ORIGINAL ARTICLE
pISSN 0976 3325 | eISSN 2229 6816
Open Access Article
www.njcmindia.org

Sex Ratio at Birth and its Determinants: A Cross Sectional Hospital Based Study

Purnima Upreti[1], Rajesh Kumar Singh[2]

Financial Support: None declared
Conflict of Interest: None declared

How to cite this article:
Upreti P, Singh RK. Sex Ratio at Birth and its Determinants: A Cross Sectional Hospital Based Study. Natl J Community Med 2017; 8(5):272-276.

Author's Affiliation:
[1]Assistant Professor, Dept of Obstetrics and Gynaecology; [2]Associate Professor, Dept of Community Medicine, Govt Medical College, Haldwani.

Correspondence
Dr PurnimaUpreti
purnima_upreti@yahoo.com

Date of Submission: 21-04-17
Date of Acceptance: 11-05-17
Date of Publication: 31-05-17

ABSTRACT

Introduction: Sex ratio is used to reflect gender equity of the population. Sex ratio in India has shown an upward trend since Census 1991 but during the same period, child sex ratio (0-6 years) has shown a declining trend. Sex ratio at birth affects child sex ratio. This study was planned to determine the sex ratio at birth among deliveries conducted in a government tertiary care hospital of Kumaon region of Uttarakhand.

Materials and Methods: A cross-sectional hospital based study conducted in tertiary care centre of Nainital district. Partcipants were selected using systematic random sampling. A pre-tested and pre-structured questionnaire was used to collect information. Data analysed using SPSS version 17 and is presented as numbers, percentages and ratios.

Results: Sex ratio at birth was 852 girls to 1000 boys. The highest sex ratio of 1059 was found among the first birth order offsprings which declined to 897,654 and 619 as the birth order increased to second, third and fourth respectively. Sex ratio at birth in rural population was higher (953) than in urban (752). Sex ratio at birth among literate mothers was 857 and in illiterate mothers it was 829.

Conclusion: Sex ratio at birth increased with advancing maternal age and literacy status of females whereas it decreased with increase in birth order and number of live females in the families.

Keywords: sex ratio, sex ratio at birth, birth order

INTRODUCTION

Sex ratio is used to determine gender equity of the population.In India, sex ratio is defined as the number of females per 1000 males in the population [1]. Sex ratio in India has shown an upward trend since Census 1991 from 927 in 1991, 933 in 2001 and 940 in 2011. But during the same period, child sex ratio (0-6 years) in India has shown a declining trend. Child sex ratio (0-6 years) at country level was 945 in 1991, 927 in 2001 and has now declined to 914 in Census 2011[1]. Child Sex Ratio is mainly affected by Sex Ratio at Birth (S.R.B.)

Internationally, the phrase 'sex ratio at birth' (SRB) refers to the number of male live-births forevery100femalebirths [2] whereas, in India, SRB denotes the number of female live-births for every 1000 male births [1]. The SRB affects the 'doubling time' as well as the sex composition of a population [3]. Data related to SRB are necessary to understand trends in infant morbidity and mortality [4, 5]. SRB has been used to assess the impact of environmental factors on the endocrine system and reproductive health of humans [6-10]. Sex ratio at birth varies from one country to another. It varies within the same country as well.Age of the mother, birth order, exposure to endocrine-disrupting compounds and sex-selective abortions are some of the factors which may affect sex ratio at birth [11, 12, 13].

Sex ratio at birth for children born in last 5 years has gone down by 24% in Uttarakhand as per the

latest National Family Health Survey (NFHS-4) conducted from January 30 to July19, 2015. As per the survey, for every 1000 boys 888 girls were born as compared to 912 during the earlier survey conducted in 2005-2006 [14].

Since Sex ratio at birth is not affected by factors like infanticide and under reporting of female births, it is considered as the most accurate indicator of sex selection at birth.

This study was aimed to determine the sex ratio at birth among deliveries conducted in a government tertiary care hospital of Kumaon region of Uttarakhand and to study the association of sex ratio at birth with various socio-demographic factors, birth order and sex of the previous child or children.

MATERIAL AND METHODS

This is a cross-sectional study conducted in the department of Obstetrics and Gynaecology of Dr. SushilaTiwari Government Hospital and Government Medical College, Haldwani (a tertiary care centre situated in district Nainital of Uttarakhand) between January 2016 and June 2016. The sample size was calculated by using the formula $4pq/d^2$ at 95% confidence interval, where p (proportion of female births) was assumed to be 50% and absolute error (d) as 5%. The sample size came out to be 400. Systematic random sampling was used for selection of study participants and every 5th woman who delivered a live baby in the hospital during the study period was included in the study.

