Section: Paediatrics

Original Research Article

PREVALENCE OF PNEUMONIA AMONG UNDER FIVE CHILDREN IN GUNTUR DISTRICT, ANDHRA PRADESH: A COMPARATIVE STUDY

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Abstract

Background: Every year, over 150 million cases of pneumonia arise among under five age group in developing countries. Government of India has implemented several programmes to reduce the incidence of pneumonia. The current study was conducted to estimate pneumonia prevalence, to compare its prevalence in tribal, rural and urban areas of Guntur district and to identify multiple risk factors associated with occurrence of Pneumonia among under five children. **Materials and Methods:** After obtaining, Institutional Ethics Committee approval, a community based cross-sectional study was carried among under five age group children living in tribal, rural and urban areas of Guntur. A total of 90 children, 30 each from urban, rural and tribal areas of Guntur district were analysed. **Result:** The resident children of tribal area (50%) were more affected with pneumonia compared to rural (43.33%) and urban areas (30%). In urban area, 16.67% of the children with pneumonia belonged to middle class in contrast to rural (20%) and tribal areas (20%) where they belonged to lower middle class and lower class respectively. Illiteracy and insufficient exclusive breast feeding during initial six months of life in urban (23.33%) and rural areas (26.67%) and in tribal area factors like inadequate ventilation (46.67%), overcrowding (46.67%), indoor air pollution (13.33%) and usage of unclean fuel (6.67%) were strong predictors of pneumonia. **Conclusion:** Inadequate exclusive breast feeding for infants less than six months old, higher levels of outdoor pollution in urban areas, excessive solid fuel use causing indoor air pollution in rural areas, poor hand hygiene and lack of knowledge regarding the signs and symptoms in tribal area were scavenged to be the foremost causes for enhanced risk of pneumonia in children in the present study. Hence, implementation of community based interventions like health education, ensuring complete immunization, advocating for exclusive breastfeeding, improving ventilation, minimizing the usage of solid fuels, proper handwashing and adequate training of community health workers on identifying the signs and symptoms of pneumonia can reduce the incidence of pneumonia in these regions.

INTRODUCTION

Pneumonia is a type of acute respiratory illness involving inflammation of lungs where in alveoli become filled with pus and fluid resulting in restriction of oxygen flow leading to difficulty and painful breathing. It is caused by Haemophilus influenzae type b, Streptococcus pneumoniae, Respiratory syncytial virus, Pneumocystis jiroveci in association with HIV.[1] Pneumonia is contagious like cold when it is caused by infectious microbes and can spread via air-borne droplets. Several factors including, insufficient exclusive breast feeding during initial six months of life, low birth weight, overcrowding, inadequate ventilation, indoor pollution, malnutrition, incomplete immunization by 12 months and insufficient adherence to hand hygiene practices contribute to the occurrence of pneumonia.[2]

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WHO guidelines classify pneumonia as follows, pneumonia is considered when mother/ caregiver complaints symptoms of cough and/ or breathing difficulty and rapid breathing. Severe pneumonia is labelled when there is chest in drawing irrespective of the rate of breathing. Very severe pneumonia is considered when the child is not competent to drink, inconsistent vomiting, seizures, sluggish or unconscious, strider in a calm child or severe malnutrition. [3]

A child dies of pneumonia every 39 seconds! Children under five years are the most susceptible age group for the development of pneumonia which accounts for high morbidity and mortality. [4] Every year, over 150 million cases of pneumonia arise among under five age group in developing countries. [5] Every single day, pneumonia claims the life of a child for every 43 seconds. Pneumonia constitutes 14 % of all deaths among children under the age of five. When compared to other infectious diseases, pneumonia kills more children. Every year around 7,25,000 children under the age of five and 1,20, 000 new born are susceptible to pneumonia. [6]

WHO has identified measures for prevention of pneumonia in children. Improvement of nutrition, reduced exposure to environmental pollutants, for the first 6months exclusive breast feeding, adequate complementary feeding, Vitamin A supplementation and immunization with pertussis, measles, Hib, and pneumococcal conjugate vaccine reduce the risk of pneumonia and could help to prevent long-term sequelae, including asthma, restrictive and obstructive lung diseases. [7,8]

In the past 15 years, substantial progress in India has caused reduction in childhood pneumonia. India is the leading country with largest population of children younger than 5 years worldwide. Government of India has implemented several programmes to reduce the incidence of pneumonia. In 1975, to enhance the nutritional status of children below 6 years, Integrated Child Development Service Scheme (ICDS) was established and Mother's Absolute Affection (MAA) programme in 2016, which promotes exclusive breastfeeding during first 6 months of life. [1] The two leading causes of death in children under the age of five are pneumonia and diarrhea. [9]

An integrated Global Action Plan for Pneumonia and Diarrhea (GAPPD) was developed by the WHO and UNICEF to minimize deaths from diarrhea and pneumonia by 2025. [3] Based on this, promoting exclusive breastfeeding, supplementing with essential nutrients like vitamin A and adequate complementary feeding protect children from pneumonia. Additionally, vaccination, proper hand hygiene, safe drinking water, reducing house hold air pollution, prophylaxis and treatment with cotrimoxazole for HIV-infected and exposed children can prevent pneumonia and diarrhea. And also treating ill children by improving health care facilities, continued feeding and providing oxygen, antibiotics and low osmolality rehydration solution.

Identifying the risk factors linked to pneumonia is essential for the development of strategies to minimize pneumonia occurrence. The present study was carried as there are very limited epidemiological studies, in India which have narrated the occurrence of pneumonia at community level.

Aims and objectives

1. To estimate pneumonia prevalence among under five children.
2. To compare pneumonia prevalence in tribal, rural and urban areas of Guntur district.
3. To identify multiple risk factors associated with occurrence of Pneumonia among under five children.

