



Effect of child labour on growth of children

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This community based group comparison study was undertaken to assess the effect of child labour on the growth of children. The study subjects were 223 child labourers aged between 8–15 y who were matched by age to an equal number of controls and pair matched for gender. The mean weight of the male child labourers and the controls increased from 23.8 (± 5.9) to 41.2 (± 9.7) kg and 23.9 (± 4.8) to 44.4 (± 10.3) kg respectively, while mean height increased from 121.5 (± 12.6) to 151.9 (± 10.6) cm and 122.0 (± 8.4) to 154.8 (± 10.8) cm respectively from 8–15 y. At older ages (12 y and above for weight and 14 y and above for height) the difference was statistically significant. The same was not observed for the female study subjects. Similarly standard deviation (s.d.) scores for weight for age and height for age of male comparison subjects was significantly ($P < 0.01$) nearer to National Centre for Health Statistics (NCHS) standard than that of the child labourers. Body mass index (BMI) below normal value, that is, 18.5 was observed in significantly ($P = 0.0261$) more child labourers 180 (80.7%) than controls 160 (71.1%). With increasing duration of employment BMI decreased from 18.1 (± 3.5) to 17.3 (± 2.2). Genital development was observed to be delayed significantly in male child labourers. Therefore, it can be concluded that labouring at a young age has a deleterious effect on the growth of the child.

Keywords: child labour; employment; growth; anthropometric measurement; genital/breast development; community based comparative cross sectional study

Introduction

Seventeen million children in India are working within a variety of hazardous industries¹ and such work may have a detrimental effect on these children's health and development.

Childhood is the period of rapid growth. Proper growth requires a supportive environment which gives adequate diet, rest, play, and recreation. Children from a lower socio-economic background who live in environments which are unhygienic, for instance slums, usually suffer from repeated infections and under-nutrition. They may also be forced to work to earn a living. When they are forced to do physically demanding labour, they are denied the necessary physical, social and psychological stimuli necessary for healthy development during a period of rapid growth. Thus along with precarious living conditions, child labour may adversely affect the growth of children. Though the effect of child labour on the growth of children is emphasised in various studies very few² attempted to study this question using children in India matched against a suitable comparison group. In spite of the fact that social and psychological factors influence genital development,³ correlation of this with labouring at a young age, where these social and psychological factors co-exist is not well studied.

Against this background this present population based study was undertaken to assess the effects of child labour on the growth of children.

Materials and methods

This community based group comparison study was conducted in two randomly selected slums under the field practice area of the Department of Preventive and Social Medicine, Government Medical College, Nagpur, India.

For the present study a child labourer was defined as a child up to 15 y of age, who worked in any occupation and who resided in the study areas.^{4,5} The comparison group subjects included children from the neighbourhood who were matched for age (frequency) and gender, and who were not working at any occupation.

Out of all the child labourers (234) in the study area, 11 (4.7%) were excluded due to non availability and non-cooperation, while 223 (95.3%) were included in the study. An equal number of control pairs matched for sex and group matched for age were selected at random from the same areas. All the study subjects were from the age group 8–15 y.

Anthropometric measurements namely height in cm and weight in kg were recorded to the nearest 0.1 cm and 100 gm respectively for each study subject, according to standard methodology and using equipment described by WHO.⁶

Statistical analysis

Data were analysed using student *t*-test, chi-square test, Mann Whitney U-test and standard deviation scores for weight for age (WFA) and height for age (HFA).

When height and weight data of male child labourers was graphically plotted on computer a symmetrical curve was observed and hence a parametric test, that is, *t*-test was used to test for the difference between means. For females there were distortions in height and weight curves, so, in this group, non-parametric statistics, that is Mann Whitney U-test were used instead.

To eliminate the confounding effect of age, on height and weight comparison between the two groups, standard deviation (s.d.) scores for HFA and WFA were calculated using NCHS standards.⁷

Results

There were 223 child labourers and an equal number of controls in the study including 180 (80.7%) male and 43

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Table 1 Occupation of child labourers in order of frequency of occupation

Occupations		Child labourers <i>n</i> = 223
1	Garages/workshops	73 (32.7)
2	Cottage industries (kite making, cushion, agarbatti, sari etc.)	68 (30.5)
3	Hotels/tea stall	15 (6.7)
4	Construction work	18 (7.1)
5	Bicycle repairing shops	10 (4.5)
6	Shoe making	8 (3.6)
7	Cooler fitting	6 (2.7)
8	Salt factory	5 (2.2)
9	Hawker	4 (1.8)
10	Printing press	4 (1.8)
11	Tailoring	3 (1.4)
12	Others (plastic factory, truck cleaner, electric fitting, pan shop etc.)	9 (4.0)

Figures in the parentheses indicate percentages.

