

Human sex ratio at birth in South West Nigeria

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BACKGROUND: Human sex ratio at birth differs from one population to the other. This variation has been attributed to cultural practices, seasonal variation, small-family size policy and sex selective technology. Information on secondary sex ratio in Nigeria is limited.

AIMS AND OBJECTIVE: To analyzed human sex ratio at birth for samples of the Nigerian population in 4 urban settings in Southwest Nigeria, in order to know the trend and to compare the findings with those of previous reports.

MATERIALS AND METHODS: Data were collected from Obafemi Awolowo University (OAU) teaching hospital at Ile Ife and Wesley Guild hospital at Ilesa, Osun state; General hospital at Ogbomoso, Oyo state and Ekiti state specialist hospital at Ado-Ekiti, Ekiti state. The data consisted of 35 209 live single births recorded between 1995 and 2004. Each set of data was analyzed to determine the sex ratio by year, month and quarterly values. Chi-square analysis was used to determine the deviation of the sex ratios for the years from the average value.

RESULTS: The annual average ratios of 104.7:100, 102.8:100, 98.9:100 and 100.8:100 were recorded for OAU teaching hospital, Wesley Guild Hospital, General Hospital and Ekiti State specialist hospital, respectively. When pooled together, the average ratio was 102.7:100. This shows some bias for male births. Data also indicates more male birth in the rainy season, suggesting a seasonal variation of sex ratio.

CONCLUSION: These findings are representative of the populations in southwest Nigeria and are comparable to values obtained for other regions in Nigeria and other populations of African origin.

Key words: Birth/human sex ratio/Nigeria

Introduction

In Nigeria there is a strong social emphasis on fertility and a tradition of son preference. Males and females are produced in approximately equal numbers in most species with separate sexes regardless of the mechanism of sex determination.^[1] In humans, female is homogametic (XX) while the male is heterogametic (XY).

The sex ratio of man is expected to be more or less equal because of the 1:1 segregation of X and Y-chromosomes in the male.^[2] In 2004, males accounted for 50.4% of the global total.^[3] In the absence of manipulation, human secondary sex ratio is commonly assumed to be 105-107 male births for every 100 female birth. However, sex ratios at birth or among infants may be considerably skewed by sex-selective abortion and infanticide. Even in the absence of such practices, a range of sex ratios at birth of between 103 to 107 boys per 100 girls has been observed in different societies and among different ethnic and racial groups within a given society, though more extreme ratios documented in some populations should be attributed rather more to cultural preferences than to biological variation in the propensity to bear boys or girls.

Darwin cites a sex ratio of 120 boys to 100 girls for Jewish communities in 19th century Livonia, where infanticide is not historically documented and the means for pre-natal sex determination did not exist.^[1] In the United States, the sex ratios at birth over the period 1970-2002 were 105 for the white non-Hispanic population, 104 for Mexican Americans, 103 for African Americans and Indians and 107 for mothers of Chinese or Filipino ethnicity.^[4] Among European countries, the ratios ranged between 104 in Belgium and 107 in Portugal. In the aggregated results of 56 Demographic and Health Surveys^[5] in African countries, the ratio is 103, though there is also considerable country-to-country variation.^[6] Information on secondary sex ratio in Nigeria is limited. Ayeni^[7] reported a value of 107.85:100 for Ibadan. Effiong *et al.*^[8] noted a sex ratio of 106:100 among 31490 live-born Yoruba children delivered in Ibadan. Boroffice^[9] reported sex ratios of 107:100 for Ibadan and 104:100 for the old Western states in Nigeria. Values

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of 107:100 and 104:100 were obtained from Hausa and Igbo population births, respectively.^[10,11] The most current report of data recorded up to 1995 noted an annual average sex ratio of 108.8:100 and 96:100 for Ibadan and Lagos, respectively.^[2] In order to know the trend of sex ratio in Nigeria, this study was undertaken to determine the secondary sex ratio of single live births in samples of Nigerian population in southwest Nigeria between 1995 and 2004 and compare the findings with those of previous reports.

