

Growth during First 2 Years of Life among Kashmiri Urban Children

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KEYWORDS Crown Head Length. Weight. Income. Weaning. Literacy Status. Birth Order

ABSTRACT Children differ in the rate and pattern of growth and development as a whole and within each field. The importance of studying the growth and development of children hardly needs emphasis. It is a subject which concerns everybody. The immediate cause of growth faltering among pre-school children are an outcome of a complex web of biological, social and economic factors and their relationship, which are location specific. The present study was carried out with an objective of assessing the growth pattern of Kashmiri children and identify the factors which influence their growth on a sample size of 194 children. The study was conducted on a longitudinal basis over a period of two years. The results revealed that growth and its patterns in Kashmiri urban children in first two years of life are quite comparable to North Indian children. Rate for growth follows a pattern which is similar to other well to do children for weight but in case of stature there is a slight lag. Kashmiri children have the potential to catch up to the growth under favorable conditions. Feeding and weaning practices, maternal literacy and working status were found to be the important determinants of growth.

INTRODUCTION

Growth is an essential feature that distinguishes a child from an adult. The process of growth starts from the time of conception and continues until the child grows into a fully mature adult. During the early embryonic period of life, an exponential increase in the number of cell occurs. At the early embryonic stage, fetal cells divide and differentiate to form tissues and organs. In the latter half of pregnancy and early childhood, there is additionally an increase in the cell size. This manifests as increase in the protein to DNA ratio. The cell size continues to enlarge until about ten years of age. After that, increase in cell size occurs rather slowly. The body cells remain in a state of dynamic equilibrium; hence aging cells are continuously replaced by new cells. However, the rate of turnover of cells in different tissues is variable.

The terms "growth and development" are often used together. These are not interchangeable because they represent two different facets of the dynamics of change, that is, those of quantity and quality.

The term growth denotes a net increase in the size or mass of tissues. It is largely attributed to multiplication of cells and increase in the intra cellular substance. Hypertrophy or expansion of cell size contributes to a lesser extent to the process of growth.

Various factors have been found to be affecting growth. Some of them are:

- a) Fetal growth which include genetic potential, sex, fetal hormones, fetal growth factors, placental factors and maternal factors.
- b) Post-natal period is affected by sex, intrauterine growth retardation, genetic factors, hormonal influence, nutrition infections, chemical agents and trauma.
- c) Social factors include socio-economic level, poverty, natural resources, climate, emotional factors, cultural factors and parental education.

For assessment, the weight of the child in the nude or minimal light clothing is recorded accurately on a lever or electronic type of weighing scale. The weighing scale should have a minimum unit of 100 gm. It is important that child be placed in middle of weighing pan. The weighing scale should be corrected for any zero error before measurement. Length is recorded for children less than 2 years of age. The child is placed supine on a rigid measuring table or an infantometer. Its head is held firmly in position against a fixed upright head board. Legs are straightened, keeping feet at right angles to legs with toes pointing upwards. Its free foot board is brought into firm contact with the child's heels. Length of the baby is measured from a scale, which is set in the measuring table. Measure-

ment of length of a child lying on a mattress with cloth tapes is inaccurate and not recommended (Ghai 2009).

Growth faltering is clearly a phenomenon intimately associated with perils of weaning. The evidence from numerous studies unequivocally indicates that immediate causes of growth faltering are poor diets and infection and that these are interactive (N.A.S. 1989). Information from studies indicates that dietary factors constraining growth include energy as well as micro-nutrients (Murphy et al. 1992). Other factors which may influence growth are socio-economic status of a family, family size, maternal and paternal education, sex of the baby etc. Stimulation of physical and mental development affects the predictable pattern of development by accelerating it. Good health, encouragement and opportunities to learn, plus a strong motivation on the child's part, will speed up development in all areas. Adair et al. (1993) in a study examined determinants of growth from birth to 24 months in a sample of approximately 3000 urban and rural Filipino children. Individual, household, and community data were collected bi-monthly. Separate longitudinal, multivariate models were used to identify determinants of weight in children from birth to 6 months and 6-24 months of age. Previous weight, male gender, mother's height, and season of the year showed significant positive associations with weight in all models. Full and mixed breast-feeding significantly increased weight, but the effects of breast-feeding declined as children got older. Breast-feeding had a direct growth-enhancing effect in addition to its indirect effect through the prevention of diarrheal morbidity. Detrimental effects of recent diarrheal morbidity were particularly important in the older age group, but these effects were mitigated by breast-feeding. Since infant feeding variables are included in the models, the results strongly suggest an effect of diarrheal morbidity on growth independent of its known effects on infant feeding and dietary intake. Febrile respiratory infections had important detrimental effects on weight in both age groups.