MATERIALS AND METHODS

After obtaining, Institutional Ethics Committee approval (GMC/IEC/067/2022), a community based cross-sectional study was carried among children aged less than five years living in tribal, rural and urban areas of Guntur. After briefly explaining the purpose of the study, the mothers of children were given informed consent before start of the study. The confidentiality of both the mother and children was respected.

Sample size: It was calculated by taking the prevalence (P) of Pneumonia 59%, from a previous study done by Jayashree Gothankar et al [14]. Assuming allowable error (L) of 20%, Prevalence (P): 59%, Sample size calculation formula: 4pq/l2:

N= 4*59*41/20*20= 24.19

Considering a non-response rate of 10%, the final sample size was adjusted to 30. So, a total of 90 children were taken into study from tribal, rural and urban areas of Guntur district.

Method of data collection: The list of all the primary health centers (PHC's) in tribal, rural and urban areas was compiled and a single PHC from each area was selected by using random number tables. Then one sub center from each PHC was selected by simple random method. One village/ ward from each sub center was selected by lottery method. If the desired sample size was not attained from that village/ward, subsequent village/ward was selected. In each village/ward, one house was selected by simple random techniques and from that house right hand rule was followed till the sample size was achieved. Selected investigators like Accredited Social Health Activist (ASHA), Auxiliary Nurse Midwifery (ANM), Anganwadi staff were trained first. A survey was conducted to gather data from children under the age of five accompanied by one of their parents. By interview technique, data was collected and interpreted into a pre-tested, pre- designed, semi-structured questionnaire. Supervisory visits were done regularly. The questionnaire contained 3 parts: Socio-demographic details like type of family, overcrowding, ventilation, economic status of family, type of fuel used for cooking, education status of mother, indoor air pollution was included in first part.

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Clinical parameters like type of breathing and chest in drawing were included in second part and anthropometric measurements were included in last part of questionnaire.

Anthropometric measurements: The weight for age, and height for age measurements were taken from each sampled child. It was calculated according to Waterlow's classification of malnutrition. [19]

Parameter	Normal	Mild	Moderate	Severe
Height for age (%)	95	90-95	85-90	85
Weight for age(%)	90	80-90	70-80	70

Fast breathing and Chest in drawing were the Criteria used for assessment of Pneumonia.

Inclusion Criteria

All the children of 0-5 years of age group, accompanied by at least one of their parents on the day of data collection were part of study.

Exclusion Criteria

Pre-term infants, newborns and children with any chronic or severe illnesses were excluded from study.

Data Analysis: The data so collected was entered into the MS Excel spreadsheet and analyzed by using SPSS version 28 (statistical package for social science). Results were represented in the form of tables and figures. Chi square test was done to know the significance of the results.

RESULTS

Out of 90 children, 30 each from urban, rural and tribal areas of Guntur district were analyzed to evaluate pneumonia prevalence and to identify association of various risk factors among them and the results were as follows:

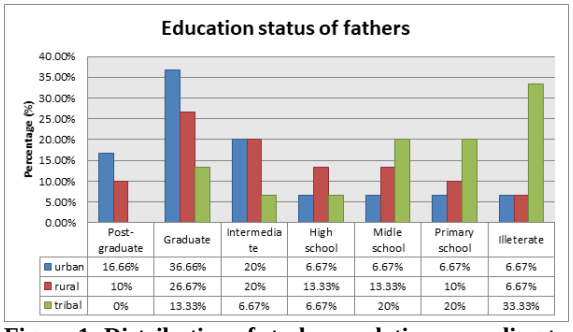

Figure 1: Distribution of study population according to father's education.

Male children were predominant in urban (56.67%) and rural areas (53.33%) where as in tribal area female children were predominant (63.33%). Majority of the children in urban area, (26.67%) were in the age group 49-60 months; in rural area (30%) 0-12 months and in tribal area (30%) 25-36 months. In urban (60%), rural (66.67%) and tribal areas (50%) most of children were Hindus. According to Kuppuswamy scale of socio-economic status, majority of the children from urban (40%), rural (33.33%) and tribal areas (23.33%) belonged to upper class, upper middle class and lower class respectively. Majority of the children in urban (73.33%) and rural areas (53.33%) were from nuclear family and in tribal area (40%) were from joint family. [Table no 1]

In the present study, in urban (93.33%) and rural area (93.33%) the literacy rate of fathers was found to be high. [Figure 1]

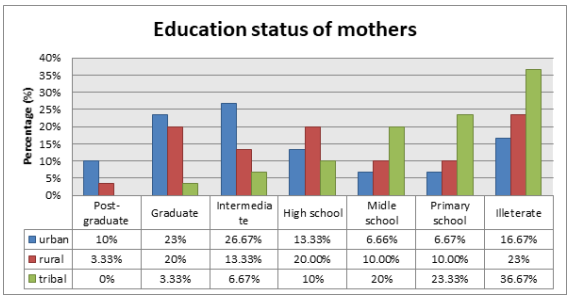

Figure 2: Distribution of study population according to mother's education.

