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A descriptive study to assess the impact of air pollution on birth weight of newborns at selected maternity corporation centres, Chennai

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Abstract

Background: A child birth is closely related to maternal health because during antenatal period, the fetus is part of the mother and who receives oxygen and other nutrients through the mother's blood. If a healthy mother brings forth a healthy baby, there is less chance for low birth weight. And the air pollution at current levels is a serious threat to health. The exposure to air pollutants in the first, second and third trimester of pregnancy may leads to small for gestational age and LBW.

Objectives: 1.To survey the air pollution level at selected areas in Chennai. 2. Assess the birth weight of newborns. 3. Association between air pollutants (SO_2, NOX, and RSPM & TSPM) and birth weight of newborns. 4. Association between demographic variable proforma, clinical proforma, obstetrical proforma and air pollution proforma with birth weight of newborns.

Methods: A Non-Experimental, Prospective Descriptive design with Non-Probability Purposive sampling technique was adopted. 350 mothers of newborns were selected from five maternity corporation centres.

Results: Majority of the newborns (73.7%) had normal birth weight, 24.3% of them were had low birth weight and very few newborns (2%) had very low birth weight, where none of the newborns belonged to extremely low birth weight. There is a significant association between age, weight gain during pregnancy, PIH, preterm delivery, fetal complications, presence of stagnated water, close distribution of houses and birth weight of newborns at the level $P<0.01$ & $P<0.05$ level. The findings also revealed that there was a significant association between SO_2, NOX, RSPM &TSPM and birth weight of newborns at $p<0.05$ level.

Conclusion: The findings of the study revealed that there is a significant association between SO_2, NOX, RSPM &TSPM and birth weight of newborns at $p<0.05$ level.Therefore, it needs to increase the pregnant mothers awareness through MCH services by designing an appropriate strategies including provision of targeted information, education and communication regarding effect of air pollution on birth weight of newborns.

Keywords: Air pollution, Sulphur di-oxide (SO2), Nitrous oxide (NOX), Respirable Suspended Particulate Matter (RSPM), Total Suspended Particulate Matter (TSPM), Birth weight, Newborns.

Introduction

Park (2009) [11] stated that the mother and infant constitute a priority group in many communities. Globally they comprise approximately 70% of the population of a developing country. Newborn health may be analyzed from different perspectives. One of these is birth weight, which is an important factor in the determination of neonatal and post-neonatal morbidity and mortality. Hence, the WHO considers low birth weight as the most important single factor in infant survival.

A child birth is closely related to maternal health because during antenatal period, the foetus is part of the mother and who receives oxygen and other nutrients through the mother's blood. If a healthy mother brings forth a healthy baby, there is less chance for low birth weight. The researcher felt that a high risk pregnancy is one in which the life or health of the mother or infant is jeopardized by a disorder coincidental with or unique to pregnancy. Mortality decreases when high risk status is identified an intensive care is given. Other than health problems the pregnant women are exposed to many physiological, environmental risk factors were done, were as the environmental factors were not focused. Due to urbanization, industrialization and destruction of ozone layers etc plays a vital role in increasing the environmental risk factors. As these factors are preventable the researcher was interested to select this topic for good.

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Objectives of the Study
1. To survey the air pollution level at selected areas in Chennai.
2. To assess the birth weight of newborns.
3. To identify the association between Sulphur Dioxide (SO_2), Nitrous Oxide (NOX), Respirable Suspended Particulate Matter (RSPM), Total Suspended Particulate Matter (TSPM) and the birth weight of newborns.
4. To find out the association between demographic variables, clinical variables, obstetrical variables and air pollution variables with birth weight of newborns.

Review of Literature
Mannes et al., (2008) [10] conducted a study on impact of ambient air pollution on birth weight among antenatal women in Sydney between1998-2000. The effect of air pollutants exposure in the first, second and third trimester of pregnancy on risk of small for gestational age during pregnancy and of pollutant exposure on birth weight was examined. For a 1 part per million increase in CO levels a reduction of 7-29 gms in birth weight was estimated. For a 1 part per million increases in mean Nitrogen Dioxide levels a reduction of 1 estimated PM in second statistically significant adverse effect on birth weight. For 1 microgram per cubic meter increase in mean Particulate Matter levels a reduction of 4 grams in birth weight was estimated

Guindi et al., (2009) [9] Aimed to determine the effects of severe maternal anaemia on pregnancy outcome. A retrospective study comparing 2 groups of pregnant women. 111 pregnant women with anaemia (Hb<8g/dl), 111 non-anaemic pregnant women (Hb>10g/dl). The findings showed that, in the anaemic group, iron deficiency was the most common cause of anaemia (92.7%). Maternal anaemic was found to be significantly associated with more frequent preterm birth (29.2% Vs 9.2%) and increased low birth weight. The study concluded that low birth weight have been reported in mother with mild to moderate maternal anaemia. Severe anaemia in pregnancy may have adverse effects on the new borns.

Methods: A Non-Experimental, Prospective Descriptive design was adopted for the study. Non-Probability Purposive sampling technique was adopted for the study. The tool was validated by experts and modifications were made according to expert's suggestion. The pilot study was conducted and found highly reliable with 'r' value 0.92. Data was collected the main study. Data was analyzed and interpreted by using descriptive and inferential statistics in terms of frequencies, percentages, mean, standard deviation and chi square value.

