Physical Parameters of 6-7 Year Old Children As Effected By Toxicity in Environment

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Abstract

The present study was undertaken to assess the impact of environmental toxicity on the physical development of the children aged 6-7 years in two eco-settings of Ludhiana city of the Punjab state in India. The residential locality around industrial area was termed as neurotoxicant polluted setting (NPS). The residential locality 20 km. away from industrial area was termed as neurotoxicant free setting (NFS). The neurotoxicant free setting (NFS) had no industry in its vicinity. The sample comprised of 240 children aged 6-7 years (belonging to low socio-economic status, born and brought up in the specified setting for the last six years and not of migrant family) randomly drawn from the Government schools located in the two settings. Out of these 240 children, 120 each were drawn purposively from the two eco-settings. It was once again distributed in the manner that equal number of children are from the two sexes i.e., n=60 each. Standard anthropometric measurements and instruments were used to measure height (cm), weight (Kg) and head circumferences (cm) to assess the child's physical development. The results clearly indicate that the respondents (both boys and girls) of NFS are better than their counterparts in NPS on various parameters of physical development.

Keywords*: Physical Development, Children, Neurotoxicant Polluted Eco-settings, Neurotoxicant Free Eco-settings.*

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Introduction

Children are partly the products of the environment, material and non- material, consequently any changes in it are likely to affect them as well. According to Schell (1991), child development and growth patterns are an indicator of the environmental health. For the same reason increasing concern is being expressed to the increase in environmental pollution that is releasing potentially dangerous chemicals or toxicants in the air the children breathe, water they drink and the land they live on.

Their increased susceptibility can arise from increased exposure to environmental toxins (pound for pound of body weight, children drink more water, eat more food and breathe more air than adults), increased exposure of individual organ systems from differences in distribution of toxins, immaturity of excretory pathways, alterations in target organ susceptibility, and a longer life span in which to express illness. Children are indeed different from adults, both in patterns of exposure to environmental risk and in their responses to environmental hazards. There are several examples in the literature demonstrating that exposure to a chemical during a critical period of development will produce neurotoxicity, whereas exposure to the same chemical during adulthood will have little or no effect (Rodier 1976, Rodier *et al* 1979 and Balduini *et al* 1991). The major determinants of these differences are however related to the rapid growth and development of children.

Of the various toxicants, childhood lead poisoning is now recognized as the number, one preventable global environmental disease of children. Lead poisoning affects children's health and development, especially in densely populated urban and industrial cities.

However since it is not possible to cover the whole of India at one time, therefore the impact of neurotoxicants was assessed on children in Ludhiana, the industrial capital of Punjab with maximum industries; in the present study entitled, "Impact of neurotoxicants on physical development of children, aged 6-7 years." The study has been planned with the following objectives: -

1. To assess the physical development of the children across "neurotoxicant free" eco-settings.
2. To assess the physical development of the children of "neurotoxicant polluted" eco-settings.
3. To compare the physical development of children across "neurotoxicant free" and "neurotoxicant polluted" eco-settings.

Material and Methods

The research methodology followed for conducting this study has been described under the following sub-headings:

1 Locale of the study
2 Selection of the sample
3 Tools for data collection
4 Analysis of data

Locale of the study

The present study was undertaken in Ludhiana city in two different eco-settings. The schools situated in the localities around Buddha Nullah i.e. in Salemtabri locality were termed as "neurotoxicant polluted" setting. The second locale which was away from Buddha Nullah and industrial area but in the Ludhiana city, were the schools in the Civil lines and in Gobind Nagar. This locale was termed as "neurotoxicant free" setting.

TABLE 1 : toxicity level in the water of the neurotoxicant polluted and neurotoxicant free eco-setting

Neurotoxicant polluted eco-setting is the area having the following toxicants in quantities greater than the prescribed limits given below

S. No.	Toxicants (mg/ l)	Inland Surface Water	Public Sewers	Land for Irrigation
1.	Lead	0.1	1.0	__
2.	Copper	3.0	3.0	
3.	Arsenic	0.2	0.2	0.2
4.	Selenium	0.05	0.05	
5.	Fluoride	2.0	15	__
6.	Phenolic compounds	1.0	5.0	__
7.	Cadmium	2.0	1.0	__

Neurotoxicant free setting is the setting having the above toxicants in quantities less than or equal to the prescribed limits given above.

Selection of the sample

The sample comprised of 240 children between the age group of 6-7 years randomly taken from the Government Schools. Out of the 240 children, 120 each were drawn purposively from the two eco-settings as mentioned above. It was distributed in the manner that equal number of children fall in the two sexes i.e. n=60 each.

