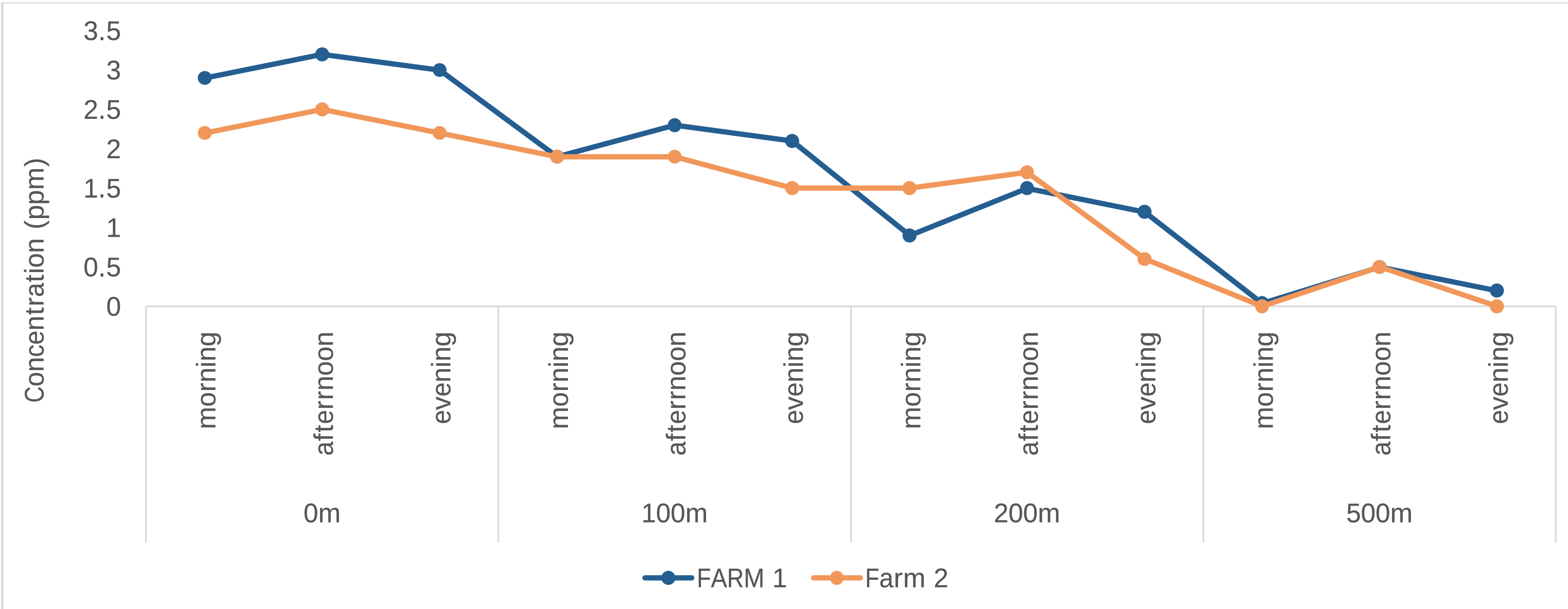
GSJ: Volume 10, Issue 11, November 2022
ISSN 2320-9186



