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Comparative Study and Significance of the Nasal Morphometry Among the Ibibio and Bini Tribes in Southern Nigeria

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ABSTRACT

Introduction: the nasal morphometry is an integral part of cephalometry which has been described as second most reliable indicator of sexual differences after pelvimetry. Other applications include reconstructive surgery and ergonomics. This study was aimed to assess the nasal morphometry of the Bini and Ibibio tribes in Southern Nigeria and its significance.

Methods: this study involved 300 adult Bini and 300 adult Ibibio tribes of Southern Nigeria. The nasal length and width of subjects were evaluated using appropriate anatomical landmarks. The nasal index was calculated as the percentage ratio of nasal width to the nasal length and the nasal morphological distribution was assessed among the study population.

Results: the mean nasal length of male Binis (47.10 ± 4.63) and Ibibios (44.35 ± 7.84) was significantly ($p<0.05$) higher than female Binis (42.45 ± 5.75) and Ibibios (39.77 ± 5.93) respectively. Similarly, the mean nasal width of the male Binis (42.14 ± 6.35) and Ibibios (39.53 ± 6.56) was significantly ($p<0.05$) higher than the female Binis (37.53 ± 5.68) and Ibibios (34.62 ± 5.45) respectively. The nasal indices of the male Binis (90.55 ± 5.66) and Ibibios (88.95 ± 4.22) and female Binis (87.95 ± 4.13) and Ibibios (86.17 ± 4.57) respectively showed the dominance of platyrrhine nasal morphology among the study population.

Conclusion: aside the applications of nasal morphometry in the forensic identification and reconstructive surgeries among the study population, it would serve as a source of crucial anthropometric parameters in ergonomic design and production of face or medical masks and respirators.

Keywords: Nasal morphometry; Forensic Science; Ergonomics; Southern Nigeria.

Introduction

Physical anthropometry can be described as the art and study of measurements of human body dimensions in living individuals or skeletal remains. Among the diverse branches of physical anthropometry is cephalometry which entails evaluation of dimensions of the whole or parts of the cranial region[1-3]. The application of cephalometry has been indicated in forensic and medical diagnostic procedures especially orthodontics, reconstructive surgeries and forensic science[4,5]. Generally, variations in physical identity of different population can be primarily linked to their variable cephalometric morphologies[6]. The major determinants of these variations in human physical morphologies within or across different tribes or population include gender, tribe, age and geographical location[7-9]. In essence, cephalometric parameters can be used to distinguish gender in different age groups within the same or different tribes and in the same or different geographical locations. The most vital cephalometric features used for the aforementioned applications are the facial morphometric characteristics of an individual which include the nasal morphometry[10-12].

The nose is the part of the respiratory tract which lies superior to the hard palate and contains the peripheral part of the olfactory system.[13] It is composed of the external nose and the nasal cavity, which is divided into the right and left cavities by a median dermacation known as the nasal septum[13,14]. The external nose is the prominent part that projects from the face and contributes to the identity of an individual. Therefore, the nose is an anatomical feature that can be of importance during forensic identification of an individual. In addition, due to the central facial positioning of the nose, the nasal morphology contributes prominently to the level of beauty or handsomeness of an individual[15]. Hence, the nose is a vital feature in facial aesthetics and reconstructive surgeries like rhinoplasty[16]. The cartilaginous and bony components of the supporting framework of the nose determine the nasal shapes and sizes in different individuals[17]. The shapes and sizes of the nose in turn constitute the bases of variation in the nasal morphology of different individuals.

The nasal morphometry can be described as the study of the physical morphology and dimensions of the nose and their applications. The five different types

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of human nose, based on the nasal morphometry of different human population, include hyperleptorrhine (long narrow nose), leptorrhine (moderately narrow nose), mesorrhine (modereate sized nose), platyrrhine (moderately wide nose) and hyperplatyrrhine (very wide nose)[18,19]. The nasal morphological characteristics have been reported to exhibit variation across gender and age groups both within intra-racial and inter-racial populations. In addition to the aforementioned applications of the nasal morphometry in the demonstration of physiognomic variation among different population, it is potentially useful in the industrial ergonomic design of clinically-important nasofacial wears such as face masks, surgical masks, N95 respirators and others barrier face coverings which helps to protect against infections[19-21].

In this study, the nasal morphometry was assessed among the Bini and Ibibio tribes of Southern Nigeria and compared with the nasal morphological characteristics of other tribes, races and population. The significance of the nasal morphometry was also elucidated.

