Original Research Article

Health profile of plastic industry workers in Mangaluru city – A cross sectional study

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Abstract

Background: The majority of modern products made today have some sort of plastic component. With the high demand for plastic manufacturing, distribution and compounding, comes a high demand for workers. Plastics pose short and long term health hazards on human beings **Aim:** To study the health profile of Plastic industry workers in one of the plastic factories in Mangalore. **Materials and Methods:** A cross-sectional study was conducted among the plastic factory workers (n=53) working in aplastic factory in Coastal Karnataka. Pre-tested semi structured questionnaire was administered after obtaining written informed consent to collect socio demographic details, knowledge and practice of personal protection measures, current and past illnesses. Thorough clinical examination and routine blood investigations were performed. **Results:** Majority of the workers were males(60.4%),with a mean age of 29.7 years.94.3% were Hindus and 58.5% were local residents.98.1% of them were literate. 41.5 % and 18.9% of them suffered from cuts and burns respectively. 41.5% of them had features suggestive of dermatitis, while 15.1% of them had eye irritation.39.6% of them had eosinophilia. **Conclusion:** The health profile of the plastic workers was found to be satisfactory except for the presence of dermatitis, cuts and burns. A significant proportion of them donot use personal protective equipments, emphasis has to be laid on their use and its promotion. This is a preliminary study which revealed certain health problems of plastic workers; we recommend more such studies to throw adequate light on this field of occupational health.
Key words: Plastic factory, workers, dermatitis, eosinophilia.

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Email: satishcmore@gmail.com
Received Date: 16/12/2017 Revised Date: 19/01/2018 Accepted Date: 02/02/2018
DOI: https://doi.org/10.26611/1011521

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 05 February 2018

INTRODUCTION

Work plays a vital role in sustaining life. Every worker spends at least 8 to 10 hours in the workplace daily. The working population are major contributors to socioeconomic development and represent half of the world's population.[1] The majority of modern products made today have some sort of plastic component. With the high demand for plastic manufacturing, distribution and compounding, comes a high demand for workers in plastic industry.[2] In today's modern and busy lifestyle, plastic has become part and parcel of our life. It is expected that use of plastics in the form poly vinyl chloride (PVC) in India will increase up to 3.1 million metrictonne/year by 2016-17.[3] The basis of every plastic material is the polymer. Exposure to isocyanates is irritating to the skin, mucous membranes, eyes, and respiratory tract.[4] The most common adverse health outcome associated with isocyanate exposure is asthma due to sensitization. Other health effects are contact dermatitis (both irritant and allergic forms) and hypersensitivity pneumonitis (HP). In the manufacturing of plastic products, Vinyl chloride monomer and di (2-ethylhexyl) phthalate are widely used, these are carcinogenic in nature and also cause serious health hazards to the exposed workers. It is well known that the components of plastics exert its effect on almost all body

How to cite this article: G Chandana, Satish More, Prasanna KS, Sachidananda K, Chethana K. Health profile of plastic industry workers in Mangaluru city – A cross sectional study. *MedPulse International Journal of Community Medicine* February 2018; 5(2): 22-25. https://www.medpulse.in/

parts including liver, lung, skin, and gonads affecting reproductive hormones.[3]

Booming use of plastics in India, which are replacing almost every traditional household appliance has invariably increased the number of plastic industries and work force enrolling into such industries. Considering the various occupational hazards suffered by workers involved in manufacture and handing of plastics, this study was undertaken to explore the health profile of group of workers in one such plastic industry in Dakshina Kannada district.

METHODOLOGY

A cross- sectional study was conducted in a plastic factory in Mangalore, a port city in coastal Karnataka. The selected plastic factory was a small scale manufacturing unit, producing plastic tubs, buckets, pots, containers etc. The study was carried out in the month of April 2015 in the premises of the factory. A total of 59 workers are employed in the factory, however only 53 workers were available during the study who agreed to take part. Permission was sought from plastic factory management for conducting the study. After clearance from the institutional ethics committee, a pre-tested semi structured questionnaire was administered after obtaining written informed consent from each worker.

Socio-demographic profile, knowledge and practice of personal protection measures were assessed by interviewing. Details of the personal hygiene, current and past illnesses were obtained by history, followed by thorough clinical examination. Routine blood investigations were performed. Data thus collected was analysed using trial version of SPSS 16. Workers who were found to have any health problem were referred to the main hospital for evaluation and treatment.