In urban (83.33%) and rural areas (77%) the literacy rate of mothers was found to be high in the present study. [Figure 2]

In urban area 26.67% of the children's fathers were in profession in contrast to rural (23.33%) and tribal areas (36.67%) where majority of them were farmers. [Table 2]

In the present study, in urban area 46.67% of the children's mothers were unemployed in contrast to rural (36.67%) and tribal areas (50%) where majority of them were unskilled workers. [Table 3]

Low birth weight (1.5-2.5kg) was more prevalent in urban area (26.67%) whereas extremely low birth weight (<1.5kg) was high in rural area (13.33%). Most of the children from urban (60%) and tribal areas (46.67%) had birth order=2 whereas it was 1 in children from rural area. Pre-term delivery was more prevalent in rural area (16.67%). In tribal (76.67%) and rural (70%) areas most of the children received exclusive breastfeeding for more than 6months respectively. In urban area 36.67% of the children were exclusively breastfed for <6 months. In tribal area 3.33% of the children were not received breastfeeding. The proportion of fully immunized children in urban, rural and tribal areas observed was 66.67%, 50% and 56.67% respectively. [Table 4]

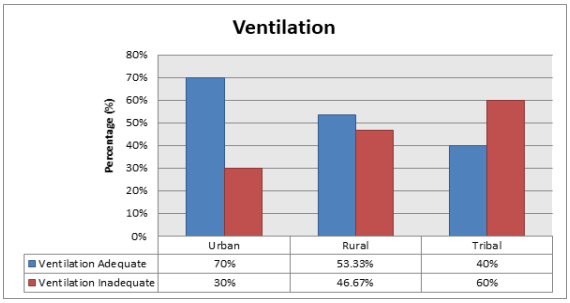

Figure 3: Distribution of the study population based on adequacy of ventilation

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Adequacy of ventilation was observed more among the children of urban area (70%) and least among the children of tribal area (40%) whereas inadequate ventilation was observed more in children of tribal (60%) and least in urban area (30%). [Figure 3]

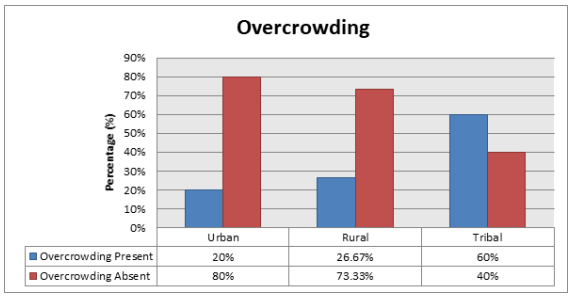

Figure 4: Distribution of the study population based on overcrowding

Overcrowding was observed more among the children of tribal area (60%) and least among the children of urban area (20%). [Figure 4]

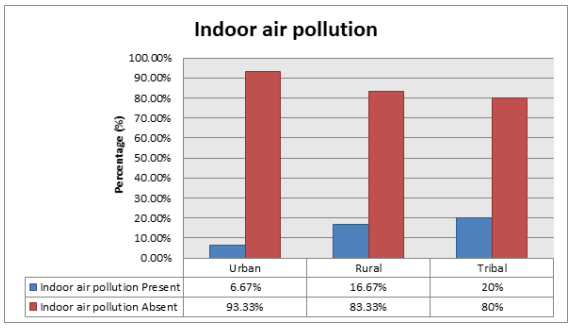

Figure 5: Distribution of study population based on exposure to indoor air pollution

Indoor air pollution was observed more among the children of tribal area (20%) when compared to urban (6.67%) and rural areas (16.67%). [Figure 5]

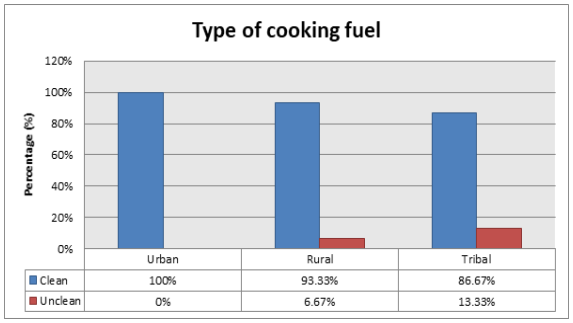

Figure 6: Distribution of study population based on the type of fuel used for cooking.

Clean fuel includes LPG, solar, electrical energy whereas unclean fuel includes dung, kerosene, coal and wood. Unclean fuel usage was high among the families of children from tribal (13.33%) and rural areas (6.67%) when compared to children from urban area (0%). All (100%) the families of children from urban area used clean fuel for cooking. [Figure 6]

The problem of being overweight was noticed more in urban (6.67%) and tribal areas (6.67%) when compared to rural area (3.33%). Grade 1 underweight was noticed among urban (30%) and rural areas (30%) when compared to tribal area (23.33%). Grade 2 (26.67%) and grade 3 (20%) underweight was observed high in tribal area. [Table 5]

Grade 1 stunting was observed more among the children of rural area (30%) when compared to urban (26.67%) and tribal areas (20%). Grade 2 (26.67%) and grade 3 (13.33%) stunting was high among the children of tribal area. [Table 6]

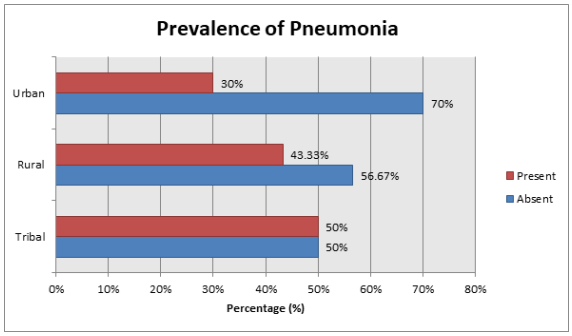

Figure 7: Prevalence of pneumonia among the study population.