Kumar et al. (2007) supports the concept that breast fed infants grow differently from infants fed formula in the first year of life, but the two groups grow similarly later in life. Martorell et al. (2010) used data from 5 cohorts (Brazil, Guatemala, India, the Philippines, and South Africa) to explore the relative importance of birth weight

and postnatal weight gain for schooling in pooled analyses ($n = 7945$). Weight gain during the first 2 years of life had the strongest associations with schooling followed by birth weight; weight gain between 2 and 4 years had little relationship to schooling. Catch-up growth in smaller babies benefited schooling. Nutrition interventions aimed at women and children under 2 years are among the key strategies for achieving the millennium development goal of universal primary education by 2015. Good infant growth is important for future health. Assessing growth is common in pediatric care all over the world, both at the population and individual level. Nguyen et al. (2012) in a study, "Physical Growth during the First Year of Life" aimed to describe and compare the birth weight distributions and physical growth (weight and length) of children during their first year in one rural and one urban area of Hanoi Vietnam. The second aim was to study associations between the anthropometric outcomes and indicators of the economic and educational situations. A total of 1,466 children, born from 1st March, 2009 to June 2010, were followed monthly from birth to 12 months of age in two health and demographic surveillance sites; one rural and one urban. In all, 14,199 measurements each of weight and length were made. Birth weight was recorded separately. Information about demographic conditions, education, occupation and economic conditions of persons and households was obtained from household surveys. It was found that urban infants have higher birth weight and gain weight faster than rural infants. The mean birth weight for urban boys and girls were 3,298 grams and 3,203 grams as compared to 3,105 grams and 3,057 grams for rural children. At 90 days, the urban boys were estimated to be 4.1% heavier than rural boys. This difference increased to 7.2% at 360 days. The corresponding difference for girls was 3.4% and 10.5%. The differences for length were comparatively smaller. Both birth weight and growth were statistically significantly and positively associated with economic conditions and mother education.

The importance of studying the growth and development of children hardly needs emphasis. It is a subject which concerns large number with a rising number among underweight below 5 years. The immediate cause of growth faltering among pre-school children is an outcome of a complex web of biological, social and economic

factors and relationship, which are location specific. Even those who escape serious disease are likely to be significantly under weight, a condition that spirals back on itself to retard growth and subsequent development in other areas.

The main objectives of the study are detailed as under:

1. To assess the growth in children.
2. To identify factors influencing growth.

MATERIAL AND METHODS

The present study has been carried out over a period of 2 years on longitudinal basis with the aim to obtain empirical information about Kashmiri urban children on growth in the first two years of life and compare it with that of other Indian children. One basic need that was fulfilled by conducting the present study was to obtain much needed growth norms and patterns of Kashmiri urban children.

Sampling

A multistage purposive random sampling technique was used to select the urban children born to normal mothers without any evident medical problem likely to influence growth. The children have been selected from five wards of Srinagar (urban) city which was arbitrarily divided into four zones. The initial sample of 300-350 children was selected and followed up for 2 years, however moderate compliance to follow up and data collection as per Performa (Schedule) designed especially for the purpose left with only 194 children for complete analysis and interpretation.

Methods Used

For Assessment of Growth

Anthropometric measurements of weight and Crown Heal Length were taken.

Tools Used (Testing Kit) For Growth

Electronic Weighing Machine
Infantometer (specially designed for the purpose)

Testing Procedures

Length was measured with the help of an infantometer with the child lying supine. The head

touching the headboard, and the knees were held extended. The second board touching the feet (the whole foot and not just the toes). The length was read from the measurements marked on the infantometer.

Weight was recorded with the help of an electronic weighing machine. During the first year when the child was unable to stand the mother was asked to pick up the child in her lap and then weight of both mother and child was recorded. After that only mother's weight was recorded and her weight was subtracted from the weight (mother and child) recorded earlier. This way the child's weight was obtained. During 2nd year the child was asked to stand on the weighing machine and his weight was recorded.

Follow-up

At the time of registration children were arranged in such a way that they made three separate cohorts for each month. Each cohort would accordingly get a turn to follow up after a gap of 3 months as per their turn. On an average twenty children were observed every week.

As described earlier, a certain number of children could not be followed because either they had changed their address or were out of station for more than six months. Some children or their parents were uncooperative for the assessment of growth. Four children died during a 2 year period. The final sample left was only 194, who have been regularly followed without many problems.