Materials and Methods

Three states of southwestern Nigeria were considered for this study. The Yoruba's are the major ethnic group in southwest Nigeria. Other ethnic groups such as the Hausa, Nupe and Fulani (from the north) and Ibo, Itshekiri, Efik and Ijaw (from the south-east and south-south) are found in the minority. The data used were collected from the birth records of four different hospitals in urban areas of Osun, Oyo and Ekiti states. It consists of births recorded for a period of 10 years (1995-2004). These hospitals are Wesley Guild hospital at Ilesa, Osun state; Obafemi Awolowo University (OAU) teaching hospital at Ile-Ife, also in Osun state; General hospital at Ogbomoso, Oyo state and Ekiti state specialist hospital at Ado-Ekiti, Ekiti state. Each set of data were analysed by year, month and quarterly values. All the data sets were subsequently pooled together to determine the annual sex ratio in southwestern Nigeria. Secondary sex ratio was determined using the formula $(x/y \times 100): 100$ (where "x" is the number of male births and "y" is the number of female births). Chi-square analysis was used to determine the deviation of the sex ratios for the years from the average value at 0.05 level of significance.

Results

The annual secondary sex ratios of births recorded in Obafemi Awolowo University teaching hospital Ile-Ife, from 1995 to 2004 are presented in Table 1. The average sex ratio for the 10 years pooled together was 104.7:100. The highest sex ratio of 125.0:100 was recorded in 2001 and the lowest sex ratio of 99.8:100 was recorded in 1996. The sex ratio for the years was

Table 1: Annual sex ratio of live births recorded in Obafemi Awolowo University Teaching Hospital Ile Ife, Osun State between 1995 and 2004

Year	Males	Females	Total	Sex ratio
1995	943	915	1858	103.1:100
1996	851	853	1704	99.8:100
1997	851	841	1692	101.2:100
1998	827	828	1655	99.9:100
1999	689	692	1381	99.6:100
2000	739	675	1414	109.5:100
2001	654	523	1177	125.0:100
2002	522	511	1033	102.2:100
2003	731	730	1461	100.1:100
2004	650	554	1204	117.3:100
Total	7457	7122	14579	104.7:100

insignificantly different from the average for the 10 years pooled together ($\chi^2=6.8$, $df=9$). The monthly sex ratio for this hospital over the years considered varied between 98.6:100 and 108.4:100 [Table 2]. The highest monthly sex ratio of 108.4:100 was recorded in September while the lowest sex ratio of 98.6:100 was recorded in October. Table 2 presents the quarterly analysis of the data. The third and last quarters had the highest and the lowest ratios of 106.6:100 and 100.1:100, respectively.

Table 3 shows the annual secondary sex ratios of births recorded in Wesley Guild hospital Ilesa, between 1995 and 2004. Average sex ratio of 102.8:100 was recorded for the

Table 2: Monthly and quarterly sex ratio of live births recorded in Obafemi Awolowo University Teaching Hospital Ile Ife, Osun state between 1995 and 2004

Month	Males	Females	Total	Sex ratio
Jan.	644	611	1255	105.4:100
Feb.	566	546	1111	103.7:100
Mar.	669	638	1307	104.9:100
Apr.	674	647	1321	104.3:100
May	798	756	1554	105.6:100
Jun.	674	634	1308	106.3:100
Jul.	673	641	1314	105.0:100
Aug.	642	603	1245	106.6:100
Sept.	668	617	1285	108.4:100
Oct.	721	732	1453	98.6:100
Nov.	567	558	1125	101.6:100
Dec.	600	597	1197	100.6:100

Quarter	Males	Females	Total	Sex ratio
Jan-Mar.	1879	1795	3674	104.7:100
Apr-Jun.	2146	2036	4182	105.4:100
Jul-Sept.	1983	1860	3843	106.6:100
Oct-Dec.	1888	1886	3774	100.1:100

$\chi^2 = 0.23$, $df = 3$, $P < 0.05$

Table 3: Annual sex ratio of live births recorded in Wesley Guild Hospital Ilesa, Osun state between 1995 and 2004

Year	Males	Females	Total	Sex ratio
1995	533	494	1027	107.9:100
1996	473	495	968	95.6:100
1997	518	548	1066	94.5:100
1998	620	608	1228	102.0:100
1999	456	451	907	101.1:100
2000	477	443	920	107.7:100
2001	401	342	743	117.3:100
2002	298	299	597	99.7:100
2003	424	445	869	95.3:100
2004	356	306	662	116.0:100
Total	4556	4431	8987	102.8:100

ten-year period. The highest sex ratio of 117.3:100 was recorded in 2001 while the lowest sex ratio of 94.5:100 was recorded in 1997. There was no significant deviation of the sex ratios for the 10 years from the average pooled sex ratio ($\chi^2=6.1$, $df=9$). The highest monthly sex ratio was 123:100 recorded in the month of July and the lowest value of 92.7:100 was recorded in May [Table 4]. On quarterly analysis, the third and last quarters of the years recorded the highest and lowest sex ratios of 107.9:100 and 97.7:100 respectively [Table 4].

