



## ON A TECHNIQUE FOR ESTIMATING FEMALE FETICIDE RATE AND THE NUMBER OF MISSING FEMALE CHILDREN IN INDIA AND ITS DIFFERENT STATES.

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**ABSTRACT** The present work carried out develops a methodology to estimate the parameters of female feticide rate missing female children in the age group of 0-5 in India and its different states; for which direct data are difficult to be obtained. Therefore, appropriate formulae and methods have been made enabling to estimate the above rates the other associated parameters from are compiled census data providing information on the population of males and females in the age group 0-5.

**KEYWORDS :** Sex Ratio; Female Feticide Rate; High masculinity; Missing Female Children

### Introduction:

The sex ratio at birth conventionally defined as the number of male births per hundred female births is a biological constant, which undergo only slow changes and therefore a significant change is unexpected during a small interval of time. Sex ratio is a valuable source for finding the population of women and the ratio of women to that of men. Population Census of 2011, recorded that the population ratio in India 2011 is 940 females per 1000 of males. The Sex Ratio 2011 missing female children shows an upward trend from the census 2001 data. Census 2011 report that there were 943 females to that of 1000 males. Since then for decades, India has seen a decrease in the sex ratio till 2011. However, in the last two decades there has been slight increase in the sex ratio; in comparison of the last five decades where the sex ratio has been moving around 930 males to that of 1000 of males.

Nevertheless, from the analysis of Census Data, the dramatic drop in the sex ratio of the female population in the 0-6 age group, from 962 girls to 945 girls and then to 927 girls per 1000 boys in 1981, 1991 and 2001 censuses respectively, showing consistent decrease in female Population indicating an almost positive role of sex-selective abortion (while getting prior information about the sex of the unborn fetus) by amniocentesis/ ultrasound/ material serum analysis, etc. despite of the same practice recently banned in India officially.

Of course, there are counter arguments in support of such drops in the female population because of under enumeration of female children in Indian censuses; and prolonged apathy towards the raising up of female children causing high Infant and child mortality rates. Griffiths et al (2000) maintain that such high masculinity in the population may be the cumulative effect of slow but consistent differences in the sex ratios carried on for a long period of time; as Indian Censuses report increase of sex ratio for the population as a whole increasing from 102.9 to 107.5 during 1921 to 1981. Further 1991 Census recorded a further upraise in the sex ratio to 107.9 and recorded a slight downfall to 107.2 in 2001 Census. The analysis of consistently decreasing female population is more focused if we look at the child sex ratio status (Population in the age group 0-6) from 1961 to 2001.

It declined from 976 to 927 from 1961 to 2001 and 927 to 919 during 2001 to 2011. That is indeed an evidence of falling or missing female population. The same feature is highlighted if we look at the data of various Indian states. (Vide table 1) Excepting 13 states in India like Nagaland, Mizoram, Gujrat, Karnataka, Goa, Kerala A & N Island, Arunachal Pradesh, NCT Delhi, Haryana, Punjab, Himachal Pradesh and Chandigarh almost every state of India the proportion of females decrease showing that there is significant fall in the number of female children as a whole in India.

### A method of estimation for missing female population in the age

### sector (0-5):

The present work carried out develops a methodology to estimate the parameters concerning missing female child in the age group of 0-5 and female feticide in India and its diverse states; for which direct data are difficult to be obtained. Therefore, appropriate formulae and methods have been made enabling to estimate the above rates as well as other associated parameters from indirect data; such as data providing information on the population of males and females in the age group 0-5.

### Following are the objectives that will be focused on:

- The trend of the child-sex ratio (0-6) years between 1981-2011
- Comparison between the sex ratio and child-sex ratio.
- The rate of change of girls in India since 1961.
- Calculation of missing female child in the age group (0-5).
- Estimation Female Feticide based on several parameters.
- A brief overview of female feticide in different states of the India.

