**IMPACT OF GAS FLARES ON NEONATAL WEIGHT AND HEALTH PROFILE IN YENAGOA BAYELSA STATE, NIGERIA**

Abstract

**Aim/Objective:** This study assesses the impact of gas flares on neonatal weight and health profile in Okolobiri and its environs. **Materials and Methods:** A descriptive study design was adopted in this research using well-structured questionnaire and digital infant scale for weight (kg) measurement of all 32 neonates. **Results:** Findings from this study shows a gradual increase in neonatal weight according to their maternal age from 15-19yrs (2.80kg), 20.24yrs(2.94kg),25-29yrs(2.85kg),30-34yrs(2.86kg), 35-39yrs(3.20kg) and ≥40yrs (3.50kg) respectively. More so neonatal weight whose mothers were exposed to daily inhalation of gas flares over a considerable duration of time was lower (2.69kg) compare with neonates (3.09kg) whose mothers sometimes perceive and inhaled gas flares during and after pregnancy. Furthermore 65.625% attend antenatal care regularly during pregnancy compared with 34.375% who do not among maternal considered in this study. The study also observe (28.125%), (96.875%) and (87.50%) regular maternal consumption of meat/fishes, water and vegetables/fruits planted within the gas flares environment. Neonatal feeds were mostly breast milk (62.50%) and neonates with health challenges were 28.125% compared with 71.875% that has no health issues**. Conclusion:** Maternal nutrition based on products harvested within the immediate gas flares environment during and after pregnancy has detrimental effect on their respective neonates and thus contributes majorly to the disparity in weight among the neonates. Hence neonates with health challenges observed in this study were mainly due to the effect of gas flares discharged into the environment they depend on.

**Keywords; Gas flares, Maternal, Neonates, Weight, Durations**

**INTRODUCTION**

Focusing on the prevalence of underweight among neonates in gas flaring communities can help identify the extent of the problem and its impact on the health of neonates. Factors such as environmental pollution, stress from living in proximity to gas flaring sites, limited access to health care and poor nutrition may contribute to the high prevalence of underweight among neonate in these communities (Li., *et al.,* 2022) Gas flaring is a common practice in oil producing communities that release toxic pollutant into the environment potentially detrimental to human health. Gas flaring activities, which involves the controlled burning of natural gas released during oil extraction processes, can emit various pollutant into the environment.

Yenagoa, is heavily impacted by gas flaring and the communities in this area face significant environmental pollution which may affect the health and well-being of resident particularly vulnerable population like neonate. This has been associated with adverse health outcome, including respiratory problems, low birth weight, and undernutrtion.

.By conducting a study in this area, researchers can gather data to help the health challenges faced by newborns in gas flaring communities and inform intervention to improve maternal and neonatal health outcome. This research can raise awareness about the health risks associated with gas flaring and advocate for better environmental regulations to protect the health of vulnerable population such as, pregnant women and infant in these communities.

Prevalence of previous study by (omoniyi and John, 2022) reported 17% incidence of cough/underweight associated with gas flaring among neonate in Bayelsa state. Some of the key pollutants emitted during gas flaring activities include: - Particulate matter: tiny particles of solid or liquid pollutant suspended in the air during gas flaring. Particulate matter can be generated from the incomplete combustion of hydrocarbon and other compounds, it can vary in size with fine particles (PM2•5) and coarse particles (PM10) having different health impact depending on their size and composition, inhalation of this substance can lead to respiratory issues, cardiovascular problem and other adverse health effect, especially for vulnerable population such as children, newborns and individuals with preexisting health conditions.

- Volatile organic compound; these are group of carbon based chemical that easily evaporate into the air at room temperature, can contribute to the formation of ground level ozone a key components of smog that can impact air quality and human health, exposure to (VOC) has been linked to respiratory issues, neurological effects, and long term health risks including cancer and other chronic diseases.

Overall the emission of this pollutant of gas flaring activities can have adverse effects on both human health and the environment, and the effort to minimize this emission is through improve flaring practices, regulatory measures, and pollution control technologies. This is essential for reducing the impact of gas flaring on air quality and public health in surrounding communities (Omotseye *et al.,* 2017).

