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CARRIAGE RATE OF *Neisseria meningitides* AMONG PUPILS OF ISLAMIC BOARDING SCHOOLS (TSANGAYA ALMAJIRAI) IN KANO, NIGERIA

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ABSTRACT
The study was a cross-sectional study that determined the carriage rate of Neisseria meningitides among pupils of Islamic boarding schools (Tsangaya Almajirai) in Kano, Nigeria. Nasal swabs were randomly collected from 150 children aged 5 years to 10 years and above from three selected Tsangaya Almajiri schools in Kano using cluster sampling. The collected samples were processed for the presence of N. meningitides using standard cultural and biochemical test and further identified using latex agglutination technique. Also, Blood profile of study subjects was carried out. A questionnaire was similarly administered to identify risk factors associated with carriage status. The results of the study revealed that 23 (15.3%) of the children were carriers of N. meningitides with 2%, 12% and 5% of the isolates belonging to serogroup A, B and C respectively, while 4% were identified as non-groupable. Risk factors such as age, population density, period of sample collection and preceding viral infection were associated with carriage although not significant (p>0.05).
Keywords: Neisseria meningitides, carriage, Islamic boarding schools, Kano.

INTRODUCTION

Nigeria has since been identified among the African meningitis belt that is characterize by high level of endemic meningococcal diseases and most strikingly by the occurrence of large epidermis in the dry season, periodically and every 5 to 12 years with attack rates reaching 1,000 cases per 100,000 populations (CDC, 2016; Trotter and Greenwood, 2007). It has been documented that 10 to 20% of the population carries *Neisseria meningitidis* in their throat at any given time although the rate may be higher in epidemic situations (WHO, 2015).

Neisseria meningitidis is a gram negative diplococci and a commensal of the nasopharynx having about 12 serogroups with serotype A, B, C, W, X and Y causing major epidemics (WHO, 2015). It is transmitted through droplet of respiratory or throat secretions from carriers by close and prolonged contact as in dormitory, sharing utensils with an infected person (CDC, 2016; WHO, 2015).

Basta *et al*. (2013) demonstrated that asymptomatic carriers of *N. meningitidis* serve as a reservoir for persistence and spread of the bacterium in the population and Leimkugel *et al*. (2009) identifies crowding among other factors as important in influencing the timing and distribution of epidemics.

In the region where this study was conducted the Islamic boarding school houses the Almajirai (i.e. pupils) mostly in overcrowded living conditions which easily allow the dissemination of microorganisms including *N. meningitides* thereby increasing the carriage rate of the organism by the pupils. So many studies on carriage status of *N. meningitides* among people living in crowded conditions like student dormitories, refugee camps, military facilities or schools have been documented, but studies among Tsangaya Almajirai is scanty. This study therefore aimed at establishing the carriage rate of *N. meningitides* among pupils of the Tsangaya Almajirai in Kano, Nigeria and this will contribute to the understanding of the epidemiology of meningococcal disease, particularly in our community.

MATERIALS AND METHODS

The study was a cross-sectional study conducted on 150 randomly selected pupils aged between 5 to 10 years and above attending three Islamic boarding schools located in some parts of Kano state, Nigeria, which were selected using cluster sampling from February 2016 to May 2016. Ethical clearance and consent for the study were obtained from Kano state ministry of health, Board of Islamiyya and Quranic education, Kano state and from the Head teacher of the selected schools. All pupils without a history of the meningococcal disease were included in the study while those with a history of meningococcal disease were excluded.

The pupils for the study were randomly selected using 7.4% carriage rate of *N. meningitides* among studied subjects in Jos (Enweani *et al.*, 2008).
Anterior nasal swabs were aseptically collected from 150 selected pupils and delivered within 2 hours to the laboratory and processed using Gram's staining techniques and inoculated into modified Thayer-Martins medium for 48hours at 35°C in 5-10% CO_2 (Cheesbrough, 2006; www.HardyDiagnostics.com). *N. meningitides* isolates were further identified using biochemical test using glucose or dextrose, maltose, lactose and sucrose (www.HardyDiagnostics.com). Isolates of *N. meningitides* were also serotyped by latex agglutination techniques using *N. meningitides* antiserum as described by BD Difco *N. meningitidis* Antisera (2010). Blood profile of the study subjects was also carried out using automated blood analyzer (Coulter counter).
A questionnaire was similarly administered to identify risk factors associated with carriage status of the selected pupils and analyzed by the Chi-square tests using the Graph pad Instat3 statistical software for windows 2006. Values were considered significant when $p < 0.05$.