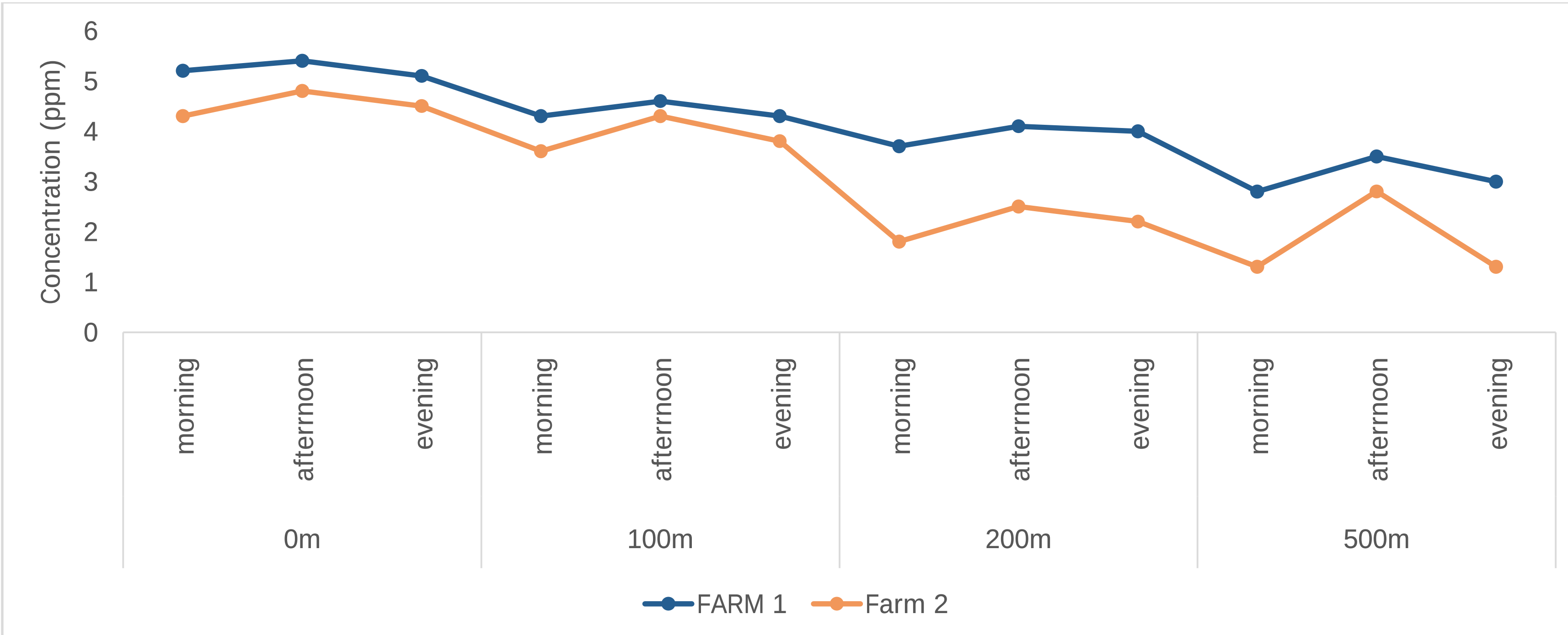
-

-

- **Fig. 12: Concentration of nitrous oxide (N_2O) in the air in farm 1 and farm 2 in the rainy season.**

-

-



-

-

- **Fig. 13: Concentration of nitrous oxide (N_2O) in the air in farm 1 and farm 2 in the dry season.**

DISCUSSION.

Results for the microbiological load of the air at various times and distances were displayed in Tables 1 and 2. The results showed that the maximum microbial load in both farms was reported at 0 m, followed by 100 m, 200 m, and finally the control (500m). Rooji et al. (2019) did not take time into account but found that the microbial exposure from livestock emission occurred at a very detectable level in the air at greater distances from the animal farms. However, Popescu et al. (2014) found that the number of bacteria was significantly higher in the cold season than in the warm season in their study of microbial air contamination in indoor and outdoor environments of pig farms, and they attributed this to increased ventilation to lower high temperatures as the primary cause.

Humid air increases the moisture content of the settle dust so that less dust becomes airborne. Seasonality affected the microbial counts which was observed in this study as higher counts were seen in the rainy season at 200m and 500m. This is so because according to Popescu *et al.* (2014) the higher count in the dry season could be due to wet and humid conditions which induced decomposition of raw organic materials in theses farms hence providing a comfortable growth condition for the bacteria and fungi increasing the airborne load. The presences of these microbes in large number could represent a significant immunological challenge to the human respiratory system (Lonc & Plewa, 2010).