The children included in the sample drawn from the two eco-settings satisfied the following criteria for their inclusion: -

a) Belonging to the low socio-economic status.

b) The child should be attending the school.

c) The child should not be of a migrant family.

d) The child should have minimum six years residence in the specified area.

Tools for data collection

The following tools were used for the collection of data.

1 Socio-Economic Status Scale (Form A urban)

The Socio-Economic Status Scale (Form A urban) designed by S.P. Kulshreshta (1981) was used to measure the socio-economic status of the selected children. This scale inquired about the background characteristics of children and their families such as age, sex, education, occupation, income, moveable and immoveable property in the family.

Anthropometric Measurements

Standard anthropometric measurements and instruments were used to measure height (cm), weight (kg) and head circumference (cm) to assess the child's physical development as well as his/her nutritional status.

Analysis of data

The collected data was classified and tabulated in accordance with the objectives to arrive at meaningful and relevant inferences. The data was analyzed using the percentages, arithmetic mean, standard deviation, coefficient of variability, Z- test.

Result and Discussion

The results of the investigation entitled, "Impact of neurotoxicants on the physical development of children aged 6-7 years" have been presented and discussed under the following headings :-

1 Socio personal characteristics of children

2 Physical development of children

Socio-Personal Characteristics of children

A perusal of data in *Table 2* reveals the almost comparable socio-personal characteristics of the respondents of NFS and NPS eco-settings.

Table 2 : Socio-personal characteristics of children

No.	Characteristics	Neuro-toxicant free (intervention)		Neurotoxicant polluted (intervention)		Neuro-toxicant free (control)		Neurotoxicant polluted (control)	
1.	Mother's education								
	– Illiterate	44	(73.3)	39	(65.0)	43	(71.7)	49	(81.7)
	– Primary	14	(23.3)	19	(31.7)	15	(25.0)	10	(16.7)
	– Middle	1	(1.7)	--		2	(3.3)	--	
	– Matric & above	--		1	(1.7)	--		--	
2.	Father's education								
	– Illiterate	5	(8.3)	10	(16.7)	8	(13.3)	15	(25.0)
	– Primary	40	(66.7)	40	(66.7)	48	(80.0)	45	(75.0)
	– Middle	14	(23.3)	6	(10.0)	2	(3.3)	--	
	– Matric & above	--		2	(3.3)	--		--	
3.	Father's occupation								
	– Labour	42	(70.0)	29	(48.3)	38	(63.3)	44	(73.3)
	– Service	7	(11.7)	7	(11.7)	13	(21.7)	1	(1.7)
	– Business	10	(16.7)	38	(63.3)	7	(11.7)	15	(25.0)
	– Others	--		--		--		--	
4.	Mother's occupation								
	– Labour	29	(48.3)	6	(10.0)	32	(53.3)	17	(28.3)
	– Service	--		3	(5.0)	--		--	
	– Business	--		--		3	(5.0)	1	(1.7)
	– Nil	30	(50.0)	50	(83.3)	25	(41.7)	41	(68.3)
	– Others	--		--		--		--	
5.	Family type								
	– Nuclear	46	(76.7)	43	(71.7)	44	(73.3)	40	(66.7)
	– Joint	14	(23.3)	17	(28.3)	16	(26.7)	20	(33.3)
6.	Family size								
	– Large(8& above)	16	(26.7)	8	(13.3)	15	(25.0)	20	(33.3)
	– Medium (5-7)	41	(68.3)	38	(63.3)	38	(63.3)	35	(58.3)
	– Small (4 or less)	3	(5.0)	14	(23.3)	7	(11.7)	5	(8.3)
7.	Birth order								
	– First	5	(8.3)	19	(31.7)	11	(18.3)	8	(13.3)
	– Second	18	(30.0)	23	(38.3)	10	(16.7)	15	(25.0)
	– Third or later	37	(61.7)	18	(30.0)	39	(65.0)	37	(61.7)

Figures in parenthesis indicate percentages.

2. Physical Development of children

Data in *Table 3* presents the mean height mean weight and mean head circumference of the respondents (boys and girls) of the neurotoxicant free and neurotoxicant polluted eco-settings at the two age groups of 6 and 7 years at the pre-intervention stage.

The results indicate that the boys of neurotoxicant free eco-setting of both the age groups are comparatively taller (mean height 110.8 cm at 6 and 115.7 cm at 7 years than their counterparts in neurotoxicant polluted eco-setting with mean height of 108.0 at 6 age level and 112.4 at 7 age level. Even their head circumferences are more than the boys of neurotoxicant polluted eco-setting. However, the respondents of neurotoxicant

polluted group at both the age level weighed more than their counterparts in neurotoxicant free group (mean weight of the boys of neurotoxicant polluted eco-setting being 16.1 at 6 and 18.5 at 7 years as compared to the boys of neurotoxicant free eco-setting with mean weight of 14.3 at 6 and 15.5 at 7 years); those in neurotoxicant polluted eco-setting being 2-3 kg heavier than those in neurotoxicant free eco-setting.

