Original Research Article

Growth charts for Indian boys (0-36 months) with down's syndrome: a pilot study

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ABSTRACT

Background: Down's syndrome is the most common genetic condition in the world today and India has one of the highest incidences of Down's syndrome. It is associated with mental retardation and congenital malformations, especially of the heart. Growth retardation is commonly seen in children with Down's syndrome. Early identification of a growth problem is important because timely interventions may positively affect the child's general health and functional abilities as well as supporting growth. Till date no growth charts are available for the children with Down's Syndrome India. The potential benefits of growth charts include: growth monitoring to detect any deviation in growth patterns, evaluating the efficacy measures aimed at promoting growth, providing reassurance to parents, evaluating the results of clinical research or intervention for individual patients and finally comparing with that of the normal population. Thus, the aim of this study was to create growth charts for Indian children with DS aged 0-36 months to investigate and characterize their size, monitor their growth.

Methods: 60 male children between ages 1-36 months with DS were selected from four different pediatric clinics in India. The data used for creation of the growth charts were age at examination (years and months), height (cm), weight (kg), and head circumference (cm). The growth charts cover the time period from birth until 3 years of age. Each child contributed only one single set of data for each age group. The data represent and unselected, therefore presumably unbiased sample of children with DS in India.

Results: On comparing the height, weight and head circumference of the normal vs Down's Syndrome children it is noted that there is significant difference is noted between the Down's Syndrome and Normal children.

Conclusions: As per the outcome of the study it is recommended that there is a vast need of growth chart specific for Down's Syndrome children which will help the doctor to analyze the height, weight and head circumference of the Down's Syndrome children.

Keywords: Down's syndrome, Growth chart

INTRODUCTION

Down's syndrome (DS) is the most common chromosomal disorder, with an incidence of Down syndrome being 1:800, which means approximately 32,000 babies with Down syndrome are born every year (the birth rate of India is 25.6 million births).[1] It is associated with mental retardation and congenital malformations, especially of the heart. DS is also characterized by dysfunction/disease in several other organs.[2] Short stature is a cardinal feature of DS. The growth retardation of children with DS commences

prenatally.[3] After birth growth velocity is most reduced between 6 months and 3 years of age. Puberty generally occurs somewhat early and is associated with an impaired growth spurt.[4]

Statural growth is a well-known indicator of health during childhood.[5] A review showed that stature of children with DS was 0.4-4.0 standard deviation below that of children without DS. This growth restriction has led to the development of specific growth charts for children with DS around the world.[6]

As growth and final height differ markedly between children with DS and healthy children, standard growth charts should not be used for children with DS. If the growth of a child with DS is plotted on a standard growth chart it may show extreme short stature. Additionally, presence of any additional condition such as hypothyroidism or coeliac disease may be overlooked.[7] Although growth is influenced by biological and influential factors, racial variations certainly have a major role.[8] Growth assessment is the single most useful tool for defining health and nutritional status at both the individual and population level. This is because disturbances in health and nutrition, regardless of their etiology, almost always affect growth.[9]

Early identification of a growth problem is important because timely interventions may positively affect the child's general health and functional abilities as well as supporting growth.

Growth monitoring strives to improve nutrition, reduce the risk of inadequate nutrition, educate caregivers, and produce early detection and referral for conditions manifested by growth disorders. At the population health level, cross-sectional surveys of anthropometric data help define health and the nutritional status for purposes of program planning, implementation and evaluation. Growth monitoring is also used in all settings to assess the response to intervention.[10]

Several syndrome specific growth charts have been developed.[11] Previously published growth charts for DS are based on American, Arab, Sicilian and Dutch populations.[12]

The American DS growth charts are frequently used all over the world. Several studies on children's growth charts have been published from many parts of India in the last decade, and growth charts for Indian children were also produced. In January 2015, Indian Academy of Pediatrics (IAP) published revised growth charts for 5–18-year old for normal children.[13,14] Till date no growth charts are available for the DS children India.

The potential benefits of growth charts include: growth monitoring to detect any deviation in growth patterns, evaluating the efficacy measures aimed at promoting growth, providing reassurance to parents, evaluating the

results of clinical research or intervention for individual patients and finally comparing with that of the normal population. Thus, the aim of this study was to create growth charts for Indian children with DS aged 0 – 36 months to investigate and characterize their size, monitor their growth.

METHODS

The study is based on data from 60 children between ages 1-3 yrs with DS boys. Data were collected from records on all individuals with DS children. Thus, all other children, regardless of complicating disease such as congenital heart defect and hypothyroidism, were included.

