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# THE CO-EXISTENCE OF STAPHYLOCOCCUS AUREUS NASAL CARRIAGE AND SARS COVID-19 ANTIBODIES AMONG APPARENTLY HEALTHY NIGERIAN STUDENTS POPULATION IN EKPOMA, EDO STATE, NIGERIA

**Okodua M. A.[1], Unuabonah F. H.[1], Eyaufe A. A. O.[2*], Oni I. V.[2], Oni O. D.[2] and Iserhienihien O.[3]**

[1]Department of Medical Laboratory Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria.
[2]Department of Microbiology, Ambrose Alli University, Ekpoma. Edo State. Nigeria.
[3]Department of Community Medicine, Ambrose Alli University, Ekpoma, Edo State, Nigeria.

***Corresponding Author: Dr. Eyaufe A. A. O.**

Department of Microbiology, Ambrose Alli University, Ekpoma. Edo State. Nigeria.

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## ABSTRACT

This study investigates the co-existence rate of nasal carriage of Staphylococcus aureus and SARS-CoV-2 virus among apparently healthy students of Ambrose Alli University in Ekpoma, Edo State. A total of 173 nasopharyngeal swab specimens were collected and analyzed. Bacterial isolates were identified using Gram staining and biochemical tests, including catalase and coagulase tests, along with a diagnostic kit for total antibody to SARS-CoV-2 (ELISA). The prevalence of nasal carriage of Staphylococcus aureus was 17.3%, SARS-CoV-2 was 65.9%, and co-infection of both was 9.8%. The highest co-existence rate was observed in the age range of 21-25 years, with 19.3% for Staphylococcus aureus and 62.5% for SARS-CoV-2. The study population comprised 109 females and 64 males, potentially contributing to the observed high prevalence rates. The results suggest that COVID-19 vaccination and outpatient treatment may be crucial in reducing hospital admissions and the risk of Staphylococcus aureus co-infection in individuals with SARS-CoV-2 antibodies.

**KEYWORDS:** Staphylococcus aureus, SARS-CoV-2, co-existence, prevalence, nasal carriage.

## INTRODUCTION

*Staphylococcus aureus* are commonly found on the skin of mammals, birds and fomites. Humans are considered to be the major source of staphylococcal food poisoning. *Staphylococcus aureus* is found in nasal passages, throat, hair and skin of carriers. Food is usually contaminated from nasal secretions, sneezing and coughing and direct hand contact of infected carriers (Eisenberg, Lynch & Breeding, 1975).

*Staphylococcus aureus* remains a significant cause of mortality and morbidity in tropical countries. Available reports have also shown that about 30-50% of the human population are carriers of *Staphylococcus aureus* especially in the nasopharynx and that the nasal carriage of *Staphylococcus aureus* is implicated in the most community and hospital infections (Onile, 1985; Kluytmans, Van & Verbrugh, 1997).

A novel Corona Virus known as severe acute respiratory syndrome Corona Virus 2 (SARS.COV.2 also called COVID-19 and 2019-nCoV) was first reported in Wuhan, Hubei Province, China in December 2019. Ever since the virus has been spreading worldwide claming thousands of lives. Due to serious respiratory disease in humans, some patients need to be hospitalized and in severe cases intensive care with mechanical ventilation support is essential (~5-15%). Although diseases, nosocomial pneumonia (NP) in intensive care units remains a major risk factor for the lower respiratory tract infections. Nosocomial Infections (NIs) are usually described as infections acquired during hospitalization within 48-72 h after admission and they mainly spread through person to person contact, devices and instruments.

Among microorganisms, the bacteria including *Staphylococcus spp., Enterococcus spp., Klebiella pneumonia, Enterobacter spp., Escherichia coli, Acinetobacter Spp.,* and *Pseudomonas spp. a*re the most frequently detected causative agents of nocosomial infections (Dandagi, 2010). These opportunistic pathogens can also cause super infections, especially in combination and viral respiratory tract infections in hospitalized patients. However, even patients without underlying diseases and in all age groups may be at the risk of co-infections as well (Kluytmams et al, 1997). Some studies have shown that viral agents such as influenza viruses can be associated with secondary bacterial pneumonia that might occur throughout hospitalization and lead to death of individuals with or without pre-existing respiratory diseases. The damage of