Studies have shown an increase incidence of wasting, underweight, stunting and other related diseases, related to airborne disease linked to flaring in the Niger region.The percentage of gas flares in Nigeria has been reducing since (2002) and stood at 10% in 2018.The country still ranks in the top 10 gas flaring countries in the world, with 7•4billion cubic feet in 2018, the total gas flares in Nigeria accounted for (6•9%) of the top 10 gas flaring countries. Gas flaring introduces toxic pollutant, which can lead to environmental problem such as acid rain, as well as the generation of greenhouse gases which contribute to global climate change.

The study of underweight among neonate in gas flaring communities within the context of global discussion on environmental health, sustainable development, equitable policies, and environmental justice, we can better understand the interconnected nature of environmental challenges and work towards addressing this issues in a comprehensive and inclusive manner (Malisalidis *et al.,2020;* Oluwajob *et al*.,2020).

Underweight neonate are at increased risks of morbidity, mortality, and long term health consequences according to World Health Organization,2019 approximately 22% of neonate worldwide are underweight and low birth weight and underweight neonate are major contributors to infant mortality, accounting for 60% of all infant deaths (WHO,2020). international in sub Saharan Africa 24% of neonate are underweight with Nigeria having one of the highest rates (UNICEF, 2020).West Africa has a neonatal mortality rate of 34 death per 1,000 live birth, with underweight being a significant risks factors (UNICEF,2020).In Nigeria, 18% of neonates are underweight with significant regional disparities (NDHS,2018), In Bayelsa state yenegoa LGA 31% of neonates were underweight with gas flaring communities yet to be fully ascertain or isolated.

## MATERIALS AND METHODS

## Design

## A cross sectional descriptive approach with semi structured questionnaire to obtained direct maternal data and that of the neonates regarding weight and other associated factors in gas flaring communities was used.

## Study Area

The study was conducted in okolobiri, polaku, Obunagha and koroama communities in yenagoa LGA. These communities are in one cluster of gbarain/Gbarantoru of Ekpetiama clan.

**Study Population**

The study population consists of neonates born within the first 28 days of Life whose mothers are resident of the communities mentioned earlier..

## Sample Size

Using JayKaran formulae 2013,it was calculated using 2% prevalence from previous study in yenagoa (Solomon *et al.,*2021)

N=pq(e/1.96)²

N=2×98/(5/1.96)²

N=196/6.51

=30.11 participants (neonate).

Where p=working prevalence

q=100-p

e= sampling error tolerated at 95%confidence's

at non-response rate of 10%

N=10/100×30•11

=0•1×30•11=3.011

Sample size=30•11+3•011

=33 sample size

**Data source**

This study use primary source of data collected from the respondents and documented in the questionnaires

## Data Collection

Sstructured questionnaire divided into four sections was used to receieve data from mothers. Section A contains the socio demographic profile of respondent. Section B: contain assessing the weight, health and nutritional status of neonates. Section C contains identifying factors contributing to underweight among neonates. Section D; contain assessing the potential implications of gas flaring activities on neonatal health outcome.

## Data Analysis

Data was analyzed using SPSS version 23 and expressed as frequency and percentage with means and ± standard deviation presented in tables and chart

**RESULTS**

Results obtained from analyzed data in this study are arranged in tables using simple percentage, means and standard deviation.

**Table .1; Socio-demographic Characteristics of neonatal parents**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Frequencies (n=32)** | **Percentage (%)** |
| (Females) | 32 | 100 |
| Males | **-** | **-** |
| **Total** | **32** | **100** |
| **Age(yrs)** | | |
| 15-19 | 4 | 12.500 |
| 20-24 | 7 | 21.875 |
| 25-29 | 10 | 31.250 |
| 30-34 | 9 | 28.125 |
| 35-39 | 1 | 3.125 |
| >40 | 1 | 3.125 |
| **Total** | **32** | **100** |
| **MARITAL STATUS** | | |
| Married | 23 | 71.875 |
| Single | 8 | 25.000 |
| Divorced | 1 | 3.125 |
| **TOTAL** | **32** | **100** |
| **RELIGION** |  |  |
| Christianity | 32 | 100 |
| Islam | **-** | **-** |
| African tradition | **-** | **-** |
| **TOTAL** | **32** | **100** |