Table 2 Daily calorie intake of study subjects

Age group (y)	<i>n</i> ^a	Daily calorie intake mean (\pm 2 s.d.)	
		Child labourers	Controls
8–9	15 (6.7)	1647.2 (275.7)	1710.5 (245.1)
10–11	29 (13.0)	1780.5 (194.8)	1700.0 (160.7)
12–13	64 (28.7)	1783.3 (173.8)	1814.5 (242.5)
14–15	115 (51.6)	2080.0 (204.6)	1984.6 (194.8)

^aNo. of study subjects in each age group.
Figures in parentheses indicate percentages.
Males = 180 (80.7%)
Females = 43 (19.3%).

(19.3%) female study subjects. The largest number 115 (51.6%) belonged to the 14–15 y age group. The mean age of the male child labourers was 13.2 (\pm 1.5) y and that of the comparison group subjects was 13.9 (\pm 1.9) y; while for females their mean age was 12.5 (1.4) y respectively for child labourers and the comparison group. The majority of child labourers 190 (85.2%) as well as controls 187

(83.8%) belonged to the Muslim community, the others being members of the Hindu community. Almost all child labourers 222 (99.5%) and controls 218 (98.3%) belonged to classes—III and IV as identified on the basis of the modified Kuppaswamy's socio-economic status scale.⁸ Child labourers were working in various jobs, both on an organised and unorganised basis. Table 1 describes the occupations of child labourers. Garages, workshops and cottage industries employed a sizeable proportion of children included in the study. The mean age for taking a job was 11.1 (\pm 3.6) y. Mean daily working hours were 8.5 (\pm 6.2) and the average duration of their jobs were 25.3 (\pm 13.1) months.

Table 2 shows the daily calorie intake of study subjects. In each age group both child labourers and controls had a very similar daily calorie intake.

In each age group the male controls were heavier than the child labourer, however, this only reached statistical significance ($P < 0.05$) from 12 y and onwards. Controls were taller than child labourers, with the difference reaching statistical significance at the 14 and 15 y age bracket (Table 3). With respect to female study subjects, no significant difference was observed for height and weight between the two groups. (Table 4).

Standard deviation (s.d.) scores of WFA and HFA for the comparison group were observed to be nearer to the NCHS standards as compared with child labourers. Statistical significance ($P < 0.01$) was observed for males (Table 5).

Significantly more ($P < 0.026$) child labourers were thinner (BMI < 18.5)⁹ than controls (Table 6). Further, increasing length of employment was found to be associated with decreased mean BMI (Table 7). Genital development was observed to be delayed significantly in male child labourers. Comparison of breast development in female study subjects showed no significant difference between the two groups (Table 8).

Discussion

Growth in childhood is affected by many factors namely, poor socio-economic conditions leading to deficient dietary habits, hygienic practices and environmental sanitation, whilst reduced daily calorie intake results in repeated infection and undernutrition. In the present study confounders such as age and sex were explicitly controlled for

Table 3 Height and weight of male study subjects

Age (y)	Height in cm			Weight in kg		
	Child labourers mean (2 s.d.)	Controls mean (2 s.d.)	<i>t</i> -value	Child labourers mean (2 s.d.)	Controls mean (2 s.d.)	<i>t</i> -value
8	121.5 (12.6)	122.0 (8.4)	0.13	23.8 (5.9)	23.9 (4.8)	0.05
9	124.5 (8.6)	124.8 (7.4)	0.13	26.2 (4.8)	27.0 (4.5)	0.6
10	126.1 (7.2)	127.4 (8.5)	0.9	28.7 (4.9)	29.2 (5.2)	0.5
11	132.4 (9.2)	136.1 (10.4)	1.7	31.8 (6.5)	33.4 (6.4)	1.1
12	136.2 (10.2)	139.1 (12.2)	1.9	34.7 (8.5)	37.4 (8.7)	2.5 ^a
13	140.7 (11.2)	142.4 (10.3)	1.0	37.3 (6.7)	39.8 (6.8)	2.3 ^a
14	146.4 (8.6)	149.1 (9.2)	2.8 ^a	39.4 (10.1)	41.6 (8.9)	2.2 ^a
15	151.9 (10.6)	154.8 (10.8)	2.8 ^a	41.2 (9.7)	44.4 (10.3)	3.2 ^a

^a Statistically significant.

Table 4 Height and weight of female child labourer study subjects

Age group (y)	Height (median) in cm			Weight (median) in kg		
	CL	Controls	U-value ^a	CL	Controls	U-value ^a
8	118.0	118.0	—	23.8	24.2	—
9	122	122.5	9	24.2	24.3	8.5
10	124	125	23	26.7	27.6	24.0
11	132	132	18	28.6	27.6	21.0
12	138	139	62.1	33.1	31.6	67.5
13	140	140	49.0	35.6	36.6	46.0
14	142	143.5	40.0	38.7	37.0	7.5
15	151.5	153	61.5	40.2	40.3	52.5

^a Not significant.
 CL = Child labourers.