Almost similar results are observed in case of girls. Here again the girls of neurotoxicant free group are taller at both the age levels i.e mean height 106.4 at 6 and 114.7 at 7 as compared to those in the neurotoxicant polluted eco-settings who have mean height of 106.3 cm at 6 years and 110.8 cm at 7 years. Similarly the girls of neurotoxicant free eco-setting had greater head circumference (mean head circumference = 49.6 cm at 6 and 49.9 cm at 7 years) as compared to those in the neurotoxicant polluted eco-setting (mean head circumference = 49.4 cm at 6 and 49.7 cm at 7 years. As with boys, the mean weight of the girls of neurotoxicant polluted eco-setting is more (mean weight at 6 years = 15.2 kg and at 7 years = 17.4 kg) as compared to those in the neurotoxicant free eco-setting having mean weight of 12.4 kg at 6 and 15.1 at 7 age group.

The results clearly indicate that the respondents (both boys and girls) of neurotoxicant free eco-setting are better than their counterparts in neurotoxicant polluted eco-setting with respect to the height and head circumference parameter of physical development. On the other hand, those in neurotoxicant polluted eco-setting are heavier than those in the neurotoxicant free eco-setting, when their mean weights are compared. It shows that toxicity basically affects more negatively the height and head circumference of the respondents which are partly genetic and partly environmental traits; and less the weight of respondents, this being more a function of environmental inputs.

Table 4 presents statistically significant difference in physical

Table III : Assessment of the physical development of the respondents of the neurotoxicant free and neurotoxicant polluted eco-settings

Age (in yrs)	BOYS								GIRLS							
	Neurotoxicant free				Neurotoxicant polluted				Neurotoxicant free				Neurotoxicant polluted			
	No. of children (n)	Height (cm) Mean (SD)	Weight (kg) Mean (SD)	Head circum-ference (cm) Mean (SD)	No. of children (n)	Height (cm) Mean (SD)	Weight (kg) Mean (SD)	Head circum-ference (cm) Mean (SD)	No. of children (n)	Height (cm) Mean (SD)	Weight (kg) Mean (SD)	Head circum-ference (cm) Mean (SD)	No. of children (n)	Height (cm) Mean (SD)	Weight (kg) Mean (SD)	Head circum-ference (cm) Mean (SD)
6	35	110.8 (6.8)	14.3 (3.0)	50.8 (1.7)	22	108.0 (4.6)	16.1 (1.7)	50.6 (1.4)	16	106.4 (6.3)	12.4 (2.2)	49.6 (1.10)	25	106.3 (4.0)	15.2 (2.3)	49.4 (1.1)
7	35	115.7 (7.4)	15.5 (3.0)	50.9 (1.2)	38	112.4 (5.4)	18.5 (1.9)	50.9 (1.0)	44	114.7 (6.0)	15.1 (2.3)	49.9 (1.4)	35	110.8 (6.0)	17.4 (2.0)	49.7 (1.3)

development among the respondents of the neurotoxicant free and neurotoxicant polluted eco-settings (i.e their pre-intervention status) A perusal of the data indicates that among boys statistically significant differences ($p< 0.05$ in case of 6 years and $p< 0.01$ in case of 7 years) was observed in the mean weight of the respondents of both the eco-settings. In case if mean height, significant differences ($p<0.05$) were observed only at the age groups of seven years.

Table 4 : Statistical significant differences in physical development among the respondents of the neurotoxicant free and neurotoxicant polluted eco-

Age (in years)	Variable	Boys (Z-value)	Girls (Z-value)
6	Height	1.67	0.06
	Weight	2.57**	3.9*
	Head Circumference	0.87	0.57
7	Height	2.16**	2.89*
	Weight	5.0*	4.79*
	Head Circumference	0	0.67

* Critical value of Z at 1% level of significance = 2.58

** Critical value of Z at 5% level of significance = 1.96

A critical analysis of the whole scenario reveals that weight is the only physical variable that significantly differentiates between the two eco-settings at both the age-groups and in both the sexes. The data also reveals that with increase in age, the differences in the mean height of the respondents of the two eco-settings become significant i.e the effect of toxicity becomes more prominent with increase in age.

The conclusions derived from the results of the present study are given as under:

Neurotoxicity does not show significant negative effect on weight whereas head circumferences and height seem to be affected by it marginally.