A pre-tested and pre-structured questionnaire was used to collect information on the socio-demographic profile of women , pregnancy outcome and sex of child. Data was entered in MS excel and analysed using SPSS version 17.

Ethical approval for the study was taken from the institute ethical committee.

RESULTS

Out of 400 births, 140(35%) were of first order, 129(32.2%) of second order, 86(21.5%) of third order, 34(8.5%) of fourth order and 11(2.75%) of fifth or higher order. Out of 400 babies born, 184 were females and 216 were males giving overall sex ratio of 852 females per 1000 males.

Sex ratio at birth was lowest (714) among offspring born to mothers aged less than twenty years and highest (1000) among those born to mothers aged 40 years and above. Offspringsborn to educated mothers had a higher sex ratio(857)as compared to those born to illiterate mothers(829)). Hindus had sex ratio at birth of 892 and Muslims had a notably low (732) sex ratio. Sex ratio at birth in rural areas was higher (953) than in urban areas (752).Sex ratio at birth among offsprings born to mothers from nuclear families was higher as compared to those from joint families (905 vs 824) (Table 2).

The highest sex ratio (1059) was found among the first birth order offsprings which declined to 897,654 and 619 as the birth order increased to second, third and fourth respectively. Lowest (571) sex ratio was found among offsprings of fifth or higher birth order (Table 2)

The effect of the sex of the previous live child/children on the sex ratio of subsequent births was studied. For the second order births, the sex ratio was 1064 if the first child was male and 756 if the first child was female. For the third order births, sex ratio was 1222 if previous two children born were males whereas if one male and one female had been born, the sex ratio was 708. If the previous two children born were females, the sex ratio (471) was even lower than that noted for first and second order births.

Table 1: Socio-demographic profile of study participants

Variables	Number (%)
Maternal age (Years)	
< 20	12 (3)
20-24	128 (32)
25-29	171 (42.75)
30-34	68 (17)
35-39	19 (4.75)
>40	2 (0.5)
Mean age (SD)	26.31 (4.15)
Education of mother	
Illiterate	75 (18.8)
Primary	37 (9.2)
Secondary	139 (34.8)
Higher secondary	56 (14)
Graduate & above	93 (23.2)
Religion	
Hindu	299 (74.75)
Muslim	97 (24.25)
Sikh	4 (1)
Area of residence	
Rural	209 (52.25)
Urban	191 (47.75)
Type of family	
Joint	259 (64.75)
Nuclear	141 (35.25)
Occupation of wife	
House wife	377 (94.25)
Working	23 (5.75)
Parity	
1	140 (35)
2	129 (32.2)
3	86 (21.5)
4	34 (8.5)
>5	11 (2.7)

Table 2: Sex ratio at birth in relation to socio-demographic variables

Socio-demo-Graphic variables	Live births	Sex of child at last delivery		Sex ratio at birth
		Females	Males	
Maternal age(Yrs)				
< 20	12	5	7	714
20-24	128	58	70	829
25-29	171	79	92	859
30-34	68	32	36	889
35-39	19	9	10	900
>40	2	1	1	1000
Education of mother				
Illiterate	75	34	41	829
Literate	325	150	175	857
Religion				
Hindu	299	141	158	892
Muslim	97	41	56	732
Area of residence				
Rural	209	102	107	953
Urban	191	82	109	752
Type of Family				
Joint	259	117	142	824
Nuclear	141	67	74	905
Parity				
1	140	72	68	1059
2	129	61	68	897
3	86	34	52	654
4	34	13	21	619
>5	11	4	7	571

For the fourth order births, if the previous three children born were males, the sex ratio was 2000 whereas if two males and one female were born earlier, the sex ratio was 857.If the previous three children born were one male and two females, the sex ratio for the fourth order was found to be 600.If the previous three children born were females, the sex ratio for fourth order was 0 The overall sex ratio was still biased against females for fifth and higher birth order. (Table3)

DISCUSSION

In our study, the sex ratio at birth was found to be 852 females to 1000 males. This is comparable to the sex ratio at birth (SRB) of 866 in Uttarakhand state reported by Annual Health Survey in EAG states [1]. It is lower than the S.R.B. of 888 girlsfor every 1000 boysas per the latest National Family Health Survey (NFHS-4) conducted from January 30to July19, 2015 [14]. A study from Bhopal city reported a sex ratio of 788 girls to 1000 boys [15]. Jha et al showed a sex ratio of 877 girls to 1000 boys [16].