The various count of airborne bacteria and fungi reported by different researchers could be as a result of different types of sampling methods adopted and device used. Different climate conditions also play a vital role in this disparity (Popescu *et al.,* 2014). The determined number of organism in the air indicates the need for setting standards on air quality in animal dwellings and the occupational environment and for developing reliable systems for monitoring the above factors (Duquenne *et al.,* 2013).

This study is in agreement with the findings of Popescu *et al.* (2014) whose study showed that the most frequent bacterial isolates were Gram positive with up to 90% occurrence whereas Gram negative bacteria occurrence was between 0.02% and 5.2%. This may be because the Gram negative bacteria have lower survival rate in the air. Kim & Ko (2019) reported that the main predominant specie of the airborne bacteria was *Enterobacter* species. Makut *et al.* (2014) reported same isolates as were seen in this study. They noted that bioaerosols may contain Gram negative bacteria such as *E. coli, Shigella* species and *Pseudomonas* species and Gram positive bacteria such as *Staphylococcus aureus, Streptococcus* species, *and Micrococcus* species.

The microbial flora of the air in pig houses depends on the environmental parameters and the reason for the high levels of air contamination in pig houses are malfunctioning ventilation systems, high humidity of the feed and the climatic conditions. Improper hygiene can also cause considerable microbial pollution (Popescus *et al.,* 2014).

Mould and yeast can live practically anywhere and have particularly favourable conditions inside the animal house (Lonc & Plewa, 2010). According to Soliman *et al.* (2009) fungi like *Candida albican, Aspergillus niger, Penicillium* species, and *Mucor* species were predominant in broiler farm in Egypt. Also Agranovski *et al.* (2007) isolated and identified from a poultry many fungal strains including *Cladosporium. Aspergillus, Penicillium, Fusarium, Mucor, Trichophyton.* Some microbial specie and serotype such as *Trichophyton* species and *Aspergillus fumigatus* are pathogenic for animals and humans. Many of these organisms are opportunists which are particularly dangerous for animals with compromised immunity.

It was observed that the NH_4 concentration before cleaning the floors were 2ppm to 12ppm while it dropped to 1ppm to 5ppm after cleaning the floor. It can be inferred that animal activity and events such as manure removal exert an effect in the daily concentration of gases (Huaitalla *et al.,* 2013). Wathes *et al,* (2003) also observed mean values of NH_4 emission. The mean values are 5.1ppm, 11.1ppm for England with the maximum of 14.3ppm and 41.1ppm for the sow litters and sow slat respectively and in Germany it was observed to be 12.5ppm and 10.2ppm for the mean value and maximum 27.3ppm and 43.7ppm respectively. These values are so high as compared with what we obtained and this so because of their high protein content feed which increases the nitrogen input.

Huh & Kim (2013) also reported that in the air going through the composting process, the range of concentration of the generated CO_2 was 1086ppm – 2621ppm whereas that of the concentration of the generated CO_2 in the air outside the swine farm was 305ppm – 661ppm suggesting a major difference in distribution. Huaitalla *et al.* (2013) suggested that during the summer season, the CO_2 concentration was in the range of 300ppm -1500ppm and the daily mean concentration was 588ppm, which met the Chinese Standard NY/T 388-1999 'Environmental quality standard for livestock and poultry farms', which indicated an average

CO_2 concentration of 819ppm for pig farms from China. During the winter, the range was from 1400ppm – 8000ppm which surpassed the Chinese threshold (819ppm).

