Contributors of anaemia among women in Greater Bengal: A comparative study of West Bengal of India and Bangladesh

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Introduction

In the era of globalization and modernization, anaemia remains a serious public health problem especially in countries with limited resources [1]–[3]. Women of child-bearing age are vulnerable to anaemia leading to unbreakable cycle of anaemia from one generation to the next. Anaemia is the causal factor for depression, maternal and perinatal death, cognitive impairment, series of morbidities [4]–[7] and adverse birth outcomes, i.e. low birth weight and preterm birth [8], and work productivity loss [9]. This makes anaemia a priority area for public health decision-makers, particularly for women in developing countries. Thus, WHO has set a target to reduce anaemia in women of childbearing age by 50% by 2025 to meet the 2nd objective of the Sustainable Development Goals (SDGs) [10].

Anaemia in the reproductive age of women is defined as a haemoglobin level less than 11 g per decilitre [11]. Large-scale studies have found that low socio-economic status and lack of education are the major determinants of anaemia in women [12]–[14].Some studies, have shown that high fertility, physical work, parasite infections and menstrual disorders are responsible for anaemia in women [15], [16]. Earlier studies have found a strong relationship between female sterilization and anaemia in women of child-bearing age [17], [18].

The current study aims to compare the level and determinants of anaemia in two political space i.e. West Bengal in India and Bangladesh (that constituted Bengal Province during the British Rule) having a series of similarities in language, geography, climatic conditions and cultural practices[19]. However, Bangladesh is dominated by Muslims while West Bengal has about 70% Hindus leading to differences in eating patterns and some development indicates like sanitation and use of contraception practices that are distinctly different in these two spaces. However, infant mortality rate is higher in Bangladesh, whereas the literacy rate of women, the proportion of the urban population is higher in West Bengal [20]. West Bengal is the Indian state where anaemia is the , must below the performance of Bangladesh. So what factors have led to remarkable improvement of anaemia level in Bangladesh as compared to West Bengal when economically Bangladesh is poorer and the education level of women is lower or fertility is relatively higher in that country? Is it the diet or improved sanitation or different contraception practices or something more that are not well explored? Thus, the present comparative study investigated the determinants of anaemia among women in West Bengal and Bangladesh to achieve the SDGs second goal for fighting against malnutrition, especially in limited resources countries.

Data and Methods

Nationally representative cross sectional survey data (Demographic Health Survey/ DHS) from Bangladesh (BDHS 6), 2011 and India (NFHS 4), 2015-16, were used to analyse the prevalence of maternal anaemia and associated risk factors. Two country data sets were used to understand and to compare the prevalence of maternal anaemia and associated risk factors. The outcome measure is dichotomous variable, which indicates 1 if a woman has anaemia, 0 otherwise. The independent variables were selected basis on the available literature on the determinants of anaemia in the countries like Bangladesh and India. The ordinary kinging, a linear geostatistical interpolation technique, was used to prepare the prevalence map of anaemia. Univariate Moran I statistics technique was further employed to identify the hotspot and cold spots of anaemia among women in Bangladesh and West Bengal. The statistical analysis was performed using STATA version (14.1) and spatial analysis in ArcMap version (10.3).

Multiple logistic regression analyses were applied in three models to capture the differences in covariate's effect of outcome measure in two countries separately and jointly. Interaction terms of religion and country/state are introduced in the combined data set to explore the effect of religion and space in determining anaemia.

Results

The highest prevalence of anaemia was observed in West Bengal, India (63.66%) while about 41% of women were anaemic in Bangladesh. Furthermore, the highest prevalence can be observed with more hotspots i.e. districts of Puruliya, Dakshin Dinajpur, Koch Bihar(**Figure 1**). In Bangladesh, the marginal geographical areas of Rangpur and Mymensing district had a high concentration of hotspots of anaemia.

Determinants of anaemia: Bangladesh vs. West Bengal

Bivariate analysis of Table 1 reveals that older women (age group 30+), women with BMI<18 (thin), with children 2+, illiterate, Hindus, poor, with unimproved sanitation and rural population suffer significantly more from anaemia in both these countries. In Bangladesh households experienced food insecurity were more likely to suffer from anaemia; whereas it is revealed from Wes Bengal data that consumption of chicken reduces the prevalence of anaemia significantly .

