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Original Research Article

The Inheritance Pattern of Some Human Morphogenetic and Serological Traits among Two Nigerian Ethnic Groups in Akwa-Ibom State

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Abstract

Background: A population is characterized by a set of gene(s) controlling traits and these traits are essential prerequisite for studying genetic diversity in human population. The objectives of this study are to evaluate the distribution, inheritance patterns of morphogenetic, serological traits; and also association of these traits within the two ethnic groups. ***Methods:*** The distribution of morphogenetic, serological traits were studied among the Ibibio and Ananng in Ikono and Oruk Anam respectively using a total of 1200 participants. Thirteen traits were accessed. Standard methodology was used to collect data and analyzed. ***Results:*** The distribution of morphogenetic traits amongst the two populations were 96.67%, 68.83%, 56.08%, 35.58% and 17.50% for right handedness, free earlobe, tongue rollers, bent little fingers and dimpled cheeks respectively. The Ibibio's right handedness, left handedness and ambidextrous were 96.33%, 3.17% and 0.5%; while for the Ananng's were 97.00%, 2.67% and 0.33% respectively. There were significant association between morphogenetic traits (tongue folding and bent little finger) and ethnicity. Also dimples, widow's peak and Rhesus factor were significantly associated with sex. The distribution of serological traits amongst the two populations was 50.67%, 20.17%, 18.33%, 10.83%, 93.17%, 6.83%,74.92%, 24.67% and 0.42% for blood group O, B, A, AB, rhesus positive, rhesus negative, genotype AA, AS and SS respectively. ***Conclusion:*** The frequency of the different morphogenetic and serological phenotypes varied in the two ethnic groups. Dimples, widow's peak and Rhesus factor were significantly associated with sex. This study will serve as base-line information for further studies.

Keywords: Morphological characters, Inheritance patterns, Blood groups, genotypes, Ethnic groups.

INTRODUCTION

Morphogenetic variations occur among living organisms of the same population [1]. Majority of morphogenetic characters are mostly inherited in simple Mendelian pattern as either autosomal dominant or autosomal recessive [1, 2].

Morphogenetic traits are observable genetically inherited traits that can be transmitted from parents to offspring [1-3]. Genetics factors and/or environment factors bring about genetic variations within individuals of the same species; like the Homo sapiens in association with migration, assortment, genetic drift and gene flow [1- 4]. Human genetics deals with the study of inheritance as it occurs in human populations and their relevance in understanding human diversity cannot be diminished [1-6]. The continuous researches in the field of human genetics have made great socio-economic contribution to human welfare [3-6]. The mechanisms underlining genetic control of inheritance of these morphogenetic traits are poorly understood and remain puzzling or unclear.

Genotype is the genetic makeup of an organism. Individual's genotype (either AA or AS or SS) and blood group (A, B, AB and O/ Rhesus factor [Rh+ and Rh-]) differ amidst many morphogenetic traits, but some traits are more commonly expressed in different populations [2, 3, 6-8]. Genotype, blood groups and rhesus (Rh) factor are sometimes known as serological traits [8]. Ethnic variations in serological traits, digito-palmar dermatoglyphics and other

morphometric traits are of immense benefits to evolutional biologist, anthropologist, human geneticist, clinicians, blood transfusion services and policy makers [1-9]. Studies have been documented on the relationship between serological traits and the prevalence of some human diseases like Malaria [9, 10], duodenal ulcer [11, 12], cancer [13], etc. Also, sexual dimorphism and ethnic variations of fingerprints patterns revealed genetic admixture in some populations like northern Sinai tribes [14], Kosovo; between Albanian and Turkish populations [15]. Additionally, close anthropological patterns of morphogenetic traits like digital ridges were similar among indigenous black Zimbabweans, Malawians, and some South Africans [16].

The Ibibio ethnic group is the fourth largest ethnic group in Nigeria and the Ananng ethnic group is close relatives to the Ibibios with respect to origin and language [17]. Numerous researches on the inheritance pattern of morphogenetic and serological traits in Nigeria among different ethnic groups are documented [1-5, 7-8, 18-20], but none in Ibibio and Ananng ethnic groups to the best of our knowledge. Against this backdrop, there is an urgent need for the documentation on the inheritance patterns of some human morphogenetic and serological traits among these two Nigerian ethnic groups (Ibibio and Ananng) in Akwa Ibom State. Therefore, specific objectives are to evaluate the distribution, inheritance patterns of some human morphogenetic, serological traits; and to determine association between these selected traits among the Ibibio and Ananng ethnic groups in Ikono/ Oruk Anam, South-south Nigeria.

