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Low Birth Weight and Its Association with Pattern and Risk of Acute Respiratory Infection Among Infants in Rivers State, Nigeria: What Can we do to Improving the Situation?

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Abstract

Birth weight is known as a predictor of infant's survival and physical and mental growth in the future. Reduced immunosufficiency and impaired lung function are the two major mechanisms linking birth weight to acute lower respiratory infection. The aim was to determine the existence and the pattern of relationship between risk of Acute Respiratory Infection (ARI) among infants and birth weight. The study design was population-based case-control study of 1,100 randomly selected infants from 12 communities in 6 Local Government Areas of the 3 senatorial districts of Rivers State. The subjects were selected using a multistage random sampling technique down to the community level. The features of the subjects were represented using descriptive methods were as bivariate logistics regression at the 5% level of significance was used to test the disparities in ARI between normal birth weight and low birth weight infants. Measures of size effect of ARI on birth weight differences were interpreted using Odds Ratio (OR). More cases of ARI (19.4%) occurred among infants of low birth weight in urban communities than rural communities (10.0%). In overall, infants having low birth weight status, had a higher frequency (15.6%) in the occurrence of ARI than those with normal birth weight (6.3%). Among infants of low birth weight (<2.5 Kg) the odds for ARI (unadjusted) was 2.72 times higher insignificance compared to infants with normal birth weight (≥ 2.5 Kg) (OR=2.72, p<0.0001, 95% CI= 0.239-0.564), whereas the odds for ARI (adjusted) was a significant risk, lower among infants with normal birth weight by 46% (OR=0.54, p < 0.0001, 95% CI = 0.328 – 0.879) against infants having low birth weight. These findings provide the indicator of trend of focus regarding rural and urban communities in the occurrence of ARI among infants based on birth weight to effectively manage the condition. Low birth weight as a risk of ARI affords the scientific basis for evoking aggressive awareness campaign and renewed public health policies to addressing implied factors associated with low birth weight during the prenatal period of life of the child as a deliberate step towards reducing the burden of ARI among infants.

Keywords

Low birth weight, Acute Respiratory Infection, Pattern, Population-based Case-Control, Urban, Rural

Introduction

Birth weight is an important indicator of health status among infants and a principal factor that determines the infant's survival and physical and mental growth in the future [1,2]. In epidemiological study and clinical interventions, infants with birth weight, 2.5 Kg and above are classified as having Normal Birth Weight (NBW), while infants with birth weight, lower than 2.5Kg are classified as having Low-Birth Weight (LBW). Globally, about 23 million LBW infants from 121 million births were recorded yearly, representing about 19% LBW infants annually, a high proportion of which are in developing countries, including Nigeria [2]. The majority of these infants appear to be Small For Gestational Age (SGA), but were born at term [3]. This differs from the situation in industrialized countries, where most LBW infants are preterm. The prevalence of LBW deliveries in a tertiary hospital in Rivers State was 8.3%, out of which 53.6% were SGA [4].

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According to [5], important risk factors of LBW, include, low birth interval (< 3years), maternal disease, twin pregnancies and non-use of ferrous sulphate during pregnancy. Their study revealed that suffering from maternal diseases increased the risk of LBW by 2-fold. These diseases include; hypertension, pre-eclampsia, Urinary Tract Infection (UTI), malnutrition. Also, fetal infections such as rubella, cytomegalovirus, toxoplasmosis, tuberculosis and herpes simplex are equally some of the most important risk factors for LBW. They further argued that some pregnancies are associated with blood vessel stenosis from hypertension resulting in LBW in infants.

Also, malnutrition is a major problem causing LBW in newborns, especially in developing countries. Pregnant women who are undernourished are at greater risk of delivering LBW babies [6].

In the works of [7], it was argued that, premature infants may have inadequate surfactant leading to respiratory distress syndrome with low alveolar compliance and increased work to breath. Mucous plugs in the bronchioles may lead to a decreased Oxygen (O_2) in the alveoli, causing a decreased surfactant production and decreased compliance fibrotic pulmonary changes, fluid in the alveoli or interstitial tissues, or collapsed alveoli lead to a decreased tissue compliance and requires increased work to breath. The normal work of breathing requires only 3-5% of the body's total energy expenditure, but this can rise to as high as 50% of the body's total energy expenditure, which circumstances decreased compliance.

