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Anthropometric Measurements of Babies in Urban and Rural Areas in Relation to their Socio-Economic Variables

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ABSTRACT This study was conducted with the objectives to assess the comparative health status of urban and rural babies in relation to their ecological variables. The experimental material comprised 400 babies selected from urban and rural localities during the age of one to two years. The babies were divided into four categories of age group, two categories of localities and genders. Thus, working a sample of 25 male and 25 female babies in each age group from urban and rural localities. The selection of localities was purposive, while that of babies was random. Significant differences observed at all the age groups for all the anthropometric measurements revealed that there was enough diffences in the level of development of babies at the interval of three months. Mean squares due to gender were non-significant of all the components of physical development in urban area, while significant for in rural area for height and weight. This revealed that there was preference of male babies for care resulting in better health particularly in rural areas. The comparison of mean values of anthropometric measurements indicated that urban babies were in general, better than rural babies, particularly where height and weight were compared. In addition, height and weight were comparatively better indicator of health than head & chest circumferences as they revealed more clear differences in comparison of urban and rural data. Among socio-economic variables, family income and fathers' occupation were the most important determinants of health of babies followed by education of fathers' and birth order. Size of family was only important in rural area influencing health of babies.

INTRODUCTION

Babyhood refers to the period of development that begins at one year after birth and ends at about 2 years of age. Although it comprises only 2 per cent of the life span, yet it is the most remarkable and busiest time of development (Berk, 1996). Infants are marvelously equipped to learn immediately after birth. Through classical conditioning babies acquire stimulus associations that have survival value. Operant conditioning permits them to control events in their surrounding world. The habituation - dishabituation sequences reveal that even newborns are attracted to novelty, and will decrease attention to repetitive stimulation, their recognition of memory improves steadily with age.

During infancy, new system of action emerge constantly, such as, control of head and chest combined into sitting with support; kicking, rocking on all fours and reaching are gradually put together into crawling; standing and stepping are united into walking alone (Hofsten, 1989; Pick, 1989; Thelen, 1989). The way simple motor skills are reorganized into more effective motor systems is the most obvious in the area of fine motor skills (Manchester, 1988). Infants can coordinate one motor skill with other actions to produce complex skills, such as, stacking blocks, putting objects into containers and eating with a spoon.

During 12 months of age babies expect a person to reach for an object that the person is looking at with positive affect rather than for another object to which the person is not attending (Spelke et al., 1995). During the age of 18 to 24 months infants even seem to understand that people's actions are intentional and goal directed (Meltzoff, 1995), but in contrast 14 months old do not show this understanding (Repacholi and Gopnik, 1997). Therefore, it appears to provide evidence that infants during this age have at least some limited ability to reason non-egocentrically about people's desires (Flavell, 1999).

Baby hood is a critical period for physical and motor development. During this period children learn to control over their body and become physically independent. To get a complete picture of development of children is essential to know how they develop physically as well as psychologically. Directly, physical development determines what children can do, if children are well developed for their ages, they will be able to

compete in equal terms with their peers in various aspects of development. If not, they will be handicapped in competition with them and may be excluded from the peer group. By the end of the first year, infants deliberately feel shyness when they meet stranger. These emotions of children affect the behaviour of others, and emotional reactions of others regulate children's social behaviour. Therefore, it is very important to take care of them during this period so that they develop confidence in their body movements. The present study was undertaken with the objectives to assess the physical development of babies, its association with ecological factors and impact of intervention programme on its improvement.

METHOD

Selection of Respondents: A total of 400 babies in four age groups, namely, 12 to 15, 15 to 18, 18 to 21 and 21 to 24 months were selected from urban and rural areas. The major criteria for selection of respondents were age, locality, sex and economic variables of family. The details of number of babies in each age group, locality and gender are given in Table 1. Anthropometric measurements of babies, such as, height, weight, head and chest circumferences were observed to find out about their general health status. Height of the babies was observed with the help of anthropometric rod; weight with the help of weighing machine (bath room scale), and head and chest circumferences were measured with the help of fabric tape.

Socio-economic Variables: In this section measurement techniques followed for investigating some important ecological factors, such as birth order, education and occupations of fathers, size and income of families were described. The major criteria for selection of ecological factors were the evidence from past research and current prevailing status of society.