Analysis

Simple frequency analysis was done to group children within various weights and Crown Heal Length (CHL) ranges and to determine the average with standard deviations for weight and Crown Heal Length at specific months (quarterly intervals) during a two year period.

Percentile of weights and Crown Heal lengths at specific months were computed and compared to NCHS and ICMR standards.

Impact of various socio- medical factors like weaning, feeding pattern, mother's literacy, working status, income, birth order and birth spacing on growth pattern was determined and differences if any tested by applying a test of significance (t-test).

RESULTS AND DISCUSSION

Table 1 shows that 37.6 % of fathers were in 30-35 year age group, while as maximum (38.1%) of mothers fell within the age group 25-30 years. Maximum fathers (52.4 percent) were either class III employees or doing business while as 78.9 percent mothers were housewives.

Table 1: Socio-demographic characteristics of children

Characteristics		Father		Mother	
		Num- ber	% age	Num- ber	% age
Parental Age (in years)	<25	7	3.6	44	22.7
	25-30	43	22.1	74	38.1
	30-35	73	37.6	50	25.8
	35 +	71	36.7	26	13.4
Educational Status	Illite- rate	30	15.1	73	37.6
	Pri- mary	7	3.6	9	4.6
	Matri- culate	57	29.4	37	19.1
	College	48	24.7	41	21.1
	Univ., techni- cal or Profess- ional	52	26.8	34	17.5
	Class I*	34	17.5	7	3.6
Working Status	Class II	37	19.1	29	14.9
	Class III	45	23.2	4	2.1
	Class IV	58	29.2	0	0.0
	Class V	17	8.8	1	0.5
	Class VI	3	1.5	153	78.9

Class I Serving in a Government organization such as Engineers ,Doctors, College or University Teachers,Bureaucrats.

Class II Clerical services and any other skilled workers.

Class III Peons and other allied full time and part time jobs.

Class IV Business and agriculture.

Class V Part Time and labourers.

Class VI House Wives and unemployed males.

It is observed from Table 2 that majority of the children (64.9%) belonged to first or second birth order. 52.6% of these children were exclusively breast fed while 46.9% had received mixed feeds. 83% had been weaned between 4 to 6 months after birth and 17% had delayed weaning. 91.7% were completely immunized. The majority of children had not suffered any prolonged or serious illness likely to influence growth.

Table 2: Other Socio-demographic characteristics of children.

S. No.	Characteristics	Num- ber	Per- cent- age
a) Birth order	1st. born	65	33.5
	IInd born	61	31.4
	IIIrd. born	47	24.2
	IVth. and above	21	10.9
b) Immunization	Fully immunized	178	91.7
	Partially	10	5.2
	Not immunized	6	3.1
c) Feeding	Exclusively B.F	102	52.6
	Mixed Feed	91	46.9
	Top Feeds	1	0.5
d) Weaning	Normal	161	83.0
	Delayed	33	17.0

From Table 3 it is observed that as far as growth was concerned the average weight of newborn (around birth) was 2.97 ± 0.49 kg and the average Crown Heal Length was 49.17 ± 3.17 cm. The assessment of the weight and Crown Heal Length at quarterly intervals during the first and second year revealed that the overall weight and Crown Heal Length of children at 6 months was 6.48 ± 1.05 kg and 62.64 ± 4.37 cm respectively. At 12th month it was 8.72 ± 1.31 kg and 71.71 ± 4.38 cm respectively thus confirming the fact that weight of children had doubled by 6 months and tripled by 12 months of age. However, with respect to Crown Heal Length there was only 46% (45.84%) increase up to 12 months from the base value (birth value).

Table 3: Mean $\pm$ S.D (Weight and CHL) at various months

Age (in months)	Mean $\pm$ S.D	
	Weight (Wt) in kgs.	Crown Heal Length (CHL) in cms.
At birth	2.97 ± 0.49	49.17 ± 3.17
3rd	4.96 ± 0.83	57.53 ± 4.06
6th	6.48 ± 1.05	62.64 ± 4.37
9th	7.69 ± 1.21	67.18 ± 4.13
12th	8.72 ± 1.31	71.71 ± 4.38
15th	9.49 ± 1.37	75.36 ± 4.32
18th	10.21 ± 1.53	78.54 ± 4.32
24th	11.29 ± 1.59	82.70 ± 4.21

The second year of life in the present study shows that mean weight and Crown Heal Length at 18 months was 10.21 ± 1.53 kg and 78.54 ± 4.32 cm respectively. At 24th months the values were 11.29 ± 1.59 kg and 82.70 ± 4.21 cm for weight and

Crown Heal Length respectively. These values were almost comparable to national average reported by NIN and were better than ICMR. Thus a 4 fold increase (quadruple effect) of weight change was seen by 24 months of age though Crown Heal Length showed only 68.19% increase from the base value (birth value) in comparison to usual 75% increase reported in various standards.