Methods

Study population

This study was carried out in Benin City in Edo State (6^0 20' 21.0660" N and 5^0 37' 2.8092" E) and Uyo City in Akwa-Ibom State (5^0 2' 20.2668" N and 7^0 54' 34.092" E) of Southern Nigeria. It involved a total of 600 subjects (300 Binis and 300 Ibibios), which included equal number of male and female subjects between ages 18-35 years, randomly selected to represent the study population.

Inclusion and exclusion criteria

The objective of the study was explained to prospective subjects and only those who gave informed consent were included in this study. Other inclusion criteria include: subjects being born and brought up in Nigeria; the subject and both parents belonging to either the Bini or Ibibio tribe and subjects being in healthy condition without any nasofacial deformities. Prospective subjects who did not meet the inclusion criteria were excluded from the study.

Measurements of nasal morphological parameters

The nasal length was measured as distance from nasion and pronasale, the nasal width was measured as distance between lateral ends of ala of the nose and the nasal index was calculated as the percentage ratio of the nasal width to the nasal length[19,22]. The measurements were taken with the aid of digital sliding caliper (at a precision level of 0.1mm) from each included subject in sitting position with their head held in an anatomical position. Three readings were taken by an assessor for each parameter and the average value used as the definitive value.

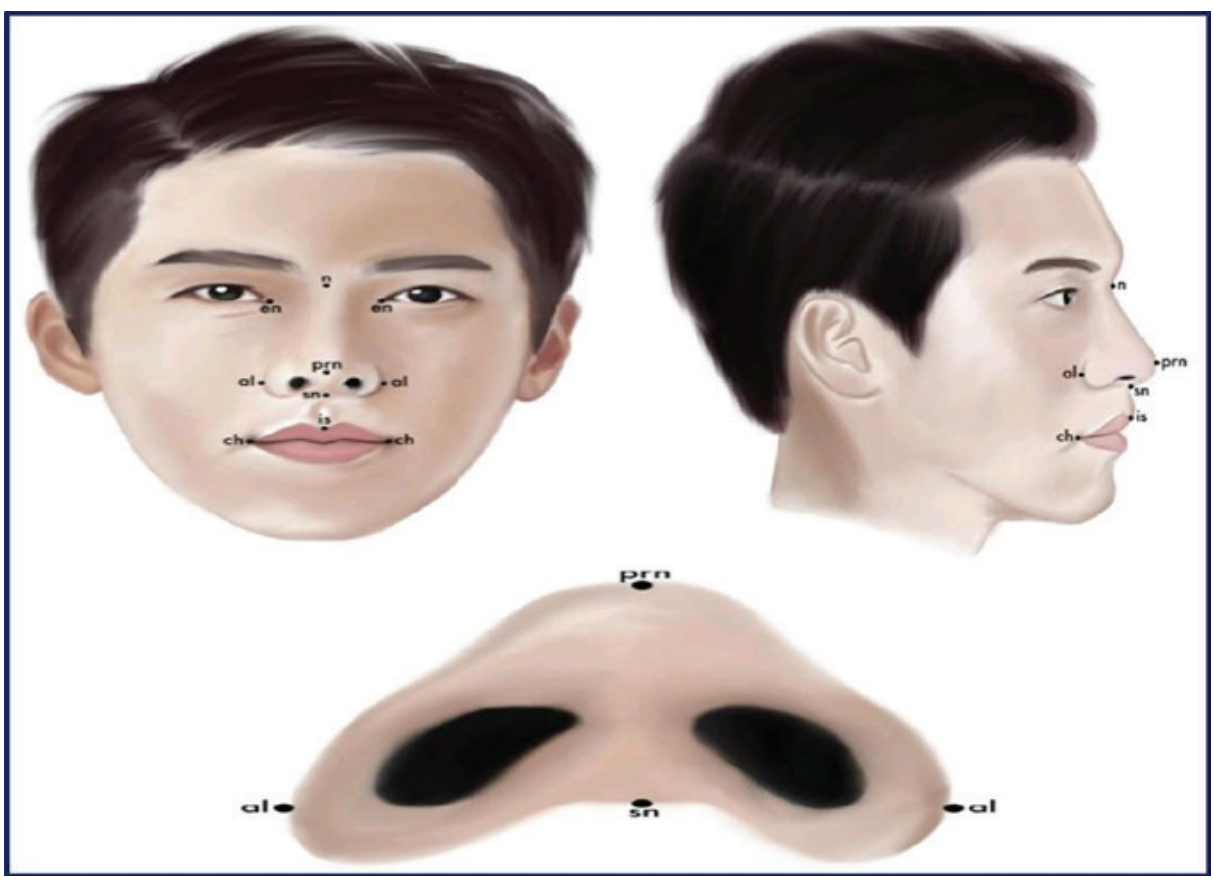

Figure 1. Nasal morphometric landmarks - nasal length from nasale (n) to pronasale (prn); nasal width from right to left alae (al)[22].