RESULTS

a) Factorial Analysis: Analysis of variance indicated that there were highly significant differences in mean values for height of babies in different age groups in both urban ($F=5.78^{**}$) and rural ($F=5.40^{**}$) samples (Table 2). Mean squares due to gender were nonsignificant in urban area ($F=0.89$) and significant in rural area ($F=4.97^{*}$) suggesting that the mean height of male and female babies over all age groups were similar in urban area, while different in rural area. Mean squares due to interaction of age x gender were nonsignificant in both areas indicating similar increase in height in both genders with age. Variation for weights of babies were significantly different for different age groups in urban ($F=7.35^{**}$) as well as in rural ($F=5.41^{**}$) area. Mean squares due to gender were nonsignificant in urban area ($F=2.81$), but significant in rural area ($F=7.50^{**}$). This revealed that the pooled mean over the age groups of males and females were similar in the urban area but different in rural area. Nonsignificant interaction of age x gender in both areas indicated that increase in weight in males and females was in the same order over the different age groups in both areas.

The differences for head circumferance in urban ($F=8.11^{**}$) as well as in rural ($F=5.02^{**}$) area were significant (Table 2). The nonsignificant differences for gender and interaction of gender x age in both locales revealed that the pooled mean of head circumference was similar irrespective of gender, which increased in similar pattern in boys as well as in girls in both the

Table 1: Details of babies selected for different age groups and gender under urban and rural areas

Locality	*Gender*	*Age in months*				
		12-15	*15-18*	*18-21*	*21-24*	*Total*
Urban	Boys	25	25	25	25	100
	Girls	25	25	25	25	100
Rural	Boys	25	25	25	25	100
	Girls	25	25	25	25	100
Total		100	100	100	100	400

areas under study. Mean squares for age were significant in urban (F=6.47**) and in rural area (F=3.68*) indicating significant increase in circumference of chest during the age groups under study (Table 2). Nonsignificant differences for gender and age x gender in both areas indicated that boys had chest circumference equal to that of girls, and that the pattern of increase in chest circumference over the age and gender were also similar. Means of males and females were at par in both areas as indicated by their respective F values.

Overall comparison of pooled mean values of height in urban area (73.74±3.33 cm) to that of rural area (72.77±2.91 cm) revealed non-significant differences (Z=0.62) (Table 3). However, the comparison of mean height in different age groups showed that mean height of urban babies (75.17±2.84 cm) was significantly higher than the rural babies (73.42±2.64 cm) only in the age group of 18-21 months (Z=3.00*), while nonsignificant in remaining age groups. Comparison of means of urban with that of rural sample indicated that babies, in general, were at par but in urban area, they excelled in two age groups (15-18 months, Z=2.17* and 18-21 months, Z=2.11*).

The mean values for head circumference showed that there was no significant difference in head circumference of males and females in urban as well as in rural area. Nonsignificant Z values for all the age groups as well as for overall mean revealed that mean head circumference of urban babies was almost equal to that of the rural babies. Overall mean of babies for chest circumference in urban area (43.52±2.53 cm) was equal to that of rural area (42.51±2.50 cm) as indicated by nonsignificant Z test (Z=1.13). But Z values for 12-15 age group(2.22*) and 21-24 age group (2.54*) indicated the superiority of urban children to rural children in these age groups.

Association of Anthropometric Measurements with Ecological Variables: Association of birth order was nonsignificant with all the anthropometric measurements in urban area (Table 4). But in rural area, birth order was significantly associated with height ($\chi^2 = 6.64$*)

Table 2: Factorial analyses of variances for anthropometric measurements of babies under urban and rural areas of Hisar