MATERIALS AND METHODS

Study design and area

This research was a cross-sectional survey, made up of indigenous individuals within Ediene clan (Ibibio ethnic group); in Ikono Local Government Area and selected communities in Orok Anam Local Government Area (Ananng ethnic group), Akwa Ibom State, and Nigeria. Ikono Local Government Area is bounded on the north by Ini Local Government Area, south by Abak and Uyo Local Government Areas, east by Itu and west by Ikot Ekpene Local Government Area. The Local Government Area has a landmass of 407.16 square kilometers; with a total population of 131,904; comprising 62,403 females and 69,501 males according to the 2006 national census [21]. Oruk Anam have common boundaries with Ukanafun and Abak Local Government Areas in the north, Ikot Abasi in the south, Mkpat Enin in the east and in the west by Ukanafun and Imo river running through the borderline of Rivers State and Abia State. Oruk Anam Local Government Area has a landmass of 512 square kilometers; with a total population of 172,654; comprising 86,239 males and 86,415 females [21].

Ethical considerations

Ethical approval was obtained in accordance with the Helsinki declaration; from the Akwa Ibom State Ministry of Health Research Ethical Review Board, Uyo, Akwa Ibom State, Nigeria before the commencement of this research.

Study population and recruitment of participants

A total of 1200 participants were randomly recruited for this study between the ages of 6 years to 94 years in Ikono and Oruk Anam Local Government Areas (LGAs) of Akwa Ibom State, Nigeria. Six hundred (600) participants were recruited from six selected villages namely Osuk-Ediene, Ikot Oku Ediene, Uyo Afiah Nkan, Uyo Obio, Afiah Ediene and Ikot Ediah; all in Ediene clan, Ikono Local Government Area of Akwa Ibom State, Nigeria. Also 600 participants were recruited from six selected villages namely Ikot Offiong, Ikot Akam, Ikot Atim, Ikot Affangeh, Ibesit Okpokoro and Ikot Essien; all in Orok Anam Local Government Area of Akwa Ibom State. These villages were homogenous populations comprising mainly the indigenous people. The less than 1% non-indigenous people were not selected for this study. Written and informed consent were taken from all participants. They also fulfilled both inclusion and exclusion criteria for the study.

Inclusion criteria and exclusion criteria

Only individuals who are indigenes of Ikono and Oruk-Anam Local Government Areas of Akwa Ibom State were recruited for this study. Individuals from other ethnic groups residing in Ikono and Oruk-Anam Local Government Areas were excluded from the study. Individuals with deformity in their fingers, faces and intentionally craved hair-lining were not allowed to participate in the study. In addition, participants who refused to participate and/or fully cooperate with all guidelines of this study were also excluded.

Questionnaire and determination of simple morphogenetic traits

A simple structured questioner were administered to participants, for collection of social-demographic variable (sex, ethnicity, age, etc) and other relevant information. In recording and observing of some morphogenetic traits, various standard techniques were used [22]. For tongue folding and tongue rolling, each individual was asked to perform the activity, however each person was classified as folder or none-folder and roller or non-roller respectively depending on their ability to either fold or turn up the laterals edges of their tongue. Meanwhile, in the cases of earlobe, dimples, hand clasping, cleft chin, mid-phalangeal hair, bent little fingers, widow's peak and handedness, physical observations were carried out and results recorded accordingly. Observed variations in participants were assigned dominant or recessive according to documented research [2, 22].