The prevalence of pneumonia was high among the children of tribal area (50%) when compared to children of rural (43.33%) and urban areas (30%). [Figure 7]

The prevalence of pneumonia was high among the children of age group 0-12 months i.e., 13.33%, 20% and 16.67% in urban, rural and tribal areas respectively. In tribal area it was equally high among the children of age group 25-36 months (16.67%). [Table 7]

The Prevalence of pneumonia among children with grade 1 underweight was 13.33% and 16.67% in urban and rural areas respectively whereas in tribal area its prevalence among children with grade 2 underweight was 16.67%. [Table 8]

The prevalence of pneumonia among the children with grade 1 stunting was 13.33%, 16.67% and 16.67% in urban, rural and tribal areas respectively. [Table 9]

In urban area, 16.67% of the children with pneumonia belonged to middle class in contrast to rural (20%) and tribal areas (20%) where they belonged to lower middle class and lower class respectively. [Table 10]

In all the three areas, the prevalence of pneumonia was found to be high among the children whose mothers were illiterates. [Table 11]

The prevalence of pneumonia was observed high among children who were breastfed for <6 months in urban (23.33%) and rural areas (26.67%). [Table 12]

The Prevalence of pneumonia was 13.33%, 20% and 16.67% of the completely immunized children from urban, rural and tribal areas. [Table 13]

The prevalence of pneumonia was observed more among the children who had low or extremely low birth weight when compared to children with normal birth weight in all the three areas. [Table 14]

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In urban (23.33%), rural (33.33%) and tribal areas (46.67%) prevalence of pneumonia was observed more among the children with inadequate ventilation. In urban (16.67%) and tribal areas (46.67%) the prevalence of pneumonia was observed more among the families of children with overcrowding in contrast to rural area (23.33%) where a higher prevalence of pneumonia was found in families where there was no overcrowding. Prevalence of pneumonia in association with indoor air pollution (13.33%) and usage of unclean fuel (6.67%) was observed more among the children of tribal area. [Table 15]

Prevalence of pneumonia was observed more in the children of age group 0-12 months (68.2%) and lower middle class (92.9%) and the results were statistically significant ($p<0.05$). Prevalence of pneumonia was observed more among the children with partial immunization (81.2%); exclusive breast feeding for <6 months (76.9%); low or extremely low weight at birth (80%) and the results were statistically significant ($p<0.05$). Illiteracy was significantly associated with pneumonia ($p<0.05$) in the current study. [Table 16]

Children with grade 2 underweight showed a higher prevalence of pneumonia (52.6%) but it was not statistically significant ($p>0.05$). In our study, grade 3 stunting (75%) was significantly ($p<0.05$) associated with pneumonia. [Table 17]

The prevalence of pneumonia was observed more in children with inadequate ventilation (75.6%) and overcrowding (78.1%) and it was statistically significant ($p<0.05$). Exposure to indoor air pollution resulted in a higher prevalence of pneumonia (61.5%) but it was not statistically significant ($p>0.05$). [Table 18]

Table 1: Demographic details of children

Characteristics	**Frequency n(%)**		
	Urban	**Rural**	**Tribal**
Gender:			
Male	17 (56.67%)	16 (53.33%)	11 (36.67%)
Female	13 (43.33%)	14 (46.67%)	19 (63.33%)
Total:	30 (100%)	30 (100%)	30 (100%)
Age (in months):			
0-12 months	6 (20%)	9 (30%)	7 (23.33%)
13-24 months	6 (20%)	4 (13.33%)	4 (13.33%)
25-36 months	3 (10%)	6 (20%)	9 (30%)
37-48 months	7 (23.33%)	6 (20%)	5 (16.67%)
49-60 months	8 (26.67%)	5 (16.67%)	5 (16.67%)
Total:	30 (100%)	30 (100%)	30 (100%)
Religion:			
Hindu	18 (60%)	20 (66.67%)	15 (50%)
Christian	7 (23.33%)	6 (20%)	11 (36.67%)
Muslim	5 (16.67%)	4 (13.33%)	4 (13.33%)
Total:	30 (100%)	30 (100%)	30 (100%)
Socio-economic status:			
Upper class	12 (40%)	9 (30%)	6 (20%)
Upper middle class	6 (20%)	10 (33.33%)	5 (16.66%)
Middle class	9 (30%)	3 (10%)	6 (20%)
Lower middle class	2 (6.67%)	6 (20%)	6 (20%)
Lower class	1 (3.33%)	2 (6.67%)	7 (23.33%)
Total:	30 (100%)	30 (100%)	30 (100%)
Type of family:			
Nuclear	22 (73.33%)	16 (53.33%)	11 (36.67%)
Three generation	2 (6.67%)	10 (33.33%)	7 (23.33%)
Joint	6 (20%)	4 (13.34%)	12 (40%)
Total:	30 (100%)	30 (100%)	30 (100%)

Table 2: Distribution of study population according to father's occupation.

	Frequency n (%)		
Occupation of fathers	**Urban**	**Rural**	**Tribal**
Profession	8 (26.67%)	4 (13.33%)	1 (3.33%)
Semi-profession	6 (20%)	4 (13.33%)	1 (3.33%)
Farmer	2 (6.66%)	7 (23.33%)	11 (36.67%)
Clerical	3 (10%)	3 (10%)	1 (3.34%)
Shop owner	2 (6.67%)	2 (6.67%)	2 (6.67%)
Skilled worker	4 (13.33%)	1 (3.34%)	1 (3.33%)
Semi-skilled worker	2 (6.67%)	2 (6.67%)	1 (3.33%)
Unskilled worker	2 (6.67%)	6 (20%)	10 (33.33%)
Unemployed	1 (3.33%)	1 (3.33%)	2 (6.67%)
Total	30 (100%)	30 (100%)	30 (100%)

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Table 3: Distribution of study population according to mother's occupation.

