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To Study the Association of Socioeconomic Status with Antenatal, Perinatal, and Postnatal Risk Factors among Children with Cerebral Palsy in Kamrup Metro

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ABSTRACT: Cerebral palsy is an Umbrella term covering a group of non-progressive but often changing motor impairment syndromes secondary to lesions or anomalies of brain arising in the early stages of development. The occurrence ratio is 1.5-3/1000 live births. The aetiology of CP is multifactorial and not very well-known. Sociodemographic profile like age, gender, race, education, residential location, income level, marital status, occupation, social class, and social deprivation can affect maternal health and pregnancy outcomes. This study assessed the socio-demographic profile in cerebral palsy children. A paediatric assessment form which sought information on socio-demographics profile was used to obtain data from the respondents who were taken from private and government rehabilitation centres. Individuals and family's socioeconomic status (SES), which determines their position in the social order, has a significant impact on their health. Income, education, occupation, and the degree of access to vital community resources are all combined to measure this complicated metric. The modified Kuppuswamy scale is commonly used to measure SES in urban and rural areas. A cross-sectional study was done to evaluate the association between socioeconomic status (SES) and the risk factors of cerebral palsy (CP) among 40 participants who are diagnosed with CP. Results showed 60% of the children with cerebral palsy belonged to the lower socioeconomic group and low birth weight showed a significant association with SES ($p = 0.025$). Other antenatal, perinatal, and postnatal risk factors were not significantly associated with SES. The findings emphasize the importance of strengthening antenatal care, maternal nutrition, and early identification of high-risk pregnancies, particularly among socioeconomically disadvantaged families.

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1. INTRODUCTION

A neurological disorder called cerebral palsy (CP) occurs initially in infancy or early childhood and permanently impairs posture, mobility and muscle coordination. "Cerebral" refers to the brain and "palsy" means loss of ability to move a muscle or part of the body[1]. It is a form of chronic motor disability which is non-progressive, incurable and results from damage to the growing brain before, during or post birth[2]. The static motor impairment develops during prenatal, perinatal and postnatal stages and can lead to impairments such as motor dysfunctions, sensory disturbances, perception, intellectual problems, behavioural issues, vision and hearing defects, epilepsy, and secondary musculoskeletal problems[3]. According to published research worldwide, the prevalence of CP ranges from 1.5 to 4 per 1000 live births; however, the range for India is larger, ranging from 2.08 to 3.88 per 1000 live births[4]. The brain damage induces neurological mechanisms of movement, balance, and postural control to develop in an unorganized and delayed manner. As a result, the muscles used for these motor components are uncoordinated and ineffective. Specific impairments include abnormal patterns of muscular activation, such as excessive co-contractions, and hypertonicity or hypotonicity accompanied by weakness[5]. There are four major subtypes of cerebral palsy according to clinical presentation. These are spastic, athetoid, ataxic and mixed. Spastic CP is the most common type, where the motor cortex is affected. The lesion may cause non-progressive permanent damage to the cerebral cortex and pyramidal tract dysfunction. Athetosis is the term for the involuntary movements that occur in athetoid CP. These are bizarre, purposeless movements that may be uncontrollable. The involuntary motions can be jerky, tremorous, writhing, slow or rapid, or unpattern. Ataxic CP is characterized by hypotonia and incoordination caused by cerebellar damage. This is a rare form of CP. Mixed CP is a form of CP where a child shows symptoms from more than one type, most often spastic and athetoid CP. It happens when several parts of the growing brain that regulate movement and coordination are harmed prior to, during, or immediately following birth. The topographical classification of CP depends on the localization/limb distribution of neuromotor impairment in spastic CP. It subdivides spastic CP into: quadriplegia (symmetric and severe spasticity of all four limbs), diplegia (involvement of the four limbs but more spasticity and weakness in the lower limbs) and hemiplegia (involvement of the upper and lower limbs on one side of the body). Rare forms of spastic cerebral palsy include monoplegia (one-limb spasticity) and triplegia (three-limb spasticity)[2,5,6]. Although the exact cause of CP is mostly unknown, it has been linked to several risk factors. Intrauterine exposure to infections, prematurity, congenital defects, maternal fever during birth, ischemic stroke, intrauterine growth retardation (excessive gestational age), and complications from multiple gestations are several prenatal and perinatal risk factors for cerebral palsy. Any one of these conditions alone can be severe enough to develop CP. The two most significant risk factors among all of these are low birth weight and prematurity. Brain damage leading to CP can be found in the prenatal and in the perinatal period. Postnatal aetiologies include postnatal trauma, infections, Severe untreated jaundice (bilirubin buildup) causing kernicterus and constitutes 10%–25% cases of CP[7,8]. A person's socioeconomic status (SES), which is a measure of their position in society, has a significant impact on their experiences both as a child and as an adult. Family socioeconomic status appears to have a greater impact on performance in some neuropsychological systems than others, including executive functioning, oral and written language, and memory especially in early life. SES is assessed based on a number of factors, such as parental education, occupation, and income. It is a method of examining how people or families fit into society using social and economic metrics that have been demonstrated to affect the well-being and health of individuals[9]. According to a systemic review by Solaski, Majnemer, and Oskoui, 8 out of 12 analysed studies indicated a link between higher prevalence of CP and lower SES, some of which remained after adjusting for gestational age and birth weight. This implies that the risk of cerebral palsy may be influenced by socioeconomic status in addition to known biological variables like low birth weight and prematurity[10]. Therefore, SES may be linked not only with the risk of developing CP but also with access to rehabilitation and subsequent functional outcomes. However, the relationship is complex and may be mediated by antenatal, perinatal, and postnatal factors. Evidence from Assam is comparatively limited. According to a clinical investigation conducted at Tezpur Medical College, prenatal, natal, and postnatal factors were found in 16%, 30%, and 38% of children with cerebral palsy, respectively, with birth asphyxia being the most often documented factor[11]. The significance of producing region-specific epidemiological evidence on CP in the state was highlighted more recently by the report of another study conducting an epidemiological survey involving 1,986 children with CP from Assam[12]. However, rather than specifically analysing the relationship between socioeconomic level and prenatal, perinatal, and postnatal risk factors, the current research from Assam has primarily discussed the clinical and epidemiological profile or distribution of risk variables. Therefore, a study investigating the association between SES and these risk factors among children with CP in Assam (Kamrup metro) is needed.