Determination of serological traits

Laboratory analysis of blood samples was carried out at the Department of Medical Laboratory Sciences, Faculty of Clinical Sciences, University of Uyo Teaching Hospital, Uyo, Nigeria. Blood grouping, rhesus factors and genotyping were carried out using blood samples collected from each participant through vein puncture. The blood samples were stored temporarily in refrigerated heparanised containers pending laboratory analysis. Blood group and rhesus factors were investigated by following the protocols as documented [3, 8]. The red blood cells were typed for ABO blood group systems and Rh (D) following standard serological techniques. Tests with antisera A (Anti A), antisera B (Anti B) and antisera D (Anti D) were performed by the conventional tile technique as previously reported [3]. Genotyping was performed following the protocols as documented [7]. Cells were washed 2-3 times in a test tube containing normal saline and a drop of the washed cells was placed on a tile. This is followed by the haemolysis of blood on the tile and the placement of genotypes AS and AA controls on a cellulose acetate paper using an applicator stick. After ensuring that the Tris buffer inside the electrophoresis tank covered the electrode, the cellulose acetate paper was then placed in the tank and covered. Electricity was applied; readings were taken after 5-10 minutes and recorded accordingly.

Data collection and statistical analysis

Information was coded using Microsoft Excel Spreadsheet for subsequent statistical analysis. The coded data was analyzed using Statistical Package for Social Sciences (SPSS) version 21.0. Data were compared using simple percentages, Chi-square (χ^2) test and student's t-test. The comparison of the prevalence of the selected trait expressed and gender was determined using student's t-test analysis. Statistical significant was set at 5%.

RESULTS

The distribution and inheritance patterns of morphogenetic traits amongst the two populations revealed that 96.67% have right handedness (dominant trait), while the numerical value for individuals with free earlobe, tongue rollers, bent little fingers and dimpled cheeks were 826 (68.83%), 673 (56.08%), 427 (35.58%) and 210 (17.50%) respectively. The Ibibio's right handedness, left handedness and ambidextrous were 578 (96.33%), 19 (3.17%) and 3 (0.5%); while for the Ananng's were 582 (97.00%), 16 (2.67%) and 2 (0.33%) respectively. The association between the distribution of morphogenetic traits and ethnicity were significant for tongue folding and bent little finger ($P<0.005$), while other morphogenetic traits were not significant statistically among the two ethnic groups (Table 1).

On the other hand, the distribution and inheritance pattern of serological traits amongst the two populations were 607 (50.67%), 242 (20.17%), 220 (18.33%) and 130 (10.83%) for blood group O, B, A and AB respectively; while 1118 (93.17%) and 82 (6.83%) for rhesus positive and rhesus negative respectively. The genotype distribution in both populations were 899 (74.92%), 296 (24.67%) and 5 (0.42%) for AA, AS and SS respectively as displayed on Table 2. Comparatively, there was high proportion of blood group B in females (144 individuals) than in males (128 individuals), and high proportion of blood groups A, AB and O in males than in females. Rhesus positive (727 individuals) and rhesus negative (50 individuals) was predominant in males than females, likewise genotypes AA and AS (583 and 178 individuals respectively) (Table 3).

Association between sex and traits (morphogenetic and serological traits) showed that dimples, widow's peak and rhesus factors were significantly related to sex ($P<0.005$). The study revealed that presence or absence of dimpled cheeks and curve hairline or straight hairline for widow's peak were significantly associated with sex; likewise rhesus factors (Table 3). Earlobe (both attached and free earlobe), dimples (present and absent), hands clasping (left and hands clasping), round or smooth cleft chin, tongue folding (folders and non-folders), absent of mid-phalangeal hair and bent little finger were more predominant in males than females (Table 3).

Table-1: The distribution and inheritance pattern of various morphometric traits in the two populations