The World Health Organization working group on case management of ARIs, described ARI as a clinical state characterized by rapid breathing of more than expected upper limit for age with or devoid of chest- in drawing, too sick to feed, nasal discharge, cough, fever with or without auscultatory findings of less than 2weeks [8]. According to [9], up to one-third of infants with respiratory viral infections develop lower respiratory tract symptoms, including tachypnea, wheezing, severe cough, breathlessness and respiratory distress.

Two major mechanisms, link birth weight to ALRI: they are reduced immunosufficiency and impaired lung function. The immune response of LBW infants is severely compromised, affecting particularly SGA babies [10-12]. Preterm infants tend to have impaired lung function during childhood, due either to bronchopulmonary dysplasia (abnormal development of cells or tissues) secondary to mechanical ventilation or to dyspnea (difficult or labored inspiration), in which the integrated development of airways and alveoli is disrupted by preterm birth [5].

The latter mechanisms may, however, have limited relevance for developing countries, including Nigeria, where most LBW infants are SGA and were severely preterm infants rarely survive. Preterm infants are at greater risk of death than SGA infants of comparable birth weight [13,14].

Studies showed clear dose-response patterns in which infant pneumonia mortality decreases as birth weights rise [15,14]. The median relative risk from these studies was 7.3 for LBW babies compared to those weighing 2,500 grams (2.5Kg) or more.

In a cross-sectional study covering 500 under five children in urban and rural areas in Ahmedabad district, Gujarat, India, it was revealed that the occurrence of ARI was more in low birth weight babies (<2.5Kg), (36.18%) [16]. Similarly, in a systematic review and meta-analysis conducted on 36 studies to identify risk factors for severe acute lower respiratory infections in children, there was a significant association of severe acute lower respiratory infections with low birth weight of odds ratio with 95% confidence intervals - 3.18 (CI 1.02-9.90) [17].

Equally, in a study which investigated the prevalence and risk factors of LBW in 1109 hospital births from three (3) maternity, chosen from stratified random sampling in Zahedan city, Islamatic Republic of Iran, the result showed overall prevalence of LBW of 11.8% (95% CI:9.9%-13.7%), with a close range for boys and girls (11.1% and 12.6%) [5].

In the study of [18], infants with a history of low birth weight appeared to have significant association with ARIs occurrence and severity. This was consistent with the works of [19-21], in which the explanation given was that low birth weight baby, had a poor pulmonary function and low immunity, which makes them more liable to have ARI mainly in its severe picture [22]. However, this finding was against that revealed by [23], in Iraq, where low birth weight was not observed to be significant factors for ARI severity. Nevertheless, there is a paucity of documented studies comparing the occurrence of ARI among infants in urban and rural areas in Nigeria.

Consequently, it interests the researchers to determine to what extent low birth weight is implicated in the pattern and risks of acute respiratory infections in the context of our setting, Nigeria.

Aim of the study

The aim was to ascertain the existence and patterns of relationship between risk of ARI among infants and birth weight.

Research hypotheses

Null Hypothesis H_0- There is no relationship between pattern and risk of ARI and weight at birth among infants in Rivers State, Nigeria.

Alternative Hypothesis H_1- There is a relationship between pattern and risk of ARI and weight at birth among infants in Rivers State, Nigeria.

Materials and Methods

Research design

The design of the study was a population-based case - control method, aimed at the determination of the pattern and risk of ARI among infants in relation to weight at birth in the areas of study.

The inclusion criteria for cases where children below 12 months of age in the study areas presenting at least any two of the signs and symptoms of cough, running nose or fever less than 3 days duration among others within 2 weeks of the enrollment/interview. While the inclusion criteria for controls were children below 12 months of age in the study areas without such signs and symptoms within 2 weeks of the enrollment/interview.

The exclusion criteria were removel of any case or control with difficulty in obtaining complete information required for the study (Figure 1), illustrating the design concept.