2. AIM OF THE STUDY

To study the association between socioeconomic status and antenatal, perinatal, and postnatal risk factors among children with cerebral palsy in Kamrup Metro.

2.1 OBJECTIVES

1.To assess the socioeconomic status of families of children with cerebral palsy.

2.To determine the antenatal risk factors associated with cerebral palsy among the study participants.

3. To identify the perinatal and postnatal risk factors for cerebral palsy among the study participants.

4.To evaluate the association between socioeconomic status and antenatal, perinatal, and postnatal risk factors among children with cerebral palsy.

3. MATERIALS AND METHODS

This study was conducted with the aim to understand the association between socioeconomic status and antenatal, perinatal, and postnatal risk factors among children with cerebral palsy in Kamrup Metro.

3.1 Type of Study: Cross-sectional study

3.2 Place of Study: Private and government rehabilitation centres

3.3 Study Population: Children diagnosed with cerebral palsy between the age group of 5-12 years who met the inclusion and exclusion criteria were included in the study. This study was conducted in a time period of ten months.

3.4 Sample Size: 40 cases

3.5 Selection Criteria:

Inclusion criteria

- Both the genders are included
- Age group between 5-12 years.
- Parents and patients who were willing to give consent and participate in the study.

Exclusion criteria

- Children above the age of 12 years and below 5 years.
- Parents and patients not willing to participate in the study.
- Children diagnosed with other neurological conditions such as autism, myopathy, and muscle dystrophy.

Children with cerebral palsy were selected based on the inclusion and exclusion criteria. After discussing the purpose of the study and the details of the protocols with their parents, informed written consent was obtained, and 40 cases were enrolled in the study. Detailed socio demographic information, antenatal, perinatal and post-natal history were assessed by using the paediatric assessment form. In prenatal history, maternal age, infections, medical history, social habits, consanguineous marriage and other relevant maternal factors were assessed. Perinatal and postnatal history such as mode of delivery, birth weight, birth asphyxia, birth term, neonatal complications, NICU admission etc were assessed.

For assessing the socioeconomic status modified Kuppuswamy scale was used. This scale originally created in 1976 has three index factors- 1. Education of the head 2. Occupation of the head and 3. Total monthly income. These 3 domains add up to a total of 3-29 which further categorise the population into five socio-economic classes (class I – class V)[13,14].

4. RESULTS

The data was collected and analysed using frequency and percentage were calculated to interpret the socioeconomic status (SES) of family like education, occupation, income and the antenatal, perinatal and postnatal risk factors. Pearson's chi-square test was used to find out the association between SES and the risk factors of Cerebral palsy. Fisher's exact test was used where expected frequencies were <5. *$p < 0.05$ considered statistically significant.