As can be seen from Table 4, the present study showed a 4 fold increase (quadruple effect) of weight change by 24 months of age though CHL shows only 68.19% increase from the base value (birth value) in comparison to usual 75% increase reported in various standards.

Table 4: Percentage increase over different quarters from Birth to 24th month in weight and CHL

Age in months	%age increase over previous 3 months		Cumulative %age Increase from 0 month to the end of 6th month, 1st and 2nd year	
	Weight	CHL	Weight	CHL
3	87.83%	17.00%		
6	30.64%	8.88%	118%	
9	18.67%	7.24%		
12	13.39%	6.74%	193%	45.84%
15	8.83%	5.08%		
18	7.58%	4.21%		
24	18.96%	5.29%	280%	68.19%

The rate of growth for weight parameter was very fast that is, 87.83% in first three months. Thereafter, there was a steady slowing down of growth in the next six months ranging between 18.67% to 13.39% which, in the second year of life shows further slowing at a consistent rate.

Comparison of different percentile values of Weight and CHL with NCHS and AIIMS standards have revealed that the values in the present

study at birth fall below NCHS for both boys and girls and continue to remain throughout the first and second year of life and the overall values correspond roughly to the 25th percentile of NCHS values. The percentile value of weight once compared to the values of North Indian children (upper SES computed at AIIMS) show that the children in the present study were initially lower to AIIMS percentile values up to six months of age, but then the gap narrowed by 12 months of age and thereafter even overshoot in the last six months of second year for weight. The percentile values for Crown Heal Length once compared to the values of North- Indian children (upper SES computed at AIIMS) did not show any consistent pattern in the first three months but thereafter shows a similar pattern as was seen for weight showing thereby that our children have the potential to catch up under favorable environment.

The growth of children in relation to various socio-medical factors showed that the mean weight and Crown Heal Length among male and female children had a significant difference during first nine months of life with males having better mean weight and height compared to their counterparts. However, this difference was minimal at 12 months of age and from 15 months of age there was no significant difference in the weight and Crown Heal Length. Even the percentile values showed a similar pattern between male and female children which was more evident in respect of Crown Heal Length than weight.

In respect of feeding pattern (Table 5) and weaning (Table 6) it was seen that there is a clear cut difference in the weight and Crown Heal Length at 12th and 24th months of age. The weight was definitely better amongst children exclusively breastfed compared to mixed fed children in the first year. Weight and Crown Heal Length at 12th and 24th months was significantly better

Table 5: Growth (CHL & WT.) of children in relation to feeding pattern

		<i>E.B.F</i> <i>Exclusively</i> <i>Breast Fed</i>			<i>M.F</i> <i>Mixed fed</i>			<i>A.F</i> <i>Artificial fed</i>	<i>P-value</i>
		<i>Mean</i>	<i>±</i>	<i>S.D</i>	<i>Mean</i>	<i>±</i>	<i>S.D</i>	<i>Mean</i>	
Wt. at	12th month (in kgs)	8.99		1.24	8.07		1.38	9.00	<.05(S)
Wt. at	24th month (in kgs)	11.3		1.56	11.25		1.63	12.50	>.71(IS)
CHL at	12th month (in cms)	72.56		4.06	71.08		4.70	76.10	<.02(S)
CHL at	24th month (in cms)	82.76		3.96	82.60		4.52	85.70	>.75 (IS)

amongst children weaned appropriately (6-9 months) compared to children with delayed weaning.

Table 6: Growth (CHL & WT.) of children in relation to weaning pattern

	<i>Normal</i>		<i>Delayed</i>		<i>P-value</i>
	<i>Mean±S.D</i>		<i>Mean±S.D</i>		
Wt. at 12th month (in kgs)	9.06	1.12	7.11	0.89	<.00 (S)
Wt. at 24th month (in kgs)	11.74	1.27	9.14	1.12	<.00 (S)
CHL at 12th month (in cms)	72.55	3.98	67.72	4.00	<.00 (S)
CHL at 24th month (in cms)	83.75	3.53	77.65	3.54	<.00 (S)

Table 7: Growth (CHL & Wt) of children in relation to mother's literacy status

	<i>Literate</i>		<i>Illiterate</i>		<i>P-value</i>
	<i>Mean±S.D</i>		<i>Mean±S.D</i>		
Wt. at 12th month (in kgs)	9.07	1.16	8.16	1.35	<.001 (S)
Wt. at 24th month (in kgs)	11.80	1.35	10.44	1.60	<.001 (S)
CHL at 12th month (in cms)	72.91	4.24	69.80	3.91	<.001(S)
CHL at 24th month (in cms)	84.06	3.70	80.39	4.04	<.001 (S)

Table 7 shows that the growth in relation to literacy status of mothers had shown a significant difference in the weight and Crown Heal Length at 12th and 24th months of age. The mean weight and Crown Heal Length being better in case of children born to literate mothers than with those of children born to illiterate mothers.