	Frequency n(%)		
Occupation of mother	**Urban**	**Rural**	**Tribal**
Profession	6 (20%)	2 (6.67%)	0 (0%)
Semi-profession	0 (0%)	1 (3.33%)	0 (0%)
Farmer	1 (3.33%)	7 (23.33%)	12 (40%)
Clerical	0 (0%)	0 (0%)	0 (0%)
Shop owner	1 (3.33%)	1 (3.33%)	0 (0%)
Skilled worker	2 (6.67%)	1 (3.33%)	1 (3.34%)
Semi-skilled worker	4 (13.33%)	2 (6.67%)	1 (3.33%)
Unskilled worker	2 (6.67%)	11 (36.67%)	15 (50%)
Unemployed	14 (46.67%)	5 (16.67%)	1 (3.33%)
Total	30 (100%)	30 (100%)	30 (100%)

Table 4: Distribution of birth-related characteristics among the study population

Characteristics	**Frequency n(%)**		
	Urban	**Rural**	**Tribal**
Birth weight:			
Normal	21 (70%)	19 (63.34%)	20 (66.67%)
Low birth weight	8 (26.67%)	7 (23.33%)	7 (23.33%)
Extremely low birth weight	1 (3.33%)	4 (13.33%)	3 (10%)
Total	30 (100%)	30 (100%)	30 (100%)
Birth order:			
1	12 (40%)	15 (50%)	11 (36.67%)
2	18 (60%)	12 (40%)	14 (46.67%)
3	0 (0%)	3 (10%)	3 (10%)
≥4	0 (0%)	0 (0%)	2 (6.66%)
Total	30 (100%)	30 (100%)	30 (100%)
Duration of pregnancy:			
Term	28 (93.33%)	25 (83.33%)	26 (86.67%)
Preterm	2 (6.67%)	5 (16.67%)	4 (13.33%)
Total	30 (100%)	30 (100%)	30 (100%)
Exclusive Breastfeeding:			
<6 months	11 (36.67%)	9 (30%)	6 (20%)
≥6 months	19 (63.33%)	21 (70%)	23 (76.67%)
No breastfeeding	0 (0%)	0 (0%)	1 (3.33%)
Total	30 (100%)	30 (100%)	30 (100%)
Immunization:			
Fully immunized	20 (66.67%)	15 (50%)	17 (56.67%)
Completely immunized	6 (20%)	9 (30%)	7 (23.33%)
Partially immunized	4 (13.33%)	6 (20%)	6 (20%)
Unimmunized	0 (0%)	0 (0%)	0 (0%)
Total	30 (100%)	30 (100%)	30 (100%)

Table 5: Distribution of weight for age among the study population according to Waterlow classification

	Frequency n(%)		
Weight for age	**Urban**	**Rural**	**Tribal**
Overweight	2 (6.67%)	1 (3.33%)	2 (6.67%)
Normal	11 (36.66%)	13 (43.33%)	7 (23.33%)
Grade 1	9 (30%)	9 (30%)	7 (23.33%)
Grade 2	6 (20%)	5 (16.67%)	8 (26.67%)
Grade 3	2 (6.67%)	2 (6.67%)	6 (20%)
Total	30 (100%)	30 (100%)	30 (100%)

Table 6: Distribution of height for age among the study population according to Waterlow classification

	Frequency n(%)		
Height for age	**Urban**	**Rural**	**Tribal**
Normal	15 (50%)	13 (43.33%)	12(40%)
Grade 1	8 (26.67%)	9 (30%)	6 (20%)
Grade 2	5 (16.67%)	6 (20%)	8 (26.67%)
Grade 3	2 (6.66%)	2 (6.67%)	4 (13.33%)
Total	30 (100%)	30 (100%)	30 (100%)

Table 7: Age-wise distribution of pneumonia among the study population

		Frequency n(%)					
		Urban		**Rural**		**Tribal**	
	Pneumonia	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Age	0-12 months	4 (13.33%)	2 (6.67%)	6 (20%)	3 (10%)	5 (16.67%)	2 (6.67%)
	13-24 months	2 (6.67%)	4 (13.33%)	4 (13.34%)	0 (0%)	3 (10%)	1 (3.34%)
	25-36 months	2 (6.67%)	1 (3.33%)	1 (3.33%)	5 (16.67%)	5 (16.67%)	4 (13.33%)

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	37-48 months	1 (3.33%)	6 (20%)	1 (3.33%)	5 (16.67%)	1 (3.33%)	4 (13.33%)
	49-60 months	0 (0%)	8 (26.67%)	1 (3.33%)	4 (13.33%)	1 (3.33%)	4 (13.33%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 8: Association of malnutrition according to weight for age with pneumonia among the study population

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Weight for age	Overweight	0 (0%)	2 (6.67%)	0 (0%)	1 (3.33%)	1 (3.33%)	1 (3.34%)
	Normal	2 (6.67%)	9 (30%)	4 (13.33%)	9 (30%)	4 (13.33%)	3 (10%)
	Grade 1	4 (13.33%)	5 (16.67%)	5 (16.67%)	4 (13.33%)	3 (10%)	4 (13.33%)
	Grade 2	2 (6.67%)	4 (13.33%)	3 (10%)	2 (6.67%)	5 (16.67%)	3 (10%)
	Grade 3	1 (3.33%)	1 (3.33%)	1 (3.33%)	1 (3.34%)	2 (6.67%)	4 (13.33%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 9: Association of malnutrition according to height for age with pneumonia among the study population

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Height for age	Normal	3 (10%)	12 (40%)	4 (13.32%)	9 (30%)	4 (13.33%)	8 (26.67%)
	Grade 1	4 (13.33%)	4 (13.33%)	5 (16.67%)	4 (13.34%)	5 (16.67%)	1 (3.33%)
	Grade 2	1 (3.34%)	4 (13.33%)	2 (6.67%)	4 (13.33%)	3 (10%)	5 (16.67%)
	Grade 3	1 (3.33%)	1 (3.34%)	2 (6.67%)	0 (0%)	3 (10%)	1 (3.33%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 10: Association of Socio-economic status with pneumonia