Morphogenetic traits	Inheritance pattern in individuals	Ethnicity (%)		Total (N=1200	X^2	P-value
		Ibibio (N=600)	Ananng (N=600)			
Tongue rolling Rollers Non-rollers	 Dominant Recessive	 357 (59.50) 243 (40.50)	 316 (52.67) 284 (47.33)	 673 (56.08) 527 (43.92)	0.674	1.3266
Earlobe Attached Free	 Recessive Dominant	 151 (25.17) 449 (74.83)	 223 (37.17) 377 (62.83)	 374 (31.17) 826 (68.83)	0.543	0.992
Dimples Present Absent	 Dominant Recessive	 109 (18.17) 491 (81.83)	 101 (16.83) 499 (83.17)	 210 (17.50) 990 (82.50)	1.053	3.107
Hands clasping Left hand Right hand	 Dominant Recessive	 139 (23.17) 461 (76.83)	 112 (18.67) 488 (81.33)	 251 (20.92) 949 (79.08)	0.732	0.958
Handedness Right Left Ambidextrous	 Dominant Recessive Not clear	 578 (96.33) 19 (3.17) 3 (0.5)	 582 (97.00) 16 (2.67) 2 (0.33)	 1160 (96.67) 35 (2.92) 5 (0.42)	0.274	0.619
Cleft chin Round/ smooth Cleft or dimple chin	 Recessive Dominant	 414 (69.00) 186 (31.00)	 449 (74.83) 151 (25.17)	 863 (71.92) 337 (28.08)	0.582	1.107
Tongue folding Folders Non-folders	 Dominant Recessive	 69 (11.50) 531 (88.50)	 42 (7.00) 558 (93.00)	 111 (9.25) 1089 (90.75)	2.513	0.007*
Widow's peak Curve hairline Straight hairline	 Dominant Recessive	 207 (34.50) 393 (65.50)	 194 (32.33) 406 (67.67)	 401 (33.42) 799 (66.58)	1.361	2.048
Mid-phalangeal hair Present Absent	 Dominant Recessive	 102 (17.00) 498 (83.00)	 119 (19.83) 481 (80.17)	 221 (18.42) 979 (81.58)	0.714	1.461
little finger Straight Bent	Recessive Dominant	397 (66.17) 203 (33.83)	376 (62.67) 224 (37.33)	773 (64.42) 427 (35.58)	2.507	1.831*

'*' indicate 5% level of significance.

Table-2: The distribution and inheritance pattern of serological traits in the two populations

Serological traits	Inheritance pattern in individuals	Ethnicity (%)		Total (N=1200)	X^2	P-value
		Ibibio (N=600)	Ananng (N=600)			
Blood group **A** **B** **AB** **O**	 Dominant Dominant Dominant Recessive	 109 (18.17) 124 (20.67) 71 (11.83) 296 (49.33)	 111 (18.50) 118 (19.67) 59 (9.83) 312 (52.00)	 220 (18.33) 242 (20.17) 130 (10.83) 608 (50.67)	1.834	2.371
Rhesus factor **Rh (D) +** **Rh (D) −**	 Dominant Recessive	 551 (91.83) 49 (8.17)	 567 (94.50) 33 (5.50)	 1118 (93.17) 82 (6.83)	1.128	2.610
Genotype **AA** **AS** **SS**	 Dominant Dominant Recessive	 453 (75.50) 145 (24,17) 2 (0.33)	 446 (74.33) 151 (25.17) 3 (0.50)	 899 (74.92) 296 (24.67) 5 (0.42)	1.073	1.863

Table-3: Independent association between sex and traits in the two populations

Traits	Phenotypes	Sex		t- test	P-value
		Male	Female		
Tongue rolling	Rollers	292	381		
	Non-rollers	216	311	1.645	2.362
Earlobe	Attached	243	131	1.092	2.243
	Free	518	308		
Dimples	Present	117	93	1.711	3.326*
	Absent	603	387		
Hands clasping	Left hand	146	105	2.265	3.417
	Right hand	558	391		
Handedness	Right	613	547		
	Left	21	14	0.931	1.388
	Ambidextrous	4	1		
Cleft chin	Round or smooth	491	372	0.8575	1.529
	Cleft or dimple chin	147	190		
Tongue folding	Folders	61	50	0.421	0.794
	Non-folders	556	533		
Widow's peak	Curve hairline	139	262	1.047	2.379*
	Straight hairline	256	543		
Mid-phalangeal hair	Present	101	120	0.521	1.071
	Absent	514	465		
little finger	Straight	337	436	0.328	0.875
	Bent	241	186		
Blood group	A	122	98		
	B	128	144		
	AB	86	44	2.185	3.067
	O	402	206		
Rhesus factor	Rh (D) +	727	391	1.631	0.816*
	Rh (D) −	50	32		
Genotype	AA	583	316	1.925	2.867
	AS	178	118		
	SS	2	3		

'*' indicate 5% level of significance.

