

Baby's gender, maternal age and parity: Any relationship? A study in a tertiary institution in southern Nigeria

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Abstract

Background: Human sex ratio which is the ratio of males to females in a population has been linked to a lot of factors including maternal and paternal age and job type, parity, and environmental factors. We investigated the sex ratio and relationship between maternal age and parity and the sex ratio at Rivers State University Teaching Hospital (RSUTH), Port Harcourt.

Methods: This is a retrospective study of pregnant women who delivered by caesarean section at the RSUTH from 1st January, 2018 to 31st December, 2018. Their information was retrieved from the labour ward and theatre records and reviewed. Data was extracted, coded and analyzed using the statistical package for social sciences (SPSS) IBM version 25.0 (Armonk, NY).

Results: Two thousand, two hundred and ninety-four (2294) women delivered in 2018. Of this, one thousand one hundred and eighty-two (1182) women had caesarean section (CS) giving a CS rate of 52%. Male born were 1258 (54.8%) and female born were 1036 (45.2%) giving a sex ratio of 1.2. The CS babies were 1240; 698 (56.3%) males and 542 (43.7%) females giving a CS sex ratio of 1.29. The mean age of the women who had CS was 32 years \pm 4.79, age range was 15-45 years and modal age group and parity were 30-34 years and 2-4 respectively. P value for maternal parity and sex ratio was not significant but significant for sex ratio and maternal age for higher other deliveries

Conclusion: The overall sex ratio was 1.2. There was a significant relationship between sex ratio and maternal age for higher other deliveries.

Keywords: Sex ratio; Gender; CS; Maternal age; Parity.

1. Introduction

A lot of women today are waiting until later in life to have children. This is largely explained by more women acquiring higher level of education before getting married and having children. [1-3] In United States of America (USA), birth rates for women in their thirties are at the highest levels in three decades. In humans, the sex ratio at birth is slightly biased towards the male sex. It is estimated to be 1.05 or 1.06 or within a narrow range from 1.03-1.06. [4] In most developed countries, about 105 boys are born for every 100 girls, giving a ratio of 1.05 known as secondary sex ratio. The primary sex ratio is the ratio of males to females at conception. The overall secondary sex ratio (sex ratio) had been declining in the US, Canada and several European countries since 1950s and 1960s. [5] In US, the ratio is declining for whites but increasing in African-Americans and other races. [5]

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The chance of having a boy appears to decrease with increasing maternal age, father's age and the number of children in the family.[6] Almond and Edlung in 2007 studied the effect of maternal age on the sex of the offspring and found that younger women are more likely than older ones to give birth to sons. They also discovered that more educated females have more sons. [7] It has been hypothesized that sex of a baby depends not only on X and Y spermatozoa but the length of follicular phase of menstrual cycle, day of intercourse and coital frequency have been suspected to be involved. [1,8] It was speculated that during late follicular phase, the cervical mucus was less selective to the highly motile but less resilient Y spermatozoa. [1] There are also environmental factors affecting the average sex ratio. The environmental factors like improved prenatal and obstetrical care during the first part of the 20th century are mainly responsible for an increased secondary sex ratio over this period in many countries. Exposure to chemicals like 1,2 -dibromo-3-chloropropane (DBCP) used to kill worms in agriculture, polychlorinated biphenyls, mercury and use of clomiphene citrate have been shown to have effects on sex ratio.

The male fetus is more likely to abort than the female fetus, hence with more pregnancies reaching term, proportionally more males are born. [6,9,10] A study done in 2008 in UK suggests that a baby's sex is linked to the mother's diet around the time of conception and may explain why fewer boys were born by whites in industrialized world. [11] It was discovered that there was a strong link between high energy diet consumption around time of conception and giving birth to sons. The results showed that 56% of the women in the highest energy intake group had sons compared with only 45% of the women in the lowest energy intake group. [11]

In this study we therefore investigated women's age and parity as factors which could affect the sex ratio at birth. This is the first of its kind in this part of Nigeria.