Ni *et al.* (2018) reported that over a 63 day period in two naturally ventilated pig buildings, the H_2S concentration was about 280ppb and in a pig building between pig cycles with manure stored in under-floor pit, the measured H_2S ranged from 221 to 1492 ppb. This is very high compared with the result obtained from this study. Blunden *et al.* (2008) measured the seasonal variation in H_2S concentration in a finishing swine confinement house with 673, 429, 47, and 304 ppb in winter, spring, summer and fall respectively. Ni *et al.* (2018) also observed that the concentration of H_2S rises as the manure accumulates under the floor. Liu & Powers (2013) also reported that the average H_2S concentration at the edge of the emission source (0m) was 40 ± 48 ppb which is less than the acute Maximum Residual Level (MRL) (1000 ppb) but higher than the intermediate MRL (20 ppb) for H_2S. They also stated that the ambient H_2S concentrations in the vicinity of swine facilities decreases quickly to be less than 20 ppb as distances from emission source increases.

The study of the microbiological implication of pig farms on environment have been studied in this work and it has been observed that there was:

1. An increase in microbial load in and around the farm. This was seen in the study as the distance and time increased, the microbial load increased

2. An increase in the Particulate Matter whose constituent maybe delirious to both human and animal.

3. Presence of potentially pathogenic species of both bacteria and fungi.

4. A production of many gases some of which maybe toxic when in large concentration.

5. An increase in air pollution due to the improper handling and disposal of the waste. This was observed more in farm 1 which is a twelve years old and do surface disposal of the waste, the pollution was more than in farm 2 that is four year and their waste is collected in septic tank.

Therefore, proper sanitary measures are to be put in place to avoid their increase and these farms should be located far from residential areas.

REFERENCES.

Agranovski, V., Reponen, T. & Ristovski, Z. (2007). Survey of bioaerosol emissions from Australian poultry buildings. *European Aerosols Conference, Salzburg,* Abstract, 28.

Benhazi, T. M., Seedorf, J., Rutley, D. L., & Pitchford, W. S., (2008). Identification of Risk Factors for Sub-optimal Housing Condition in Australian Piggeries Part 2: Airborne pollutants. *Journal of Agricultural Safety and Health. 14*(1). 21-39.

Benhazi, T., (2007). Improving Air Quality in Piggery Buildings. *Journal of Agricultural Safety and Health.* January, 2007, 237-241.

Blunden, J., Aneja, V. P. & Westerman, P. W. (2008). Measurement and analysis of ammonia and hydrogen sulphide emissions from a mechanically ventilated swine confinement building in North Carolina. *Atmosphere Environment, 42* (14): 3315-3331.

Cappuccino, J. G. & Sherman, N., (2014). *Microbiology: A Laboratory Manual* (tenth edition). Glenview IL, USA. Pearson Education Inc.

Duchaine, C., Grimard, Y. & Cormier, Y. (2000). Influence of building maintenance, environmental factors and seasons on airborne contaminants of swine confinement building. *American Industrial Hygiene Association Journal, 61* (1), 56-63.

Dumont, E. (2018). Impact of treatment of NH_3 emission from pig farms on greenhouse gas emissions. Quantitative assessment from the literature data. *New Biotechnology, 46* (1), 31-37.

Duquenne, P., Marchaw, G. & Duchain, C. (2013). Measurement of endotoxins in bioaerosols at work place: A critical review of literature and a standardization issue. *Annals of Occupational Hygiene, 77:* 137-172.

European Union Directive (2016). 2016/2284 of the European Parliament on the reduction of national emissions of certain atmospheric pollutants, amending directive 2003/35/EC and repeating directive 2001/81/EC.

Huaitalla, M. R., Gallmann, E., Xuejun, L. & Hartung, E. (2013). Aerial pollutants on a pig farm in Peri-Urban, Beijing, China. *International Journal of Agriculture and Biological Engineering,* 6 (1), 36-47.

Huh, J-K. & Kim, K-Y. (2013). Time-based trend of carbon emissions in the compositing process of swine manure in the context of agriculture 4.0. *Processes, 6* (168): 25-43.