The adjusted odds ratio shows (**Table 2**) that the adolescent women had a higher probability of having anaemia (OR, 1.23; 95% CI: 1.06–1.42) as compared to the women in the age group of 30 & above in West Bengal, whereas the result was not significant for Bangladesh indicating no age differential effect in odds of anaemia. However, in both the countries, the Thin (BMI, <18 kg/m^2) women were more likely to be anaemic than the women with normal weight (West Bengal: OR, 1.22; 95% CI: 1.10–1.36; Bangladesh: OR, 1.39; 95% CI: 1.19–1.62). Pill, injection and IUD together had a the significant protective effect in reducing anaemia in both countries. We found that illiterate or primary educated women were highly associated with anaemia in West Bengal (OR, 1.18; 95% CI, 1.04–1.38) as compared to higher educated women. In addition, women who belonged to the poor wealth quintile had a greater probability of being anaemic than those who belonged to the rich wealth quintile (West Bengal: OR, 1.20; 95% CI: 1.05–1.38; Bangladesh: OR, 1.45; 95% CI: 1.18–1.77). With respect to the food security index, women who were not secure in terms of food had a higher odds of anaemia (OR, 1.12; 95% CI: 0.99–1.21) in Bangladesh. In contrast, those women who never consumed or consumed fruits weekly (OR, 1.21; 95% CI: 1.07–1.36) and never consumed chicken or meat (OR, 1.28; 95% CI: 1.06–1.56) were more likely to be anaemic in West Bengal.

Further, in **Table 3**, an interaction term in joint model, taking into account shows that the highest odds of anaemia were observed among Hindu women in both Bengals (Give OR of two countries). However, the probability of being anaemic was higher in West Bengal of this same group ‘Hindu”. Further it was observed that even Muslims in West Bengal had higher anaemia compared to its counterpart Muslim in Bangladesh (OR, 1.93; 95% CI: 1.70–2.19). Hence, socio cultural context plays stronger role in West Bengal as both the religious groups are significantly more anaemic as against Bangladeshi Muslims, while in Bangladesh, religious aspect is perhaps stronger in determining anaemia as Hindus are markedly more anaemic as compared to the Muslims of that country.

Conclusion

The comparative study of anaemia between West Bengal and Bangladesh found that women of West Bengal are more prone to be anaemic. Furthermore, Hindu women are more vulnerable to anaemia than Muslim women in both countries. Low socioeconomic status, female sterilisation, less consumption of different food, especially fruits and chicken, having more children and unimproved sanitation are the major contributors of anaemia. Since 1970s, Indian government have implementing several programmes to combat anaemia, - yet the supplementary approach is not working in West Bengal, as only 28% of women receive 100 IFA during pregnancy. Thus, instead of supplementary approach, Indian government should focus on better sanitation, food based approach, non-permanent method of contraception, fertility reduction and economic-educational development of women to attain anaemia related sustainable development goals, while Bangladesh need significant focus of regional differences in Anaemia.

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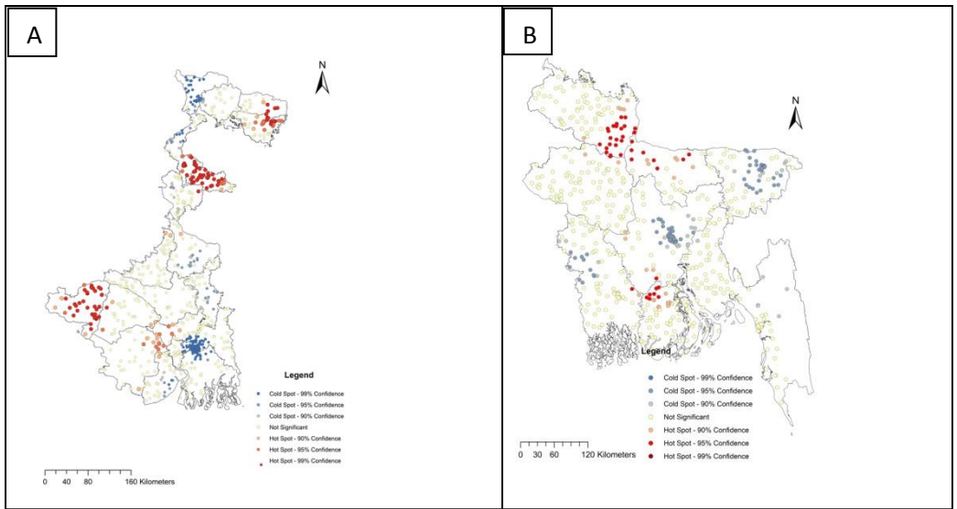

Figure 1 hotspots of the prevalence of anaemia among women in West Bengal (A) and Bangladesh (B).

Table 2 Result of logistic regression to access the contributors of anaemia among women in West Bengal and Bangladesh.

