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Potential health problems among workers of food parlors due to exposure to LPG, electric and biomass fuel-based stoves

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Abstract

Respiratory diseases and mortality due to indoor air pollution are amongst the greatest threats to health in the developing countries of Asia. In commercial kitchens, the working conditions are harder than in offices despite the fact there are limited data specially dealing with commercial kitchens. A study was therefore undertaken to characterize the levels of pollutants in gas, electric and biomass fuel based stoves using parlors. An attempt was also made to find out the impact of indoor air quality on health status of working people. Work zone environmental pollution was assessed by measuring the RSPM (Respirable Suspended Particulate Matter), SOx, NOx and aerial temperature of kitchens. Total 500 workers (cooks, helpers and servers) were examined and their health data was collected. Cooks health was affected than helpers and servers. The observations revealed that the concentrations of RSPM (90-889 µg/m^3), SOx (40-60 µg/m^3), NOx (3.5-60 µg/m^3) and aerial temperature (38-45^{0}C) were above permissible limits in kitchens.

Keywords: *Health problems, Cooking stoves, Work zone environmental pollution*

INTRODUCTION

Ages are changing and mankind has traveled a long way from rock age to rocket-age. Increase in globalization, urbanization and employment opportunities not only enables both husband and wife to work but also pressurize them to spend more time on work. Members of the family have no time to spend together, no apparent involvement in household responsibilities like cooking and others allied domestic jobs. This fact allowing every busy family to buy the food from parlors and fast food restaurants has led to the uncountable rise in the number of parlors and fast food restaurants in the past decade. Though this has given a great relief to the busy families, but on the other side of the coin, the un-hygienic and substandard kitchens and premises are spoiling the health of the crew and workers of parlors. In developing countries approximately 3.5 billion city people are suffering from Work zone Environmental Pollution (WEP), due to fuel consumption particularly at kitchens [1]. By keeping in view above cited conditions, the present work was carried out as a case study on impacts of heat, its stress and indoor air quality on the health of parlor workers.

MATERIALS AND METHODS

In the present study, fifty parlors were selected in different areas of Visakhapatnam in order to assess the heat stress in parlors workers (500 people) and to monitor indoor air quality of kitchens in parlors. In order to assess the heat stress among parlor workers, the health data of parlor workers was collected by distributing questionnaires. Individual health check-up (temperature, heart beat and blood pressure) was carried out with the help of medical practitioner. Indoor air quality of kitchens was monitored by using Handy Air Volume Sampler (HAVS), on line gas analyzers (Swan) and indoor air temperature was measured by using Wet Bulb Globe Thermometer (WBGT), where humidity was measured by Hygrometer in indoor atmosphere.

RESULTS AND DISCUSSIONS

The observed room temperature range was 380^{0}C to 450^{0}C in the parlor kitchens. While the humidity range observed was 70% to 80%. The permissible limit of corrected effective temperature (CET) is 230 to 250^{0}C according to ILO [2] regulations. All the observed temperatures were above the permissible limits. This increase in room temperature exerts heat stress to

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parlor cooks at kitchens. The health data collected from cooks, helpers and servers revealed that heat stress in workers was observed in the form of skin disorders and excess sweat. Some workers (75%) reported problems like prickly heat, dehydration, heat stroke and heat cramps and persons (25%), who have been working as cooks from past fifteen years complained about respiratory and cardiac disorders [3]. The overall mean was 76.0% in cooks and became progressively worse with increasing severity of cough (Table 1).

Table 1. Number of subjects examined in the survey and standard errors of workers.