**Field survey (2025)**

**Table 2; Maternal age versus neonatal weight**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variables**  **(Age)** | **N** | **Neonatal weight (kg)** | **Z-score** | **Minimum** | **Maximum** |
| 15-19 | 4 | 2.80±0.627 | 1.00 | 2.00 | 3.50 |
| 20-24 | 7 | 2.94±0.533 | 1.00 | 2.00 | 3.60 |
| 25-29 | 10 | 2.85±0.444 | 1.00 | 2.00 | 3.50 |
| 30-34 | 9 | 2.86±0.642 | 1.00 | 2.10 | 3.70 |
| 35-39 | 1 | 3.20±0.00 | 0.00 | 3.20 | 3.20 |
| >40 | 1 | 3.50±0.00 | 0.00 | 3.50 | 3.30 |

**Source: Field survey (2025)**

The above table shows the relationship between neonatal weight and maternal age in gas flares environment in Bayelsa state, Nigeria.

**Table 3; Maternal Closeness to gas flares odor inhalation versus Neonatal weight during pregnancy**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Perceive/daily Inhalation** | **Frequency**  **(n)** | **Effect on Neonatal weight**  **(kg)** | **Minimum** | **Maximum** | **Variance** |
| Yes | 17 | 2.69±0.52 | 2.00 | 3.60 | 0.27 |
| Sometimes | 15 | 3.09±0.46 | 2.00 | 3.70 | 0.21 |
| No | - | - | -- | - | - |

Table 3 above is an indication of gas flares effect on neonatal weight among mothers exposed to gas flares daily during pregnancy.

**Table 4: Did you attend antenatal care during pregnancy?**

|  |  |  |
| --- | --- | --- |
| **Response** | **Frequency (n=32)** | **Percentage (%)** |
| Yes | 21 | 65.625 |
| No | 11 | 34.375 |

**Source; Field survey (2025)**

**Table 5: Maternal Consumption of meats/fishes During Pregnancy**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Frequency(n)** | **Percentage (%)** |
| Regularly in gas flaress | 9 | 28.125 |
| Not regular | 23 | 71.875 |
| Total | 32 | 100 |

**Table 5 above shows the regularity of maternal consumption of animals and fishes from the river, ponds, and forest that have been polluted within gas flares environment during pregnancy and their resultant effect.**

**Table 6; Proximity to gas flares site**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Frequency(n)** | **Percentage (%)** |
| Close | 25 | 78.125 |
| Not very close | 7 | 21.875 |
| Total | 32 | 100 |
| **MATERNAL DURATION OF STAY IN GAS FLARES VICINITY** | | |
| Variables (yrs) | Frequency(n) | Percentage (%) |
| 1 | 7 | 21.875 |
| 2-3 | 12 | 37.50 |
| 4 | - | - |
| >4 | 13 | 40.625 |
| **Total** | 32 | 100 |
| **Gas flares odor Perceived** | | |
| Daily | 17 | 53.125 |
| Weekly | 5 | 15.625 |
| Rarely | 10 | 31.250 |
| None | - | - |
| **Total** | 32 | 100 |

**Source; Field survey (2025)**

**Table 7; Maternal Source of Drinking water During Pregnancy**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Frequency(n)** | **Percentage (%)** |
| Boreholes | 22 | 68.75 |
| Ponds | 8 | 25 |
| Well | 1 | 3.125 |
| Bottle water | 1 | 3.125 |
| **Total** | **32** | **100** |

**Source; Field survey (2025)**

**Table 8; Maternal intake of Vegetables/fruits during pregnancy**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Frequency(n)** | **Percentage (%)** |
| Regular | 28 | 87.50 |
| Not regular | 4 | 12.50 |
| **Total** | **32** | **100** |

**Source; Field survey (2025)**

**Table 9; Neonatal Feeds**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Frequency (n=32)** | **Percentage (%)** |
| EBF | 4 | 12.50 |
| Formulae | 1 | 3.125 |
| Breast milk | 20 | 62.50 |
| Infant feeding | 2 | 6.25 |
| Both | 5 | 15.625 |

**Source; Field survey (2025)**

The table (9) above shows the different nutritional feeding formulae adopted by neonatal mothers to care for their newborn babies.