ciliated cells can also be observed in association with respiratory syncytial virus infection; it can result in deterioration of mucociliary clearance, increased adhesion of bacteria to mucins and enhanced colonization of the bacteria in the airway. Moreover, new receptors for bacterial adherence can emerge following the virus-induced death of the airway epithelial cells. In addition, after an acute inflammatory reaction and pulmonary tissue damage induced by viral infections, a resolving/repair phase of the lung tissue takes place (Nouwen et al, 2004). Due to varied immune responses in different individuals, this phase may cause an enhanced susceptibility to respiratory bacterial infections. Thus, bacterial super infection can occur after a viral infection, which in turn might lead to increased morbidity and mortality (Paget & Trottein, 2019). Nevertheless any probable contribution of the bacteria to the development of the infectious diseases caused by the newly discovered Corona Virus is still completely unknown. In a study by Póvoa et al., the risk of ventilator associated bacterial pneumonia in COVID-19 patients was studied. In addition, although there are few recently published retrospective reports of co-infections in patients with COVID-19, our study is adding to a growing evidence base of the role bacterial co-infections may have in individuals with COVID-19 antibodies.

## MATERIALS AND METHODS

### Area of Study

### Geographical Description of the Study Area

The study was carried out in Ekpoma town located in Esan West Local Government Area of Edo State, Nigeria. Ekpoma lies within longitude 6.13˚E and latitude 6.73˚N with a population of about 61,870 people (Population of Cities, 2007) and incidentally, the headquarters of Esan West Local Government Area, Ekpoma is situated at elevation 364 meters above sea level and apparently the fourth biggest city in Edo State (Shi et al., 2015).

### Sample Size

The study consist of 173 undergraduate students (100-500 Levels) of Ambrose Alli University, Ekpoma, Edo State. Nigeria.

### Sample Collection

The nasal swab was collected using a sterile culture swab which comprises a small twist of absorbent cotton wool attached to the end of an orange stick (Yesilyurt, & Hassan, 2003) used to collect the sample and a container into which the swab applicator was placed after sampling.

### Exclusion and Inclusion Criteria

Samples were collected from students not taking any antibiotics or undergoing any kind of treatment for any known ailment/disease.

### Ethical Consideration

Ethical permission was obtained from the Ethics Committee of Ambrose Alli University, Ekpoma, Edo State.

### Statistical Analysis

This was done using the student "t" test to determine the level of significance. A P-value of less than or equal to 0.05 ($P \leq 0.05$) was considered to be statistically significant.

## RESULTS

Table 1 shows the distribution of nasal carriage of Staphylococcus aureus and Covid-19 antibody according to the age range of the subjects. Age 21-25 had the highest number of subjects, 88; highest number positive for Staphylococcus aureus, 17 (19.3%) and highest number positive for Covid-19 antibody, 55 (62.5%) and the highest positive for both S. aureus and Covid-19; 9 (10.2%). Table 2 shows the distribution of Staphylococcus aureus and Covid-19 according to gender of the subjects. The subjects consist of 109 females and 64 males. Females had the highest number positive for Staphylococcus aureus, 19 (17.4%); Covid-19, 70 (64.2%); and for both S. aureus/ Covid-19, 11 (10.1%). Table 3 shows the distribution according to the level of study of the subjects. 200L had the highest number of subjects, 44; 300L has the highest number positive for S. aureus, 11 (26.2%); 100L had the highest number positive for Covid-19, 35(85.4%); 300L had the highest number of positive for S. aureus and Covid-19 antibody, 7(16.7).

**Table 1**

| Age range(years) | n | No. positive for S. aureus (%) | No. positive for Covid-19 Antibody (%) | No. positive both S.aureus & Covid Antibody (%) | a vs b | a vs c | b vs c |
|---|---|---|---|---|---|---|---|
| ≤20 | 55 | 8(14.5%) | 43(78.2%) | 7(12.7%) | | | |
| 21-25 | 88 | 17(19.3%) | 55(62.5%) | 9(10.2%) | | | |
| 26-30 | 21 | 4(19.4%) | 14(66.7%) | 1(4.8%) | | | |
| >30 | 9 | 1(11.1%) | 2(22.2%) | 0(0%) | | | |
| Total | 173 | 30(17.3%)(a) | 114(65.9%)(b) | 17(9.8%) | | | |
| X2 | | 0.826 | 11.79 | 2.127 | 83.931 | 4.161 | 115.58 |
| p.value | | 0.843 | 0.01 | 0.546 | 0.000 | 0.040 | 0.000 |

