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Original Research Article

STUDY OF ANTHROPOMETRIC MEASUREMENTS TO ASSESS GROWTH PATTERN OF CHILDREN AT THE AGE OF TWO TO THREE YEARS WITH HISTORY OF PREMATURE BIRTH

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ABSTRACT

Background: The aim was to depict any existing difference between the growth of children with history of prematurity from that of the control population.

Materials and Methods: A case control study was conducted in R.G.Kar Medical College, Kolkata among 240 children(120 cases and 120 controls) to assess the effect of prematurity on the growth of children aged two and three years by using anthropometric parameters We measured height, weight, head circumference, chest circumference and mid upper arm circumference on both cases and controls (in both age groups and sexes).

Results: Comparison of respective data was done from same age and gender groups of cases and controls using students t test. The study suggested that statistically significant differences exist between cases and controls regarding chest circumference in two year age group and height in both two and three years age group in both males and females.

Conclusion: The results indicate that prematurity does affect the growth of children at least upto three years.

KEY WORDS: Growth, Prematurity, Anthropometry.

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INTRODUCTION

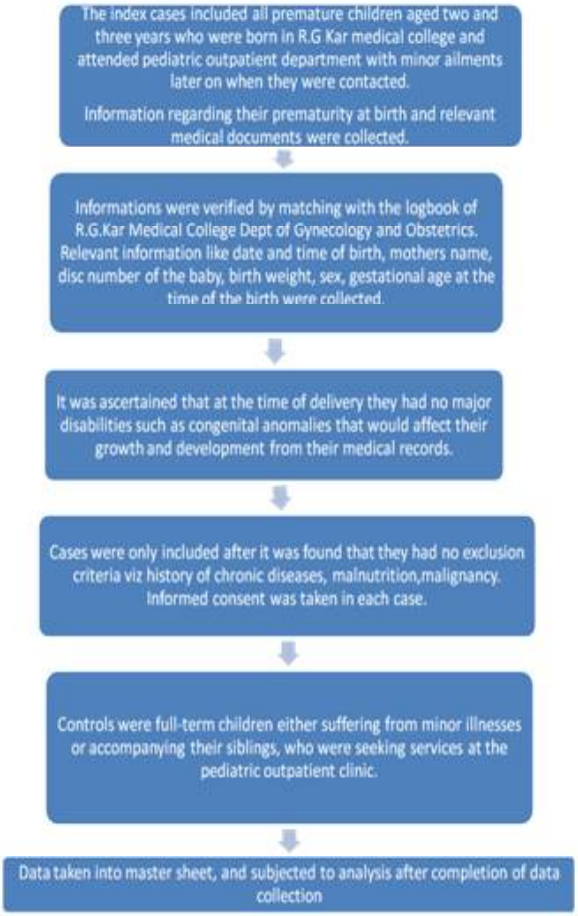
Growth refers to the increment in body size or any of its parts resulting from cell multiplication and increase in the size of cell mass. As growth denotes organized increment of mass of human body, its assessment requires measurement of human tissue mass. Growth depends on various factors in both pre natal and post natal phases [1]. Premature birth (before 37 full weeks of gestation) leads to disturbance in the normal rate of growth. The less a premature infant weighs at birth, the more profound the growth disturbance will be [2]. In the majority of cases, growth in height is as much affected as growth in size from the very begin-ning [3]. During the first three years of life, prematures

are more likely to have lower average height and weight than full-term ones of the same age unless an allowance is made for the length of gestation [4]. Incidence of prematurity in India is about 10-12% of all births [5]. Therefore research regarding the relationship between growth and prematurity are necessary, so that the exact way by which prematurity affects growth can be determined and specific measures can be taken to negate them to the maximum extent possible. The present study was conducted to assess the effect of prematurity on the growth of children of West Bengal aged two and three years with history of prematurity.

MATERIALS AND METHODS

We have conducted a case-control study in R.G. Kar Medical College and Hospital, Kolkata, West Bengal during a period from May 2009 to April 2010 on 120 children with history of premature birth as index cases. Controls (120) were full-term children and matched by age and sex.