The data used for creation of the growth charts were age at examination (years and months), height (cm), weight (kg), and head circumference (cm). The growth charts cover the time period from birth until 3 years of age. Each child contributed only one single set of data for each age group. The data represent and unselected, therefore presumably unbiased sample of children with DS in India.

Growth measurements (weight, length and head circumference) were taken at 3-month intervals. Measurements were taken by trained personnel and second person assisted in alignment and immobilization of the child during the measurements.

Length was measured to the nearest millimeter using the recumbent length board infant measuring table. The weight was assessed by a sensitive balance scale to the nearest gram. Head circumference was measured by millimeter by a non–stretchable plastic tape taking maximum occipitofrontal diameter. The recorded measurements for weight, length and head circumference represent a combination of cross-sectional and longitudinal data.

Data for weight and height were transformed into logarithms before the statistical analysis in order to obtain normal distributions. All growth charts are based on means and standard deviations using the weighted regression fitness system. For statistical comparison Repeated measures ANOVA is used. The software used was SPSS v 16.0 is used for analysis purpose.

RESULTS

The Figure 1 represents the height of both normal and Down's syndrome children. The 5th, 25th and 50th percentile of both normal and Down's syndrome children was compared. The statistical findings suggest that there is a significant difference in the height of the children between the normal and DS group among the time period. The significant difference noted in the height of the children between the normal and DS group among the time period is ($p < 0.005$).
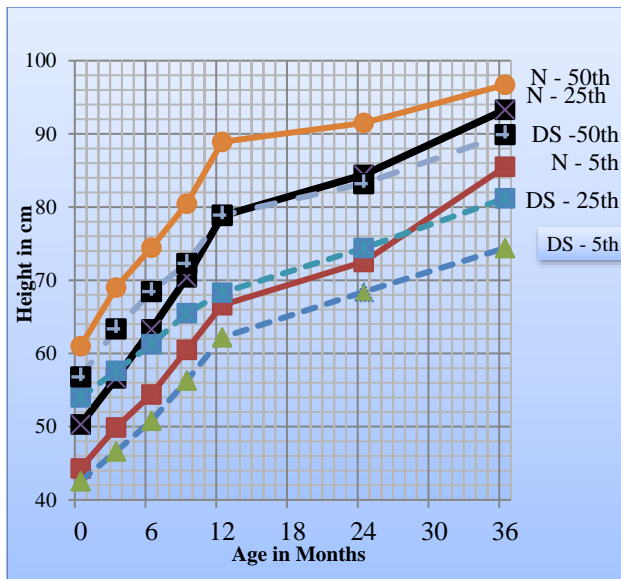
Figure 1: Height for age percentile curves for down syndrome boys and normal boys from birth to 36 months. Age is reported in months. Dotted lines (ds) are superimposed.

The figure 2 represent the weight of both normal and Down's syndrome children. The 5th, 25th and 50th percentile of both normal and Down's syndrome children was compared.
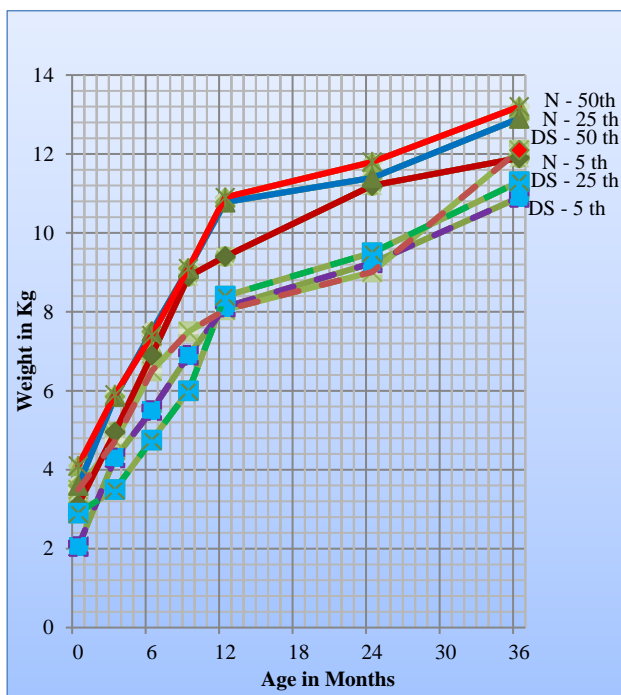

Figure 2: Weight for age percentile curves for Down Syndrome boys and normal boys from birth to 36 months. Age is reported in months. Dotted Lines (DS) are superimposed.