Variable	*Source of variation*	*Locality*								
		Urban					*Rural*			
		DF	*SS*	*MS*	*F*		*SS*	*MS*	*F*	
Height	Age (A)	3	748.93	249.64	5.78	**	753.93	251.31	5.40	**
	Gender (G)	1	38.72	38.72	0.89		231.13	231.13	4.97	*
	AXG	3	12.22	4.07	0.09		23.07	7.69	0.17	
	Error	192	6279.04	43.12			8929.92	46.51		
	Total	199	7078.91				9938.05			
Weight	Age (A)	3	105.90	35.30	7.35	**	79.80	23.3	5.41	
	Gender (G)	1	13.52	13.52	2.81		32.10	32.10	7.50	**
	AXG	3	0.36	0.12	0.03		17.40	5.80	1.34	
	Error	192	921.60	4.80			825.60	4.30		
	Total	199	1041.38				954.90			
Head circum-ferance	Age (A)	3	230.84	76.95	8.11	**	93.09	31.03	5.02	**
	Gender (G)	1	13.52	13.52	1.42		9.25	9.25	1.49	
	AXG	3	9.86	3.29	0.34		1.12	0.37	0.06	
	Error	192	1820.16	9.48			1186.56	6.18		
	Total	199	2074.38				1290.2			
Chest circum-ferance	Age (A)	3	139.38	46.44	6.47	**	76.38	25.45	3.68	*
	Gender (G)	1	15.13	15.13	2.11		18.00	18.00	2.60	
	AXG	3	7.22	2.41	0.34		11.62	3.87	0.56	
	Error	192	1378.56	7.18			1375.09	6.91		
	Total	199	1640.29				1481.09			

*, ** : Significant at 5% and 1% level of significance, respectively.

Table 3: Means and standard deviations for anthropometric measurements of babies in urban and rural areas

Variable	*Locality*	*Age in months*				*Pooled mean*
		12-15	*15-18*	*18-21*	*21-24*	
	Urban	71.06	72.81	75.17	76.01	73.74
		(2.21)	(1.93)	(2.84)	(3.45)	(3.33)
1. Height	Rural	70.25	7.94	73.42	75.53	72.77
		(2.81)	(3.13)	(2.64)	(3.35)	(2.91)
Z values for urban versus rural		1.60	1.67	3.00*	0.71	0.62
	Urban	7.22	7.67	8.42	9.12	8.11
		(2.92)	(1.81)	(2.00)	(1.90)	(2.26)
2. Weight	Rural	6.50	6.90	7.35	8.15	7.25
		(2.83)	(1.74)	(2.96)	(2.91)	(1.96)
Z values for urban versus rural		1.25	2.17*	2.11*	1.67	0.81
	Urban	42.36	43.18	44.01	45.28	43.71
		(1.81)	(1.85)	(2.81)	(2.85)	(2.65)
3. Head circumference	Rural	42.25	42.65	43.30	44.57	43.71
		(1.56)	(1.91)	(2.85)	(2.78)	(2.43)
Z values for urban versus rural		0.03	1.41	1.25	1.24	0.47
	Urban	42.60	43.00	43.70	44.85	43.52
		(1.41)	(2.80)	(2.63)	(2.70)	(2.53)
4. Chest circumferance	Rural	41.71	42.32	42.71	43.40	42.51
		(2.50)	(2.52)	(2.68)	(2.81)	(2.50)
Z values for urban versus rural		2.22*	1.32	1.88	2.54*	1.13

Figures in parentheses denote standard deviations.
* : Significant at 5% level of significance.

and weight ($\chi^2 = 13.62^{**}$) of babies. Majority of those who were the healthy belonged to first order of birth. Birth order also closely related with weight of babies ($\chi^2 = 13.62^{**}$) but poorly with head and chest circumferances of babies. It appeared that babies in first order, in general, had better health than those from second birth order in rural area. This may be may probably be attributed to either better attention of parents for first born babies and/or limited resources in case of second or more babies particularly in poor sections in rural area. In addition, height and weight seemed to be better indicator of health than head and chest circumferences in present study.

Health of babies was significantly influenced by education of their fathers in both areas. Height of babies was related to education of the fathers in both urban (χ^2=17.67**) and rural ($\chi^2$10.02*) areas. In urban area, maximum percentage of babies who were the tallest belonged to fathers who were highly educated, while the shortest belonged to the fathers who were not much educated. Similarly body weight was influenced by the education of fathers in both urban (16.76*) and rural (12.94*) areas. But not in case of head and chest circumferences. Thus, there was favourable influence of education of fathers on the height and weight of babies.