Flow Chart Showing the workflow adopted in the study



Weight, height, head circumference, chest circumference, mid upper arm circumference were measured on all children using standard technique.

1. Body weight(kg) -by weight machines (conventional).

2. Length/height(cm) - by stadiometer/ infantometer.

3. Head circumference, Chest circumference , Mid Upper Arm circumference (cm)- by non-stretchable measuring tape(Fig-1,Fig-2,Fig-3)

At the end of work the data were coded and transferred onto a master sheet and subjected to statistical analysis. Analysis was done using student's t-test. The Epi Info (TM) 3.5.1 and Microsoft Excel softewares were used to do the percentile calculation with the CDC2000 standards. The average value (mean) of each anthropometric parameter of the control group and cases were calculated separately for males and females and compared for significance with students t test at 95% confidence limit.

Fig. 1: Measurement of Head Circumference.

Fig. 2: Measurement of Chest Circumference.

Fig. 3: Measurement of Mid-arm Circumference.

The total number of premature included in the present study was 120 children. Premature children aged two years at the time of the study constituted 50% (60) of the total sample, with a male to female ratio of 1:1. Those aged three years constituted 50%, (60) with a male to female ratio of 1:1. The average values of the anthropometric parameters in cases and controls are shown in Table 1.

The height and chest circumference in two year age group cases are statistically significant.In three year age group cases only the height is statistically significant as shown in Table 2.

Table 3 shows that the growth pattern of full-term children aged two and three years was higher in certain anthropometric parameters than that of children aged two and three years with history of prematurity.

Percentile distributions for weight, height and head circumference were calculated by using EPI

Table 1: Values of averages of different anthropometric parameters.

PARAMETERS	2 year male case (n=30)	2 year male control (n=30)	2 year female case (n=30)	2 year female control (n=30)	3 year male case (n=30)	3 year male control (n=30)	3 year female case (n=30)	3 year female control (n=30)
weight (kg)	11.73	11.93	11.35	11.55	13.25	13.5	12.9	13.37
height(cm)	82.8	83.9	81.7	82.43	90.07	91.57	89.6	90.8
head circumference (cm)	47.13	47.3	46.13	46.4	49.3	49.6	48.8	49.13
mid upper arm circumference (cm)	13.85	14.08	12.65	12.85	16.23	16.43	16	16.27
chest circumference (cm)	47.5	48.4	46.45	47.18	50.73	50.87	50.6	50.73

Table 2: Statistically significant and insignificant anthropometric data.

	Weight	Height	Head circumference	Mid upper arm circumference	Chest circumference
2 year male	t = 0.7276, p >0.05 Statistically insignificant	t =2.2523 p<0.05 Statistically significant	t=0.58029 p>0.05 Statistically insignificant	t=0.83085 p>0.05 Statistically insignificant	t=2.85097 p<0.05 Statistically significant
2 year female	t= 0.79726 p>0.05 Statistically insignificant	t=2.52015 p<0.05 Statistically significant	t=0.91026 p>0.05 Statistically insignificant	t=0.88782 p>0.05 Statistically insignificant	t=2.50741 p<0.05 Statistically significant
3 year male	t=1.08871 p>0.05 Statistically insignificant	t=2.18708 p<0.05 Statistically significant	t= 1.31132 p>0.05 Statistically insignificant	t=0.571004 p>0.05 Statistically insignificant	t=0.376116 p>0.05 Statistically insignificant
3 year female	t=1.527838 p>0.05 Statistically insignificant	t=2.49038 p<0.05 Statistically significant	t=1.415189 p>0.05 Statistically insignificant	t=0.848820 p>0.05 Statistically insignificant	t=0.380076 p>0.05 Statistically insignificant

Table 3: Percentile distributions for 2 years aged male cases and controls.

percentile	2 year male weight case	2 year male weight control	2 year male height case	2 year male height control	2 year male head circumference case	2 year male head circumference control
10	8	7	2	1	9	11
25	18	15	21	22	11	4
50	2	5	5	5	8	12
75	2	3	2	2	1	1
90	0	0	0	0	1	2

Table 4: Percentile distributions for 2 years aged female cases and controls.