According to the 2010 Census, the sex ratio in India is 940 females per 1000 males. Even though there is an on the edge improvement from the 2001 Census, where it was 933, it continues to be considerably argumentative towards women. India's sex ratio of 940 is the lowest amongst the most populous countries in the world, namely Pakistan, China, Bangladesh, Indonesia, Nigeria, Japan, Brazil, USA and Russia. The sex ratio in India over the past 100 years has shown an alarming decline from 972 in 1901, to 946 in 1991, to 933 in 2001 and 940 in 2010. The child sex ratio has declined extremely since 1961, from 976 to 945 in 1991, to 925 in 2001 and 914 in 2010. An enormous number of states like Gujarat, Punjab, Himachal Pradesh, Delhi and Haryana have recorded a decline of 60 or more points in the ratio since 1991. The ratio has declined to less than 900 girls per 1000 boys in states like Delhi, Gujarat, Haryana, Punjab and Himachal Pradesh.

The estimate of missing female children is associated with errors due to under enumeration of Female population mostly caused by female feticide, female infant and child mortality. Therefore, it would be in the fitness of the things, if it is estimated from male children mortality derived from the estimated male children in (0-5) age group and then multiplying the same by female/male ratio in the age group (0-5). Symbolically, the same may be written as

$$5P_0^m \left[ \frac{5L_0}{5L_0} \right]^m * \alpha - (5P_0^f)$$

where  $5P_0^m$  and  $5P_0^f$  represents the population of male and female children in the age group (0-5) respectively. The life table population (0-5) in the age group is  $5L_0$  and  $l_0$  is the radix of the life table.  $\alpha$  is the ratio of females to the total number of births.

Note that the expected female population(without female feticide or higher female mortality than male children in the same age group) minus the actual recorded female Population during the five years group (0-5) would be the estimated population of the number of missing females in the age group (0-5).

Finally, to estimate female feticide rate during the same 5 year period we proceed to the following technique by Biswas and Gurung (2000); the actual sex ratio of females at birth is given by the following parameters

$\delta$ =feticide rate,  $\alpha$ =true biological sex ratio,  $I_f$  = male infant mortality rate,

$\delta$ = female infant mortality rate

$\delta$  is calculated by given formula

$$\delta = 1 - \frac{(1 - I_m) * \alpha * (1 - p_1)}{(1 - I_f) * p_1 * (1 - \alpha)}$$

Where  $p_i$  can be estimated as

$$p_1 = \frac{\alpha (1 - I_m)}{(1 - \alpha)(1 - \delta)(1 - I_f) + \alpha(1 - I_m)}$$

Taking  $I_m = \lambda I_f$

$$p_1 = \frac{\alpha (1 - \lambda I_f)}{(1 - \alpha)(1 - \delta)(1 - I_f) + \alpha(1 - \lambda I_f)}$$

or,

$$p_1(1 - \alpha)(1 - \delta)(1 - I_f) = \alpha (1 - p_1)(1 - \lambda I_f)$$

or,

$$\frac{1 - I_m}{1 - I_f} = \frac{p_1(1 - \alpha)(1 - \delta)}{\alpha (1 - p_1)}$$

$$\frac{(1 - I_m) - (1 - I_f)}{(1 - I_m) + (1 - I_f)} = \frac{p_1(1 - \alpha)(1 - \delta) - \alpha (1 - p_1)}{p_1(1 - \alpha)(1 - \delta) + \alpha (1 - p_1)} \quad \text{as} \quad \left\{ \frac{A}{B} = \frac{C}{D} \Rightarrow \frac{A - B}{A + B} = \frac{C - D}{C + D} \right\}$$

$$\Rightarrow \frac{I_f - I_m}{2 - [I_m + I_f]} = \frac{p_1(1 - \alpha)(1 - \delta) - \alpha (1 - p_1)}{p_1(1 - \alpha)(1 - \delta) + \alpha (1 - p_1)}$$

On substitution of the same feticide rate is estimated. The missing female population and the female feticide for different states of India and India as a whole is shown in the tables 2 and 3.