**Table 10; Is your baby having any health issues?**

|  |  |  |
| --- | --- | --- |
| **Response** | **Frequency(n)** | **Percentage (%)** |
| Yes | 9 | 28.125 |
| No | 23 | 71.875 |
| **Total** | **32** | **100** |
| **Was your baby born preterm?** | | |
| **Response** | **Frequency** | **Percentage (%)** |
| Yes | 2 | 6.25 |
| No | 30 | 93.75 |
| **Total** | **32** | **100** |

**Field survey (2025)**

Table 10 above describes the frequency of neonates with health challenges due to exposure to gas flares.

**Discussion of Findings**

The results from this research study shows that thirty two neonates and their mothers were the respondents that disclosed information about their socio-demographic characteristics, antenatal, dietary intake, duration of exposure to gas flares, health issues among the neonates and their proximity to gas flares site during pregnancy and after delivery.

**Socio-demographic**; Maternal age who responded to this research ranges from 15 to >40years.However age 25-29yrs make up 31.250% followed by30-34yrs (28.125%) and 20-24yrs(21.875%) among the highest respondents in this study. The marital status of married respondents was 71.875% with 25.00% single and 3.125% divorce respectively. One hundred percent of the study population was mainly Christians.

**Maternal age/neonatal weight**; The current study reveal a lower weight of 2.8kg among neonates delivered by mothers that are between 15-19yrs of age accompany by age 25-29yrs of 2.85kg and age 30-34yrs (2.86kg0 respectively. However mothers within age 20-24yrs gave birth to neonates of 2.94kg having the highest weight among the neonates studied. Healthy state of mothers during pregnancy contributes immensely to the wellbeing of the neonates while regular exposure to gas flares may contribute about 50% of preterm babies compared with non-exposures (Solomon *et al*.,2021).

**Maternal closeness to gas flares**; This study reveal a lower weight of neonates (2.69kg) whose mothers reside close to gas flares sites compared with those that sometimes gets closer to gas flares region of 3.09kg.Changes throughout pregnancy due to decrease vascular resistance and metabolic changes in association to gas flares have resulted in hypertension during pregnancy and thus increase neonatal morbidity and mortality rate (Rebelo *et al.,* 2014).Regular inhalation of gas flares components such as lead, cadmium that usually cross the placenta blood barrier during pregnancy result in low birth weight, preterm birth and severe brain/nervous system damage among neonates (WHO,2016).

Findings from this study show 78.125% of neonatal mothers living close to gas flares while 21.875% are not very close to gas flares sites during pregnancy.

However 40.625% among the respondents have resided in gas flares environment for over 4years followed by 37.50% (2-3yrs) and 21.875% within a year respectively. Duration of exposure to gas flares have effect on both maternal and fetus that depend on the mother for survival and after birth. This has resulted in low birth weight and cardiovascular issues among neonates (Solomon *et al.,* 2021). This study further 68.75% and 25.0% among mothers who depend on borehole and pond as source of drinking water. More so 87.50% depend regularly on fruits/vegetables planted on gas flares soil compared with 12.50% partially dependent mothers during and after pregnancy.

Other findings from this study reveal 71.875% and 28.125% not depending regularly on fish and animals within the gas flares region for consumption. Studies have shown the presence of heavy metals in communities waters close to gas flares sites and consumption of such waters including fish, animals and vegetables have positive correlation to the development of kidneys, lung and reduced body weight among mothers and neonates (Chibuzor *et al.,* 2016).