The annual sex ratios of live births recorded in General Hospital Ogbomoso, for a period of 10 years (1995-2004) are shown in Table 5. The average sex ratio of 98.9:100

Table 4: Monthly and quarterly sex ratio of live births recorded in Wesley Guild Hospital Ilesa, Osun state between 1995 and 2004

Month	Males	Females	Total	Sex ratio
Jan.	377	394	771	95.7:100
Feb.	367	362	729	101.4:100
Mar.	368	383	751	96.2:100
Apr.	438	401	839	109.1:100
May	394	425	819	92.7:100
Jun.	384	399	783	96.2:100
Jul.	426	346	772	123:100
Aug.	407	411	818	99.2:100
Sept.	403	388	791	103.9:100
Oct.	384	343	727	112.0:100
Nov.	308	319	627	96.6:100
Dec.	338	353	691	95.9:100

Quarter	Males	Females	Total	Sex ratio
Jan-Mar.	1112	1138	2250	97.7:100
Apr-Jun.	1215	1224	2439	99.2:100
Jul-Sept.	1235	1145	2380	107.9:100
Oct-Dec.	1030	1014	2044	101.5:100

$\chi^2 = 0.6$, $df = 3$, $P < 0.05$

Table 5: Annual sex ratio of live births recorded in General Hospital Ogbomoso, Oyo state between 1995 and 2004

Year	Males	Females	Total	Sex ratio
1995	254	257	511	98.8:100
1996	241	214	455	112.6:100
1997	226	219	445	103.2:100
1998	160	154	314	103.9:100
1999	160	159	319	100.6:100
2000	187	196	383	95.4:100
2001	175	197	372	88.8:100
2002	241	231	472	104.3:100
2003	254	281	535	90.4:100
2004	339	355	694	95.5:100
Total	2237	2263	4500	98.9:100

was recorded for the years. In 1996 and 2001, the highest and lowest sex ratios of 112.6:100 and 88.8:100 were recorded, respectively. The annual sex ratios for these years did not show a significant difference from their average pooled value ($\chi^2=4.7$, $df=9$). Monthly analysis of the data showed that October had the highest sex ratio of 112.8:100 and the lowest value of 80.0:100 was recorded in July [Table 6]. Table 6 also shows the quarterly analysis. The highest and lowest sex ratios of 103.3:100 and 96.3:100 were recorded in the second and first quarters, respectively.

Table 7 presents the annual sex ratios of live births recorded in Ekiti state specialist hospital Ado-Ekiti,

Table 6: Monthly and quarterly sex ratio of live births recorded in General Hospital Ogbomoso, Oyo state between 1995 and 2004

Month	Males	Females	Total	Sex ratio
Jan.	209	207	416	101.0:100
Feb.	211	198	409	106.6:100
Mar.	204	243	447	84.0:100
Apr.	247	208	455	118.8:100
May	231	220	451	105.0:100
Jun.	208	236	444	88.1:100
Jul.	176	220	396	80.0:100
Aug.	212	231	443	91.8:100
Sept.	218	225	443	96.9:100
Oct.	274	243	517	112.8:100
Nov.	259	265	524	97.7:100
Dec.	226	247	473	91.5:100

Quarter	Males	Females	Total	Sex ratio
Jan.-Mar.	624	648	1272	96.3:100
Apr.-Jun.	686	664	1350	103.3:100
Jul.-Sept.	606	676	1282	89.6:100
Oct.-Dec.	759	755	1514	100.5:100

$\chi^2 = 1.1$, $df = 3$, $P < 0.05$

Table 7: Annual sex ratio of live births recorded in state specialist Hospital Ado-Ekiti, Ekiti state between 1995 and 2004

