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Original Article

Observation of Socio-demographic Characteristics and Risk Factor on the Occurrence of Birth Defects

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ABSTRACT

Introduction: *Birth defects significantly contribute to neonatal mortality and morbidity worldwide. Socio-demographic characteristics and environmental risk factors have been associated with the occurrence of birth defects.* ***Methods and materials:*** *This case-control observational study was conducted at the Pediatric Surgery and Medicine Department in Dhaka Shishu (Children) Hospital, Bangladesh, from January 2012 to December 2013. A total of 280 infants aged 0-364 days were recruited, with 140 cases presenting structural birth defects, and 140 control infants without any structural birth defects. Detailed socio-demographic and risk factor data were collected and analyzed using SPSS V.16.* ***Results:*** *The mean maternal age of the case and control group were being observed 25.86±5.196 and 23.41±4.65 years which was statistically significant (p=0.001). The mean paternal age in the case and control group were being observed 32.10±5.39 and 29.85±6.38 years which was also statistically significant (p=0.05). Paternal exposure to insecticides, fertilizers, and prolonged sunlight, as well as both paternal smoking and maternal passive smoking, were all significantly more common in the case group (p=0.001). The distribution of birth defects in the case group was most frequently observed within the gastrointestinal system (17.9%), followed by the genitourinary system (15.7%), and cardiovascular system (14.3%).* ***Conclusion:*** *This study highlights the associations of socio-demographic characteristics and environmental risk factors with the occurrence of birth defects in Bangladesh. These findings emphasize the importance of improved parental education, occupational health and safety, and access to prenatal care in rural areas to*

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reduce the risk of birth defects.

Keywords: *Neonatal, Defect, Socio-demographic, Disability, Congenital*

INTRODUCTION

Birth defects, also known as congenital anomalies, represent a significant global public health concern due to their association with infant morbidity, mortality, and long-term disability. According to the World Health Organization (WHO), approximately 3% of all live births worldwide are affected by a major birth defect, resulting in approximately 7.9 million infants being born with serious congenital anomalies every year [1–3]. Birth defects are estimated to contribute to 295,000 neonatal deaths globally within the first 28 days of life, accounting for 10.9% of total neonatal mortality [4]. In addition, congenital anomalies can result in significant long-term disability, leading to considerable health, social, and economic burden on affected individuals, their families, and society at large [5]. In Bangladesh, a low-income country in South Asia with a population of over 160 million, the burden of birth defects is particularly concerning. A study conducted in 2012 estimated that 7.6% of neonatal deaths in Bangladesh were attributable to birth defects [6]. Furthermore, a systematic review of hospital-based studies in Bangladesh reported that the prevalence of congenital anomalies among live births ranged from 1.2% to 7.7%, with the most common types being neural tube defects, orofacial clefts, and congenital heart defects [7]. These findings suggest that birth defects represent a significant public health challenge in Bangladesh, highlighting the importance of understanding the socio-demographic characteristics and risk factors associated with their occurrence. Various socio-demographic factors have been associated with an increased risk of birth defects, including maternal age, socioeconomic status, education level, and geographical location [8]. A study conducted in neighboring India reported that lower maternal education and socioeconomic status were significantly associated with higher prevalence of birth defects [9]. In addition, a systematic review of global literature indicates that advanced maternal age and rural residence were associated with an increased risk of specific types of birth defects, such as Down syndrome and neural tube defects [10,11]. However, the influence of these socio-demographic factors on the occurrence of birth defects in Bangladesh remains unclear, necessitating further investigation. Various modifiable risk factors have also been identified as contributing to the occurrence of birth defects, including maternal infections, exposure to environmental toxins, and lifestyle factors such as tobacco and alcohol use during pregnancy [12]. Additionally, maternal nutritional status, particularly the consumption of folic acid and other micronutrients, has been shown to play a crucial role in the prevention of birth defects [13]. Bangladesh, high prevalence of maternal under nutrition and micronutrient deficiencies has been reported, potentially increasing the risk of birth defects in this population [14]. Furthermore, limited access to and utilization of prenatal care services may exacerbate the risk of birth defects in Bangladesh, as early detection and intervention can be critical for improving pregnancy outcomes. Given the significant burden of birth defects in Bangladesh and the potential influence of various socio-demographic factors and risk factors on their occurrence, it is essential to conduct a comprehensive, data-driven investigation in this context. This study aims to explore the socio-demographic characteristics and risk factors associated with the occurrence of birth defects in Bangladesh, providing valuable information to guide public health

interventions and policy development aimed at reducing the prevalence of congenital anomalies and improving neonatal health outcomes in this population. By identifying key socio-demographic and risk factors associated with birth defects in Bangladesh, targeted prevention strategies can be developed to address the specific needs of vulnerable populations, ultimately reducing the burden of birth defects in the country.

