

## Eyestrain in Working Children of Footwear Making Units of Agra, India

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Children of footwear making units are working in the soling process. The process includes fixing of upper part with the sole of the footwear. The adhesives contain a mix of organic solvents, which are released in the working environment and cause irritation and lacrimation of eyes. In addition poor illumination and ventilation further aggravates the eyestrain. The present study was carried out to find out the prevalence and the associated factors of eyestrain in working children of footwear making units. The study included 139 exposed and 160 comparison group subjects. Self-reported eyestrain was recorded through personal interview. The prevalence of eyestrain in child laborers was 25.9%, which was significantly more than the 12.4% prevalence in comparison group subjects ( $P=0.01$ ). Working children of footwear making units were at 2.4 times higher risk of developing eyestrain as compared to comparison group subjects, though statistically non significant. Significantly higher proportion of eyestrain was reported in those aged >12 years, males and those working daily for >4 hours. The higher prevalence of eyestrain in the working children of footwear units may be attributed to exposure to workplace factors.

**Key words:** Working children, India, Occupational health.

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In India according to 1991 census, out of a total population of 838.6 million, working children were 11.28 million, which was 1.34 percent of the total population [1]. The informal economy harbors most child labor [2].

The footwear industry is a significant segment of the leather industry in India. The industry is labour intensive and is concentrated in the small and cottage industry sectors. The major production centers India are Chennai, Ranipet and Ambur in Tamil Nadu, Mumbai in Maharashtra, Kanpur and Agra in Uttar Pradesh, Jalandhar in Punjab, and Delhi. Children are employed in the manufacture of shoes, particularly in the Agra. Estimates state that as many as 25,000 children may be involved in shoe-making, both for the domestic and international markets [3].

In the shoe-making industry, children work on soling (fixing upper portions of shoes to leather or rubber soles) with glue. Children in cramped poorly lit rooms suffer from continuous skin contact with industrial adhesives and breathing vapors from glues. Thus, the children working in the footwear industry are exposed to physical factors like poor illumination and poor ventilation, and chemicals like fumes of solvents in glues. These chemicals can result in eyestrain.

Eyestrain (asthenopia) is a symptom complex that

involves sensations of irritation to the eye itself, changes in vision (such as blurred or double vision), and associated symptoms such as headache [4,5]. The main cause of eyestrain is thought to be fatigue of the ciliary and extraocular muscles due to the prolonged accommodation and vergence required by near-vision work [4-7]. Another causative factor that has been implicated in eyestrain is dryness of the eyes resulting from an increased exposed surface area of the cornea when focusing and a decreased blink rate due to mental concentration [5]. Other causes of eyestrain include environmental factors (illumination levels, glare, brightness and viewing angles) and personal factors (uncorrected vision, stress, visual fatigue, poor posture and alcohol/drug use) [8]. A recent study among computer operators in India revealed 43.6% prevalence of eyestrain [9] while in another study among radiologists the prevalence of eyestrain was 36% [10]. Further exposure to fumes of solvent results in irritation of eyes and increased lacrimation [11].

This is the first attempt to find out the prevalence and factors associated with the eyestrain in the working children of footwear making units.

### METHODS

The present study aimed to assess the prevalence of eyestrain among 139 child laborers (not completed 18

years) working in the footwear making unit at Agra as exposed group and 160 comparison group children. The comparison group comprised of children from government-run school from the neighboring areas of the NCLP schools and from the classes, which matches the age-group of working children. The Institutional ethical committee cleared the project. The comparison group included only those children who never worked in any form of child labor. The informed consent of the parents was not obtained. However, the informed consent of the class teacher and the verbal assent of the children were obtained.

Using interview technique as a tool for data collection the demographic characteristics, occupational and clinical history were recorded on a pre-designed proforma. The questionnaire was pretested and the interview conducted by the same investigator. The socio-economic status of the two groups was group-matched. Socio-economic status was defined according to the modified Kuppaswamy's scale [12]. Eyestrain was assessed through evaluation of self-reported common symptoms including itching, burning, lacrimating or irritated eyes; tired or heavy eyes and difficulty seeing clearly (including blurred or double vision). Univariate and multivariate analysis of eyestrain was carried out according to the risk factors which included age  $\geq 12$  years, female sex, daily working duration  $\geq 4$  hours, and experience in the job  $> 2$  years. The age, daily working hours and duration of employment were arbitrarily dichotomized.

To assess the illumination levels at workplace a walk through survey was conducted in several houses where the footwear making was routinely carried out.

Statistical analysis included calculation of proportions and percentages, application of test of significance i.e. Chi-square test and calculation of Odds ratio with 95% confidence intervals. Multivariate analysis was carried out by dichotomizing the variables. Statistical software SPSS 15.0 was used for statistical analysis.