Area of study

The study was conducted in 12 communities of rural and urban settings combined, in 6 Local Government Areas (LGAs), out of 23 LGAs in the 3 senatorial districts in Rivers State, Nigeria. Rivers State with Port Harcourt as the State capital, is part of the 36 states in

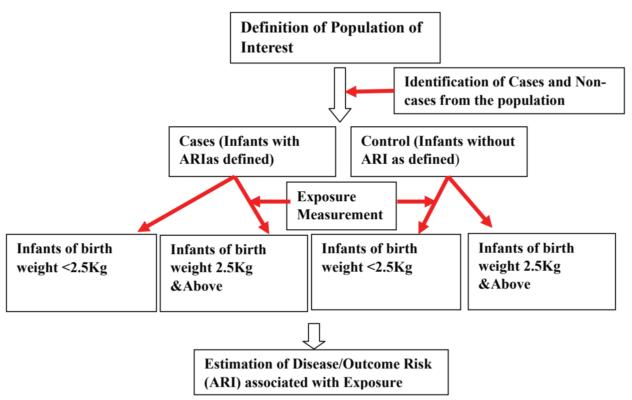

Figure 1: Schematic Diagram of Case-Control Study (Observational Study). Adapted from http://www.drcath.net/toolkit/casecontrol.html

S/N	Community	LGA	Senatorial District
1	Akinima	Ahoada West	Rivers West
2	Okarki	Ahoada West	Rivers West
3	Buguma City	Asari-Toru	Rivers West
4	Krakrama	Asari-Toru	Rivers West
5	Okehi	Etche	Rivers East
6	Chokocho	Etche	Rivers East
7	Rumuwoji	Port Harcourt City	Rivers East
8	Town City Slum	Port Harcourt City	Rivers East
9	Oyigbo	Oyigbo	Rivers South East
10	Okoloma	Oyigbo	Rivers South East
11	Botem/Genebuee	Tai	Rivers South East
12	Nonwa	Tai	Rivers South East

Table 1: Communities where sampling was conducted in the study

Nigeria with coordinates, latitudes $4^0 51^1 29.0761^{11}$ and $4^0 51.4846^1$N, longitude $6^0 55^1 15.2886^{11}$ and $6^0 55.2548^1$E, [24]. It has a land mass of about 37,000 square kilometers and bounded in the north by Imo and Abia States; in the south by the Atlantic Ocean; to the east by Akwa Ibom State and to the west by Bayelsa and Delta States. Table 1 showed the sampling communities in the study (Table 1).

Study population

The population studied was children under 1year in the areas of study. The estimated population of Nigeria was about 167 million (2006 census report) and children under 1year of age constitute 4% (6.6 million) of the total population [25].

In developing countries, such as Nigeria, 10-15 percent of all ARI may progress to disease of moderate to severe intensity [26], resulting in 29,040 to 43,560 cases annually, though with geographical zones and urban/rural settings variation.

Sample size determination

The sample size was determined based on [27] formula.

$$\text{Sample size} = \frac{r + 1\,(p^*)\,(1-p^*)\,(Z_\beta + Z_{\alpha/2})^2}{r(P_1 - P_2)^2} \text{.................... Eq (1)}$$

Where;

r = Ratio of Control to Case, 1 for equal number of Case and Control

p* = Average proportion exposed = Proportion of Exposed Cases + Proportion of Control Exposed/2

Z_β = Standard normal variant of power = for 80% power it is 0.84 and for 90% power value is 1.26

$Z_{\alpha/2}$ = Standard normal variant for level of significance = 1.96

$P_1 - P_2$ = Effect size or different proportion expected based on previous studies. P_1 is the proportion in cases and P_2 is proportion in control.

So, from Equation 1 and applying the power of study of 80% (0.84), expected proportion in the case group and the control group to be 0.35 and 0.20 respectively and putting values we have;

$$\text{Sample size} = \frac{1 + 1\,(0.275)\,(1-0.275)\,(0.84 + 1.96)^2}{1\,(0.35-0.20)^2} = 138.9$$

≈ 139 Cases and Control each gives a total of 278 at least.