Data analysis

Statistical analysis of data was performed using IBM-SPSS (version 20, IBM Corp., NY, USA) and comparisons were done using *t*-test and one-way analysis of variance (ANOVA) with $p<0.05$ considered as statistically significant.

Ethical approval

The ethical approval for this study was obtained from Research and Ethics Committee of Igbinedion University, Okada, Edo State, Nigeria (Reference Number: 08/009215/HSC).

Results

The nasal length, nasal width, nasal index and the distribution of the different nose types among the two study population are presented in Tables 1-4. The length of the nose showed similar outcome in the two tribes with significantly higher mean values recorded among Bini males (47.10 ± 4.63) than Bini females (42.45 ± 5.75) and among the Ibibio males (44.35 ± 7.84) than Ibibio females (39.77 ± 5.93). Regarding the width of the nose among the study population, the mean nasal width was significantly higher among the males [Bini males (42.14 ± 6.35); Ibibio males (39.53 ± 6.56)] than their female [Bini females (37.53 ± 5.68); Ibibio females (34.62 ± 5.45)] counterparts. The mean nasal index value was significantly higher among Bini males (90.55 ± 5.66) compared to the Bini females (87.95 ± 4.13). However, the nasal index was non-significantly higher among the Ibibio males (88.95 ± 4.22) than their females (87.17 ± 4.57) counterparts.

Table 1. The nasal length among the Bini and Ibibio tribes.

	Bini Tribe		Ibibio Tribe	
	Male	Female	Male	Female
Number of subjects (n)	150	150	150	150
Mean (mm)	47.10	42.45[a]	44.35[a]	39.77[b,c]
Standard Deviation (SD)	4.63	5.75	7.84	5.93
Minimum (mm)	39.50	38.37	38.75	37.76
Maximum (mm)	48.33	46.96	45.84	42.88

[a,b,c] indicate significant difference compared to Bini male, Bini female and Ibibio male respectively.

Discussion

In forensic identification of humans or skeletal remains, determination of gender is one of the most important procedures and cephalometric parameters have been described as second most reliable indicator of gender differences after pelvimetric parameters.[23,24] These cephalometric parameters include the nasal morphological parameters. Essentially, the human nose has been described as a significant facial feature that can be used to distinguish the human population based on gender, age groups, tribes or ethnicity, races and geographical location.[25-27] In particular, the nasal morphometry constitute vital part of human cephalometry that can applied for description of inter-tribal or intra-tribal gender variation in different human population.[28]

According to results of this study, both nasal parameters showed gender-related significant differences within the two study population (Tables 1

Table 2. The nasal width among the Bini and Ibibio tribes.

	Bini Tribe		Ibibio Tribe	
	Male	Female	Male	Female
Number of subjects (n)	150	150	150	150
Mean (mm)	42.14	37.53[a]	39.53[a]	34.62[b,c]
Standard Deviation (SD)	6.35	5.68	6.56	5.45
Minimum (mm)	34.45	33.76	33.79	32.76
Maximum (mm)	45.45	42.75	42.59	39.77

[a,b,c] indicate significant difference compared to Bini male, Bini female and Ibibio male respectively.

Table 3. The nasal index among the Bini and Ibibio tribes.

	Bini Tribe		Ibibio Tribe	
	Male	Female	Male	Female
Number of subjects (n)	150	150	150	150
Mean	90.55	87.95[a]	88.95	86.17[c]
Standard Deviation (SD)	5.66	4.13	4.22	4.57
Minimum	84.87	83.70	82.10	83.47
Maximum	92.13	91.05	92.79	92.70

[a ,c] indicate significant difference compared to Bini male and Ibibio male respectively.

Table 4. The morphological classification and percentage distribution of the nose types among the Bini and Ibibio tribes.