Type of stoves	Age group		Respiratory Illness	Skin burns	Heat stroke	No effect	Total
Biomass fuel based	15-25	N	16	12	8	4	40
		Mean(S.E)	80.2(0.8)	73.4(2.3)	71.5(3.1)	79.6(0.9)	
	26-35	N	20	14	1	3	38
		Mean(S.E)	81.6(3.6)	75.7(2.4)	70.2(0.8)	67.4(2.0)	
	36-45	N	29	20	5	2	56
		Mean(S.E)	65.9(2.1)	75.5(2.2)	70.5(1.9)	75.6(1.4)	
	46-55	N	8	4	8	Nil	20
		Mean(S.E)	81.6(1.3)	77.0(2.0)	66.6(2.1)		
	56 and above	N	17	4	5	Nil	26
		Mean(S.E)	73.4(3.6)	70.8(4.3)	62.2(3.2)		
		Total	90	54	27	9	180
			76.0(2.1)	65.4(1.1)	67.3(2.3)	56.8(1.3)	78.5(0.8)
Kerosene	15-25	N	8	26	4	2	40
		Mean(S.E)	47.7(11.0)	68.6(17..3)	20.4(5.2)	76.2(4.5)	
	26-35	N	34	18	8	2	60
		Mean(S.E)	83.4(1.3)	77.7(4.5)	79.9(3.7)	71.5(2.3)	
	36-45	N	48	22	6	4	80
		Mean(S.E)	90.1(0.9)	84.6(5.8)	79.4(3.8)	70.9(4.0)	
	46-55	N	5	7	6	2	20
		Mean(S.E)	81.3(3.7)	78.5(4.7)	81.2(3.6)	76.2(5.1)	
	56 and above	N	8	6	3	3	20
		Mean(S.E)	79.9(3.7)	76.8(3.2)	82.6(4.2)	70.3(2.0)	
		Total	103	79	27	13	220
			80.4(1.9)	68.8(0.9)	76.8(2.1)	56.3(1.1)	75.4(0.6)
LPG	15-25	n	13	4	2	1	20
		Mean(S.E)	65.7(2.1)	74.3(3.2)	66.8(1.3)	73.2(7.9)	
	26-35	n	24	6	6	4	40
		Mean(S.E)	78.9(3.2)	70.4(4.3)	76.8(4.5)	87.5(4.2)	
	36-45	n	9	4	5	2	20
		Mean(S.E)	67.8(3.4)	78.4(4.2)	86.5(3.8)	67.8(2.4)	
	46-55	n	8	3	5	1	17
		Mean(S.E)	76.4(4.2)	75.2(1.8)	80.6(2.1)	79.0(1.2)	
	56 and above	n	1	1	1	Nil	3
		Mean(S.E)	86.5(3.5)	72.2(2.1)	69.6(1.2)		
		Total	55	18	19	8	100
			60.6(0.8)	54.6(0.5)	46.8(0.3)	40.4(1.8)	68.6(0.4)

In addition to heat stress, workers (cooks, helpers, servers) were also becoming victims of indoor air pollutants. The Respirable suspended Particulate Matter (RSPM), Sulphur dioxide and Oxides of Nitrogen were reported above the permissible limits were presented in Table 2.

Table 2. Indoor air pollutants concentrations (SO_2, NO_X & RSPM) measured during cooking in kitchens at different parlors.

Kitchens - Indoor (I) and Outdoor (O)						
	SO_x (µg/m^3)		NO_x (µg/m^3)		RSPM (µg/m^3)	
	I	O	I	O	I	O
Mean	50.2	23.4	47.5	12.2	489.5	175.6
SD	45.9	20.3	41.6	3.4	334.7	123.2
Min	40.5	20.2	40.6	3.8	180.1	168.3
Max	60.1	44.9	60.3	32.8	889.4	187.8

From the results it was clear that Respirable Suspended Particulate Matter (600-889 µg/m^3) concentration in all parlors kitchens except in control is two to three times higher in kitchens compared to dining halls. These levels were very high in kitchens where source of smoke was combustion of biomass fuel and kerosene stoves [4]. Improper ventilation was another reason for high Respirable Suspended Particulate Concentration [5] parlors using Liquid Pressure Gas (LPG) and electrical stoves, cooks were exposed to three times lesser RSPM levels (68-75 µg/m^3) compared to cooks of biomass fuel using parlors.

The sulphur dioxide and nitrogen Oxides concentrations in kitchens (except control) ranged from 40.68µg/m^3 to 60 µg/m^3 and 3.2 to 60bµg/m^3 respectively. The values were identified at congested kitchens of parlor which were located at Rood Transport Corporation (R.T.C.) Complex Visakhapatnam, India.

Enclosed outdoor kitchens or simply outdoor cooking resulted in even lower levels of indoor exposure (RSPM-200-300 µg/m^3, SOX and NOX) but still exceeded health guidelines for outdoor air pollution (24-hour Indian standard for particulate matter less than 10 µm is 100 µg/m^3). The sources of Indoor environment was combustion of fuels caused health problems in workers like irritation to throat, bronchitis and pulmonary emphysema on prolonged exposure [6]. The sources of oxides of nitrogen in kitchen were mainly combustion source, which includes L.P.G. and kerosene stoves and wood stoves. Oxides of nitrogen were relatively inert gas and moderately toxic, it irritates alveoli of lungs on continuous exposure [7].

CONCLUSION

The heat stress in parlor workers at kitchens (cooks, server & helper) was acute. It was conspicuously observed in cooks than in helpers and servants. This is possibly because, the helpers and servers keep on moving out of kitchens, but cooks need to spend more time near stoves in congested kitchens. However, we believe that, although most of the parlors had provision for ventilation in the kitchens, it was not adequate. Thus, exposure to cooking fuels produced a significant amount of respiratory illness. Use of smokeless devices and provision of adequate ventilation might be helpful to prevent some of these effects.

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