For a matching power of 1:3, the minimum sample size required for this study is;

139 X 3 = 417 + 139 = 556 Cases and Controls.

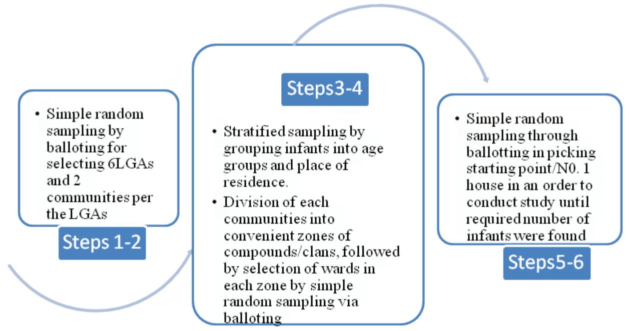

Figure 2: Multi-stage simple random sampling techniques and Stratified sampling method

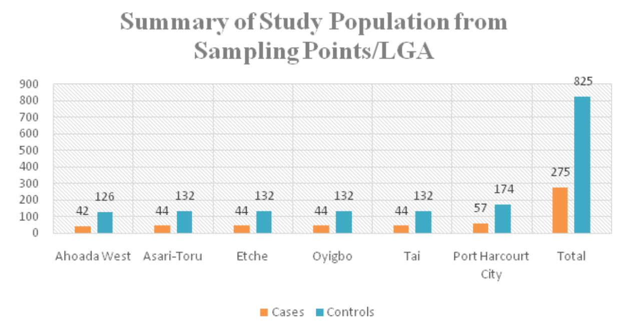

Figure 3: Summary of Study Population from Sampling Points/LGA

However, for purposes of representative sample population for the study, the number was increased proportionally from the selected communities, up to 1,100 infants being greater than 3% of the prevalence value in the light of the lower ARI prevalence rate of 10%, [26] which may advance to moderate to severe cases.

Sample and sampling techniques

(Figure 2) showed the illustration of multi-stage simple random sampling techniques and stratified sampling method in choosing the caregivers/infants of cases and the control group that were used in the study, this ensured that, every infant/mother/caregiver of the population was given a chance of being selected.

A total of 1,100 infants consisting 275 cases and 825 controls (1:3) were proportionally selected, among the communities using an allocation factor of 6:4 (660:440) for urban and rural communities for both cases and control, based on the size of study population of the communities, and allocation factor of 1:4.5:4.5 (100:500:500) for the age group of <2 months, 2 months – 6 months and 7 months up to 12 months. Figure 3 gives the summary of the study population per sampling points/LGA.

Data collection instrument

Set of structured questionnaires was used for data collection. The items covered demographic characteristics, knowledge and attitude of the target/study population regarding birth weight in the pattern and risk of ARI among infants. The content validity review was conducted on the questionnaire, while pilot-testing for understanding of items by target/study population was done, using 10 caregivers/infants who did not form part of the sample used for the study.

The researcher personally administered the questionnaires on the mothers/caregivers of the randomly picked infants for relevant information, through the help of recruited Community Health Practitioners after one-day training on the pattern of administration of the questionnaires and retrieved on the same day.

To collect data on ARI, mothers/caregivers were asked whether their child under 1year of age had been ill, presenting at least any 2 of the 3 signs and symptoms of; cough, running nose or fever less than 3 days duration within the 2 weeks of the enrollment/interview. Those infants with such outcome attributes of ARI at any time during the 2 weeks of the interview were classified as having ARI (cases).

The control group data was obtained from a matched study population to the cases of ARI from the same referent population based on uncontrollable variable (age), grouped as less than 2 months, 2 months – 6 months, 7 months up to 12 months. Data on birth weight was generated from history of weight at birth for both cases and controls, obtained from birth certificate or immunization card or such other information and categorized as infants with birth weight below 2.5 Kg (low birth weight) and infants with birth weight 2.5 Kg and above (normal birth weight). This is to guide against increasing the 5% chance of erroneously rejecting the null hypothesis when making comparism of study variable between cases and control groups of the study.

Data Analysis

Data from the responses as collated were presented in a tabular form with nominal scale, reflecting values for cases and controls for the variable of study (birth weight). The entries were double checked for identification of any error of recording. Statistical Package for Social Studies (SPSS), software version 21.0 was used for the statistical analysis, to test the hypothesis for result at the 5% significant level and also to show distribution of difference in normal birth weight and low birth weight. Descriptive method was employed to represent the characteristics of the subjects and the differences in ARI between low birth weight and normal birth weight of infants were tested in a bivariate and stepwise logistics regression at the 5% level of significance. Odds ratio (OR) was used to interpret the measures of size effect of ARI from low birth weight and normal birth weight differences.

Ethical approval

Ethical approval for the study was gotten from the University of Port Harcourt Teaching Hospital Ethical Committee and the Research Ethics Group of the Centre for Medical Research and Training, College of Health Sciences, University of Port Harcourt. Explanation on the nature and purpose of the study and level of participation of the respondents (mothers/caregivers) and their infants were undertaken and their informed consent sought before the interview. Participation was still voluntary even after providing consent in the course of the study.