2. Materials and methods

This is a retrospective study conducted at the Rivers State University Teaching Hospital (RSUTH), Port Harcourt. Rivers State, Nigeria. It is a teaching hospital located in the southern part of Nigeria, dominated by Christians. The hospital serves as a referral hospital for the primary and secondary health facilities in the State and other neighbouring States in the southern regions of Nigeria. There is an average annual delivery of over 2000 in the department of Obstetrics and Gynaecology. The study period was from 1st January 2018 to 31st December 2018. A total of 1182 caesarean sections were done in 2018.

Data collection was done using the theatre records and documented in a structured proforma. The theatre records include the gender of the babies, singleton or multiple births, name, age, gestational age, indication for surgery, names of surgeons and anaesthetists, type of anaesthesia, final diagnosis, time in and time out, outcome of the CS and parity of the mothers. For the sake of the study, information obtained from theatre records were age and parity of the women who had CS during the study period, the number of babies delivered, their gender and if singleton or multiple deliveries. Data collected was entered into an Excel sheet analyzed using IBM SPSS version 25.0. The data were presented as tables and figures. Categorical measurements were given as numbers and percentages, and numerical measurements as mean and standard deviation. Comparative analysis was done with Chi square test at a 95% confidence interval and p-value <0.05 was statistically significant.

3. Results

Two thousand, two hundred and ninety-four (2294) women delivered in 2018. Of this, one thousand one hundred and eighty-two (1182) women had caesarean section (CS) giving a CS rate of 52%. Male born were 1258 (54.8%) and female born were 1036 (45.2%) giving a sex ratio of 1.2. The CS babies were 1240; 698 (56.3%) males and 542 (43.7%) females giving a CS sex ratio of 1.29 which is similar to the overall sex ratio for the year of study. This is shown in figure 1. The mean age of the women who had CS was 32 years \pm 4.79, age range was 15-45 years and modal age group and parity were 30-34 years and 2-4 respectively. This is shown in table 1. The number of male babies is greater than the female babies throughout the maternal age groups. The same applies to their parity with males dominating the female number across the parity. Parity did not affect the male-female sex ratio in this study. The sex ratio did not change significantly with increasing maternal age and parity for single deliveries but significant for sex ratio and maternal age for higher order deliveries specifically within age group of 35-39 years with sex ratio of 7.0 (p value: 0.01). This was done using post hoc analysis of the individual groups to determine where the actual significance lies. This is shown in tables 2 and 3.

For singleton CS deliveries, the males were six hundred and thirty-three (55.9%) while the females were five hundred (44.1%) giving a sex ratio of 1.26. For 49 multiple CS deliveries resulting in 107 babies, males were 65 (60.7%) and

females were 42 (39.3%) giving a sex ratio of 1.5. Of the multiple deliveries, twins were forty-three (43) while triplets and quadruplets were three (3) respectively. This is shown in figure 2. Sex ratio for twin deliveries in this study is 1.3.

The number of male babies increased with maternal age and dropped from age 35 years upwards with a marked decrease from age 40 and above. This is also applicable to the number of female babies but the difference in sex ratio is not statistically significant. For parity, the number of males and females increased with increase in parity although with a male preponderance. This number drastically reduced from para 5. The highest number of multiple deliveries occurred at para 2-4 indicating multiparity associating with increase in multiple gestations. These are shown in tables 4 and 5.