DISSCUSSION

The occurrence of genetic variations in man are caused by several environmental factors acting in tandem with selection, gene flow, genetic drift and migration [2, 23-25]. The distribution and inheritance patterns of human morphogenetic and serological traits differed across human populations as documented [1-7, 8, 18-25]. This study was directed to investigate the distribution patterns of morphogenetic and serological traits among the Ibibio and Ananng ethnic groups through physical inspection and examinations. The findings of this study on the distribution and inheritance patterns of selected human morphogenetic traits varied among both ethnic groups; with higher proportion of Ibibio's displaying dominant pattern of inheritance for tongue rolling, free earlobe, present of dimples, left hand clasping, tongue folding, dimple chin and curve hairline for widow's peak than the Ananng's. These findings are in tandem with other reports where individuals of different origin and geographical location may expressed some morphogenetic features differently or in a similar fashion due to alleles moving within the ethnic group [2, 26]. In our present results, dominant alleles were predominant than recessive alleles among the Ibibio ethnic group; which is not in harmony with the documented research among the Assamese Sikhs were recessive alleles were more prevalent than dominant alleles [27].

The frequency of tongue rolling in these two ethnic groups revealed that there were more rollers (dominant alleles) than non-rollers (recessive alleles) which collaborates with published findings in Lagos [1], Punjab population of Pakistan [2], Calaber [3], Edo state among eight ethnic groups (Yoruba, Urhobo, Izon, Isoko, Itsekiri, Igbo and Anioma) [5], Ekpomas [7], Binis of Isoko ethnic group [18], Urhobos [28] and Osogbo, South-Western Nigeria [29]. Also, a higher percentage of tongue rollers among the females were observed in this population investigated. This finding agreed with documented study in Punjab, Pakistan [2], Binis of Isoko ethnic group [18] and Urhobos [28] where higher percentage of females are tongue rollers, but does not collaborate with other reports in Lagos [1], Calabar by Kooffreh et al., [3] and

Bayelsa State where more males are tongue rollers than females [30].

Free earlobes were more than attached earlobes among recruited individuals in both ethnic groups as revealed in this study. It is similar to the results previously documented in Nigerian populations [1, 3, 4, 7, 18, 19], Pakistan [2, 31] and Indian populations [22, 27, 32] in which free earlobes were more predominant than attached earlobes. This study also revealed that free earlobes were more prevalent among males than females, disagreeing with different documented studies were more females have free earlobes [2, 3, 27]. There was no significant difference between earlobe attachment and sex; therefore been harmonious with previously documented research [1]. Cheeks dimpled were found to be less prevalent (17.5%) in the studied populations having more males with dimples than females. We may suggest that trait like small face was co-inherited with dimple trait; suppressing the phenotypic expression of dimples in these current studied populations. Also variation in the expression of dimples might be due to penetrance and it is concomitant with the reported study in Ilorin, Nigeria [23]. In Lagos state [1], Pakistan [2], Calabar [3] and among the Isoko ethnic group in Delta State, Nigeria cheeks dimpled were less prevalent in the populations investigated with more males having dimples than females; which are in tandem with our present findings. Higher prevalence of 29.4% [33], 33.5% [23] were documented in South-west Nigerian populations and 37.7% in South-south and South-east Nigeria [34] for dimpled cheeks when compared with this present study in Ikono and Oruk Anam, Akwa Ibom State, Nigeria. Also this study revealed significant associations for dimpled cheeks and widow's peak with respect to sex among the Ibibio and Ananng ethnic groups in Ikono and Oruk Anam respectively. The associations observed in this study might be due to close proximity of genes controlling these morphogenetic traits and similar results have been reported by researches among the heterogeneous population in Lagos state, but with respect to only checks dimples [1]. In contrast, other researches documented associations between sex and other morphogenetic traits, other than checks dimples in Nigerian populations [18, 28] and Quetta, Pakistan [31].

The results from this study showed that right hands clasping were more predominant than left hands clasping and it is similar to documented research in Calabar [3] and Delta state [5]; both in South-south Nigeria with varying frequency. Also in this study, more males exhibited both right hands and left hands clasping. Higher frequency of left hands clasping (55.41%; 466) with more females exhibiting it was reported in North West Bulgaria [36] and in Ilorin, South west Nigeria (53.4%; 1067) [23] which are not in agreement with our findings. Left hand clasping was higher in males than in their females' counterparts as revealed in our results. In contrast, right hand clasping was observed to be more predominant as reported [37], suggesting that hand clasping traits are possibly products of autosomal genes. It is also likely that the observed variations in the distributions and inheritance patterns of these morphogenetic traits might be as a result of selective expression arising from natural selection in the populations and supported by documented research [5].