Major Findings of the Study
Demographic Variables of Study Participants
Equal no of the study participants (52.0%) were in age group of 21-25 years, 39.1% were educated up to primary school, and 58.3% of them had monthly income of Rs.1001-3000, most of the participants (53.1%) were had height between 146-155cms, 57.7% of their weight ranged from 41-50 kg, majority of the participants (82.9%) had BMI between 18.5-24.9 and none of the mothers had the habits of smoking, tobacco chewing and alcoholism.

Clinical Variables of Study Participants
A significant percentage of the mothers were identified to have medical problems such as anaemia (24.36%),

hypertension (3.7%), chronic diseases (0.9%) and other infections (10.3%) during pregnancy.

Obstetrical Variables of Study Participants
A significant percentage of the participants (51.1%) were primigravidae, 45.7% of the mothers had weight gain of 8-10kgs during pregnancy, 50.6% of the mothers went 4-6 times for antenatal visits, few of the mothers had PIH (11.7%), preterm (5.4%), history of multiple pregnancy (2.6%), adequate spacing (32.6%), history of abortion (12%), pre-pregnant underweight (8%), fetal complications (15%) and history of IUGR / LBW (8.9%). 54.0% newborns were male, majority of the newborns (73.7%) weighed between 2.5-3.5 kg at birth.

Air Pollution Variables of Study Participants
All the participants (100%) were living in urban areas whereas most of them (60.6%) were living in the same area for about 1-3 years, and almost all of them (93.7%) were unemployed, many of them (55.7%) were using gas for cooking at home, 44% of their house roofs were concrete, most of their (64.6%) houses had cement floors, many of them (54.3%) having smokers at home, 3.1% of the mothers were travelling 60–90 mts per day, 39.4% of the mothers were having factories near by the house, many of the mothers (54.9%) had stagnated water near by the house and most of their houses (64.3%) were located near to highways, majority of their houses (83.42%) were closely distributed and almost all of them (94.9%) were using bus as a mode of transportation.

Table 1: Frequency and Percentage of Birth Weight of Newborns.

(N=350)

Birth weight of Newborns	Frequency(n)	Percentage(P)
Normal	258	73.7
LBW	85	24.3
VLBW	7	2.0
ELBW	-	-

Table 2: Association between SO_2 and the Birth Weight of Newborns.

(N=350)

SO₂					
Birth weight of Newborns	Less than permissible Limits		More than permissible Limits		χ² Value
	n	p	n	P	
Normal	103	29.4	155	44.3	6.451* (df-2)
LBW	39	11.1	46	13.1	
VLBW	6	1.7	1	0.3	

Table-2 indicated that there was a significant association between Sulphur Dioxide (SO_2) and the birth weight of newborns at the level of $p<0.05$. Hence the null hypothesis Ho_1 is not accepted.

Table 3: Association between NOX and the Birth Weight of Newborns.

(N=350)

NOX					
Birth weight of Newborns	Less than permissible Limits		More than permissible Limits		χ² Value
	n	p	n	P	
Normal	103	29.4	155	44.3	6.451* (df-2)
LBW	39	11.1	46	13.1	
VLBW	6	1.7	1	0.3	

The data presented in the table-3 revealed that there was an association between Nitrous Oxide and the birth weight of newborns at the level of $P<0.05$. Hence the null hypothesis Ho_2 is not accepted.

Table 4: Association between RSPM and the Birth Weight of Newborns

(N=350)

RSPM					
Birth weight of Newborns	Less than permissible Limits		More than permissible Limits		χ^2 Value
	n	p	n	P	
Normal	51	14.6	207	59.1	5.866* (df-2)
LBW	26	7.4	59	16.9	
VLBW	3	0.9	4	1.1	

The data presented in the table-4 revealed that there was an association between Respirable Suspended Particulate Matter and the birth weight of newborns at the level of $P<0.05$. Hence the null hypothesis Ho_3 is not accepted.

Table 5: Association between TSPM and the Birth Weight of Newborns

(N=350)

TSPM					
Birth weight of Newborns	Less than permissible Limits		More than permissible Limits		χ^2 Value
	n	p	n	P	
Normal	51	14.6	207	59.1	5.866* (df-2)
LBW	26	7.4	59	16.9	
VLBW	3	0.9	4	1.1	

The data presented in the table-5 showed that there was an association between Total Suspended Particulate Matter and the birth weight of newborns at the level of $P<0.05$. Hence the null hypothesis Ho_4 is not accepted

Conclusion
The findings of the study indicated that there was a significant association between air pollutants (SO_2, NOX, RSPM, and TSPM) and birth weight of newborns. The findings also revealed that there was a positive association between selected demographic, clinical, obstetrical, air pollution variables such as age, maternal weight gain, PIH, preterm delivery, foetal complications, presence of stagnated water, close distribution of houses and birth weight of newborns.

Recommendations
➤ A comparative study can be conducted between different states upon the level of air pollution.
➤ The study can be replicated in the major polluted areas.
➤ A study can be conducted to assess the level of knowledge regarding air pollution among people residing in polluted areas.
➤ The same study can be conducted to assess the effects of air pollution on general health among people in highly polluted areas.

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