**Table 1: Number of female births per thousand males in India and various states**

S.N	Area	2011	S.N	Area	2011
1	India	943	19	Kerala	968
2	Andaman and Nicobar Islands	876	20	Lakshadweep	946
3	Andhra Pradesh	993	21	Madhya Pradesh	931
4	Arunachal Pradesh	938	22	Maharashtra	929
5	Assam	958	23	Manipur	985
6	Bihar	918	24	Meghalaya	989
7	Chandigarh	818	25	Mizoram	976
8	Chhattisgarh	991	26	Nagaland	931
9	Dadra and Nagar Haveli	774	27	Odisha	979
10	Daman and Diu	618	28	Puducherry	968
11	Delhi	868	29	Punjab	895
12	Goa	973	30	Rajasthan	928
13	Gujarat	919	31	Sikkim	890
14	Haryana	879	32	Tamil Nadu	996
15	Himachal Pradesh	972	33	Tripura	960
16	Jammu and Kashmir	889	34	Uttar Pradesh	912
17	Jharkhand	948	35	Uttarakhand	963
18	Karnataka	973	36	West Bengal	950

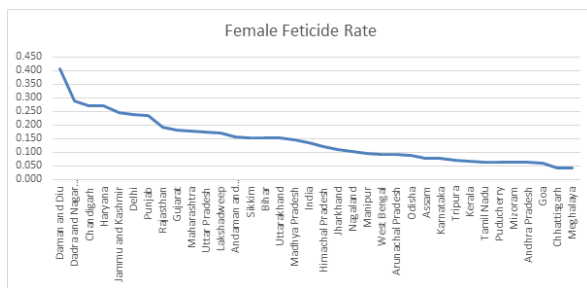
**Table 2: Estimation of female feticide rate for different states of India**

Area Name	$p_1$	$p_2$	$\alpha$	$I_m$	$I_f$	$\frac{(1 - I_m) * \alpha * (1 - p_1)}{(1 - I_f) * p_1 * (1 - \alpha)}$	$\delta$ (Feticide Rate)
India	0.524	0.523	0.485	0.025	0.031	0.865	0.135
Daman and Diu	0.526	0.512	0.382	0.017	0.027	0.594	0.406
Dadra and Nagar Haveli	0.514	0.521	0.436	0.035	0.036	0.712	0.288
Chandigarh	0.527	0.529	0.450	0.021	0.019	0.728	0.272
Haryana	0.545	0.548	0.468	0.041	0.048	0.731	0.269
Jammu and Kashmir	0.562	0.541	0.471	0.040	0.041	0.754	0.246
Delhi	0.533	0.534	0.465	0.025	0.031	0.761	0.239
Punjab	0.540	0.540	0.472	0.028	0.033	0.766	0.234
Rajasthan	0.532	0.536	0.481	0.050	0.053	0.807	0.193
Gujarat	0.531	0.530	0.479	0.039	0.042	0.817	0.183
Maharashtra	0.533	0.530	0.482	0.024	0.025	0.823	0.177
Uttar Pradesh	0.527	0.526	0.477	0.055	0.059	0.825	0.175
Lakshadweep	0.532	0.531	0.486	0.027	0.020	0.829	0.171
Andaman and Nicobar Islands	0.507	0.512	0.467	0.019	0.027	0.842	0.158
Sikkim	0.511	0.515	0.471	0.023	0.030	0.845	0.155
Bihar	0.525	0.521	0.479	0.044	0.045	0.846	0.154
Uttarakhand	0.533	0.533	0.491	0.034	0.038	0.847	0.153
Madhya Pradesh	0.520	0.523	0.482	0.057	0.062	0.853	0.147
Himachal Pradesh	0.523	0.526	0.493	0.036	0.039	0.877	0.123
Jharkhand	0.518	0.518	0.487	0.036	0.043	0.888	0.112
Nagaland	0.511	0.513	0.482	0.015	0.026	0.895	0.105
Manipur	0.517	0.524	0.496	0.008	0.015	0.903	0.097
West Bengal	0.513	0.513	0.487	0.030	0.034	0.907	0.093
Arunachal Pradesh	0.508	0.507	0.484	0.033	0.031	0.908	0.092
Odisha	0.516	0.518	0.495	0.055	0.058	0.912	0.088
Assam	0.512	0.510	0.489	0.055	0.056	0.921	0.079
Karnataka	0.512	0.514	0.493	0.034	0.035	0.921	0.079
Tripura	0.509	0.508	0.490	0.029	0.029	0.930	0.070
Kerala	0.505	0.510	0.492	0.011	0.013	0.933	0.067
Tamil Nadu	0.516	0.516	0.499	0.021	0.023	0.935	0.065
Puducherry	0.505	0.509	0.492	0.017	0.020	0.936	0.064
Mizoram	0.528	0.512	0.494	0.031	0.037	0.937	0.063
Andhra Pradesh	0.516	0.516	0.498	0.040	0.046	0.937	0.063