**RESULTS**

The mean age of the child labourers was found to be  $10.8 \pm 1.5$  years while the same for the comparison group was  $11.0 \pm 1.5$  years. The difference was statistically non-significant. The mean duration of exposure for the child labourers was  $20.5 \pm 16.2$  months while the mean daily hours of work was  $3.9 \pm 1.9$  hours.

The prevalence of eyestrain in child labourers was 25.9%, which was significantly more than the 12.4% prevalence in comparison group subjects ( $P=0.01$ ).

Working children of footwear making units were at 2.4 times higher risk of developing eyestrain as compared to comparison group subjects (OR=2.44; 95% CI: 0.81-2.69), though statistically non-significant.

**Table I** shows the univariate analysis of study risk factors of eyestrain in working children. However, when the risk of having eyestrain was calculated none of the factors were found to pose excess risk on univariate analysis. **Table II** shows the multivariate analysis of eyestrain according to study risk factors. The multivariate analysis suggested 3 times higher risk in those aged  $\geq 12$  years as compared to those aged  $< 12$  years (OR: 3.13; 95% CI: 1.14-8.55). Other factors were found as statistically non-significant risk factors.

**DISCUSSION**

The prevalence of eyestrain in the working children of footwear industry was found to be 25.9%. This is the first time the eyestrain is reported in a working group exposed

**TABLE I** UNIVARIATE ANALYSIS OF STUDY RISK FACTORS OF EYESTRAIN IN WORKING CHILDREN

Risk factors	(N=139)	Eyestrain Present(n=36)	OR (95% CI)
<i>Age (in y)</i>			
<12	116	26(22.4)	1.0
$\geq 12^*$	23	10 (43.5)	2.7 (0.6-3.9)
<i>Sex</i>			
Female	83	16 (19.3)	1.0
Male*	56	20 (35.7)	0.4 (0.3-1.5)
<i>Employment duration</i>			
<2 y	103	26 (25.2)	1.0
$\geq 2$ y	36	10 (27.8)	1.1 (0.5-2.5)
<i>Working hours</i>			
$\leq 4$	110	24 (21.8)	1.0
$> 4^*$	29	12 (41.4)	2.5 (0.6-3.6)

\* $p < 0.05$

**TABLE II:** MULTIVARIATE ANALYSIS OF STUDY RISK FACTORS

Risk factor	Adjusted Odds ratio (95% CI)
Age (<12 years)	3.13 (1.14-8.55)*
Sex (male)	0.46 (0.2-1.05)
Working hours (>4 hours)	2.06 (0.81-5.24)
Duration of exposure (>2 years)	0.75 (0.28-1.97)

\*Significant

to organic solvent fumes at workplace. However, similar high prevalence of eyestrain has been reported in computer professionals [5,8,9] and radiologists [10]. The suggested causes of eyestrain include fatigue of ciliary and extraocular muscles [4-7] and dryness of eyes [5]. Irritating effects of fumes emanating from adhesive solutions could also result in lacrimation. These adhesives contain a mixture of organic solvents such as hexane, benzene, propane, dimethyl heptane, cyclohexane, xylene, cyclopentane. Earlier studies on adult population also reported that the workers exposed to organic solvents suffer from eye irritation and lacrimation [11]. When asthenopia was analyzed according to two sexes it was found that more males had it. This can be attributed to high proportion of males working in the process of soling where organic solvents are used. The organic solvent fumes irritate the eyes resulting in lacrimation and itching [13]. The poor illumination at workplace as observed during walk through survey further adds to the eyestrain. The high prevalence in > 12 year old can partly be attributed to the cumulative exposure to the poor illumination and solvent fumes causing strain on eyes. The proportion of those complaining eyestrain was more in those working for more than 4 hours daily. This can be partly attributed to the development of fatigue. A study among visual display users working for more than 4 hours a day was found to be a significant risk factor [14]. A non-significantly higher prevalence of eyestrain in those working for more than 2 years as compared to those who have worked for lesser duration was observed.

There are certain limitations to the study. The asthenopia is self reported and thus is subjected to self-reporting bias and subjectivity. But the measures were taken to keep this subjectivity to a minimum by using standard definition and asking for specific symptoms of eyestrain. Secondly, the illumination levels at the workplace were not measured and thus the correlation of eyestrain with different illumination levels cannot be done. However on walk through survey it was found that the illumination level was poor being provided by a 40-60W electric bulb or oil-wick in a room of 10ft × 10ft.

We recommend that child labor in any form should be curbed. Further appropriate personal devices usage such as goggles should be encouraged to minimize the exposure to harmful chemicals to the eyes. Workstations with proper illumination and ventilation will further help in controlling this problem. There should be regular work

rest cycle, which is reported to have positive effects on eyestrain [15].

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