The statistical findings suggest that there is a significant difference in the weight of the children between the

normal and DS group among the time period. The significant difference noted in the height of the children between the normal and DS group among the time period is (p < 0.05).
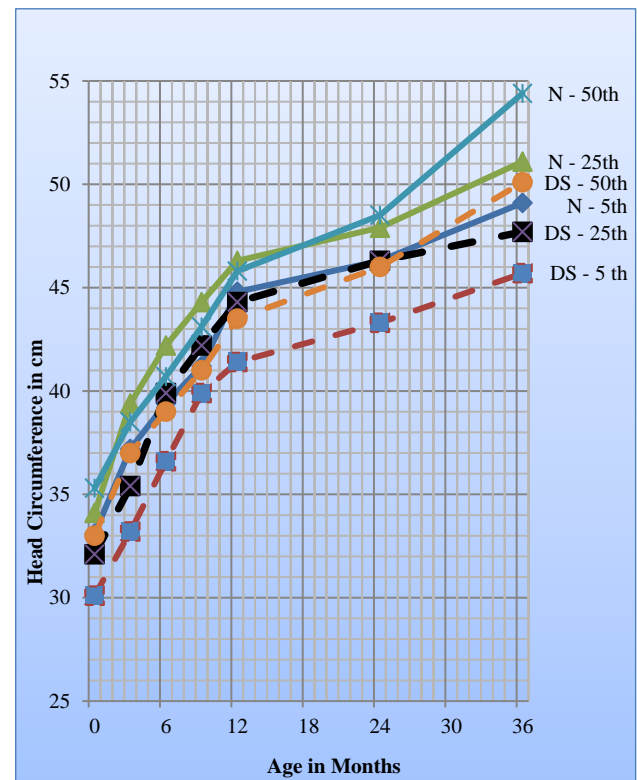

Figure: 3. Head circumference for age percentile curves for Down syndrome boys and normal boys from birth to 36 months. Age is reported in months. Dotted Lines (DS) are superimposed.

The figure 3 represent the head circumference of both normal and Down's syndrome children. The 5th, 25th and 50th percentile of both normal and Down's syndrome children was compared. The statistical findings suggest that there is a significant difference in the head circumference of the children between the normal and DS group among the time period. The significant difference noted in the height of the children between the normal and DS group among the time period is (p < 0.01).

DISCUSSION

Growth chart are very important tools in the medical care of children. In this study we developed length / height, weight and head circumference growth chards for Indian Children with DS aged 0–3 years. We have compared the mean height of children with DS with the mean height of normal population. It was clearly observed that the birth length of children with DS was–0.6 SD when compared of the mean of the normal children. When we compared the difference at the age of 3 it was–2.0 SD. The 50th percentile height of the normal children was found to be 92 cm and 83 cm for DS children to whom statural growth is evident and statistically significant. The growth

restriction seen at this stage can be due to the unknown genetic reasons15. Fetuses with trisomy 21 have an almost normal symmetrical growth, but after birth, growth velocity becomes markedly reduced in young DS children, between age 6 months and 3 years16. As growth becomes growth hormone (GH) regulated from about age 6 months one could speculate that GH deficiency occurs in DS children17.This is also supported by bone measurements at 11- 14 weeks of gestation showing short femur lengths in fetuses with trisomy 2118.

In this study the mean birth weight of the DS boys is - 0.9 SD, which is lower than the normal boys. The 50th percentile weight of the normal children was found to be 11.8 kg and 9.6 kg for DS children which is significant statistically. Length restriction and feeding difficulties may explain these lighter weights of infants with DS in this developmental stage. In one of the cohort study, the fetuses with DS who had isolated short femur were more likely to have low birth weight19. It is possible that the mean weight of infants with DS might be affected by early feeding difficulties associated to hypotonia, chronically open mouth and oral motor dysfunction20.

Considering the mental health associated with DS the growth of the head is of real interest. Head circumference (occipito-frontal circumference) measurement during infancy and childhood is one of several useful indices of a child's medical, physical, and developmental status. The 50th percentile head circumference of the normal children was found to be 48.5 cm and 45.5 cm for DS children. The growth of the DS children head circumference was found to be lower than the normal child who is also significant when compared statistically.

The charts were developed from a very small sample size of patients and did not reflect racial, ethnic, or geographical diversity. Future studies must be conducted at a big population which reflects big sample of children with reference to racial and reference to ethnicity as India has a divergent population. This will help us to provide a standard chart for India specific Down's syndrome children.

CONCLUSION

As per the outcome of the study it is recommended that there is a vast need of growth chart specific for Down's Syndrome children which will help the doctor to analyze the height, weight and head circumference of the Down's Syndrome children.

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