Year	Males	Females	Total	Sex ratio
1995	235	260	495	90.4:100
1996	236	240	476	98.3:100
1997	297	219	516	135.6:100
1998	228	252	480	90.5:100
1999	306	293	599	104.9:100
2000	378	332	710	113.9:100
2001	360	356	716	101.1:100
2002	491	486	977	101.0:100
2003	507	561	1068	90.4:100
2004	548	558	1106	98.2:100
Total	3586	3557	7143	100.8:100

for a period of ten years (1995-2004). The average sex ratio of 100.8:100 was recorded for the period of years covered. The highest sex ratio of 113.9:100 was recorded in the year 2000 while the lowest value of 90.4:100 was recorded in both 1995 and 2003. There was significant deviation of yearly sex ratios from the average pooled sex ratio ($\chi^2=17.2$, $df=9$). For the monthly sex ratios, the highest sex ratio of 123.0:100 was recorded in November and the lowest value of 81.7:100 was recorded in October [Table 8]. Quarterly analysis of sex ratios showed that the second and last quarters of the years had the highest and lowest

Table 8: Monthly and Quarterly sex ratio of live births recorded in Ekiti state specialist Hospital Ado Ekiti, Ekiti state between 1995 and 2004

Month	Males	Females	Total	Sex ratio
Jan.	266	268	534	99.3:100
Feb.	236	236	472	100:100
Mar.	304	309	613	98.4:100
Apr.	373	302	575	90.4:100
May.	319	277	596	115.2:100
Jun.	360	317	677	113.6:100
Jul.	235	227	462	103.5:100
Aug.	300	275	575	109.1:100
Sept.	338	362	700	93.4:100
Oct.	331	405	736	81.7:100
Nov.	331	269	600	123.0:100
Dec.	293	310	603	94.5:100

Quarter	Males	Females	Total	Sex ratio
Jan.-Mar.	806	813	1619	99.1:100
Apr.-Jun.	952	896	1848	106.3:100
Jul.-Sept.	873	864	1737	101.0:100
Oct.-Dec.	955	984	1939	97.1:100

$\chi^2 = 0.5$, $df = 3$, $P < 0.05$

sex ratios of 106.3:100 and 97.1:100, respectively [Table 8].

Table 9 presents the annual sex ratio for the four sets of data pooled together. The average sex ratio for the studied period was 102.7:100. The sex ratio for the years deviated insignificantly from the average for the 10 years pooled together ($\chi^2 = 0.70$, $df = 3$). The data also shows that there were more males than females.

Discussion

Secondary sex ratios of live births in samples of Nigerian population in Oyo, Osun and Ekiti states of southwestern Nigeria were studied. Overall, 35209 live births were recorded from 1 January 1995 to 31 December 2004. The average secondary sex ratio, for the 10 years pooled together was 104.7:100 for OAU teaching hospital, Ile-Ife, 102.8:100 for Wesley Guild hospital Ilesa, 98.9:100 for General hospital Ogbomoso and 100.8:100 for Ekiti state specialist hospital Ado-Ekiti. The values for OAU teaching hospital and Wesley Guild hospital are within the range of 101.1:100 and 107:100 reported for several other black populations and the average values for the four hospitals did not show significant deviation ($\chi^2=0.70$, $df = 3$) from the average of 105.5:100 for all races of the world.^[1,3,12-14] Considering these findings and other available data from south west Nigeria,^[2,7-9] Northern Nigeria^[10] and Eastern Nigeria,^[11] it would appear that in Nigeria human sex ratio at birth is 98-107 male births for every 100 female births. This range is in concert with data obtained from the natural population of Nigeria (105.0:100) in the 2006 population

Table 9: Annual sex ratio of live births recorded in Southwest Nigeria (Oyo, Osun and Ekiti States) between 1995 and 2004

Name of Hospital	Males	Females	Total	Sex ratio
OAU teaching Hospital Ile				
Ife, Osun state	7457	7122	14579	104.7:100
Wesley Guild Hospital				
Ilesa, Osun state	4556	4431	8987	102.8:100
General Hospital				
Ogbomoso, Oyo state	2237	2263	4500	98.9:100
Ekiti state Specialist				
hospital Ado-Ekiti,				
Ekiti state	3586	3557	7143	100.8:100
Total	17836	17373	35209	102.7:100

OAU - Obafemi Awolowo University

census.^[15] It is also within the range of values reported for populations of African origin.^[4-6]