RESULTS

The result of the study revealed that of 150 nasal swab samples collected from Tsangaya Almajirai pupils in Kano State, 23 (15.3%) harbored *N. meningitides* with 12 (52.2%) of the pupils having serotype B, while 2 (8.7%) and 5 (21.7%) had serotypes A and C respectively (Table 1 and 2). Also, 4 (17.4%) of the *N. meningitides* isolates were non-groupable.
Table 3 revealed that Tsangaya Almajirai pupils aged 5-10 years had the highest carriage rate of 60.9% (14/23) compared to other age groups (P=0.3710) and the carriage rate did not differ significantly among pupils residing in rural and semi-urban areas (P=1.0000). Also, the carriage rate was highest in the month of May with 52.2% (12/23) of the pupils harboring it, then in March with 8.7% (2/23) pupils harboring the organism (P=0.6405) (Table 3). Based on population density Tsangaya with population of over 75 pupils per Tsangaya had the highest carriage rate of 47.8% than those with 50 or 25 pupils (P=0.3343) (Table 3). Pupils whose parents were traders had the highest carriage rate of 65.2% (12/23) while 2 pupils whose parents were farmers had the carriage rate of 8.7% (P=0.1461) (Table 3).
Table 3 also shows that pupils that were exposed to smoke (firewood), had a history of viral infection prior to the commencement of the study and have been vaccinated had the highest carriage rate of 60.9% (P=1.0000), 65.2% (P=0.3696) and 60.9% (P=0.5024) respectively. Also, all the positive pupils indicated that they did not use any drug (antibiotic) prior to commencement.
Table 4 revealed that the blood count in terms of neutrophil and lymphocyte count of the studied pupils was weakly associated with their carriage status ($r = 0.482$, $p = 0.05$).

Table 1:Occurrence of *Niesseria meningitides* according to sites among pupils of Tsangaya Almajirai schools in Kano.

SITES	NUMBER EXAMINED	NUMBER POSITIVE	P – VALUE
A	60 (40%)	8 (34.7%)	0.4445
B	30 (20%)	2 (8.7%)	
C	60 (40%)	13 (56.5%)	
Total	**150**	**23 (15.3%)**	

Table 2: Seroprevalence of *Niesseria meningitides* among pupils of Tsangaya Almajirai schools in Kano.

SEROTYPES	NUMBER (%)
A	2 (8.7%)
B	12 (52.2%)
C	5(21.7%)
Non-groupable (NG)	4 (17.4)
Total	**23**

Table 3: Socio demographic characteristics of Tsangaya Almijiris pupils carrying *N. meningitides* in Kano

Variables		Numbers Examined	Number Positive
Age (years)	5-10	73 (48.7%)	4 (60.9%)
	>10	77 (57.3%)	9 (39.1%)
	P- value- 0.3710		
Residential Area	Rural	61 (40.7%)	9 (39.1%)
	Semi urban	89 (59.3%)	14 (60.9%)
	P value – 1.0000		
Density Ratio	25%	29 (19.3%)	2 (8.7%)
	50%	61 (40.7%)	10 (43.5%)
	75%	60 (40.0%)	11 (47.8%)
	P - value 0.3343		
Parent Occupation	Civil servant	3 (2.0%)	1 (4.3%)
	Farmers	73 (48.7%)	2 (8.7%)
	Traders	56 (37.3%)	12 (65.2%)
	Others	18 (12.0%)	5 (21.7%)
	P – value 0.1461		
Period of collection	February	60 (40.0%)	9 (39.1%)
	March	29 (19.3%)	2 (8.7%)
	May	61 (40.7%)	12 (52.2)
	P – value 0.6405		
Any preceding viral infection	Yes	80 (53.3%)	15 (65.2%)
	No	70 (46.7%)	8 (34.8%)
	P- value 0.3696		
Exposure to smoke	Yes	61 (40.7%)	9 (39.1%)
	No	89 (59.3%)	14 (60.9%)
	P- value 1.0000		
Previous use of Antibiotics	Yes	12 (8.0%)	0 (0.0%)
	No	138(92.0%)	23 (100%)
	P-value 0.3716		
Vaccination	Yes	77(51.3%)	14 (60.9%)
	No	73(48.7%)	9 (39.1%)
	P-value 0.5024		

