do not argue that such tables replace charts of weight for age and height for age for evaluation of growth progress.[19]

Due to the fact that growth patterns differ according to variations in socioeconomic, genetic and ethnic circumstances, there are still differences of opinion on whether it is wise and prudent to use the N.C.H.S. or similar curves everywhere or not. This is especially important when feeding routines vary and weaning foods are given early in life. Aside from this, studies show that infants who are fed formula or are breast-fed, grow differently.[9,20]

Considering these facts, the present study which was conducted in a private clinic in a group of Iranian babies from birth to three years of age shows that when parents are knowledgeable, concerned, obedient and confident about the advice given and when their children are fed properly, immunized on time, raised in a sanitary environment, and followed carefully by health personnel, they will remain healthy and grow well regardless of their genetics, ethnic and ecological background. Hence, we find this as another confirmatory seal on the former studies performed by others.[13,14,15,16,17]

On the other hand, when children are kept unattended and under poor hygienic and socio-economic conditions, they often become sick and under-nourished and fail to thrive normally.[10,11,12,17]

In conclusion, in order to have a healthy society in the future, children must be well-fed, immunized on time, and cared for properly. We therefore do not deem it necessary to have a different national growth chart.

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241

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