Types of Nose	Range of Nasal Index	Bini Tribe				Ibibio Tribe			
		Male		Female		Male		Female	
		Number	%	Number	%	Number	%	Number	%
Hyperleptorrhine (long narrow nose)	40 - 54.9	-	0	-	0	-	0	-	0
Leptorrhine (moderately narrow nose)	55.0 - 69.9	-	0	-	0	-	0	-	0
Mesorrhine (moderate size)	70.0 - 84.9	9	6.0	7	4.7	17	11.3	15	10
Platyrrhine (moderately wide nose)	85.0 - 99.9	141	94.0	143	95.3	133	88.7	135	90
Hyperplatyrrhine (very wide nose)	≥ 100.0	-	0	-	0	-	0	-	0

and 2). This outcome showed similarity with findings from previous studies conducted among other tribes within the geographical location of the study population. These included studies by conducted among the Urhobo, Itsekiri, Omoku, Bini, Tiv and Idoma tribes in the Southern and Central parts of Nigeria.[19,28-31]. In all their findings, the males presented higher nasal morphometric parameters than their female counterparts.

Similarly, the results of this study showed that nasal index exhibited significant sexual dimorphism within the two study population with the males having higher values than the females (Table 3). Previous studies have also reported similar gender-based variation in the nasal index among different tribes or ethnic groups which include Urohobo and Itesekiri, Omoku, Bini, Tiv and Idoma, Igbo, Yoruba, Ijaw and Ekpeye tribes of the Southern Nigeria with the male subjects presenting significantly higher nasal index than their female counterparts[28-33]. Only Ikwerre tribe reported contrary results wherein the female subjects (93.17 ± 0.51) presented significantly higher nasal index values than their male counterparts (84.81 ± 0.51)[33]. Furthermore, according to the nasal index values among the study population, there is a prevalence of platyrrhine nasal morphology. The prevalence of platyrrhine nose type among the study population further corroborated the findings from other tribes of proximate geographical location to study population[29-33].

The usefulness of nasal morphometry in the design of face masks, surgical masks and N95 respirators has been elucidated. The face mask usually covers the user's nose and mouth but may or may not meet the fuild barrier or filtration efficieny levels. However, surgical mask is a disposable mask that provides a physical barrier to fluid and particulate materials as it covers the nose and mouth thereby limiting the spread of droplets and respiratory pathogens from the user[34-36]. The fitting of a face or medical masks is a critical factor that determines its effectiveness against the transmission of respiratory infectious diseases. The safety of fitting, convenience and ability of verbal communication with others when using face mask depends of the design features[37]. The design and production of face or medical masks should be based on nasofacial anthropometrics as approved by the World Health Organisation and the two major designs of the face mask include the flat-fold and cup designs[38-39]. The flat fold design (figure 2A) is most appropriate for population dominated by leptorrhine nasal morphology while the cup-design (figure 2B) is most appropriate for the platyrrhine-dominated population.

Based on the results of this study, which showed the prevalence of platyrrhinity nasal morphology among the study population, the cup design is essentially the most appropriate face mask design. The information provided by this study would therefore be of significance during the production of face mask for the study population and proximate tribes with similar nasal morphology.

Conclusion

Nasal morphometry provides veritable parameters which significantly contribute to the sexual dimorphism among the study population. These parametes further provide useful anthropometric data with prominent applications in forensic investigations, reconstructive surgery and ergonomic design of clinically-important nasofacial wares.

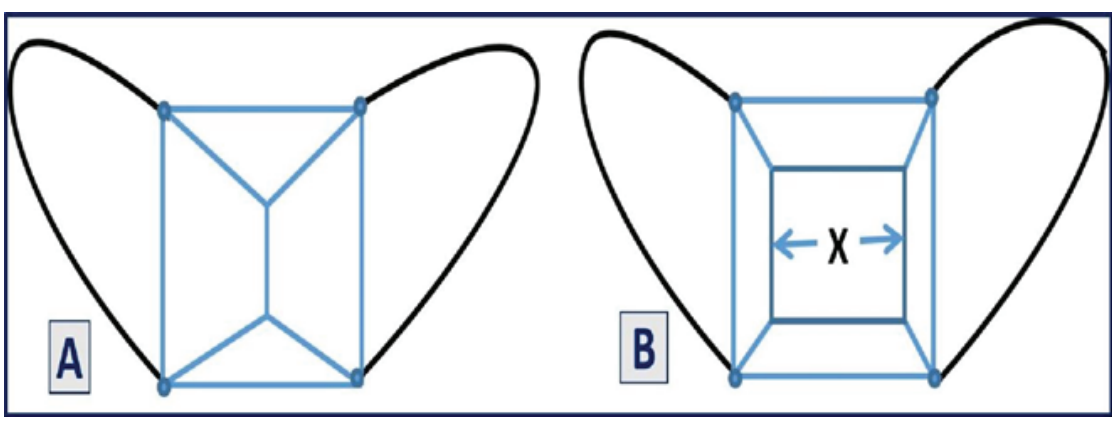

Figure 2. Schematic diagram of flat-fold (A) and cup (B) designs of face mask.