Determinants	West Bengal	Bangladesh
Demographic and health factors		
Age		
30& above ®		
Below 20	1.23***(1.06 1.42)	1.01 (0.75 1.36)
20-24	1.13**(1.00 1.25)	0.99 (0.79 1.23)
25-29	1.01 (0.92 1.12)	0.90 (0.75 1.07)
Body Mass Index		
Normal ®		
Thin	1.22***(1.10 1.36)	1.39***(1.19 1.62)
Overweight/obese	0.87**(0.78 0.97)	0.64***(0.52 0.77)
Current contraceptive		

Table 3 Effects of religion on anaemia among women in India and Bangladesh.

Determinants	OR
Demographic and health factors	
Age	
30& above ®	
Below 20	1.20 *(1.02 1.41)
20-24	1.09 (0.95 1.15)
25-29	0.93 (0.86 1.02)
Body Mass Index	
Normal ®	
Thin	.25***(1.13 1.37)
Overweight/obese	.84***(0.76 0.94)
Current contraceptive	

method		
Female sterilization ®		
Not Using	0.96 (0.86 1.08)	0.98 (0.72 1.33)
Pill/injection/IUD	0.68***(0.59 0.78)	0.71***(0.52 0.98)
Others*	0.95 (0.83 1.10)	0.98 (0.72 1.35)
Children ever born		
No child ®		
44228	1.34***(1.15 1.54)	1.14 (0.86 1.51)
2+	1.36***(1.13 1.63)	1.31* (0.94 1.82)
Socioeconomic factors		
Education		
Secondary ®		
Illiterate/primary	1.18***(1.04 1.38)	1.06 (0.90 1.22)
Higher	1.02 (0.91 1.21)	0.83 (0.62 1.10)
Religion		
Muslim ®		
Hindu	1.46***(1.31 1.61)	1.60*** (1.28 1.99)
Wealth		
Rich ®		
Poor	1.20***(1.05 1.38)	1.45***(1.18 1.77)
Middle	1.02 (0.95 1.16)	1.12 (0.92 1.38)
Sanitation		
Improved ®		
Unimproved	1.12 **(1.02 1.23)	1.08 (0.95 1.23)
Have agricultural land		
No ®		
Yes	1.19***(1.08 1.31)	1.22***(1.05 1.40)
Place of residence		
Urban ®		
Rural	1.09 **(1.00 1.19)	1.00 (0.81 1.22)
Food related factors		
Food security Index		
Secure ®	-	
Not secure	-	1.12 **(0.99 1.21)
Consume pulses		
Daily ®		-
Never/weekly/occasionally	1.02 (0.96 1.1)	-
Consume fruits		-
Daily ®		-
Never/occasionally	1.16**(1.03 1.31)	-
Weekly	1.21***(1.07 1.36)	-
Consume chicken or meat		-
Daily/ weekly ®		-
Never	1.28**(1.06 1.56)	-
Occasionally	1.06 (0.99 1.13)	-
Region		
A ®		
b	0.90 (0.78 1.04)	1.50 ***(1.11 2.02)
c	1.14 (0.96 1.34)	1.20 (0.92 0.59)
d	1.05 (0.90 1.24)	1.53 ***(1.17 1.99)
e	1.01 (0.86 1.18)	1.20 (0.89 1.63)
f		1.49 ***(1.12 1.99)
g		1.68 ***(1.27 2.20)

method	
Female sterilization ®	
Not Using	0.97 (0.82 1.02)
Pill/ injection/IUD	1.69***(0.61 0.78)
Others*	0.96 (0.80 1.04)
Children ever born	
No child ®	
01-Feb	1.30***(1.14 1.48)
2+	1.35**(1.14 1.59)
Socioeconomic factors	
Education	
Secondary ®	
Illiterate/primary	1.17***(1.06 1.28)
Higher	1.01 (0.9 1.14)
Wealth	
Rich ®	
Poor	1.24***(1.10 1.41)
Middle	1.05(0.93 1.18)
Sanitation	
Improved ®	
unimproved	1.03 (0.96 1.09)
Have agricultural land	
No ®	
Yes	1.19***(1.09 1.29)
Place of residence	
Urban ®	
Rural	1.04 (0.94 1.16)
Interaction of Country &Religion	
Bangladesh × Muslim ®	
Bangladesh × Hindu	1.58***(1.26 1.96)
West Bengal × Hindu	2.85***(2.55 3.18)
West Bengal × Muslim	1.93***(1.70 2.19)

*Note: reference category; ® and significant level; *p < 0.10. **p < 0.05. ***p < 0.01.*

*Regions of west Bengal in the table a; Himalayan **, b;**East Plain**, c;**South Plain**, d;**Central plain**, e;**West plain and in Bangladesh a;Sylhet b;Barisal, c;Chittagong, d;Dhaka, e;Khulna, f;Rajshahi, and g;Rangpur.*

**Others category of Contraceptive use; condom, male sterilization, rhythm/periodic abstinence, withdrawal, locational amenorrhea, female condom and foam or jelly.*