Table 1 Socio-demographics of the mothers and their babies (N=1182)

Sex	
Females	500(42.3%)
Males	633(53.6%)
Multiple	49(4.1%)
Types	
Singleton	1133(95.9%)
Twin	43(3.6%)
Higher multiple	6(0.5%)
Age Groups	
<20	10(0.8%)
20-24	60(5.1%)
25-29	270(22.8%)
30-34	463(39.2%)
35-39	314(26.6%)
40-44	64(5.4%)
45-49	1(0.1%)
Parity	
0	316(26.7%)
1	419(35.4%)
2-4	426(36.0%)
5+	21(1.8%)
Sexes in Details	
F	500 (42.3%)
M	633(53.6%)
Twins	
FF	6(0.5%)
FM	8(0.6%)
MF	17(1.4%)
MM	12(1%)
Higher multiples	

FFF	1(0.1%)
MFF	1(0.1%)
MMM	1(0.1%)
MMMM	3(0.3%)

F=Females; M=Males

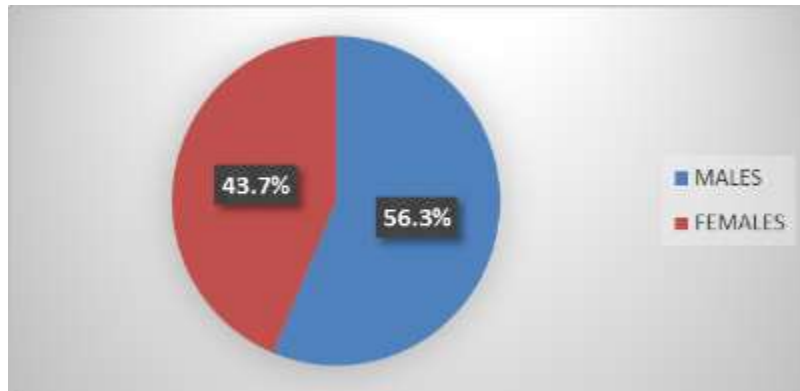


Figure 1 Proportion of Caesarean section babies (N=1240)

Table 2 Sex ratios of all the deliveries

Age	Male (n=698)	Female (n=542)	SEX ratio (M/F) 1.29	Stat test	Pvalue
<20	6(60.0%)	4(40.0%)	1.50	X2=8.03	0.24
20-24	36(56.3%)	28(43.8%)	1.29	Df=6	
25-29	146(51.8%)	136(48.2%)	1.07		
30-34	264(54.5%)	220(45.5%)	1.20		
35-39	204(61.3%)	129(38.7%)	1.58		
40-44	41(62.1%)	25(37.9%)	1.64		
45-49	1(100.0%)	0(0.0%)			
Parity					
0	189(56.6%)	145(43.4%)	1.30	X2=2.00	0.58
1	259(58.2%)	186(41.8%)	1.39	Df=3	
2-4	237(53.9%)	203(46.1%)	1.17		
5+	13(61.9%)	8(38.1%)	1.63		

Table 3 Sex ratios of multiple deliveries

Multiple Deliveries	Male (n=65)	Female (n=42)	SEX ratio (M/F) 1.55		P values	Post Hoc P values
20-24	7(87.5%)	1(12.5%)	7.00	Fischer exact 21.15	<0.01	0.63
25-29	10(43.5%)	13(56.5%)	0.77	Df=4		0.46
30-34	20(48.8%)	21(51.2%)	0.95			0.41
35-39	28(87.5%)	4(12.5%)	7.00			0.01
40-44	0(0.0%)	3(100.0%)				0.30
Parity						
0	18(56.3%)	14(43.8%)	1.29	X2=0.80	0.69	
1	32(65.3%)	17(34.7%)	1.88	Df=2		
2-4	15(57.7%)	11(42.3%)	1.36			