In ourstudy, increase in sex ratio at birth was observed with increasing maternal age and offsprings of mothers aged forty years and abovehad highest sex ratio. Our finding is in agreement with the findings of Onyiriuka AN, Ikeanyi EM [17].

Table 3: Sex ratio according to sex of previous live born siblings

Birth order	Sex of previous siblings	Live births	Females	Males	Sex ratio per 1000 males
1	-	140	72	68	1058
2	Female	65	28	37	756
	Male	64	33	31	1064
3	Two males	20	11	9	1222
	One male one female	41	17	24	708
	Two females	25	8	17	471
4	Three males	3	2	1	2000
	Two males one female	13	7	6	857
	Two females one male	16	6	10	600
	Three females	2	0	2	0

The present study suggests that younger women tend to have a higher frequency of male births. Rueness et al [18] had the similar result. Because of the physical ageing, advancing maternal age serves as a stress factor to the female reproductive system during pregnancies. The male embryos are supposed to be more susceptible to such stress factors and are at a relatively higher risk of early intrauterine demise compared to female embryos [18]. In contrast, Maconochie et al did not find any evidence that maternal age influenced sex ratio at birth [19].

We found offsprings born to mothers from rural background having higher sex ratio at birth compared to urban background. Our finding is consistent with the findings of Annual Health Survey across all E.A.G. States and Assam which showed significant higher sex ratio in rural areas compared to urban areas [1]. Jha et al also reported that the urban sex ratio was significantly lower than the rural one [16]. This may be due to easier access to prenatal ultrasound in urban areas.

Whether the parental education plays a role in improving sex ratio is debatable. In present study, offsprings born to educated mothers had a higher sex ratio as compared to those born to illiterate mothers. Kerala with higher female literacy rate has far better sex ratio than those States with low female literacy rate [20]. Educated women are so empowered that they have their say in decision making. However our finding is in contrast to the find-

ings of Toppo M, Diwakar A et al[15] and Jha et al[16] who reported low female to male sex ratio in educated mothers. This may be due to the knowledge, higher income and access of educated couples to newer technology to practice sex-selective feticide.

The current study revealed that Muslims had lower sex ratio as compared to Hindus. This finding is in contrast to the result of a study from Bhopal city in which Muslims were found to have-higher sex ratio than Hindus [15]. Jha et al did not find significant relationship between religion and sex ratio at birth [16].

The highest sex ratio was found among the first birth order offsprings which declined as the birth order increased. Our finding is similar to the results of a study from Bhopal city [15]. Our finding is in contrast to the findings of Onyiriuka AN, Ikeanyi EM [17] and some previous studies [21,22] which suggestthat the sex ratio increased with the birth order. Some researchers found no relation between sex ratio and birth order[23]. In a review of the literature, James stated that in general, results of small-sample studies have been inconclusive and contradictory [24]. Novitski and Kimball, using a large sample size found a significant association between birth order and sex ratio[25]. On the other hand, the conflicting reports may suggest that unidentified environmental factors may influence the sex ratio rather than demographic factors alone.

The current study showsthat there was notable decline in sex ratio among offsprings of higher(third, fourth)birth order as number of live females increased in the families. Toppo M., Diwakar A. et al[15] and Jha et al[16] showed a similar trend.

Despite modernization, the mindset of our society has not changed. There is male domination and female discrimination in the society. The women are compelled to conceive repeatedly in order to have at least one son.

LIMITATIONS:

The present study being a hospital based study with small sample size limits the generalization of findings to the entire community.

CONCLUSION

In the study sample sex ratio at birth was found to be 852 girls per 1000 boys. Sex ratio at birth increased with the increase in the maternal age. Rural sex ratio at birth was higher than the urban one. Offsprings born to literate women had higher sex ratio at birth. The highest sex ratio was found among the first birth order offsprings which declined as the birth order increased. The sex of earlier child or children born has a bearing on the sex ratio of the current birth. There was remarkable decline in sex ratio among offsprings of higher birth order as number of live females increased in the families.

ACKNOWLEDGEMENT:

The author's express their gratitude towards all study participants for their valuable time and patience for interview.