RESULTS

Of the59 workers employed in the factory, 53 workers were available during the study aged between 17 to 55 years, with a mean age of 29.7 ± 9.7 years.60.4% and 39.6% workers were males and females respectively. 58.5% were local residents, i.e. from Mangalore. Current work exposure ranged from 6 months to 6 years. All the workers have been enrolled under the ESI scheme. Most of the men were in the plastic making units, while the women were in the assembly units, however interchanging of duties were noted to make up for shortage of workers. Under the administrative section ten workers were employed. Majority (94.3%) of them are Hindus. Almost all the workers were literate (98.1%) with 75% having received education upto high school and above.19% of the workers had also undergone professional technical training. Monthly income of the workers ranged from Rs.3000 to Rs.25000, with majority (70%) earning between Rs. 5000-10000 (Table 1). Only one of the workers reported to have diabetes, one was a known hypertensive and 3 of them were known asthmatics. Personal hygiene as per history is satisfactory with 94.3% practicing hand washing before food and after defecation. However, regular nail trimming was seen in 77.4% of them.24.5% of them were using tobacco in either the smoke form or the chewable form, while 32.1% of them reported consumption of alcohol occasionally. All the employees engaged in handling the plastics were wearing aprons/ uniforms.67.9% reported use of gloves and 32.1% used face mask as personal protective equipment while at work. 28.3% of the individuals reported suffering from dermatitis and eye irritation. 7.5% of the workers reported breathlessness during work (Table 2). Among females, 2 (9.5%) of them had spontaneous abortions during the work tenure. Work related injuries were sustained more in males as compared to females and this association was found to be statistically significant ($p<0.05$ as shown in Table 3). Duration of work exposure had no significant association with dermatitis and redness of eye (Table 4). Clinical examination revealed that, 73.6% of them had a satisfactory oral hygiene. 18.9% of the workers were underweight; 7.5% and 15.1% were overweight and obese respectively (classified using Asian classification of Body Mass Index as shown in figure 1).All the workers had a systemic examination within the normal limits, except one person who had an ejection systolic murmur who was also found to be anaemic. On laboratory investigations it was found that, 15.1% were anaemic (males <13gm% and females <12gm%). 39.6% had high eosinophil counts, with a corresponding increase in the absolute eosinophil count as well. However gender and work exposure had no association with this finding. 3.8% and 13.2% of them had abnormal renal and liver function tests respectively.

Table 1: Socio Demographic Details Of The Workers (n=53)

Socio-demographic Characters		Frequency	Percentage
Gender	Male	32	60.4
	Female	21	39.6
Age	16-25yrs	22	41.5
	26-35 yrs	18	34.0
	36-45 yrs	9	17.0
	46-55 yrs	4	7.5

Education	Up to high school	15	28.3
	High school and above	38	71.7
Religion	Hindu	50	94.3
	Others	3	5.7
Monthly income	Rs.≤5000	12	22.6
	Rs.5001-10000	37	69.8
	>Rs.10000	4	7.5

Table 2: Gender wise distribution of health effects as reported by the plastic workers

Health effects	Male (%)	Female (%)	Total
Dermatitis	10(18.9)	5(9.4)	15(28.3)
Eye irritation	10(18.9)	5(9.4)	15(28.3)
Breathlessness	4(7.5)	0	4(7.5)

Figures in parenthesis are total percentages.

Table 3: Association of work relatedinjuries sustained with gender. (n=53)

Gender	Cuts		Burns	
	Present (%)	Absent (%)	Present (%)	Absent (%)
Males	20(62.5)	12(37.5)	9(28.1)	23(71.9)
Females	2(9.5)	19(90.5)	1(4.8)	20(95.2)
Test value	Pearson Chi square value 14.66		Fisher's Exact Test	
p-value	**<0.001**		**0.034**	

Figures in parenthesis are row percentages for each type of injury.

Table 4: Skin and eye conditions in relation to the duration of work

Duration	Dermatitis		Redness of eye	
	Present (%)	Absent (%)	Present (%)	Absent (%)
≤ 1 year	6(60)	14(40)	1(10)	9(90)
>1 year	16(37.2)	27(62.8)	7(16.3)	35(81.4)
Test value	Pearson Chi square value 1.736		Fisher's Exact Test	
p-value	**0.188**		**0.776**	

Figures in parenthesis are row percentages for each condition.