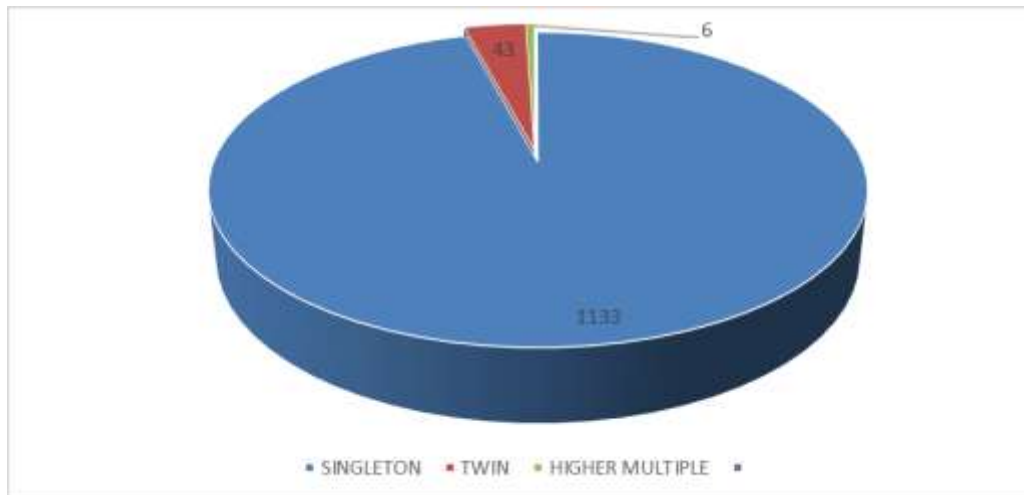


Figure 2 Proportion of the deliveries.

Table 4 Sex ratio analysis for singleton births (N=1133)

Age	Male (n=633)	Female n= 500	Sex ratio	Statistical test	P value
<20	6(60.0%)	4(40.0%)	1.5	X2= 5.53 Df=6	0.49
20-24	29(51.8%)	27(48.2%)	1.1		
25-29	136(52.5%)	123(47.5%)	1.1		
30-34	244(55.1%)	199(44.9%)	1.2		
35-39	176(58.5%)	125(41.5%)	1.4		
40-44	41(65.1%)	22(34.9%)	1.9		
45-49	1(100.0%)	0(0.0%)			
Mean ± SD	32.30±4.86	31.81±4.71		T= 1.75 df =1131	0.081

Parity					
0	171(56.6%)	131(43.4%)	1.3	X ² = 1.57 Df=3	0.67
1	227(57.3%)	169(42.7%)	1.3		
2-4	222(53.6%)	192(46.4%)	1.2		
5+	13(61.9%)	8(38.1%)	1.6		

Table 5 Singleton births versus multiple births (N=1182)

Age	Single (n=1133)	Multiple (n=49)	Statistical test	P value
<20	10(100.0%)	0(0.0%)	X ² = 2.55 Df=6	0.86
20-24	56(93.3%)	4(6.7%)		
25-29	259(95.9%)	11(4.1%)		
30-34	443(95.7%)	20(4.3%)		
35-39	301(95.9%)	13(4.1%)		
40-44	63(98.4%)	1(1.6%)		
45-49	1(100.0%)	0(0.0%)		
Mean ± SD	32.08 ±4.80	31.27±4.66	T=1.17 Df=1180	0.24
Parity				
0	302(95.6%)	14(4.4%)	X ² = 4.77 Df=3	0.19
1	396(94.5%)	23(5.5%)		
2-4	414(97.2%)	12(2.8%)		
5+	21(100.0%)	0(0.0%)		

4. Discussion

The caesarean section rate during the study period was 52%. This is very high compared to today's global rate of 21% increasing from 7% in 1990; average ranging from 5% in sub-Sahara Africa to 42.8% in Latin America and the Carribean. [12] The ideal acceptance caesarean section rate is around 10-15% according to World Health Organization (WHO). Our very high increased caesarean section rate could be because not all the caesarean sections are done for medical reasons like on maternal request. Also, our women are getting more knowledge and awareness of the usefulness of this procedure. There is also increase rate of litigation in Obstetrics. Lastly, caesarean section expertise is also on the increase. [13]