METHODS & MATERIALS

This observational case-control study was conducted at the Pediatric Surgery and Medicine Department in Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh, over a period of two years, from January 2012 to December 2013. A total of 280 infants aged between 0 and 364 days were included in the study. The study sample consisted of 140 cases with structural birth defects and 140 age-matched controls without any structural birth defects. The patient selection and data collection processes were carried out after obtaining informed consent from the legal guardians of the infants. A pre-designed, structured questionnaire was administered to the mothers of the infants after obtaining their informed written consent. Each infant underwent a comprehensive physical examination to accurately identify the presence and nature of any congenital anomalies. Relevant investigations were conducted in accordance with the departmental protocols to further characterize and confirm the identified defects. Data, collected from the questionnaires and examinations were meticulously recorded and entered into a database for statistical analysis. The Statistical Package for Social Sciences (SPSS) software, version 16, was utilized for data analysis. Pearson's correlation test was employed to assess the correlation between the studied variables, with a p-value of ≤ 0.05 considered statistically significant. Through the implementation of a rigorous methodology, this study aimed to provide a robust and comprehensive investigation of the socio-demographic characteristics and risk factors associated with the occurrence of birth defects in Bangladesh. By employing a case-control design and utilizing advanced statistical methods, the study sought to generate reliable and valid insights into the complex interplay of factors contributing to congenital anomalies in this population, ultimately informing the development of targeted prevention strategies and evidence-based policies. The ethical clearance of this study was obtained from the Institutional Review Boar d(IRB) of Dhaka Shishu (Children) Hospital of Bangladesh.

RESULTS

Table I: Demographic characteristics of the participants (N=280).

Variables	Cases(n=140) mean ± SD	Controls (n=140) mean ± SD	P Value
Age of the patient (Days)	87.17±105.61	67.50±92.42	>0.05
Maternal age (years)	25.86±5.196	23.41±4.65	<0.001
Paternal age (Years)	32.10±5.39	29.85±6.38	<0.05
Maternal BMI (Wt/m)	22.7±3.003	23.35±2.54	<0.001
Monthly family income (Tk./month)	10247.46± 6798.12	13429.74±8125.05	<0.001

The mean age of the infants (cases) with birth defects was 87.17±105.61 days, while the controls exhibited a slightly lower mean age of 67.50±92.42 days; however, this difference was not statistically significant ($p>0.05$). Significant differences between cases and controls were observed in maternal and paternal ages. The mean maternal age for the cases was 25.86±5.196 years, significantly higher than the controls' mean age of 23.41±4.65 years ($p<0.001$). Likewise, the mean paternal age was significantly higher in the cases (32.10±5.39 years) compared to the controls (29.85±6.38 years) ($p<0.05$). The mean maternal BMI was lower in the cases (22.7±3.003 Wt/m^2) compared to the controls (23.35±2.54 Wt/m^2) with a statistically significant difference ($p<0.001$). In terms of monthly income, the cases had a significantly lower mean income (Tk. 10247.46± 6798.12 per month) compared to the controls (Tk. 13429.74±8125.05 per month) ($p<0.001$).

Table II: Distribution of participants by social characteristics (N=280).

Variables	Cases (n=140) n (%)	Controls (n=140) n (%)	P Value
Maternal Education			
No Education	44 (31.4)	18 (12.9	<0.001
Education	96 (68.6)	122 (12.9)	
Paternal Education			
No Education	39 (27.9)	21 (15)	<0.001
Education	101 (72.1)	119 (85)	
Maternal Occupation			
Working Mother	5 (3.6)	2 (1.4)	>0.05
Non-Working Mother	135 (96.4)	138 (98.6)	
Residence			
Rural	111(79.3)	77(55)	<0.001
Urban	28(20)	60(42.9)	
Mode of Delivery			
LUCS	50 (35.7)	28 (20)	>0.05
NVD	90 (64.3)	112 (80)	

Maternal and paternal education levels differed significantly between the case and control groups ($p<0.001$). A higher percentage of mothers (31.4%) and fathers (27.9%) in the case group had no formal education compared to the control group (12.9% and 15% respectively). There was no statistically significant difference in the occupation of mothers ($p>0.05$), but residential status showed a significant divergence ($p<0.001$), with a higher proportion of the case group residing in rural areas (79.3%) compared to the control group (55%). Mode of delivery did not significantly differ between the groups ($p>0.05$), with 35.7% of births in the case group via Lower Uterine Cesarean Section (LUCS) and 64.3% via Normal Vaginal Deliveries (NVD), compared to 20% LUCS and 80% NVD in the control group.

Table III: Distribution of participants by maternal comorbidities (N=280).

Maternal Comorbidities	Cases(n=140) n (%)	Controls (n=140) n (%)	P Value
Hypertension	6 (4.3)	3 (2.1)	>0.05
Diabetes Mellitus	5 (3.6)	1 (0.7)	>0.05

Hypertension was seen in 4.3% (n=6) of cases and 2.1% (n=3) of controls, while diabetes mellitus was present in 3.6% (n=5) of cases and 0.7% (n=1) of controls. Despite higher prevalence in the case group, these differences were not statistically significant for either hypertension or diabetes mellitus ($p>0.05$ for both), indicating no significant association with birth defects.