percentile	2 year female weight case	2 year female weight control	2 year female height case	2year female height control	2 year female head circumferenc e case	2 year female head circumferenc e control
10	7	5	5	3	12	5
25	7	8	23	10	9	16
50	13	11	1	16	2	1
75	3	6	1	1	7	8
90	0	0	0	0	0	0

Table 5: Percentile distributions for 3 years aged male cases and controls.

percentile	3 year male weight case	3 year male weight control	3 year male height case	3 year male height control	3 year male head circumferen ce case	3 year male head circumferenc e control
10	7	0	17	9	0	0
25	10	15	4	7	8	1
50	9	13	9	14	8	14
75	4	2	0	0	11	11
90	0	0	0	0	3	4

INFO program by the Centers for Disease Control and Prevention (CDC).The data were stratified into 5 groups of, below 10th percentile, 10th percentile to 25th percentile, 25th percentile to 50th percentile, 50th percentile to 75th percentile, 75th percentile to 90th percentile and above.The results are tabulated from Table 3-Table 6.

DISCUSSION

There are inconsistent results as regards the long-term impact of prematurity on physical growth [6].The risk of neurologic and developmental impairment is increased for the small prematures who survive, particularly if they had a complicated neonatal course [7]. Very low birth weight infants (VLBW) may continue to show catch up growth through early schoolage, most achieve weight catch up during the second year and height catch up by 2.5 yr of age barring medical complications [8]. On doing statistical tests to assess the significance of the difference observed in the average values,only the height and chest circumference in two yrs age group(both males and females) and only height in 3 yrs age (both male and female) were statistically significant. The other parameters like weight, head circumference,and mid upper arm circumference are lower in value than the controls in the present study.

In the study by Judith A. Ernst et al it was found that majority of the infants, regardless of subgroup, achieved weights and lengths >5th percentile and proportionate growth with a normal weight/length ratio. At 12 months of corrected age, 30% remained at <5th percentile in weight, 21% in length, and 14% in occipitofrontal (OFC) circumference. Eighteen infants (15%) had a marked discrepancy in weight for length, with a weight/length ratio <5th percentile [9]. (28) No differences in post natal growth was found between infants whose size was appropriate for gestational age and those small for gestational age by Ford,Amy et al [10]. Poorer weight gain could not be related to more "illness" or less nutrient intake in the smaller infants[10].In our study height and chest circumference in two year age group and only height in three year cases were statistically significant and weight had no significant difference.

According to Short JR et al [2] premature birth leads to disturbance in the normal rate of growth.The less a premature infant weighs at birth,the more profound the growth disturbance will be.However significant difference between the weight of children who had history of prematurity at age two and three years was found by Khadiza A.Khalil et al [11].Preterm infants with both symmetric and asymmetric intrauterine growth retardation demonstrate limited catch-up growth. Intrauterine growth deficits persist into early childhood. Preterm

infants (n=818) prospectively enrolled in the Infant Health and Development Program was studied from birth to 36 months of corrected age. Weights and lengths were recorded at eight intervals [12]. During the first three years of life ,prematures are more likely to have lower average height and weight than full term ones of the same age unless an allowance is made for the length of gestation [13]. In the present study, the average weight of male children at 2 years of age with history of prematurity was 11.73kg and for females it was 11.35kg. These values were less than that of controls (11.93 kg and 11.55 kg for males and females respectively). In three years of age, the average values of weight for cases were 13.25 kg for males and 12.9kg for females, which were lower than the controls (13.5 kg for males and 13.37kg for females). However, the values were not significant statistically.

Regarding height, Schaffer AJ pointed that in the majority of cases, growth in height is as much affected as growth in size from the very beginning [3]. Abbassy et al [14] in their extensive longitudinal study of growth pattern among prematures and full term children added that the difference in weight and height between the two groups is likely to remain so till the age of 5 yrs[14].In the present study, the average height of male children at 2 years of age with history of prematurity was 82.8cm and for females it was 81.7cm. These values were less than that of controls (83.9 cm and 82.43 cm for males and females respectively). In three years of age, the average values of height for cases were 90.01cm for males and 89.6cm for females, which were lower than the controls (91.57cm for males and 90.8cm for females). The differences of the values were statistically significant.