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Socio-economic status	Upper class	0 (0%)	12 (40%)	0 (0%)	9 (30%)	0 (0%)	6 (20%)
	Upper middle class	1 (3.33%)	5 (16.67%)	4 (13.33%)	6 (20%)	0 (0%)	5 (16.67%)
	Middle class	5 (16.67%)	4 (13.33%)	1 (3.33%)	2 (6.67%)	4 (13.33%)	2 (6.67%)
	Lower middle class	2 (6.67%)	0 (0%)	6 (20%)	0 (0%)	5 (16.67%)	1 (3.33%)
	Lower class	1 (3.33%)	0 (0%)	2 (6.67%)	0 (0%)	6 (20%)	1 (3.33%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 11: Association of educational status of mother with pneumonia.

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Education status of mother	Literate	4 (13.33%)	21 (70%)	6 (20%)	17 (56.67%)	6 (20%)	13 (43.33%)
	Illiterate	5 (16.67%)	0 (0%)	7 (23.33%)	0 (0%)	9 (30%)	2 (6.67%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 12: Association of Exclusive breast feeding with pneumonia

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Exclusive breast feeding	<6 months	7 (23.33%)	4 (13.33%)	8 (26.67%)	1 (3.34%)	5 (16.67%)	1 (3.33%)
	≥6 months	2 (6.67%)	17 (56.67%)	5 (16.66%)	16 (53.33%)	10 (33.33%)	14 (46.67%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 13: Association of immunization with pneumonia

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Immunization	Fully immunized	2 (6.67%)	18 (60%)	2 (6.67%)	13 (43.33%)	5 (16.67%)	12 (40%)
	Completely immunized	4 (13.33%)	2 (6.67%)	6 (20%)	3 (10%)	5 (16.67%)	2 (6.67%)
	Partially immunized	3 (10%)	1 (3.33%)	5 (16.67%)	1 (3.33%)	5 (16.67%)	1 (3.33%)
	Unimmunized	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

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Table 14: Association of birth weight with pneumonia

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Birth weight	Normal	2 (6.67%)	19 (63.33%)	4 (13.33%)	15 (50%)	7 (23.33%)	13 (43.34%)
	Low birth weight	6 (20%)	2 (6.67%)	6 (20%)	1 (3.34%)	6 (20%)	1 (3.33%)
	Extremely low birth weight	1 (3.33%)	0 (0%)	3 (10%)	1 (3.33%)	2 (6.67%)	1 (3.33%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 15: Association of various risk factors with pneumonia

		Frequency n(%)					
		Urban		Rural		Tribal	
	Pneumonia	Yes	No	Yes	No	Yes	No
Ventilation	Adequate	2 (6.67%)	19 (63.33%)	3 (10%)	13 (43.33%)	1 (3.33%)	11 (36.67%)
	Inadequate	7 (23.33%)	2 (6.67%)	10 (33.33%)	4 (13.34%)	14 (46.67%)	4 (13.33%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)
Overcrowding	Present	5 (16.67%)	1 (3.33%)	6 (20%)	2 (6.67%)	14 (46.67%)	4 (13.33%)
	Absent	4 (13.33%)	20 (66.67%)	7 (23.33%)	15 (50%)	1 (3.33%)	11 (36.67%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)
Indoor air pollution	Present	1 (3.33%)	1 (3.33%)	3 (10%)	2 (6.67%)	4 (13.33%)	2 (6.67%)
	Absent	8 (26.67%)	20 (66.67%)	10 (33.33%)	15 (50%)	11 (36.67%)	13 (43.33%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)
Type of fuel	Clean	9 (30%)	21 (70%)	12 (40%)	16 (53.33%)	13 (43.33%)	13 (43.33%)
	Unclean	0 (0%)	0 (0%)	1 (3.33%)	1 (3.33%)	2 (6.67%)	2 (6.67%)
	Total	9 (30%)	21 (70%)	13 (43.33%)	17 (56.67%)	15 (50%)	15 (50%)

Table 16: Association of socio-demographic and birth related characteristics with pneumonia among the entire study population.

Characteristics	Pnuemonia n (%)		Total 50 (100%)	p value
	Present	Absent		
Age in months:				X2= 20.9
0-12 months*	15 (68.2%)	7 (31.8%)	22 (24.45%)	p < 0.001
13-24 months	9 (64.3%)	5 (35.7%)	14 (15.55%)	
25-36 months	8 (44.5%)	10 (55.5%)	18 (20%)	
37-48 months	3 (16.67%)	15 (83.33%)	18 (20%)	
49-60 months	2 (11.1%)	16 (88.9%)	18 (20%)	
Socio-economic status				X2=45.57%
Upper class	0 (0%)	27 (100%)	27 (30%)	p < 0.001
Upper middle class	5 (23.8%)	16 (76.2%)	21 (23.34%)	
Middle class	10 (55.5%)	8 (44.5%)	18 (20%)	
Lower middle class*	13 (92.9%)	1 (7.1%)	14 (15.55%)	
Lower class	9 (90%)	1 (10%)	10 (11.11%)	
Immunization				X2=29.48
Fully immunized	9 (17.3%)	43 (82.7%)	52 (57.78%)	p < 0.001
Completely immunized	15 (68.2%)	7 (31.8%)	22 (24.44%)	
Partially immunized*	13 (81.2%)	3 (18.8%)	16 (17.78%)	
Birth weight				X2= 28.11
Normal	13 (21.67%)	47 (78.33%)	60 (66.67%)	p < 0.001
Low and extremely low birth weight*	24 (80%)	6 (20%)	30 (33.33%)	
Exclusive breastfeeding				X2= 19.37
<6 months*	20 (76.9%)	6 (23.1%)	26 (28.9%)	p < 0.001
≥6 months	17 (26.6%)	47 (73.4%)	64 (71.1%)	
Literacy status of mother				X2= 32.15
Literate	16 (23.9%)	51 (76.1%)	67 (74.44%)	p < 0.001
Illiterate*	21 (91.3%)	2 (8.7%)	23 (25.56%)	

* p<0.05 Statistically significant

Table 17: Association of malnutrition with pneumonia among the entire study population.