Results

Table 2 on the distribution of demographic characteristics, revealed that a total of one thousand, one hundred infants were studied, in which the age distributions indicated that majority 506 (46.0%) were within 2-6 months' age bracket, against 491 (44.6%) within 7-11 months' age group and 101 (9.2%) within less than 2months, whereas the age of 2 (0.2%) were unknown so, excluded.

The gender distribution showed that 566 (51.4%) were male infants, against 532 (48.4%) female infants.

The study area distribution, indicated that 658 (59.8%) of the study population were from urban communities, against 440 (40.0%) study population who were from rural communities, while 2 (0.2%) of them were excluded, due to want of information.

The birth weight of the study population as shown in Table 2, also indicated that 980 (89.1%) of the infants had a birth weight of 2.5 Kg and above, compared to 95 (8.6%) who had a birth weight of less than 2.5 Kg, while 25 (2.3%) of the infants' birth weight were unknown.

Table 3 is showing an association between birth weight and occurrence of ARI of the study population (N=1,100) in which, in the category of normal birth weight (2.5 Kg and above), N=980; n=752 (91.2%) of the controls fell under that classification within the period under review, against 228 (82.9%) of cases who also had same 2.5 Kg and above birth weight and so classified as having normal birth weight.

In the category of low birth weight (less than 2.5 Kg), N=95; n=43 (15.6%) of the cases came under that category and were classified as having low birth weight, compared to n=52 (6.3%) of the controls who also came under that category and were equally classified as having low birth weight.

In any case, for the birth weight N=25; n=21 (2.5%) of the controls, against 4 (1.5%) of the cases were unable to be determined due to lack of necessary information.

Based on the evidence afforded by the data in the Table 3, it clearly showed that the cases of ARI presented a higher association between birth weight and ARI among infants, wherein, infants with low birth weight (less than 2.5 Kg), recorded higher frequency of 15.6% in occurrence, against 6.3% of the normal birth weight (2.5 Kg & above); thus, depicting a difference in frequency of 9.3%.

Table 4 shows association between acute respiratory infection and birth weight of infants (N=660) in urban communities in which, in the category of normal birth weight (2.5 Kg and above), N=585; n=455 (91.9%) of the controls fell under that classification within the period under review, against 130(78.8%) of cases who also had same 2.5 Kg and above birth weight and so classified as having normal birth weight.

In the category of low birth weight (less than 2.5 Kg), N=60; n=32 (19.4%) of the cases came under that category and were classified as having low birth weight, contrasted to n=28 (5.7%) of the controls who also came under that category and were equally classified as having low birth weight.

Nevertheless, for the birth weight N=15; n=12 (2.4%) of the controls, against 3(1.8%) of the cases were unable to be determined due to lack of necessary information.

The evidence proffered by the data in Table 4, clearly showed that the cases of ARI presented a relationship between birth weight and ARI among infants, wherein, infants having low birth weight (less than

Variables	Frequency	%
Child Age (in Months)		
< 2months	101	9.2
2-6months	506	46
7-11months	491	44.6
Unknown	2	0.2
Total	**1,100**	**100**
Gender		
Male	566	51.4
Female	532	48.4
Unknown	2	0.2
Total	**1,100**	**100**
Study Area		
Infants from Rural Communities	440	40
Infants from Urban Communities	658	59.8
Unknown	2	0.2
Total	**1,100**	**100**
Birth Weight (in Kg)		
<2.5 (Low Birth Weight)	95	8.6
≥ 2.5 (Normal Birth Weight)	980	89.1
Unknown	25	2.3
Total	**1,100**	**100**

Table 2: Distributions of demographic characteristics of study population

2.5 Kg), presented higher frequency of 19.4% in occurrence, against 5.7% for the controls with same low birth weight (less than 2.5 Kg); depicting a statistical difference of 13.7% higher in occurrence of ARI among infants having low birth weight than normal birth weight in urban communities.

Table 5 showed an association between acute respiratory infection and birth weight of infants (N=440) in rural communities in which, for the category of normal birth weight (2.5 Kg and above), N=395; n=297 (90.0%) of the controls fell under that classification within the period under review, against 98 (89.1%) of cases who also had same 2.5 Kg and above birth weight and so classified as having normal birth weight.