The mid upper arm circumference and chest circumference are also important parameters for study of growth as stated by S K Bhargava et al [15]. According to them, mid-arm and chest circumferences are simple, practicable, quick, and reliable indicators for predicting low birth weight and neonatal outcome in the community and can be easily measured [15]. *R. M. Shrestha et al* stated that mid upper arm circumference is an effective anthropometric indicator and its efficacy can be compared to the weight for age parameter[16].Sehsah stated that,at 1 year age,premature children have lower values of mid upper arm circumference in comparison to normal children [17]. In the present study, the average mid upper arm circumference of male children at 2 years of age with history of prematurity was 13.85cm and for females it was 12.65cm. These values were less than that of controls (14.08cm and 12.85cm for males and females respectively). In three years of age, the average values of head circumference for cases were 16.23 cm for males and 16cm for females, which were lower than the controls (16.43cm for males and 16.27cm for females). However, the differences in the values were not significant statistically.

Regarding head circumference, Sehsah revealed that premature children had a smaller head circumference than full term ones during the first year of life [17].During the second year of life,the head circumference of prematures increases at a lower rate than that of full term children[18]. In the present study, the average head circumference of male children at 2 years of age with history of prematurity was 47.13cm and for females it was 46.13cm. These values were less than that of controls (47.3cm and 46.4cm for males and females respectively). In three years of age, the average values of head circumference for cases were 49.3 cm for males and 48.8cm for females, which were lower than the controls (49.6cm for males and 49.13cm for females). However, the differences in the values were not significant statistically.

The study by Khadiga A. Khalil et al [11] has stated that, for children aged two years, the percentile values for chest circumference were higher for full-term children than for prematures. On the other hand, for three year old children, differences in the percentile were inconsistent. At both ages, differences in the mean values were statistically insignificant [11]. Abbassy et al [14] reported that during the second year of life, the increment in chest circumference is lower for premature children than full-term babies. On the other hand, at the age of three years, premature children were found to have higher percentile values of chest circumference and an insignificantly higher mean chest circumference compared to their controls. They found

that from the third year onwards, the increment in chest circumference is higher for prematures than mature children and by the end of the fourth year both groups enjoy a nearly equal chest circumference [14,18]. In the present study, the average chest circumference of male children at 2 years of age with history of prematurity was 47.13cm and for females it was 46.13cm. These values were less than that of controls (47.3cm and 46.4cm for males and females respectively). These differences were found to be statistically significant. In three years of age, the average values of chest circumference for cases were 49.3cm for males and 48.8cm for females, which were lower than the controls (49.6 cm for males and 49.13cm for females). However, the differences in these values were not significant statistically.

Therefore, the results of the present study is in accordance with various other studies previously done which have found children with history of prematurity to have lower values for different anthropometric parameters when they were compared with the children of same ethnic origin, who were born full term. The study of the physical growth of premature infants assumes increasing importance as evidence suggests that early growth has a prognostic significance for later neurobehavioral outcome [19]. A significant relationship was demonstrated between very low birth weight children and poor neurobehavioral outcome.This may lead later on to learning difficulties and inadequate school performance [20].

The study by Jillian Vinall et al [21] which measured the neurodevelopment using diffusion tensor imaging on preterm neonates found that prematurely born neonates had delayed microstructural development of the cortical gray matter, but not white matter. This was also associated with lesser values of anthropometric parameters. This study also suggested that intensive care after birth may help prevent future developmental delay [21].

Further, prematurity and fetal growth restriction may lead to long term changes in the adults. It was found that the blood pressure of people who had history of prematurity and fetal growth restriction was higher than people without it [22].

CONCLUSION

Therefore, from the present study, it can be concluded that the growth is affected by prematurity at least up to the age of three years, in children of West Bengal.

ABBREVIATIONS

CDC- Centers for Disease Control and Prevention
VLBW - Very low birth weight infants
OFC- Occipitofrontal circumference

Conflicts of Interests: None

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