It is observed from Table 8 that the child's growth in relationship to family income. It shows that weight and Crown Heal Length at the end of first year had lower mean values for children belonging to low income group in comparison to children belonging to a high income group. A similar pattern was also observed at the end of 24 months of age. The differences at the end of second year were more conspicuous rather than at the end of first year.

Even the birth order of the child has shown a significant effect on the weight and Crown Heal Length at the end of the first and second year of life as observed from Table 9. The first and second born had an advantage of having better weight and Crown Heal Length as compared to children with higher birth order. In respect of birth spacing weight and Crown Heal Length of children whose mother had practiced spacing > 3 years was significantly better than the children whose mothers gave birth to another baby within 3 years.

The growth of the children belonging to housewives showed significantly lower weight

Table 8: Growth (CHL & WT.) of children in relation to income pattern

	<i>Low upto Rs 20,000 p.a</i>		<i>Lower Middle Rs 20001- 40,000 p.a</i>		<i>Upper Middle Rs 40,001- 62,000 p.a</i>		<i>High Rs 62,001- 86,000 p.a</i>		<i>Above Rs 86,000 p.a</i>		<i>P- value</i>
	<i>Mean±SD</i>		<i>Mean±SD</i>		<i>Mean±SD</i>		<i>Mean±SD</i>		<i>Mean±SD</i>		
Wt. at 12th month (in kgs)	8.56	1.29	8.74	1.26	8.75	1.31	9.05	1.37	9.75	1.06	>.08
Wt. at 24th month (in kgs)	11.05	2.75	11.06	1.67	11.51	1.45	11.52	1.58	11.56	1.34	<.01
CHL at 12 month (in cms)	71.26	4.50	71.45	4.27	72.28	3.51	72.90	5.26	74.00	0.00	>.07
CHL at 24 month (in cms)	82.15	3.98	82.95	33.78	83.06	4.48	83.75	5.27	85.05	2.6	<.01

Table 9: Growth (CHL & WT.) of children in relation to birth order of the child

	<i>1st. Born</i>		<i>2nd. Born</i>		<i>3rd. Born</i>		<i>4th & above</i>		<i>P value</i>
	<i>Mean±S.D</i>		<i>Mean±S.D</i>		<i>Mean±S.D</i>		<i>Mean±S.D</i>		
Wt. at 12th month(in kgs)	8.85	1.23	9.02	1.28	8.47	1.27	8.06	1.44	< .013 (S)
Wt. at 24th month(in kgs)	11.57	1.41	11.64	1.51	10.86	1.64	10.40	1.72	< .001 (S)
CHL at 12th month (in cms)	72.80	4.18	71.84	3.84	70.73	5.08	70.35	4.08	< .039 (S)
CHL at 24th month(in cms)	83.70	4.20	82.85	3.95	81.93	4.62	80.93	3.34	< .028 (S)

and Crown Head Length at 12th month and 24th months of age in comparison to children belonging to working mothers.

CONCLUSION

Present study has revealed that growth and its patterns in Kashmiri urban children in first two years of life are quite comparable to North Indian children. Rate of growth for weight parameter was very fast, that is, 87.83% in first three months. Thereafter, there was a steady slowing down of growth in the next six months ranging between 18.67% to 13.39% which in the second year of life showed further slowing at a consistent rate. Similar pattern of growth rate increase was seen for Crown Head length. The growth pattern was similar to other well to do children for weight but in case of stature there was a slight lag. Kashmiri children have the potential to catch up the growth under favorable conditions. Feeding and weaning practices, maternal literacy and working status were important determinants of growth.

RECOMMENDATIONS

To improve and sustain better growth of our children it is recommended that better antenatal and post-natal services with improved child caring and rearing practices coupled with maternal sensitization to child's physical and psychological needs through better home environment with learning opportunities and improvement in female literacy would go a long way in improving the growth of these children. This involves a

multi-disciplinary approach of improving health care services, empowering women, encouraging female literacy and improving socio-economic status through integrated program directed towards mother and children. Extension services from home science department can play an important role in planning, organizing, and implementing various activities/ programmes directed in this direction.

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