The overall sex ratio during the study period was 1.2 and the sex ratio following caesarean deliveries for the study year was 1.29. These values are more than 1.05 seen in the study by Ein-Mor et al [1] In their study like ours, the sex ratio did not change significantly with increasing maternal age and parity in singleton deliveries. This result was also seen in another similar study. [9] Parity in this study did not affect the sex ratio like in other studies. [1,9] The change in sex ratio was significant for maternal age for higher order deliveries specifically within age group of 35-39 years with sex ratio of 7.0 (p value: 0.01) The overall sex ratio in this study is also higher than in North America and European countries where the proportion of males is on the decline. [6,14] In the United States, the sex ratio over the period 1970-2002 were 1.05 for the white non-Hispanic population, 1.04 for Mexican Americans, 1.03 for African Americans and Indians, and 1.07 for mothers of Chinese or Filipino ethnicity. [15] An analysis study in 2015 showed sex ratio of 50.2%. Also, a

dataset of 139,704 embryos derived from assisted reproductive technology (ART) showed a male sex ratio of 50.2%. [16] In our study, although the percentage of twin deliveries was small (3.6%), the sex ratio for twin gestations was 1.3 which is higher than 1.1 recorded in a similar study. [17]

The commonly reported value of secondary sex ratio is between 105 and 107, indicating an excess of male babies as seen in this study. [17,18] In recent studies [17-20], males usually exceed females at birth as seen in our study but subsequently experience different mortality rates. Countries with significant imbalance tend to have 3 characteristics: rapid decline in fertility either because of preference for smaller families or to comply with their nations population control measures like in China and India. Social pressure for women to give birth to sons which is often due to cultural preference for male heirs as seen in Africa. Also, families have widespread access to technology of sex selection and selectively abort female fetuses. All these may have played a key factor in the increase of sex ratio seen in our study.

The number of male babies in this study is greater than the female number throughout the maternal age. This also applies with increasing parity where the male babies were being delivered more than female babies. When subjected to statistical analysis, there was no significant difference in the number of males and females delivered by caesarean section. Rapaport et al [21] observed that mothers ≤ 22 years, tend to deliver more girls than boys. This is contrary to our own observation in this study. The likelihood of having a son increased for middle aged women, with the highest probably occurring at around 31.3 years like in our study. However, for the oldest women in the age group, the probability of having a son is reduced again. Majority 1,047 (88.6%) of the women in the study were in the age group of 25-39 years and they had the highest number of babies, 1,099 (88.6%). This is not surprising as this represents the reproductive age group which has been extended to late thirties because of delay in childbearing caused by education of the girl child in Nigeria. [22] In a study by Nieczuja-Dwojicka J et al [17], a decrease in the sex ratio was observed for mothers second delivery while an increase was observed for the third and subsequent deliveries. This finding is the reverse of what we observed in our study.

5. Conclusion

The caesarean section rate is high and sex ratio following caesarean deliveries was 1.29. Most deliveries occurred within the age group 25-39 years and it is the same age group that had most number of babies. There was a significant relationship between sex ratio and maternal age for higher other deliveries. There was no significant relationship between the sex ratio and maternal age and parity for singleton deliveries.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

This is from hospital's ethical committee.

Statement of informed consent

This is a retrospective study

Limitations

The study is a retrospective one. The study was conducted on a small group of 1182 births in one year.

References

- [1] Ein-Mor E, Mankuta D, Hochner-Celnikier D, Hurwitz A, and Haimov-Kochman R. Sex ratio is remarkably constant. *Fertility and Sterility*. 2010; 93(6):1961-1965.