Occupation of fathers appear to be an important variable because it was related with all the anthropometric measurements in both areas. Thus, the babies having better health belonged to the high cetegory of occupation, while with poor health with low category of occupation. Association of size of family with height was nonsignificant in urban area with all the four anthropometric measurements of babies (χ^2 = 0.78), but significant in rural area. A high percentage of babies having better health also had smaller size family in rural area. Thus, in rural area, babies in smaller families had better health

Table 4: Chi-square values of associations of ecological factors with anthropometric measurements

S. No.	Birth order	Locality	Height	Weight	Head circum-ference	Chest circum-ference
1.	Birth	Urban	2.63	0.77	0.23	2.00
	order	Rural	6.64 *	13.62 **	0.21	1.07
2.	Education	Urban	17.67 **	16.076 **	1.45	9.25
	of fathers	Rural	10.02 *	12.94 *	4.02	4.50
3.	Occupations	Urban	9.75 *	13.32 **	10.46 *	12.95 *
	of fathers	Rural	20.02 **	14.95 **	17.69 **	9.62 **
4.	Size of	Urban	0.78	1.34	1.36	0.29
	family	Rural	12.44 *	10.35 *	9.46	9.63 *
5.	Income of	Urban	11.26 *	19.84 **	10.77 **	14.89 **
	family	Rural	10.52 *	14.67 *	15.61 **	15.83 **

*, ** : Significant at 5% and 1% level of significance, respectively.

than in case of larger families, but in urban area family size had not any impact on health of babies. Income of family was also associated with all the components of physical development of babies in both urban and rural areas. The babies with better health belonged to high-income groups in both areas.

DISCUSSION

During infancy physical development is very rapid. By the end of first year, infant's height is 50% greater than it was at birth; and by 2 years, it is 75 per cent greater. Weight also show similar dramatic changes. By five months, its birth weight, has doubled; at one year it has tripled and by two years it was quadrupled. Their growth slows in early and middle childhood. Children add about 2 to 3 inches in height and 5 pounds in weight each year (Berk, 1966).

In present study, analyses of variances indicated significant differences for age in all the anthropometric measurements, namely, height, weight, head and chest circumferences. This revealed that the differences for physical development were clear in various age groups and interval of three months as the assessment period was justified for all variables of physical development. This may be due to the fact that development during this period is very rapid and growth of a baby become 50 per cent higher at two years of age to that of one year (Tanner, 1990).

Physical development of boys was at par with that of girls in urban area for all the variables. In rural area, there were significant differences for height and weight of boys and girls, but not for head and chest circumferences. Watson (1993) studied various aspects of physical development, namely, height, body weight, skin-fold thickness, biceps and subscapular and supra-illiac skin folds on about 1200 babies of about one year old. The babies were at par in the height but heavier in weight and skin folds as compared to the mean values obtained at international level. Unti (1994) reported that paediatricians should implement an optional health care in a child's critical first year of life because this is the most important period of physical development. Taylor (1999) concluded that visual motor integration task was significantly related to mental performance of the babies. Nonsignificant interaction due to age x gender (Table 2) for all the anthropometric measurements indicated that in both boys and girls, there was similar trend. This is also expected because one physical measurement is linked to other measurement.

Thus, mean values of anthropometric measurements indicated that overall means of babies from urban area were at par with that of rural area. But when the differences over different age groups were considered, it was found that urban children were better than rural children for one or two age groups in height, weight and chest circumference. Such type of differences may be due to the differences in independent variable in a particular age group, such as, cultural settings and diversity among children in physical growth especially apparent when we observe them across

the cultures, nations and different geographical areas (Meredith, 1978; Tanner, 1990).

Bradley and Caldwell (1984) had also observed that occupation of parents was not associated with developmental parameters of babies during the age of 12 to 24 months of age. This may be attributed either to the much youngest age of children to be influenced by different occupations or due to similar approaches being applied in all the occupations.

CONCLUSIONS AND IMPLICATIONS

Development of babies especially during the age of one two to years is an important phase for assessment of their growth and to formulate the plan of improvement thereof. Better health status of male babies than females particularly in rural areas emphasised the need to concentrate our effort to improve the health status of female babies especially rural areas. Among the components of physical development, height and weight of babies were comparatively better indicators than head and chest circumferences as they showed comparatively more significant differences/associations than other variables. Family income and fathers occupations were important health influencing ecological variables. Family size was important only in rural area. Thus, the data in the present study indicated the need of improvement of health status of female babies particularly in rural areas and in large families.

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