References

1. Golalipour MJ, Jahanshahi M, Haidari K. Mophological evaluation of Head in Turkman males in Goragan – North of Iran. Int. J. Morphol. 2007;25(1): 99-102.
2. Jahanshahi M, Golalipour MJ, Heidari K. The effect of ethnicity on facial anthropometry in Northern Iran. Singapore Med J. 2008;49(11): 940
3. Omotoso DR and Oludiran OO. A morphometric study of the external ears at Benin City. Nigeria J Plast Surg. 2012;8(1): 1-5.
4. Omotoso DR, Olanrewaju AJ, Okwuonu UC, Adagboyin O, Bienonwu EO. Morphometric study of cephalo-facial indices among Bini children in Southern Nigeria. Anat J Afr. 2019;8(2):1580-5.
5. Heidari Z, Mahmoudzadeh-Sagheb H, Mohamadi M, Noori-Mugahi

MH, Arab A. Cephalic and Proscopic indices: Comparison in one-day newborn boys in Zahedan. J. Fac Med. 2004;62:156-65.
6. Omotoso DR, Baxter-Grillo D, Adagbonyin O, Bienonwu E. Comparative assessment of cephalic index among Bini and Igbo tribes in Benin City, Nigeria. Int J Anat Res 2019;7(2): 6685-89. doi: 10.16965/ijar.2019.208
7. Golalipour MJ, Vakilli MA, Ahamadpour M. Height and Weight of Newborns in relation with mother age, race and parity. J. Qazvin Univ Med Sci. 2001;16:58-64.
8. Hegazy AA. Anthropometric study of nasal index of Egyptians. Int J Anat Res. 2014;2(4):761-67.
9. Oludiran OO, Omotoso DR, Sakpa CL. Nasofacial Indices among Children in Southern Nigeria Afr J Biomed Res. 2012;15(2): 141-3.
10. Porter JP, Olson KL. Analysis of the African American Female Nose. Plast. Reconstr. Surg. 2003;111(2): 620-6.
11. Heidari Z, Sagheb HM, Mugahi MN. Morphological evaluation of Head and Face in 18 – 25 years old women in South East of Iran. J Med Sci. 2006;6(3): 400-4.
12. Chenlei L, Zhongke W, Dan Z, Xingce W, Mingquan Z. 3D Nose shape net for human gender and ethnicity classification. Pattern Recog Letters 2019;126:51-7.
13. Moore KL, Dalley AF, Agur AMR. The Nose In Clinically Oriented Anatomy. 6th Edition, Lippincott Williams & Wilkins, Philadelphia. 2010;Pp: 987.
14. Chung KW, Chung HM. The Nasal Cavity in Gross Anatomy. 7th Edition, Lippincott Williams & Wilkins, Philadelphia. 2012;Pp: 403-4.
15. Uzun A, Ozdemir F. Morphometric analysis of nasal shapes and angles in young adults. Braz J Otolaryngol. 2014;80(5):397-402.
16. Mukherjee AA, Kesarwaani S, Kumar S. Anthropometric study of nasal parameters of South Indian population. Bengal J Otolaryngol Head Neck Surg. 2021;29(3):238-43.
17. Sinnatamby CS. The Nose in Last's Anatomy: Regional and Applied. 12th Edition Elsevier, Church Livingstone, Philadelphia. 2011;Pp: 568.
18. Gulzar S, Hussain A, Kumar IA, Itoo MS, Mir NS. Sexual dimorphism of nasal index, nasal breadth and nasal height among young Kashmiri population. Int J Res Med Sci. 2022;10(9): 1963-65. doi:10.18293/2320-6012.ijrms20222273
19. Omotoso DR, Adagbonyin O, Bienonwu E, Uwagbor V. Anthropometric evaluation of nasal height, nasal breadth and nasal index among Bini children in Southern Nigeria. Int J Anat Res 2019; 7(3): 6896-6900. doi: 10.16965/ijar.2019.255
20. Del Prado-Lu, JL. Anthropometric measurements of Filipino manufacturing workers. Int J Indust Ergon. 2007;37:497-503.
21. Hyungo S, Jaehoon O, Ho LT, Hyunggoo K, Yeongtak S, Sanghyun L. Comparing the protective performances of 3 types of N95 filtering facepiece respirators during chest compressions - A randomized simulation study. Med. 2017;96(42):e8308 doi:10.1097/MD.0000000000008308