- [2] Rueness J, Vatten L, Eskill A. The human sex ratio: effects of maternal age. *Human Reproduction*. 2012; 27 (1): 283-287.
- [3] Nonye-Enyidah E and Ejikem ME. Profile of intrauterine contraceptive device (IUCD) acceptors at the Rivers State University Teaching Hospital, southern Nigeria. *World Journal of Advanced Research and Reviews*. 2019; 4(2): 96-101.
- [4] Chao, Fengqing, Gerland, Patrick; Cook, Alex R.; Alkema, Leontine. "Systematic assessment of the sex ratio at birth for all countries and estimation of national imbalances and regional reference levels". *Proceedings of the National Academy of Sciences*. 2019; 116 (19): 9303–9311.
- [5] Grech V. Evidence of socio-economic stress and female foetocide in racial disparities in the gender ratio at birth in the United States (1995-2014). *Early Hum. Dev.* 2017; 106-107: 63-65.
- [6] Moller H. Changes in male: female ratio among newborn infants in Denmark. *Lancet* 1996; 348:828–9.
- [7] Almond D, Edlund L: Trivers-Willard at birth and one year: evidence from US natality data 1983-2001. *Proceedings of the Royal Society, London B* 2007; 274:5.
- [8] Fellman J. Historical outlook on the study of secondary sex ratio. *JP Journal of Biostatistics*. 2019; 16 (1): 17-38.
- [9] Ruckstuhl KE, Colijn GP, Amiot V and Vinish E. Mother's occupation and sex ratio at birth. *BMC Public Health*. 2010; 10: 269: 1-11.
- [10] Pongou R. "Why Is Infant Mortality Higher in Boys Than in Girls? A New Hypothesis Based on Preconception Environment and Evidence from a Large Sample of Twins". *Demography*. 2012; 50 (2): 421–444.
- [11] Mathews F, Jonson PJ, Neil A. You are what your mother eats: evidence for maternal preconception diet influencing foetal sex in humans. *Proc. Biol. Sci.* 2008; 275 (1643): 1661-1668.
- [12] Betran AP, Ye J, Moller AB, Souza JP, Zhang J. Trends and projectors of caesarean section rates: global and regional estimates. *BMJ Global Health*, 2021; 6 (6): e005671.
- [13] Angolile CW, Max BL, Mushemba J, Mashauri H. Global increased caesarean section rates and public health implications: A call to action. *Health Science Reports*. 2023; 6(5): e1278.
- [14] Van der Pal-de Bruin KM, Verloove-Vanhorick SP, Rosefelt N. Changes in male:female ratio among new born babies in Netherlands. *Lancet*. 1997; 349:62.
- [15] Mathews TJ, Hamilton BE. "Trend Analysis of the Sex Ratio at Birth in the United States". *National Vital Statistics Reports*. 2005; 53 (20): 1–17. PMID 15974501.
- [16] Orzack, SH, Stubblefield JW, Akmaev VR.; Colls P, Munné S, Scholl T, Steinsaltz D, Zuckerman JE. "The human sex ratio from conception to birth". *Proceedings of the National Academy of Sciences*. 2015; 112 (16): E2102-11.
- [17] Nieczuja-Dwojacka J, Marchewka-Dlugonska J, Budnik A et al. Factors influencing sex ratio at birth in Krosno, Poland. *Scientific Reports*. 2024; 14 (98): 1-11.
- [18] Garenne M. Sex-ratio at birth in Nigeria: A demographic perspective. *African Journal of Reproductive Health*. 2022; 26 (4): 92-97.
- [19] Javed R, Mughal M. Changing patterns of son preference and fertility in Pakistan. *J. Int. Dev.* 2022; 34 (6): 1086-1109.
- [20] Portner CC. Birth spacing and fertility in the presence of son preference and sex-selective abortions: India's experience over four decades. *Demography*. 2022; 59 (1): 61-88.
- [21] Rapaport T, Villasenor FA, Altman RM, Nepomnaschy PA. Sex ratio and maternal age in a natural fertility, subsistence population: Daughters, sons, daughters. *Am. J. Phys. Anthropol.* 2019; 169 (2): 368-376.
- [22] Nonye-Enyidah Esther Ijeoma and Enyidah Nonyenim Solomon. Progesterone Only Injectable Contraceptives: A Five-Year Review of Side Effects and Discontinuation Rate in a Teaching Hospital in Niger Delta, Nigeria. *Asian Journal of Medicine and Health*. 2020; 18(10): 110-117.