Earlier reports on secondary sex ratio in different populations of the world seem to readily agree that the number of males at birth has exceeded the number of females.^[2] This is observed in the secondary sex ratio reported for Korea by Russel^[13] that was put at 112.1:100 while reports for Whites varied between 104:100 and 106:100. The secondary sex ratio for the United state black population was put at 102.6:100 and the predominantly black populations of several West Indian Island were reported to have as few as 101.1:100 for Cuban Negroes^[16] and 103.1:100 for Guyanese of African Origin^[17] and 103:100 for Jamaican Negroes.^[18] From these observations, it could be said that secondary sex ratio is less male biased among black populations. This has consequently often led to the suggestion that secondary sex ratio might vary with race.^[16]

In Nigeria, the secondary sex ratio of two population samples for Ibadan and Old Western states^[9] and those of Hausa infants^[10] showed some bias for male births, while data obtained by Mosuro^[2] for Ibadan and Lagos showed preference for female births. In this study, only the average secondary sex ratio from General hospital Ogbomoso showed bias for female births, but data from the other hospitals showed that more males were born than females during the studied period. When pooled together, the results produced an average value of 102.7:100, which shows a little bias for males than females [Table 9]. This is consistent with the pooled average value of 102.3:100 obtained from the natural population in the states considered in this study. There are 3,423, 536 (1,740,619 males and 1,682,917 females), 5,591,589 (2,809,810 males and 2,781,749 females) and 2,384,212 (1,212, 609 males and 1,171,603 females) Nigerians in Osun, Oyo and Ekiti states respectively. The total provisional population of Nigeria is 140,003,542 comprising of 71,709,859 males and 68,293,683 females. These shows slight preponderance of males over females.^[15] The reason for this is not fully understood but certain factors such as genetic, family size, parental age, parental occupation, birth order, race, coital rate, hormonal treatments, exposure to environmental toxins, stress, war, several diseases, maternal weight and probably maternal metabolism^[3,19,20] are believed to influence sex ratio at birth.

For example, there was an increase in the proportion of males from 1751 to 1920 in Finland that was attributed to the effect of World War I and World War II.^[21] Also, higher incidence of Hepatitis B virus in populations is believed to increase the sex ratio while some unexplained environmental health hazards are thought to have the opposite effect.^[22] Sex-selective technology, infanticide and small-family policy are however, thought to significantly skew the naturally occurring ratio in some populations.^[1,3] These practices are based on a strong cultural preference for males over the females in some populations. In this context, it should be stated that traditionally, Nigerians favour the birth of males than females. There is a lot of joy whenever there is birth of a male child. Male birth is seen as a precious gift to treasure, give happiness and pleasure. Females are seen as belonging to other families because they may eventually get married and leave their parents home. Culturally, it is believed that father of female child only is 'weak or lazy' and this may mean the end of his generation as there is no male child to ensure continuity of the name and other attributes of the family in the future. Unusual sex ratios at birth for human societies may also be attributed to incomplete or inaccurate reporting or recording of the births or the survival of infants. In Nigeria, not all records of births are available in hospitals or birth registries as births occurring at home and births of unwanted or abandoned infants go unrecorded. Only 37.3% of births in Nigeria take place within health facilities.^[23,24]

Analysis of the monthly sex ratio for the sample period did not show a regular pattern of variation. The ratio at OAU teaching hospital showed the highest and lowest monthly sex ratio occurring in September and October, respectively, Wesley Guild hospital had highest and lowest secondary sex ratios in July and May while for the General hospital and Ekiti state specialist hospital, highest sex ratios were recorded in the months of October and November, while the lowest sex ratio were recorded in July and October, respectively. The quarterly analysis of secondary sex ratios from the hospitals sampled showed that more males were born in either second or third quarters; however, no specific pattern of variation exists for the lowest sex ratio. This is in concert with previous reports from Ibadan and Lagos in southwest Nigeria.^[2]

Even though quarterly analysis shows that there were more males to females born in either second or third quarter of the year, which coincides with the rainy season in the southwestern part of Nigeria, chi square analysis did not show any significant differences between the observed and expected ratios. Thus the quarterly ratio did not represent any significant variation. Reports on the effect of seasons on human sex ratio are however, conflicting.^[2,9,25-29]

Our observations are representative of the population in southwest Nigeria and corroborates the suggestion of Ayeni^[7] that the sex ratio at birth in African population may vary from area to area. There is need for further studies on the effect of genetic, hormonal, environmental and social factors on sex ratios of the Nigerian population.

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