The result of this study indicated that right handedness was one of the most dominant traits, revealing a clear differentiation between dominant and recessive trait in handedness. Additionally, only 35 individuals (2.92%) out of a total of 1200 individuals are having left handedness. Thus, majority of the people in this study have inherited the dominant gene resulting in right-handedness. This is in-line with the published researches in Jammu and Kashmir [8], Thrissur district [22]; both Indian populations. Globally, approximately more than 85% of individuals are right-handed [38] and agreeing with our present result in Ikono and Oruk Anam, Akwa Ibom State. There are advantages of right-handedness over lift- handedness [24, 38-42]. For instances, left-handedness has been linked to some types of disorders like alcoholism [39], allergies and autoimmune disorders [40], autism [41]. Cuellar-Partida and colleagues have documented on 48 common genetic variants linked with handedness (41 associated with left-handedness and seven to ambidexterity) using genome-wide association studies [24]. Over-representation of left-handers in some neurodevelopmental disorders and neuropsychiatric traits including schizophrenia and bipolar disorder has been reported recently [24]. Therefore, implying that handedness are largely influenced by different genetic mechanisms and polygenic in nature.

The distribution of cleft chin in this study revealed that rounded or smooth chin are more predominant than cleft or dimple chin. It is concomitant with previous documented study in Ilorin among university students [23]. In contrast, the result stated above is not in harmony with the published research in Quetta, Pakistan in which cleft chin were more predominant than rounded chin [42]. Cleft or dimple chin were predominant in females than males in our study and it is in tandem with other studies in Ilorin, Western Nigeria [33] and Pakistan [42], but disagreed with the documented study in Lagos [1]. Low frequency of subjects (9.25%) have ability to fold their tongue in both ethnic groups was observed in our current study in Ikono and Orok Anam areas. This result is similar to the documented study in Quetta Population, Pakistan [42] and Badhiya Muslims of Bihar, India [32]; but disagrees with the documented report in Andhra Pradesh [43]. Also predominant males were tongue folders than females. Tongue folders among Sonowal Kacharis of Assam, India were more of males than

females; [44] which is similar with our current findings in Akwa Ibom State, Nigeria. In contrast, in an India population (Bihar); more female (28.8%) than male (20%) were tongue folders [32] resembling the result of this current study.

The distribution of widow's peak in the two populations studied revealed less frequency of curved hair- line (33.42%) than straight hairline (66.58%). This corroborates the findings documented in Lagos state [1], Esan ethnic groups, Delta state [4], Ekpoma, Edo state [7], Ilorin [23]; all in Nigerian populations and Thrissur District, India [22]. Furthermore, both phenotypes of widow's peak were observed more in females than males and do not corroborates with the reported studies by scientists [4, 45]. The distribution of mid-phalangeal hair in our study revealed that majority of the recruited individuals lack hair on the mid-digit of their fingers which corroborate with findings in various Nigerian ethnic groups like the Yorubas [1, 20] and the Ogba tribe in Rivers State [46], Ghana [47] and Serbians [26]. Contrastingly, mid-phalangeal hair was predominantly found on the fingers of most participants in Calabar, Cross River State [3] and Ilorin, Kwara State [23]. The Efifk ethnic group of Calabar is sometimes hairy in nature and this may have contributed to the mid-phalangeal hair on their fingers. They are close relatives of the Ibibio and Ananng ethnic groups and they inter –marry among themselves; but mid-phalangeal hair were not predominant among the two ethnic groups currently studied. This suggests that mid-phalangeal hair were autosomal recessive in most individuals recruited for this study in the Ibibio and Ananng ethnic groups, Akwa Ibom State. Also the presence or absence of hair on the mid-phalangeal among the Ibibio and Ananng ethnic groups may be due to their nature of work, lifestyle (environmental factors) and are in-line with documented findings [20, 48].