Table IV: Distribution of participants by various risk factors (N=280).

Risk Factors	Cases(n=140) n (%)	Controls (n=140) n (%)	P Value
Paternal Insecticides exposure	39 (27.9)	15 (10.7)	**<0.001**
Paternal Fertilizer exposure	40 (28.6)	14 (10)	**<0.001**
Prolonged Sunlight exposure	50 (35.7)	26 (18.6)	**<0.001**
Paternal Smoking	91 (65)	49 (35)	**<0.001**
Passive Smoking (Maternal)	30 (21.4)	9 (6.4)	**<0.001**
Maternal Smokeless tobacco	15 (10.8)	3 (2.1)	**<0.05**
Consanguinity	22 (15.7)	17 (12.1)	>0.05

Paternal exposure to insecticides was noted in 27.9% of cases compared to 10.7% of controls ($p<0.001$). Similarly, paternal exposure to fertilizers was observed in 28.6% of cases and 10% of controls ($p<0.001$). Prolonged sunlight exposure was more prevalent in the case group (35.7%) than in the control group (18.6%) ($p<0.001$). Paternal smoking was found to be significantly higher in cases (65%) compared to controls (35%) ($p<0.001$). Passive maternal smoking was also significantly higher in cases (21.4%) as compared to controls (6.4%) ($p<0.001$). The use of smokeless tobacco by mothers was more prevalent in the case group (10.8%) than in the control group (2.1%) and this difference was statistically significant ($p<0.05$). However, consanguinity did not show a statistically significant difference between the groups, being present in 15.7% of cases and 12.1% of controls ($p>0.05$).

Table V: Distribution of the Birth Defects among the case group participants (n=140).

Defect region	n	%
Gastro intestinal system	25	17.9%
Genito urinary system	22	15.7%
Cardiovascular System	20	14.3%
Neural Tube Defects	18	12.9%
Facial Defects	18	12.9%
Skull Defects	15	10.7%
Limb Defects	7	5.0%
Abdominal Defects	4	2.9%
Syndromic Defects	4	2.9%
Others	6	4.3%

The most prevalent defects were in the gastrointestinal system (17.9%) and genitourinary system (15.7%). Cardiovascular defects occurred in 14.3% of cases, with neural tube and facial defects each present in 12.9%. Skull defects were observed in 10.7%, limb defects in 5%, and both abdominal and syndromic defects in 2.9% each. Other defects accounted for 4.3%.

DISCUSSION

The primary objective of our study was to assess the socio-demographic characteristics and risk factors associated with the occurrence of birth defects in Bangladesh. The results provide valuable insights into these factors and contribute to our understanding of how they impact the prevalence of congenital anomalies. Our results showed that maternal age, paternal age, maternal BMI, and monthly income significantly differed between cases and controls, which is consistent with previous research. A study conducted in China found that advanced maternal age is associated with an increased risk of birth defects [15]. Moreover, various studies also reported that advanced paternal age was associated with an increased risk of congenital heart defects [16,17]. Our findings regarding maternal BMI align with a systematic review and meta-analysis by Stothard et al. (2009) that demonstrated an association between maternal overweight and obesity and congenital anomalies [18]. The study also revealed significant disparities in parental education levels and residential statuses between infants with and without birth defects. Lower levels of maternal and paternal education have been previously linked to a higher risk of congenital anomalies [19]. Our study also found a higher proportion of cases residing in rural areas, which is in line with the findings by Njamnshi et al. (2008) in Cameroon, where children from rural areas had a higher prevalence of birth defects [20]. We observed no significant associations between maternal comorbidities, such as hypertension and diabetes mellitus, and the occurrence of birth defects. This contrasts with some studies that have reported a positive association between these maternal comorbidities and birth defects [21,22]. The discrepancy in our findings may be due to a smaller sample size, and further research is needed to explore this relationship in the context of Bangladesh. The present study identified significant associations between the occurrence of birth defects and various risk factors, such as paternal exposure to insecticides and fertilizers, prolonged sunlight exposure, paternal smoking, passive maternal smoking, and maternal smokeless tobacco use. These findings are consistent with previous studies that have reported associations between birth defects and paternal occupational exposure to

pesticides, paternal smoking, and maternal tobacco use [23–25]. Our findings underscore the need to address these modifiable risk factors to reduce the prevalence of birth defects. It was observed that the most common birth defects in our study population were in the gastrointestinal and genitourinary systems. A similar pattern of birth defect distribution was observed in a study conducted in India, where gastrointestinal and genitourinary defects were the most frequent types of congenital anomalies [12].

LIMITATIONS OF THE STUDY

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In conclusion, our study provides valuable insights into the socio-demographic factors and risk factors associated with birth defects in Bangladesh. The findings emphasize the importance of addressing modifiable risk factors, such as parental smoking and tobacco use, and highlight the need for targeted interventions, including education and awareness campaigns. Further research is necessary to better understand the influence of maternal comorbidities on the occurrence of birth defects in this population.

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