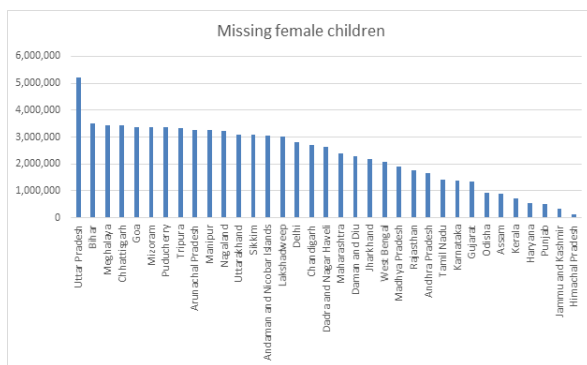
Goa	0.518	0.511	0.493	0.007	0.014	0.939	0.061
Chhattisgarh	0.509	0.510	0.498	0.047	0.050	0.956	0.044
Meghalaya	0.509	0.508	0.497	0.052	0.052	0.957	0.043

**Table 3: Estimation of missing female children in India and different States and number of female feticide**

Area Name	$M_{(0-5)}$	$F_{(0-5)}$	$\delta$	$\alpha$	$Sl_0$	$S^L_0$	Expected female under no feticide $= \left(\frac{Sl_0}{S^L_0}\right) * M_{(0-5)} + \alpha$	Observed number of missing female children	Missing Female
India	72,357,554	66,503,454	0.135	0.485	500000	472080	37194367.02	29309087	<b>7885280</b>
Uttar Pradesh	13,476,164	12,164,597	0.175	0.477	500000	462659	6946758.921	5217838	<b>1728921</b>
Bihar	8,182,247	7,654,885	0.154	0.479	500000	473843	4132398.536	3522486	<b>609913</b>
Maharashtra	6,005,694	5,366,714	0.177	0.482	500000	484504	2984828.097	2381886	<b>602942</b>
West Bengal	4,606,684	4,406,267	0.093	0.487	500000	481570	2330172.092	2076095	<b>254077</b>
Madhya Pradesh	4,763,343	4,378,949	0.147	0.482	500000	460867	2491573.224	1887376	<b>604197</b>
Rajasthan	4,773,620	4,235,238	0.193	0.481	500000	464294	2474376.167	1760862	<b>713514</b>
Andhra Pradesh	3,980,689	3,745,209	0.063	0.498	500000	473678	2093567.6	1651641	<b>4419267</b>
Tamil Nadu	3,272,274	3,085,908	0.065	0.499	500000	483859	1687328.507	1398579	<b>2887450</b>
Karnataka	3,144,843	2,989,198	0.079	0.493	500000	477162	1625132.884	1364065	<b>261068</b>
Gujarat	3,508,752	3,136,946	0.183	0.479	500000	472476	1778211.691	1358734	<b>419478</b>
Odisha	2,307,480	2,173,660	0.088	0.495	500000	462754	1233373.65	940286	<b>293088</b>
Assam	2,005,926	1,931,623	0.079	0.489	500000	468522	1047388.365	884235	<b>163153</b>
Kerala	1,508,972	1,456,806	0.067	0.492	500000	494110	751065.4864	705741	<b>45325</b>
Haryana	1,570,654	1,311,855	0.269	0.468	500000	470062	781551.2822	530304	<b>251247</b>
Punjab	1,412,270	1,200,029	0.234	0.472	500000	479636	695328.1095	504701	<b>190627</b>
Jammu and Kashmir	924,730	793,290	0.246	0.471	500000	475528	457592.25	335698	<b>121894</b>
Himachal Pradesh	346,901	315,762	0.123	0.493	500000	479115	178441.203	137321	<b>41120</b>



**Figure1: Female Feticide Rate for Different States In India**



**Figure2: Missing Female Children (0-5) Yrs of Age in India**

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