Joachim, H. S., Goïtaa, K., & Desmaraisb, C., (2010). Analysis of Air Pollution from Swine Production By Using Air Dispersion Model and GIS in Quebec. *Journal of Environmental Quality. 39*, 1975-1983.

Liu, Z. & Power, W. J. (2013). Ammonia and hydrogen sulphide emissions from swine production facilities in North America: A meta-analysis. *Kansas Agricultural Experiment Station Research Reports,* 10: 1194-1207.

Lonc, E., & Plewa, K. (2010). Microbiological air contamination in poultry houses. *Polish Journal of Environmental Studies, 19* (1), 15-19.

Makut, M. D., Nyam, M. A., Shehu, I. & Anzaky, S. J. (2014). A survey of the microflora of the outdoor air environment of Keffi metropolis, Nassarawa State, Nigeria. *African Journal of Microbiology Research, 8* (27), 2650-2655.

Napoli, C., Marcotrigino, V. & Montagna, T. (2012). Air sampling procedures to evaluate microbial contaminaton: A comparison between active and passive methods in operating theatres. *Biomedical Central Research, 1* (12), 594-601.

Ni, J-Q., Heber, A. J. & Lim, T-T. (2018). Ammonia and hydrogen sulphide in swine production. In: *Air Quality and Livestock Production.* Banhazi, T., Alanda, A. & Hartung, J. (Eds.). London UK. CRC Press: 29-47.

Nwaugo, V. O., Onyeagba, R. O., Akubugwo, E. I. & Ugbogu, O. C. (2008). Soil bacterial flora enzymatic activities in zinc and lead contaminated soil. *Biokemistri, 20* (2), 77-84.

Okolo, C. I. (2011). Tropical tips on intensive pig production: Animal management and health issues. *Tapas Institute of Scientific Research and Development, 2* (1), 240-246.

Popescu, S., Borda, C., Diugan, E-A. & Oros, D. (2014). Microbial air contamination in indoor and outdoor environment of pig farms. *Animal Science and Biotechnologies, 47* (1), 182-187.

Rooji, M. M. T., Hoek, G., Schmitt, H., Janse, I., Swart, A., Maassen, C. B. M., Schalk, M., Heederik, D. J. J. & Wouters, I. M. (2019). Insights into livestock-related microbial concentrations in air at residential level is a livestock dense area. *Environmental Science and Technology, 53* (13), 7746-7758.

Silvana, G., Cristin, B., Eva-Andrea, D., & Daniela, O., (2014). Microbial Air Contamination in Indoors and Outdoor Environment of Pig Farms. *Animal Science and Biotechnologies. 47*(1), 182-187.

Soliman, S., Sobeih, M., Hussien, M., Abdul-Latiff, H. & Moneim, A. (2009). Seasonal epidemiological surveillance on bacterial and fungal pathogens in broiler farms in Egypt. *International Journal of Poultry Science, 8* (8), 720-727.

Ume, S. I., Ezeano, C. I. & Gbbughemobi, B. O. (2018_a). Analysis of the environmental effect of pig production in Okigwe Local Government Area of Imo State, Nigeria. *International Journal of Environmental and Agriculture Research, 4* (6), 12-21.

Ume, S. I., Ezeano, C. I., Chukwuigwe, O., & Gbughemobi, B. O. (2018_b). Effect of climate change on pig production and choice of adaptation strategies by farmers in Southeast, Nigeria. *International Journal of Academic Research and Development, 3* (2), 858-808.

Wathes, C. M., Demmers, T. G. M. & Xin, H. (2003). *Ammonia concentrations and emissions in livestock production facilities: guidelines and limits in the USA and UK.* Paper presented at 2003 ASAE Annual International Meeting, Las-Vegas, Nevada, USA.

Yao, H., Choi, H. L., Lee, J. H., Suresh, A. & Zhu, K. (2010). Effect of microclimate on particulate matter, airborne bacteria and odourous compounds in swine nursery houses. *Journal of Animal Science, 88* (1), 3707-3714.