Table 5 Standard deviation (s.d.) scores for Height for age (HFA) and Weight for age (WFA)

	Child labourers		Controls	
	Mean	s.d.	Mean	s.d.
Age in years				
Male	13.2	1.5	13.2	1.9
Female	12.5	1.3	12.4	1.4
s.d. score ^a for WFA				
Male	- 1.11	0.42	- 0.89	0.37 ^b
Female	- 1.34	0.32	- 1.29	0.30
s.d. score for HFA				
Male	- 1.84	0.34	- 1.53	0.31 ^b
Female	- 2.10	0.49	- 2.00	0.47

^a s.d. scores are based on standards derived by Agrawal KN *et al* (1992) in cohort of well fed, healthy Indian children.
^b $P < 0.01$.

Table 6 Body mass index (BMI) of study subjects

BMI	Child labourers	Controls
< 16	32 (14.3)	27 (12.1)
16–16.99	90 (40.4)	70 (31.5)
17–18.49	58 (26.0)	63 (28.2)
18.5–24.99	43 (19.3)	63 (28.2)
25 and above	—	—

Figures in parentheses indicate percentages.
 BMI < 18.5 vs \geq 18.5.
 $\chi^2 = 4.95$; $df = 1$;
 $P = 0.0261$.

in the design. Also to avoid the confounding effect of age, height and weight data were analysed using s.d. scores. There was as such no difference in daily calorie intake of study subjects. Almost all were from the same environment, and had similar religious and socio-economic backgrounds. Therefore, the confounding effects of environment, lifestyle and dietary habits were, to a great extent, reduced. In this sample there was a lower number of female than male children who were child labourers. This may be

Table 7 Body mass index (BMI) and duration of job

Duration (y)	No. of child labourers	Mean BMI (\pm 2 s.d.)
< 1	42 (18.8)	18.1 (\pm 3.5)
1–2	53 (23.8)	18.0 (\pm 3.1)
2–3	79 (35.4)	18.0 (\pm 3.8)
3–4	33 (14.8)	17.9 (\pm 2.9)
> 4	16 (7.2)	17.3 (\pm 2.2)

Duration < 1 y vs > 4 y.
 $t = 2.1$; $df = 56$.;
 $P < 0.001$.

due to religious restriction against women working out of doors. This low number did preclude a valid comparison between female study subjects.

In general, weight and height estimates of controls were more than those of the child labourers even though a statistical significant difference was only observed in the higher age groups. Some earlier studies have reported similar observations,^{2,10,11} Malnutrition was observed to be prevalent in both groups. It may indicate that child labourers and controls had similar growth patterns early in life, both having some degree of growth impairment. This was then probably aggravated by working at a young age, which could have further impaired the growth of the child labourers, as is also suggested by the decreasing BMI with the duration of job.

Delayed genital development of the child labourers as was observed in the present study, further suggests impaired growth and development. The significance of this variation in genital development could not be ascertained. We were unable to find any literature with respect to this so future population based heterogeneous studies could usefully be carried out regarding this subject. Impairment of growth during the stage of life where growth should be most rapid may result in adults who have a reduced capability to safeguard their own, and their family's welfare and also the general welfare of society.

Conclusions

From the observations of this study it can be concluded that child labour has a deleterious effect on the growth of a

Table 8 Genital and breast development in study subjects

Genital development	Child labourers		Controls		t-value
	n (%)	Mean age (2 s.d.)	n (%)	Mean age (2 s.d.)	
G1	41 (18.4)	9.8 (2.1)	28 (12.6)	9.9 (2.2)	3.46 ^a
G2	44 (19.7)	11.5 (2.3)	31 (13.9)	10.4 (1.1)	5.5 ^a
G3	66 (49.3)	13.4 (2.6)	45 (20.2)	12 (1.7)	4.0 ^a
G4	39 (17.5)	14.8 (2.9)	67 (30.0)	14.0 (2.1)	3.07 ^a
G5	33 (14.5)	14.9 (1.5)	52 (23.3)	14.5 (2.1)	2.05 ^a
Breast development					
B1	5 (11.6)	8.4 (1.2)	4 (9.3)	8.2 (1.4)	Not significant
B2	12 (27.9)	9.7 (2.1)	10 (23.3)	9.5 (2.0)	
B3	11 (25.6)	12.4 (1.2)	10 (23.3)	12.6 (1.6)	
B4	9 (20.9)	13.5 (2.1)	11 (25.6)	13.3 (1.9)	
B5	6 (14.0)	14.6 (2.1)	8 (18.6)	14.7 (1.7)	
	43 (100)		43 (100)		

^a Statistically significant.

n = number of study subjects.

Genital development stage G1 + G2 + G3 Vs G4 + G5:

$\chi^2 = 20.23$; df = 1; $P < 0.001$.

Breast development stage B1 + B2 + B3 VS B4 + B5:

$\chi^2 = 0.26$; df = 1; $P > 0.05$.

child. It is the joint responsibility of all members of society to fight against this practice which is contrary to present day human resource development policy.

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