**Table 2.**

| Gender | n | No. positive for S. aureus (%) | No. positive for Covid-19 Antibody (%) | No. positive both S.aureus & Covid Antibody (%) | a vs b | a vs c | b vs c |
|---|---|---|---|---|---|---|---|
| Male | 64 | 11(17.2%) | 44(68.8%) | 6(9.4%) | | | |
| Female | 109 | 19(17.4%) | 70(64.2%) | 11(10.1%) | | | |
| Total | 173 | 30(17.3%)(a) | 114(65.9%)(b) | 17(9.8%)(c) | | | |
| $X^2$ | | 0.002 | 0.368 | 0.0023 | 83.931 | 4.161 | 149.78 |
| p-value | | 0.964 | 0.544 | 0.8790 | 0.000 | 0.040 | 0.00 |

**Table 3.**

| Level of n study | n | No. positive for S. aureus (%) | No. positive for Covid-19 Antibody (%) | No. positive both S.aureus & Covid Antibody (%) | a vs b | a vs c | b vs c |
|---|---|---|---|---|---|---|---|
| 100L | 41 | 1(2.4%) | 35(85.4%) | 0(0%) | | | |
| 200L | 44 | 9(20.5%) | 26(59.1%) | 5(11.4%) | | | |
| 300L | 42 | 11(26.2%) | 25(59.5%) | 7(16.7%) | | | |
| 400L | 15 | 2(13.3%) | 7(46.7%) | 1(6.7%) | | | |
| 500L | 31 | 7(22.6%) | 21(67.7%) | 4(12.9%) | | | |
| Total | 173 | 30(a) | 114(b) | 17(c) | | | |
| $X^2$ | | 9.706 | 11.096 | 7.303 | 83.931 | 4.161 | 149.78 |
| p-value | | 0.040 | 0.020 | 0.120 | 0.000 | 0.004 | 0.00 |

## DISCUSSION

173 nasopharygeal swab specimen, consisting of 109 females and 64 males were assessed to ascertain the co-existence rate of nasal carriage of S. aureus and SARS-COV 2 virus. The results shows that, the Age 21-25 had the highest number of subjects, 88; this is because most students in tertiary institutions in Nigeria fall under this age bracket. They were also highest number positive for Staphylococcus aureus, 17 (19.3%) and highest number positive for Covid-19 antibody, 55 (62.5%) and the highest positive for both S. aureus and Covid-19; 9 (10.2%), which is indicative that, there is a significant relationship between nasal carriage rate of S. aureus and Covid-19 in this age group. Females had the highest number positive for Staphylococcus aureus, 19 (17.4%); Covid-19, 70 (64.2%); and for both S. aureus/ Covid-19, 11 (10.1%). This may be because, the study population had more females (109) than males. Generally, it was observed that the subjects with the highest nasal carriage of S. aureus was also highest for SARS-COV 2 infection. As regards the distribution according to the level of study of the subjects. 200L had the highest number of subjects, 44; 300L has the highest number positive for S. aureus, 11 (26.2%); 100L had the highest number positive for Covid-19, 35(85.4%); 300L had the highest number of positive for S. aureus and Covid-19 antibody, 7(16.7). It was observed that 300L subjects, who had the highest number of S. aureus nasal carriage also had the highest for Covid-19. This shows that there is a correlation between nasal carriage of S. aureus and SARS-COV 2 virus. Cusumano et al (2020) in their study with 42 patients reported that bacteremia with Staphylococcus aureus is associated with high mortality rates in patients hospitalized with Covid-19.

Although the danger posed by bacterial co-infections in COVID-19 is recognized, the extent of co-infection with S.aureus has hitherto not been systematically evaluated. A meta-analysis similar with our study, reported that more than one fourth of COVID-19 hospitalized patients had co-infection (bacterial, fungal or viral), underscoring the need for establishment of protocols for the detection of co-infection to improve clinical data and patient therapy. Similarly, in about one-fourth of recorded co-infections, S. aureus was the prevalent co-pathogen. This finding is consistent with a co-infection rate of 25% (S.aureus) previously reported by Klein et al., (2016). In their study, Jenna R. Adalbert et al, (2021) reported co-infection with COVID-19 and S. aureus in 76.5% patients after hospital admission. This is high in comparison with this study and can be attributed to the fact that healthy subjects were recruited for this study and a pointer to the possibility that the patients acquired S. aureus as a result of their being hospitalized. Physician vigilance is recommended during COVID-19 interventions that may increase the risk of bacterial co-infection with pathogens, such as S. aureus.

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