**Maternal attitude towards antenatal care**; during pregnancy 65.625% answered yes to antenatal care while 34.375% was not attending antenatal care regularly. Regular antenatal care will help to detect any fetal congenital malformation and other anomalies and prevent progressive insult to the fetus while in the womb and later in life (Lara *et al.,2020).*

The study shows 28.14% neonates with health issues compared with 71.875% that has no health issues. Moreover preterm neonates were 6.25% in comparison with 93.75% term neonates. This shows that the neonates developing health issues from this study was not due to preterm but as a result of gas flares exposure by both mothers and neonates.

**Maternal exclusive breast feeding;** Neonatal exclusive breast feeding was 12.50% compared with 62.50% and 15.625% receiving breast milk and both. However 6.25%received infant feeding. Obstacle to EBF in most region of the world includes socio-economic factors, cultural background and educational levels of parents. Significant benefits of EBF include reduction of illness frequencies among neonatal infants compared with non-exclusive breast fed infants (Mohamed *et al.,* 2023).

**CONCLUSION**

This study reveal a tremendous decrease in neonatal weight (2.69kg) of respondents residing close regularly to gas flares sites compared with residents mothers neonates (3.09kg) that occasionally get exposed to gas flares. Hence neonates with health challenges observed in this study were mainly due to the effect of gas flares discharged into the environment they depend on.

Conflict of interest: None

Ethical approval and Consent

Consent was obtained from the Bayelsa state college of health ethics and research committee, and informed consent from mothers or caregivers was also obtained.

Disclaimer (Artificial intelligence)

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Details of the AI usage are given below:

1.

2.

3.

**REFERENCE**

1. Lara JC,Kate VM,Khang C, Meredith F, JILL EJ (2020). Flaring from unconventional oil and gas development and birth outcomes in the eagle ford shale in South Texas. 15(128):077003,dio:10.1289/EHP6394 PMC
2. Li M, & Wang, T. (2022). Gas flaring and its impact on air quality and human health. *Atmospheric Environment, 268*(2): 118893. https://doi.org/10.1016/j.atmosenv.2022.118893
3. Manisalidis I., Stavropoulou, E. A., & Bezirtzoglou, E. (2020). Environmental and health impacts of air pollution: A review. *Frontiers in Public Health, 8*, 14. <https://doi.org/10.3389/fpubh.2020.00014>
4. Omatseye AA,John DM,Charity OC,Mercy EK, et al (2017). Impact of gas flaring on acute respiratory distress among pregnant women and hewborn babies in Delta state central senatorial district, Nigeria. Journal of Air Pollution and Health 9(4);431-444
5. Solomon, M. U., Arthur, N. C., Onyebuchi, O. (2021). Impact of gas flares on anthropometric indices of pregnant and non-pregnant women in selected gas flaring communities in Bayelsa State, Nigeria. *International Journal of Biological and Medical Science, 14*(9), 15–21.
6. Solomon, M. U., Nwafor, A. C., Kiridi, E. G. E., & Charles, N. N. (2021). Toxic air and respiratory indices among pregnant women in Bayelsa State, Nigeria. *Spectacular Journal of Research in Medicine and Medical Sciences, 2*(5), 99–103.
7. Solomon, M. U., Charles Ngaikedi N, Kiridi Emily GE (2021).Blood serum lead and calcium level among pregnant women in gas flaring communities in Bayelsa state, Nigeria. International Journal of Scientific and Research Publication 2(5):11316
8. Solomon, M. U.,Kiridi Emily EG,Tonkiri Ayakeme, Charles Ngaikedi N, Okuroemi OH(2021). Dietary effect on cardio-renal parameters of women residents in gas flares polluted environment in bayelsa state, Nigeria. International Journal of Scientific and Research Publication 11(12):12023
9. UNICEF. (2020). Neonatal mortality rate. In *UNICEF Data: Monitoring the situation of children and women*. UNICEF.
10. WHO. (2019). Underweight newborns. In *International Statistical Classification of Diseases and Related Health Problems* (11th ed., pp. 1–4). World Health Organization.
11. WHO. (2020). Low birth weight. In *Maternal, Newborn, Child and Adolescent Health*. <https://www.who.int/data/nutrition/nlis/info/low-birthweight>