# Anthropometric measurements in Down's syndrome children during preschool period - Part I

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## Abstract

The present study was conducted to find out the difference in the anthropometric measurement of Down's syndrome children up to three years of age compared to normal controls. Anthropometric measurements of 20 children up to the age of three years with Down's syndrome, diagnosed by chromosomal studies were recorded. Down's syndrome children had lower anthropometric measurements compared to controls. Among the anthropometric measurements; weight, head circumference and chest circumference in males showed significant difference compared to controls. Midarm circumference in both sexes and chest circumference in female children did not show any significant difference between cases and controls. This may be due to the smaller sample size in our study. However; when they were grouped into different age groups the weight of these children was significantly lower in 0 to 24 months in case of males, while in females between 9 to 24 months only. Head circumference measurement was significantly low below 24 months in both male and female cases. Chest circumference measurements differed significantly only in male cases below 24 months. There was no statistically significant difference in the mid arm circumference except in females of 9 to 24 months age group. In conclusion, Down's syndrome children showed lower growth potential compared to the controls.

## Introduction

Growth and development are the important tools to find out the health status of an individual. Various factors affect the growth and development of an individual, among them; genetic factors have a major role. Wide varieties of chromosomal instability syndromes and aberrations have been described which affect the process of the growth and development. The commonest viable autosomal aneuploidal condition, the Down's syndrome (trisomy 21), seems to have a diverse degree of growth disturbances in the early infancy to adolescence period of life and also with reference to gender [1,2]. The present study is conducted to focus on the growth patterns in 47+21 XX or XY form of Down's syndrome children during the first three years of life, as against normal children of the same age and gender.

## Material and Methods

Twenty children whose age ranged from 0 to 36 months with karyotype confirmed Down's syndrome (Trisomy-21) by Ikaros Meta system; Germany formed the subject for the current study. Of the twenty children ten were males; and the remaining females. These children were compared with the age and sex matched controls (1:5) who visited the under five clinic of Pediatrics Out patient wing for the purpose of regular immunization and for other follow-ups. All children, both cases and controls were screened for factors framed in inclusion and exclusion criteria of the study sample. Children with other congenital abnormalities, chromosomal/ non chromosomal involvement and congenital cardiac anomalies were excluded from the study. Anthropometric measurements were recorded based on the

guidelines framed by Hall et al [3] in cases of Down's syndrome and normal children. The measurements in the present study include weight, head circumference, chest circumference and midarm circumference. The results were tabulated and analyzed using unpaired t test.

## Results

Weight was significantly decreased in children with Down's syndrome compared to the controls in both sexes. This significance was particularly seen in the age group of 0 to 24 months in male and 9 to 24 months in female children (Table.1).Head circumference was significantly decreased in children with Down's syndrome compared to the controls in both sexes. This was observed in all age groups of both sexes included in our study (Table.2). Chest circumference was significantly low in male children with Down's syndrome compared to controls; this was particularly observed in 0 to 9 months and 9 to 24 months age groups. But in female children with Down's syndrome, chest circumference was not significantly different from controls.(Table.3).Decrease in midarm circumference was not statistically significant in both male and female children with Down's syndrome compared to the controls except in 9 to 24 months age group in females (Table 4).

**Table1:** Weight (mean in kgs ± SD) in cases and controls

| Age group | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Cases | Controls | P-Value | Cases | Controls | P-Value |
| 0 to 9 months | 4.55 ± 1.38 | 6.52 ± 1.298 | 0.0019 * | 4.8 ± 1.44 | 5.62 ± 1.397 | 0.242 |
| 9 to 24 months | 6.93 ± 1.102 | 9.27 ± 1.474 | 0.02 * | 5.58 ± 1.859 | 8.75 ± 1.334 | 0.005 * |
| 24 to 36 months | 10.5 ± 0.000 | 12.74 ± 1.590 | - | 9.5 ± 0.000 | 12.36 ± 0.61 | - |
| Total study group | 5.86 ± 2.29 | 7.97 ± 2.44 | 0.014 * | 5.58 ± 2.03 | 7.55 ± 2.55 | 0.025* |

* P – Value is significant.
Mean (in Kgs ± SD) in cases – 5.72 ± 2.111
Mean (in Kgs ± SD) in controls – 7.76 ± 2.494
'P' Value – 0.009 *

**Table2:** Head circumference (mean in cms ± SD) in cases and controls

| Age group | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Cases | Controls | P-Value | Cases | Controls | P-Value |
| 0 to 9 months | 38.58 ± 4.140 | 41.29 ± 1.960 | 0.016* | 36.4 ± 3.20 | 39.22 ± 2.66 | 0.045 * |
| 9 to 24 months | 42.5 ± 1.803 | 45.75 ± 1.56 | 0.005* | 39.88 ± 1.03 | 44.11 ± 2.42 | 0.0026 * |
| 24 to 36 | 48 ± 0.000 | 48.64 ± | - | 43 ± 0.00 | 48.1 ± 0.55 | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| months | | 2.612 | | | | |
| Total study group | 40.7 ± 4.5 | 43.37 ± 3.28 | 0.032* | 38.45 ± 3.24 | 42.07 ± 3.91 | 0.008 * |