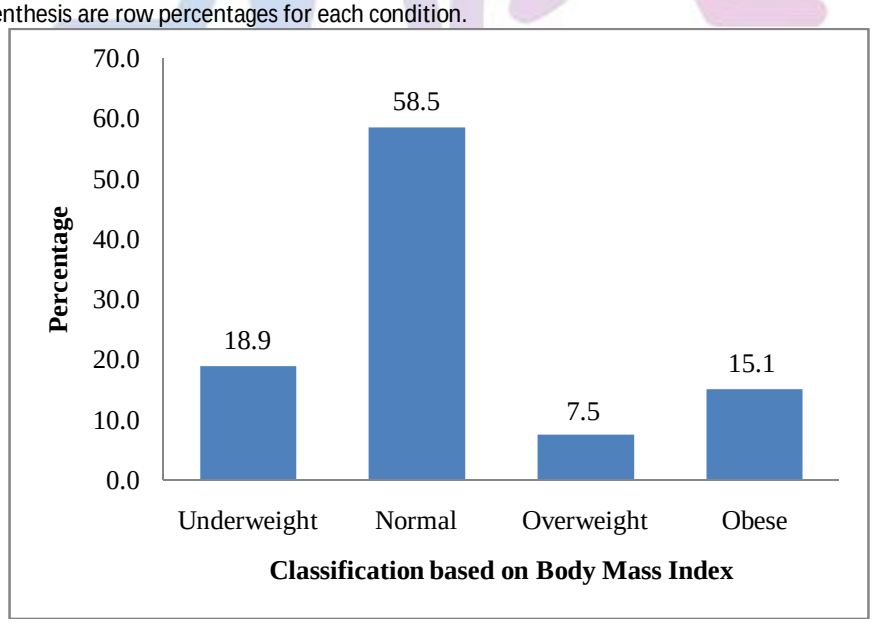

Figure 1: Categorisation according to Body Mass Index

DISCUSSION

Plastic polymers and products are extremely diverse, both in terms of chemical composition, properties and possible applications. Several hazardous substances may be released during the life cycle of a plastic product; and considering the large and growing global consumption of

plastic products, and their omnipresence and persistence in the environment, there is a need for assessing the hazards and risks of this large material group.[5] The expansion of the plastics industry during the last few decades has introduced the possibility of hazards from new polymers and from modifications to old products.

Results of this study are indicating that the workers of plastic factory are prone to skin injuries like cuts, burns and dermatitis which accounts for 41.5%,18.9% and 41.5% respectively. Contact dermatitis can result in symptoms such as rash, itching, hives, and swelling of the extremities.[4]

Khaliq *et al* found that workers of plastic factory are prone to respiratory dysfunction. A significant decrease in most of the flow rates and most of the lung volumes and capacities were observed in the workers.[6]According to R. Hebisch *et al* during recycling of plastics waste workers are exposed to air borne particles, especially inhalable fraction.[7]

Styrene helps to manufacture plastic materials used in thousands of remarkably strong, flexible and lightweight products that represent a vital part of our health and well-being. At low doses, styrene may cause irritation in the respiratory tract, and at high concentrations (>100 mg/m3) cause chronic bronchitis and obstructive pulmonary changes.[8]

In our study we found that 9.5% of the females had reported history of spontaneous abortions. According to Dematto *et al* it has been demonstrated that many plastics-related substances have adverse effects at very low levels. The ability plastic related substances to disrupt the endocrine system at low levels lends biological plausibility to the link between workplace exposures and increased risk of breast cancer and reproductive problems for women working in the plastics industry.[9]Two plastic ingredients, *bisphenol A* (BPA) and *Di(2-ethylhexyl) phthalate*(DEHP), are showing increasing evidence that they disrupt normal growth and development in many different species of animals due to their hormonal activity. Both chemicals are used to package food and contain beverages, and they are found in surface and ground water, the oceans, fish, food, and many consumer products.[10]

We found that 13.2% of the workers had deranged liver function tests. That could be due to their alcohol consumption as well. In a similar study conducted by Elisabetta Strafella *et al* found that the ALT and AST levels were not affected by alcohol consumption, and positively correlated with urinary styrene metabolites as evaluated by multiple regression analysis.[11] In our study it was noted that majority of the workers are multitasking, so the type of work could not be correlated with the health effects. Long term effects could not be elicited as the duration of exposure of the workers was short, maximum up to six years only. Since we had studied only one plastic factory the sample size was small as well.

CONCLUSION

The health profile of the plastic workers was found to be satisfactory except for the presence of dermatitis, eye irritation, eosinophilia, cuts and burns. A significant proportion of them do not use personal protective equipments, emphasis has to be laid on their use and its promotion. This is a preliminary study which revealed certain health problems of plastic workers; we recommend more such studies to throw adequate light on this field of occupational health.

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Source of Support: None Declared
Conflict of Interest: None Declared