REFERENCES

1. Child sex ratio in India. Available fromhttp://www.actionaid.org/sites/files/actionaid/child_sex_ratio_-_presentation_by_census_commissioner.pdf. Accessed on 02 January 2017.
2. Hesketh T, Xing WZ. Abnormal sex ratio in human populations: causes and consequences. ProcNatlAcadSci, USA. 2006;103(36):13271-75.
3. Markle GE. Sex ratio at birth: values, variance, and some determinants. Demography. 1974;11:131-42.
4. Stevenson DK, Verter J, Fanaroff AA, Oh W, Ehrenkranz RA, Shankaran S, et al. Sex differences in outcomes of very low birthweight infants: the newborn male disadvantage. Arch Dis Child Fetal Neonatal Ed. 2000;83:182-5.
5. Getahun D, Amre D, Rhoads GG, Demissie K. Maternal and obstetric risk factors for sudden infant death syndrome in the United States. Obstet Gynecol. 2004;103(4):646-52.
6. Davis DL, Gottlieb M, Stampnitzky J. Reduced ratio of male to female births in several industrial countries: a sentinel health indicator?.JAMA. 1998;279(13):1018-23.
7. Yoshimura T, Kaneko S, Hayabuchi H. Sex ratio in offspring of those affected by doxin and doxin-like compounds: the Yucho, Seveso, and Yucheng incidents. Occup Environ Med. 2001;58:540-1.
8. Toppari J, Shakkebaek NE. Sexual differentiation and environmental endocrine disrupters. BaillieresClinEndocrinolMetab. 1998;12:143-56.
9. Martuzzi M, Di Tanno ND, Bertollini R. Declining trends of male proportion at birth in Europe. Arch Environ Health. 2001;56:358-64.
10. Mizuno R. The male/female ratio of fetal deaths and births in Japan. Lancet 2000;356:738-9.
11. Mathews TJ, Hamilton BE. Trend analysis of the sex ratio at birth in the United States.National vital statistics reports. 2005 Jun 14;53(20):1-7.
12. James WH. Offspring sex ratios at birth as markers of paternal endocrine disruption. Environ Res. 2006;100:77-85.
13. Grech V, Vassallo-Agius P, Savona-Ventura C. Secular trends in sex ratio at birth in North America and Europe over the second half of the 20th century. J EpidemiolComm Health.2003; 57:612-5.
14. National Family Health Survey -4 2015-16. State fact sheet Uttarakhand. Available from http://rchiips.org/nfhs/pdf/NFHS4/UT_FactSheet.pdf.Accessed on 02 January 2017.
15. Toppo M, Diwakar A, Pal DK. A study of sex ratio in relation to birth order in Bhopal city.Healthline, Journal of In-

dian Association of Preventive and Social Medicine. 2012;3(1):45-9.

16. Jha P, Kumar R, Vasa P, Dhingra N, Thiruchelvam D, Moineddin R. Low male-to-female sex ratio of children born in India: national survey of 1·1 million households. The Lancet. 2006 Jan 27;367(9506):211-8..
17. OnyiriukaAN, IkeanyiEM. Sex Ratio at Birth: A Retrospective Audit of the Birth Records of a Nigerian Hospital.NJOG 2015 Jan-Jun; 19 (1):85-88
18. Rueness J, Vatten L, Eskild A. The human sex ratio: effects of maternal age. Hum Reprod. 2012;27(1):283-7.
19. Maconochie N, Roman E. Sex ratio: are there natural variations within the human population?.Brit J ObstetGynaecol. 1997;104:1050-3.
20. Anandita Dawn and RanjanBasu. Fluctuation of sex ratio in India with special reference to West Bengal.International Journal of Recent Scientific Research 2015; 6 (5): 3796-3801.
21. Branum A, Parker J, Schoendorf K. Trends in US sex ratio by plurality, gestational age, and race/ethnicity. Hum Reprod. 2009;24(11):2936-44.
22. Orvos H, Kozinsky Z, Bartfai G. Natural variation in the human sex ratio. Hum Reprod. 2001;16:803.
23. Nixon NN. Maternal age at birth delivery, birth order and secondary sex ratio in the Old Order Amish of Lancaster County. MSc Thesis submitted to the Graduate School of the University of Massachusetts, Amherst, 2013.
24. James WH. Sex ratio of offspring and the causes of placental pathology. Hum Reprod. 1995;10:1405-6.
25. Novitski E, Kimball AW. Birth order, parental ages, and sex of offspring.Am J Hum Genet. 1958;10(3):268-75.