Note: Values were considered significant when $p < 0.05$.

Table 4: Mean blood cell count of the studied subjects with regards to their carriage status Of *N. meningitides*

Carriage status(*N. meningitides*)	Mean Blood cell count (µl)	
	Lymphocyte	Neutrophils
Positive (n=23)	48.56	41.89
Negative (n=127)	41.14	33.40

($r=0.482$; $p=0.05$)

DISCUSSION

The findings of this study indicated that the 15.3% carriage rate of *N. meningitidis* reported in this study was within the documentation of the WHO (2015) which revealed that 10 to 20% of the population carries *N. meningitidis* in their throat at any given time although the carriage rate may be higher in epidemic situations. The rates were however, higher than 7.4% reported by Enweani *et al*. (2008) in Jos but lower than the 20.5% and 18.0% reported by Basta *et al*. (2012) among asymptomatic school children aged 5-10 years and 11-15 years in Bamako, Mali.

The study further identified *N. meningitidis* serotype B to be the most prevalent among the studied subjects, and this could be attributed to the fact that in the region where this study was conducted immunization efforts were centered on the use of mass meningococcal A+C vaccines. This explains the low carriage rate of serotype A and C compared to serotype B which suggested the absence of protection against this serogroup in this region and also explains the insignificant difference in the carriage rate between vaccinated and unvaccinated pupils. The observations of this study were consistent with earlier documented works of Trotter and Greenwood (2007); Fernandez *et al*. (1999) Berron and Vazquez (1994). However, the study did not concord with the observation of Cartwright *et al*. (1987) who reported that 80% of their study subject harbored serogroup C. Furthermore, the 17.4% identified non-groupable serotype was the same as 17.4% non-groupable serotypes reported earlier between 1980-1981 in Northern Nigeria and slightly lower than the 24% non-groupable serotypes in western Nigeria reported by Trotter and Greenwood (2007). The study reemphasized that carriage of *N. meningitidis* is not age specific and this coincides with earlier study by MacLennan *et al*. (2006),

although Gagneux *et al*. (2002) identifies that carriage increases to maximum in teenagers and then decline. The study also revealed that population density, period of sample collection, exposure to smoke (firewood), preceding viral infection and antibiotic use were insignificantly associated with carriage rate and this agrees with the studies of Pavlopoulou *et al*. (2004).
Other, studies by Dominguez *et al*. (2011) revealed that variables such as social class and parental education are associated with carriage in Greek school children subjects, however this study disregard the parent occupation status as a factor influencing carriage status since all the pupils share the same socio economic status as at the time of the study i.e. same accommodation and almost eating the same food. Finally, the study shows that neutrophil and lymphocyte counts of the studied pupils were weakly associated with their carriage status (*r* = 0.482).

CONCLUSION

The carriage rate of *N. meningitides* among pupils of Tsangaya Almajirai in Kano was observed to be 15.3% with serotype B having the highest carriage rate of 52.2%. Risk factors such as age, population density, period of sample collection and smoking were insignificantly associated with carriage rate. The study identified the need to introduce new meningococcal B vaccines in the region of the study and to extend the immunization activities to include pupils of Tsangaya Almajirai.

REFERENCES

Basta, N. E., Stuart, J. M., Nascimento, M. C., Manigart, O., Trotter, C., Hassan-King, M., *et al*. (2013). Methods for Identifying *Neisseria meningitidis* Carriers: A Multi-Center Study Africa Meningitis Belt. *PLoS ONE* 8(10): e78336. doi:10.1371/journal.pone.0078336.