This present research stipulated that bent little finger have a frequency of 37.33%, 64.42% for straight phenotype. Additionally, bent little finger was significantly associated with ethnicity. These results are in harmony with other findings in Lagos State among a heterogeneous ethnic group [1], Igbo ethnic group (homogeneous ethnic group) of Nigeria [19], Ilorin, Western Nigeria [23], Ogba tribes, Rivers States [49]. The distribution of bent little finger between genders revealed that more males were found to have it than females; while more females have straight little fingers than males. This sex distribution of bent little finger corroborate with other researches previously documented [19, 31, 49].

In this current study, the frequency of blood group O was more predominant, followed by B, A and AB in both ethnic groups. These findings are in harmony with documented research in Calabar, South-south Nigeria [3], Gusau, Zamfara State [50] and Kano State [51]; all Nigerian populations. Similar results were also documented in Indian populations namely Purnia District [32] and Karachi [52], but the frequency varies among different blood types depending on the population and ethnic group. Other documented researches observed the distribution of blood group in the order of B >O > A >AB among non-African populations [53-56], and the trend of O >A > B >AB in Ekpoma, Edo State, Nigeria [7], Binis, Isoko ethnic group [25] and Assamese Sikhs [27]. These trends mention above are not concomitant with our current findings in Ikono and Oruk Anam, Akwa Ibom State, South-south Nigeria.

It is noteworthy to highlight the advantages and disadvantages of blood group O in some populations. Previous published research in Punjab, Pakistan has shown that cholera infections are severe for blood group O than blood group B [2]. Studies have revealed that blood group O usually present less sever malaria when compare to group A, B and AB [57, 58]. This suggests that individuals in Ikono and Oruk Anam may have high resistance to malaria; due to evolutionary advantage conferred to them by blood group O phenotypes. It was previously documented that the antigen present on the surface of erythrocytes in blood groups A and B is presumed to act as a receptor to form a rosette structure [57]. Then the lack of oligosaccharide on erythrocytes of blood group O is not suitable for rosette structure infected by Plasmodium falciparum [57] but it is more sensitive to cholera disease. Also, there are reports that peoples with blood group A, B and AB are more susceptible to pancreatic cancer, oral, ovarian, gastric, leukemia, rectal and cervical cancers [59-62]. Thus, the relative decrease in the frequency of blood group A, B and AB hypothesized that the prevalence of these disease conditions in Ikono and Oruk Anam may be low; although our scope of this study did not include it.

The frequency of rhesus positive individual is higher (93.17%) than frequency of rhesus negative people (6.83%) among the two ethnic groups. Similar frequency of 91.78% and 8.22% for rhesus positive and rhesus negative individuals respectively was documented in Western Rajasthan, India [63], 86.03% and 13.97% respectively in Punjab, Pakistan [2]. In Calabar [3], Ekpoma [7], Binis, Isoko ethnic group of South-south Nigeria [25], Purnia district, India [32] and Sialkot district, Pakistan [54] recorded similar results obtained for rhesus factors in this present research. The frequency distribution of various ABO blood phenotype and rhesus factors phenotypes among sex, showed males have the highest proportion of blood group A, O, AB, rhesus positive and rhesus negative while females had greater frequency for blood group B. The result also revealed no statistical significant differences between sex and blood groups, indicating that they were inherited in autosomal pattern with no preference to

gender. This research recorded a high percentage of AA genotype (74.92%), followed by AS with 24.67% and the least was genotype SS (0.42%). These results correspond to the researches carried out in Bayelsa State, South-south Nigeria [30] and Ogbomoso, Western Nigeria [64]. The relevance of blood group typing, rhesus factors and genotyping aids in marriage and disease(s) counseling.

CONCLUSIONS

This cross‑sectional comparative research revealed the distribution and inheritance patterns of 13 traits in two ethnic groups. Dimples, widow's peak and Rhesus factor were significantly associated with sex. These findings will be relevant in many areas like human genetics, forensic science, clinical practice and anthropology. Also it will serve as base-line information for further anthropological and human diversity studies.

Limitations of the study

Molecular approach for determining genetic relationship of morphogenetic and serological traits to human disorders were not carried out in this research; which can be done in further study.

RECOMMENDATIONS

This present study was conducted in only two Local Government Areas in Akwa Ibom State and large scale studies involving several territories inhabited by native Ibibio and Ananng ethnic groups are recommended. Additionally, this research can be used as base-line information for future research since it is the first documented morphogenetic traits in these ethnic groups.

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