Characteristics	Pneumonia n(%)		Total 50(100%)	p value
Weight for age	Present	Absent		X2=2.76
Overweight	1 (20%)	4 (80%)	5 (5.56%)	p =0.09
Normal	10 (32.3%)	21 (67.7%)	31 (34.44%)	
Grade 1	12 (48%)	13 (52%)	25 (27.78%)	
Grade 2	10 (52.6%)	9 (47.4%)	19 (21.11%)	
Grade 3	4 (40%)	6 (60%)	10 (11.11%)	
Height for age				X2=11.28
Normal	11 (27.5%)	29 (72.5%)	40 (44.45%)	p < 0.01
Grade 1	14 (60.9%)	9 (39.1%)	23 (25.56%)	
Grade 2	6 (31.6%)	13 (68.4%)	19 (21.11%)	
Grade 3*	6 (75%)	2 (25%)	8 (8.88%)	

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* p<0.05 Statistically significant.

Table 18: Association of various household and environmental factors with pneumonia among the entire study population.

Characteristics	Pneumonia n(%)		Total 50 (100%)	p value
	Present	Absent		
Ventilation :				X2 = 37.02 p < 0.001
Adequate	6 (12.2%)	43 (87.8%)	49 (54.44%)	
Inadequate *	31 (75.6%)	10 (24.4%)	41 (45.56%)	
Overcrowding:				X2=28.1 p < 0.001
Present *	25 (78.1%)	7 (21.9%)	32 (35.55%)	
Absent	12 (20.7%)	46 (79.3%)	58 (64.45%)	
Indoor air pollution:				X2=2.6 p = 0.0052
Present	8 (61.5%)	5 (38.5%)	13 (14.44%)	
Absent	29 (37.7%)	48 (62.3%)	77 (85.56%)	
Type of fuel:				X2=0.2 p = 0.6
Clean	34 (40.5%)	50 (59.5%)	84 (93.33%)	
Unclean	3 (50%)	3 (50%)	6 (6.67%)	

* p<0.05 Statistically significant.

DISCUSSION

To estimate pneumonia prevalence, to compare its prevalence in tribal, rural and urban areas of Guntur district and to identify multiple risk factors associated with occurrence of Pneumonia among under five children, the current study was carried among 90 children aged less than five years, 30 each from urban, rural and tribal areas of Guntur district.

Male children were predominant in urban (56.67%) and rural areas (53.33%) in the current study. Similar findings were seen in the study by Pranav G. Jawade et al, [15] in their study in urban and rural population. Our study revealed an improvement in the sex ratio in tribal area similar to a study by Venkatashiva Reddy B. et al, [19] in their study among under-five children of Sugali tribe of Chittoor district, AP.

In tribal area, majority (30%) of the children were in the age group 25-36 months as seen in a similar study done by Venkatashiva Reddy B. et al, [19] (22.6%). The distribution of study population based on religion was found to be similar to a study conducted by Md Masud Hasan et al, [10] (78.6%) and Jayashree Gothankar et al, [14] (86.6%) with higher proportion of Hindus than other religions. The trend of nuclear family was prominently seen in urban (73.33%) and rural areas (53.33%) as seen in the study by Jayashree Gothankar et al, [14] 58% and 50.3% respectively.

In rural area, the rate of illiteracy among mothers of the children was found to be 10%. This is in contrast to the study by Nabanita Nirmolia et al, [5] and it was found to be 24.35%. In tribal area the rate of illiteracy among the mothers and fathers was found to 33.33% each where as in a study by Venkatashiva Reddy B. et al, [19] it was 47% and 29% respectively.

In rural area, the prevalence of premature births and that of low and extremely low birth weights was found to be 16.67% and 36.67% which is in contrast to a study done by Sunil Kumar Kasundriya et al, [13] it was 79% and 21% respectively. This difference might be attributed to health status of mothers, socio-economic status, various cultural practices.

In our study existence of inadequate ventilation was found to be 30% and 46.67% in urban and rural areas respectively. Pranav G. Jawade et al, [15] in their study in urban and rural areas found a higher proportion of inadequate ventilation, 51.28% and 72.73% respectively. Similarly, findings (74%) were obtained by Sunil Kumar Kasundriya et al, [13] in rural area.

In our study, overcrowding was seen in 20% and 26.67% in households of urban and rural areas respectively which is in contrast to a study conducted by Jayashree Gothankar et al, [14] the existence of overcrowding was much higher in urban (49.3%) and rural areas (36.8%). In the current study, indoor air pollution was found to be 6.67% and 16.67% in urban and rural areas which was found to be much less in the study by Jayashree Gothankar et al, [14] in urban (3.2%) and rural areas (2.1%) and much higher in the study by Nabanita Nirmolia et al [5] (69.55%) in rural area.

In the present study, the usage of unclean fuel was found to be high in rural area (6.67%) when compared to urban area (0%) similar to the findings in the study by Jayashree Gothankar et al, [14] in which it was found to be 24% and 6% respectively. As the biomass fuel is easily available in the tribal area, in current study its use is seen more in tribal area (13.33%) than in rural (6.67%) and urban areas (0%).