In the category of low birth weight (less than 2.5 Kg), N=35; n=24(7.3%) of the cases came under that category and were classified as having low birth weight, contrasted to n=11(10.0%) of the controls who also came under that category and were equally classified as having low birth weight.

However, for the birth weight N=10; n=9(2.7%) of the controls, against 1(0.9%) of the cases were unable to be determined due to lack of necessary information.

Going by the evidence afforded by the data in Table 5, the cases of ARI presented a relationship between birth weight and ARI among infants, in which, infants with low birth weight (less than 2.5 Kg), presented higher frequency of 10.0% in occurrence, against 7.3% of the controls with same low birth weight (less than 2.5 Kg); depicting a statistical difference of 2.7% higher in occurrence of ARI among infants having low birth weight than normal birth weight in rural communities.

Looking at tables 4 and 5, the data further indicated that difference in pattern of ARI occurrence among infants having low birth weight is 13.1% higher, in urban communities compared to 2.7% in rural communities. Meaning the difference in pattern of ARI occurrence among infants having low birth weight is 11.0% (susceptibility disadvantage potential) higher compared to normal birth weight infants in urban than rural communities.

Table 6 presents data on birth weight in the risk of ARI by matching, infants presenting signs and symptoms of ARI as cases, against infants devoid of signs and symptoms of ARI as controls within 2 weeks of interview/enrollment for the study, based on birth weight lower than 2.5 Kg as low birth weight and birth weight 2.5 Kg and above as normal birth weight.

The data showed that out of a total of N=95 infants with birth weight, lower than 2.5 Kg; n=43 infants presented with signs and symptoms of ARI as cases, against n=52 devoid of signs and symptoms of ARI as controls. Similarly, out of a total of N=980 infants that had birth weight 2.5Kg and above; n=228 presented with signs and symptoms of ARI as cases, while n=752 were devoid of signs and symptoms of ARI as controls.

On subjection of the data in the table 6 to bivariate logistic regression analysis for odds ratio (unadjusted) to ascertain if there is a relationship between risk of ARI among infants and weight at birth, showed a significant association (p<0.0001, 95% CI= 0.239-0.564), in that infants having low birth weight are at higher risk of contracting acute respiratory infection. The odds of having ARI among infants with low birth weight (<2.5Kg) (OR=2.72) were found, meaning 2.72 times higher than in infants with normal birth weight (≥ 2.5Kg).

Table 7 indicated the output from the stepwise logistic regression showing the adjusted results for spurious interacting effects, on study variable, from which the birth weight of a child (infant) was found as a significant risk factor of ARI in this study (p < 0.0001, 95%CI = 0.328 – 0.879). In that children (infants) whose birth weights were less than 2.5kg (underweight) are at higher risk of having the disease. The odds of having ARI among the infants was revealed to be 46% (that is 1 -0.54) % lower for the infants with normal birth weight contrasted with the ones that were having low birth weight (OR=0.54).

Discussion

The descriptive statistics, bivariate and stepwise multiple logistic regression analysis carried out against the null hypothesis at a significant level of 5% probability (p = 0.05), showed that the alternative hypothesis probably obtains, in that there is a relationship between pattern and risk of ARI and weight at birth in this study, and

Birth Weight (in Kg)	Total (N)	Cases (n)	%	Control (n)	%
<2.5 (Low Birth Weight)	95	43	15.6	52	6.3
≥ 2.5 (Normal Birth Weight)	980	228	82.9	752	91.2
Unknown	25	4	1. 5	21	2.5
Total	**1,100**	**275**	**100**	**825**	**100**

Table 3: Association between birth weight and occurrence of ARI of study population

Birth Weight (in Kg)	Total (N)	Cases (n)	%	Control (n)	%
<2.5 (Low Birth Weight)	60	32	19.4	28	5.7
≥ 2.5 (Normal Birth Weight)	585	130	78.8	455	91.9
Unknown	15	3	1.8	12	2.4
Total	**660**	**165**	**100**	**495**	**100**

Table 4: Association between birth weight and occurrence of ARI among infants in urban communities