Basta, N., Sow, S., Berthe, A. Tamboura, B., Onwuchekwa, U., CheickHaidara, F., Watkins, E., Bennett, J. and Maiden M. (2012). Age-specific prevalence estimates and risk factors for asymptomatic *Neisseria meningitidis* carriage in Bamako, Mali. 15th ICID Abstracts / *International Journal of Infectious Diseases* 16S (2012) e158–e316 e211 http://dx.doi.org/10.1016/j.ijid.2012.05.799

Berron, S. and Vazquez, J. A. (1994). Increase in moderate penicillin resistance and sero-group C in meningococcal strains isolated in Spain. Is there any relationship? *Clin infect Dis*, 18:161-5.

Center for Disease Control and Prevention (CDC) (2016).National center for immunization and Respiratory diseases. Meningococcal disease https://www.cdc.gov/meningococcal/index.html. Last updated October 2016.

Cheesbrough (2006).*Medical laboratory manual for tropical countries*. Great Britain: Cambridge University Press.

Coulter counter (2000-2017). Beckman Coulter, Life Science Division Headquarters 5350 Lakeview Parkway S Drive Indianapolis IN 46268.

Domínguez, A., Cardeñosa, N., Izquierdo, C., Sánchez, F., Margall, N. Vázquez, J. A. and Salleras I. (2011).Prevalence of *Neisseria meningitidis* carriers in the school population of Catalonia, Spain. *Journal ofEpidemiology & Infection 127* (3):425- 433 https://doi.org/10.1017/S0950268801006173.

Enweani, I. B., Juga G. M. and Bello C. S. S. (1997).Nasopharyngeal carriage of *Neisseria meningitidis*in Jos, Plateau State, Nigeria. *Nigerian Journal of Microbiology, 9*: 65 –68

Fernandez, S., Arreaza, I, Santiago, I, Malvar, A., Berro, S., Vazquez, J. A., Hervada, X. and Gestal, J. J. (1999).Carriage of a new epidemic strain of *Neisseria meningitidis* and its relationship with the incidence of meningococcal disease in Galicia, Spain.*Epidemiol Infect*,*123*:349-57.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2810768/pdf/10694145

Gagneux, S. P., Hodgon, A, Smith, T. A., Wirth, T., Ehrhard, I., Morelli, G., Genton, B., Binka, F. N., Achtman, M. and Pluschke, G. (2002).Prospective study of a serogroup X *Neisseria meningitides* outbreak in Northern Ghana.*J Infect Dis, 185*: 618-26.

Leimkugel, J., Racloz, V., Jacintho da Silva, L. and Pluschke, G. (2009). Global review of meningococcal disease.A shifting etiology.*Journal of Bacteriology Research, 1*(1): 006-018.

MacLennan, J., Kafatos, G., Neal, K., Andrews, N., Cameron, J. C., Roberts R., Evans, R. M., Cann, K., Baxter, N. D., Martins, C. J. and Maiden, J. M. (2006).Social behavior and meningococcal carriage in British teenagers.*Emerg Infect Dis, 12* (6):950–957. https://wwwnc.cdc.gov/eid/article/12/6/05-1297_article

Pavlopoulou, I.D., Daikos, G.L.,Alexandrow, H., Petridou, E., Pangalis, A., Theodordou, M., Syriopoulou V., P. (2004). Carriage of *Neisseria meningitides* by Greek Children: Risk factors and strain characteristics J. Clinical Microbiology and Infection 2004; 10:pp 134-142.

Trotter, C. L. and Greenwood, G. (2007).Meningococcal carriage in the African meningitis belt.*Lancet Infectious Dis. 7*:793- 803

www.HardyDiagnostics.com West McCoy Lane, Santa Maria, CA 93455, USA

World Health Organization (WHO) (2015).WHO fact sheet on meningococcal meningitis.http://www.who.int/mediacentre/factsheets/fs141/en/. Updated November 2015.