In the present study, prevalence of overweight was found to be 6.67% and 3.33% in urban and rural areas which in turn in the study by Jayashree Gothankar et al, [14] found it to be 9.1% and 9.9% respectively. Majority of the children in urban area (36.67%) were within normal limits of weight for age similar to the study by Pranav G. Jawade et al, [15] (52.38%). In tribal area, prevalence of severe underweight and severe stunting was found to be 20% and 13.33% which in turn was found to be 9.3% and 13.5% respectively in study by Venkatashiva Reddy B. et al. [19]

Children residing in tribal area (50%) were more affected with pneumonia compared to rural (43.33%) and urban areas (30%). The reason for this regional difference might be due to the gap in utilisation of

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existing services because of lack of awareness among parents, family practices leading to delay in seeking care. Similar findings with an increasing trend of prevalence of pneumonia among urban (46.7%) and rural areas (54.2%) have been reported in the study by Sujata Murarkar et al. [20] A reversal in the trend was seen in the study by Pranav G. Jawade et al, [15] in which the prevalence was found to be higher in urban (70.52%) when compared to rural areas (63.64%). These differences in the prevalence might be due to differences in socio-economic, environmental risk factor exposure and the methodology adopted in the study. A study in tribal area by Venkatashiva Reddy B. et al, [19] showed prevalence to be 51.6% which was very much similar to our study.

In our study, pneumonia was more common among the children of age group 0-24 months (53.33%) in urban and rural areas of Guntur district and the results were statistically significant ($p<0.05$). A very similar finding of 53.22% was seen in the study by Sujata Murarkar et al. [20]

In rural area, prevalence of pneumonia was found to be statistically significant ($p<0.05$) among the individuals of lower middle class (20%) and whose mothers were illiterates (23.33%). Similar findings were observed by Nabanita Nirmolia et al, [5] regarding the socio-economic status (18.22%) and rate of literacy (24.35%). Co-existence of lower socio-economic status may lead to poor rearing and feeding practices which might predispose the child to several infections. Lack of awareness and education among mothers regarding the personal hygiene, signs and symptoms may negatively affect outcome of illness. In our study, significant association($p<0.05$) was found between maternal education occurrence of pneumonia. The signs and symptoms of pneumonia will be recognized early by educated mothers and hence earlier health care access and ultimately their children have a better outcome than others. To prevent communicable diseases in children, hand hygiene of the mother with soap and water is very essential.

In rural area the prevalence of pneumonia in children who were exclusively breastfed for ≥6 months (16.66%) was found to be less than those children who were exclusively breastfed for <6 months (26.67%) and the results were statistically significant ($p<0.05$). Similar findings were seen in the study by Nabanita Nirmolia et al, [5] in which it was found to be 15.4% and 23.5% in children who were breastfed for ≥6 and <6 months respectively. Early initiation and exclusive breast feeding provides immunity to the child to a greater extent. Delay or denial may predispose the child to a number of infections like pneumonia and diarrhoea.

In the current study, prevalence of pneumonia was reported to be higher in the children with partial immunization (81.2%) than full immunization (17.3%) similar to the study by Jayashree Gothankar et al, [14] and the results were statistically significant ($p<0.05$)

The prevalence of pneumonia was found to be high among the children who had low and extremely low birth weight in all the three areas and the results were statistically significant ($p<0.05$). Similarly, it was seen in the study by Jayashree Gothankar et al. [14] Low birthweight was one of the major contributor for pneumonia morbidity.

In our study prevalence of pneumonia with inadequate ventilation and overcrowding in urban and rural areas was found to be 23.33%, 33.33% and 16.67%, 20% respectively and the results were statistically significant ($p<0.05$). This is in contrast to a study by Pranav G. Jawade et al, [15] the existence of pneumonia with inadequate ventilation and overcrowding in urban area was found to be 51.28% and 50%; in rural area it was found to be 72.73% and 54.55% respectively. Inadequate ventilation and overcrowding enhances interior moisture and creates an environment suitable for proliferation of mites, respiratory viruses, and moulds.

In the present study, the prevalence of pneumonia with overcrowding, indoor air pollution and unclean fuel usage was found to be 18.33%, 6.67% and 35% where as it was comparatively more in a study by Sujata Murarkar et al, [20] i.e., 49.12%, 55.73% and 54.29% respectively. Utilization of unclean fuel like crop residues, dung, wood, and coal within inadequately ventilated houses may result in accumulation of smoke in and around the residence.

Limitations

A primary limitation of this study was that the study did not ascertain the etiology of pneumonia in children, because it was not the primary study objective. The Diagnosis relied on counting of respiratory rate as radiological confirmation of pneumonia was unavailable. Pneumonia has various peaks in different seasons, As the study was conducted over a shorter period, seasonal variations in pneumonia were not evaluated.

Recommendations

There is a necessity to carry out community-based epidemiological studies actively monitoring the incidence of pneumonia in children throughout a year. Also awareness on exclusive breastfeeding, appropriate weaning practices, hand hygiene and signs and symptoms of pneumonia amongst mothers should be enhanced through ASHA or Anganwadi workers.

CONCLUSION

Higher levels of outdoor pollution in urban areas, increased usage of solid fuels resulting in indoor air pollution in rural areas and poor hand hygiene and lack of knowledge regarding the signs and symptoms in tribal area were the attributing factors for increased risk of pneumonia in children in our study. Hence, implementation of community based interventions like health education, ensuring complete immunization, advocating for exclusive breastfeeding, improving ventilation, minimising the

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usage of solid fuels and switch over to liquefied petroleum gas (LPG), proper handwashing and adequate training of community health workers such as ASHA workers on identifying the signs and symptoms of pneumonia reduce the burden of pneumonia in these regions.

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