22. Ariff TFT, Hanafi FFM, Abdul-Razak NWH, Chaiprakit N, Abdul-Wahab H. Anthropometric characteristics of Malay Nose - A pilot study. Esteem Acad J. 2020;16:11-20
23. Khaitan T, Kabiraj A, Ginjupally U, Ritika J. Cephalometric analysis for gender determination using maxillary sinus index: A novel dimension in personal identification. Int J Dent. 2017;7026796. doi:10.1155/2017/7026796
24. Ghosh R, Chowdhuri S, Maity S. Sexual dimorphism in right and left orbital fossa measurements from adult human skulls from an eastern Indian population J For Sci med 2019;5(4):173-176
25. Singla M, Ravi KS, Ansari MS. Morphometric study of nasal parameters in adult Jaunsari tribe population of Dehradun district of Uttarakhand. J Anat Soc India. 2020;69:25-30. doi: 10.4103/JASI.JASI_62_19.
26. Rohith MM, Roy AJ. Morphometric variations of nasal parameters in Gujarati population: An Anatomical Study. J Anat Soc India. 2020;69:127-32. doi: 10.4103/JASI.JASI_139_19.
27. Tamir A. Numerical survey of the Different shapes of Human Nose. SM Otolaryngol. 2017;1(1):1005. doi:10.36876/smotol.1005
28. Omotoso DR, Oludiran OO, Sakpa CL. Nasofacial Anthropometry of Adult Bini Tribe in Nigeria. Afr J Biomed Res. 2011;14(3):219-21.
29. Oladipo, G.S., Udoaka, A.I., Afolabi, E.O. and Bob- Manuel, I.F. Nasal Parameters of Itsekiris and Urhobos of Nigeria. International Journal of Biological Anthropology 2008; 3(1): 10.
30. Oladipo, G. S., Okoh, P.D., Akande, P.A. and Oyakhire, M.O. Anthropometric study of some craniofacial parameters: head circumference, nasal height, nasal width and nasal index of adult Omoku indigenes of Nigeria. American Journal of Scientific and Industrial Research 2011; 2(1): 54 – 57.
31. Kpela T. Danborno B, Adebisi SS. Nasal anthropometry of adult Tiv and Idoma tribes in Nigeria. Adv Anthropol. 2019; 9:103-110. doi: 10.4236/aa.2019.92008
32. Oladipo, G.S., Olabiyi, A.O., Oremosu A.A. and Noronha, C.C. Nasal indices among major ethnic groups in Southern Nigeria. Scientific Research and Essay 2007; 2 (1): 20 – 22.
33. Oladipo, G. S., Oyakhire, M.O. and Ugboma Henry, A.A. Anthropometric Comparison of Nasal Indices between the Ekpeye and Ikwerre ethnic groups in Nigeria. Asian Journal of Medical Sciences 2010; 2(4): 167 – 169.
34. Yam JYL, Ng ACK. Basics of face masks and respirators - ATOTW 434. 2020; www.wfsahq.org/resources/anaesthesia-tutorial-of-the-week. Accessed December 18, 2022.
35. Bartoszko JJ, Farooqi MAM, Alhazzani W, Loeb M. Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: A systematic review and meta-analysis of randomized trials. Influenza other Respi Viruses. 2020;14:365-73. doi:10.1111/irv.12745
36. Long Y, Hu T, Liu L, Chen R, Guo Q, Yang L, Cheng Y, Huang J, Du L. Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis. J Evid Based Med. 2020:1-9. doi:10.1111/jebm.12381
37. Ipaki B, Merrikhpour Z, Rizi MST, Torkashvand S. A study on usability and design parameters in face mask for COVID-19 protection. Hum Factors Man. 2021;31:664-78. doi:10.1002/hfm.20934.
38. Institute of Medicine, Board on Health Sciences Policy, Committee for the Assessment of the NIOSH head and face anthropometric survey of U.S. respirator users. 2020; National Academis Press.
39. Suen LKP, Guo YP, Ho SSK, Au-Yeung CH, Lam SC. Comparing mask fit and usability of traditional and nanofibre N95 filtering facepiece respirators before and after nursing procedures. J Hosp Infec. 2020;104(3):336-43. doi:10.1016/j.jhin.2019.09.014

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