Birth Weight (in Kg)	Total (N)	Cases (n)	%	Control (n)	%
<2.5 (Low Birth Weight)	35	11	10.0	24	7.3
≥ 2.5 (Normal Birth Weight)	395	98	89.1	297	90.0
Unknown	10	1	0.9	9	2.7
Total	**440**	**110**	**100**	**330**	**100**

Table 5: Association between birth weight and occurrence of ARI among infants in rural communities

Birth Weight	Cases (n)	Control (n)	Total (N)
Birth Weight <2.5Kg	43	52	95
Birth Weight 2.5Kg & above	229	752	980
TOTAL (N)	**271**	**804**	**1,075**

Ref.= Normal weight ≥ 2.5Kg

Low Birth weight, <2.5Kg **OR-Unadjusted=2.72(p**<0.0001, 95%CI= 0.239-0.564)

Table 6: Birth Weight in Risk of ARI among Infants

Factor Coeff	Std. Er.	P value.	Odds ratio	95% C.I. for Odds Ratio	
				Lower	Upper
Birth weight (in kg)					
Low birth weight					
(<2.5kg) vs Normal (≥ 2.5kg)					
-0.622	0.251	<0.0001	0.54	0.328	0.879

Table 7: Multiple Logistic Regression (via Stepwise Method) with adjusted Odds Ratio for study variables with ARI

that the pattern and risk is higher among infants having birth weight lower than 2.5 Kg (low birth weight).

The result of this research work is in line with previous studies of [16-21] as indicated by available literature highlighted herein. The explanation in this direction may not be far from the associated reduced immunosufficiency and impaired lung function implicated in low birth weight condition, making such infants to be more susceptible to ARI.

Nevertheless, the available literatures showed that such earlier studies were conducted principally on under 5 years children with lower sample sizes in which infants were composite fraction. This is capable of masking the effect of ARI on infants as a group. This may, probably, responsible for the lower occurrence of 15.6% of ARI cases among infants having low birth weight against 36.18% of [16] among under 5years children having low birth weight. The ARI occurrence in this study revealed 9.4% low birth weight infants' disadvantage susceptibility potential, while the difference in pattern of ARI occurrence among infants having low birth weight was 11.0% disadvantage susceptibility potential in urban than rural communities in this study in the midst of other cofounding factors, which after subjecting the data to bivariate and multiple logistic regression analysis for adjusted spurious interacting factors indicated a significant risk of ARI among infants having low birth weight ($p < 0.0001$, 95%CI = 0.328 – 0.879). In that children (infants) whose birth weights were less than 2.5 kg (low birth weight) are at higher risk of having the disease. The odds of having ARI among the children (infants) was revealed to be 46% (that is 1 -0.54) % lower for the children (infants) with normal birth weight contrasted with the ones that were having low birth weight (OR=0.54). However, the disparity in the occurrence of ARI among infants being higher in urban than rural communities in this study may be explained in terms of superimposed influence of overcrowding settings which are more in urban than rural areas, noting that overcrowding has a significant association with ARI as revealed in other studies [28-31].

This finding provides the basis for the trend of focus in terms of rural and urban communities in the occurrence of ARI among infants based on birth weight in our setting as to ensure effective management of the condition as well as, formulation of necessary public health programme and policies to addressing implied factors associated with low birth weight during the prenatal period of life of the child as a means of reducing the burden of ARIs among infants.

Conclusion

This study revealed that the pattern and risk of ARI are higher among infants having low birth weight than normal birth weight and higher in urban than rural communities, and so having serious implications in the growth and development of infants in the cycle of human development and health. Therefore, low birth weight as a risk of ARIs as revealed in this study further provides the scientific basis for evoking aggressive awareness campaign and renewed public health policies in addressing implied factors associated with low birth weight during the prenatal period of life of the child as a meaningful step towards reducing the burden of ARIs among infants.

Recommendations

1. Attention should be directed at formulation of specific public health programme and renewed policies to addressing implied factors associated with low birth weight during the prenatal period of life of the child.
2. There should be sustainable, aggressive awareness creation campaigns on the implications of none or late registration for ante-natal care, particularly on implied maternal nutritional outcome, such that poor nutritional status of pregnant women would be detected early enough to reduce the multiplier effect on low birth weight babies, that are classified in the high risk group for contracting acute respiratory infection.
3. Further studies on birth weight in the pattern and risk of ARI among infants in a similar research design and setting should be conducted for consistency and or complementarities.

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