*P – Value is significant.
Mean (in cms ± SD) in cases- 39.58 ± 3.984
Mean (in cms ± SD) in controls- 42.718 ± 3.650
'P' Value- 0.001 *

**Table 3:** Chest circumference (mean in cms ± SD) in cases and controls

| Age group | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Cases | Controls | P-Value | Cases | Controls | P-Value |
| 0 to 9 months | 36.0 ± 3.564 | 39.2 ± 2.34 | 0.008* | 35.3 ± 5.45 | 37.52 ± 2.98 | 0.199 |
| 9 to 24 months | 41.17 ± 2.754 | 45.76 ± 2.33 | 0.007* | 40.75 ± 2.10 | 44.1 ± 3.50 | 0.081 |
| 24 to 36 months | 45.5 ± 0.000 | 50.4 ± 2.53 | - | 43.5 ± 0.00 | 49.8 ± 0.91 | - |
| Total study group | 38.5 ± 4.55 | 42.29 ± 4.65 | 0.022* | 38.3 ± 5.034 | 41.38 ± 5.20 | 0.091 |

* P – Value is significant.
Mean (in cms ± SD) in cases – 38.4 ± 4.672
Mean (in cms ± SD) in controls - 41.835 ± 4.927
'P' Value – 0.001 *

**Table 4:** Mid arm circumference (mean in cms ± SD) in cases and controls

| Age group | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Cases | Controls | P-Value | Cases | Controls | P-Value |
| 0 to 9 months | 11.33 ± 1.03 | 12.15 ± 1.59 | 0.238 | 12.2 ± 2.43 | 11.89 ± 1.37 | 0.687 |
| 9 to 24 months | 13.17 ± 0.288 | 13.43 ± 0.87 | 0.614 | 12.43 ± 1.31 | 13.5 ± 0.76 | 0.032* |
| 24 to 36 months | 13 ± 0.00 | 14.58 ± 1.453 | - | 13 ± 0.00 | 13.5 ± 0.612 | - |
| Total study group | 12.05 ± 1.21 | 12.78 ± 1.61 | 0.182 | 12.37 ± 1.81 | 12.69 ± 1.36 | 0.518 |

*P-Value is significant.
Mean (in cms ± SD) in cases – 12.21±1.509
Mean (in cms ± SD) in controls – 12.736 ± 1.481
'P' Value – 0.001 *

## Discussion

Down's syndrome-21 Trisomy is the most common autosomal aneuploidy among the well established conditions of chromosomal abnormalities. Its mean frequency in India is 1.2 per 1000 as compared with 1.5 per 1000 in the west [4]. The patterns of development and the processes associated with them in these individuals with conditions of deviated chromosomal compliment may not be that of normal individuals. As development is influenced/linked with growth, the growth patterns exhibit wide varieties of variations. Earlier workers have observed markedly deviated growth pattern in individuals with Trisomy-21 from that of normal, exhibiting a deficient growth rate throughout the growing phase [5,6].

The children in the present study were free from other systemic disorders such as heart disease. As these are known to affect the growth and development; the role of such systemic disorders affecting growth reduction is eliminated in the present study [2]. The difference in the anthropometric parameters in cases compared to the controls is exclusively due to primary trisomy disorder.

Head, chest and mid arm circumference etc., are related with the birth weight [7].Weight was significantly decreased in Down's syndrome children in earlier studies [5,8,9].In the present study, decreased weight gain was noted from the early infancy and continued after that in males, but in females this decrease was observed only in the late infancy. Moreover, none of the cases showed gain in body weight similar to controls and they were consistently lower throughout. This contradicts the observations of Piro et al [10] who noted that the weight remains elevated from 0-12yrs in males while only in the last two years in females. However, our finding is in agreement with the findings of Clementi et al who noted decreased weight gain in the affected compared to controls [11].

Regarding head circumference in children of Down's syndrome, it is stated that males had larger circumference than females and growth velocity of the head is that of normal until 5 to 6 months of age [12]. On the contrary, undue delay to the extent of twice or thrice the time taken by that of normal for the attainment of the particular measurement was observed in cases of Down's syndrome children up to 5 years of age [8] . Our findings corroborate the findings of Sachdev et al [8] and contradict the findings of Palmer et al [12]. The head circumference data in 0 to 9 months in the present series showed a statistically significant decrease in cases of Trisomy-21. On the other hand, the decrease in the head circumference was carried to the next following age group i.e., 9 to 24 months also. This strongly suggests that the head circumference does not remain static at any given period especially in the very early infancy as stated by Palmer et al [12].

The chest circumference measurements recorded by us correlated with the findings of Jaswal et al [5], who are of the opinion that chest circumference was below normal in male Down's syndrome cases but it was normal in female Down's syndrome cases.

Midarm circumference is closely related with the birth weight and gestational age [13]. Our findings confer with the findings of Kanawati et al [14], wherein; steady increase in the initial phase followed by slow phase in the later period of first year of life in females. The decrease in Midarm circumference observed in the age group of 9 to 24 months of the present study equates with later period of first year of life as noted by Kanawati et al [14].

The various anthropometric parameters discussed in our study differed significantly from those of normal children during the preschool period. This may be due to decreased growth potential in Down's syndrome children in this age period.

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