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Table 1(a). Socioeconomic status classification of the participants parents

SES classification	n	%
Class I	1	2.5
Class II	15	37.5
Class III	17	42.5
Class IV	6	15.0
Class V	1	2.5
Total	**40**	**100.0**

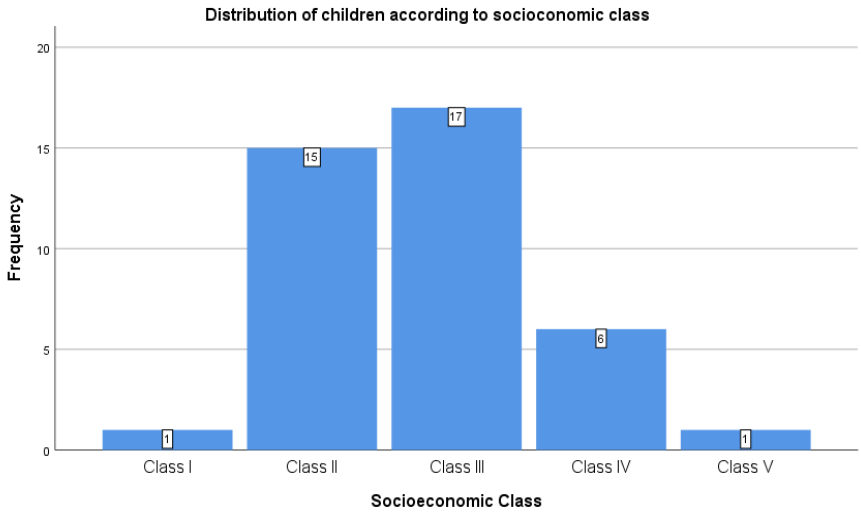
Table 1(b). SES group

SES group	n	%
Higher SES	16	40.0
Lower SES	24	60.0
Total	**40**	**100.0**

Table 1(c). Descriptive statistics of SES total score

Variable	N	Minimum	Maximum	Mean	SD
SES_TOTAL	40	4	27	14.78	4.796

Among the 40 study participants, the majority belonged to SES Class III (42.5%), followed by Class II (37.5%), Class IV (15.0%), and Classes I and V (2.5% each). Based on the categorized socioeconomic status, 16 participants (40.0%) belonged to the higher SES group, whereas 24 (60.0%) belonged to the lower SES group. The mean SES score was 14.78 ± 4.796, with scores ranging from 4 to 27.



Graph 1. Distribution of children according to socioeconomic class

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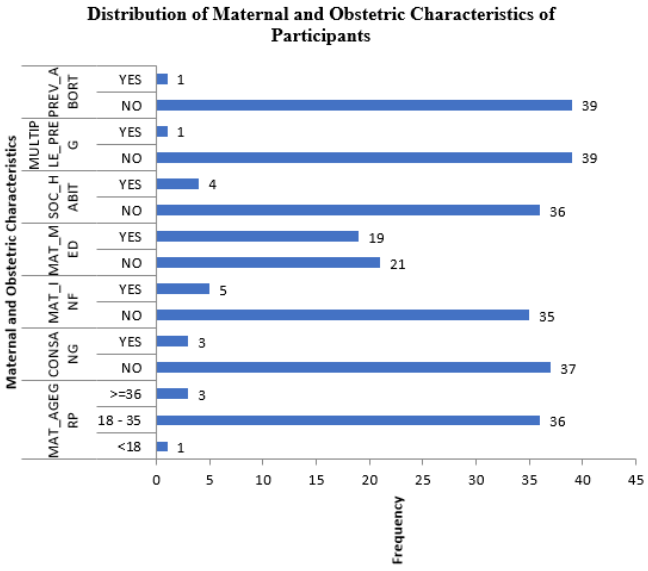
Table 2. Antenatal risk factors of the mothers of study participants.

variables	Category	n	%
MAT_AGEGRP	<18	1	2.5
	18 - 35	36	90.0
	>=36	3	7.5
CONSANG	NO	37	92.5
	YES	3	7.5
MAT_INF	NO	35	87.5
	YES	5	12.5
MAT_MED	NO	21	52.5
	YES	19	47.5
SOC_HABIT	NO	36	90.0
	YES	4	10.0
MULTIPLE_PREG	NO	39	97.5
	YES	1	2.5
PREV_ABORT	NO	39	97.5
	YES	1	2.5

Among the study participants, the majority of mothers (90.0%) were aged 18–35 years, while 2.5% were below 18 years and 7.5% were aged ≥36 years. Consanguinity was reported in 7.5% of participants, while maternal infection was reported in 12.5%. Maternal medical history was present in 47.5% of participants. Social habits were reported in 10.0% of participants. Multiple pregnancy and previous abortion were reported in 2.5% of participants each.



Graph 2. Distribution of Maternal and Obstetric Characteristics of Participants

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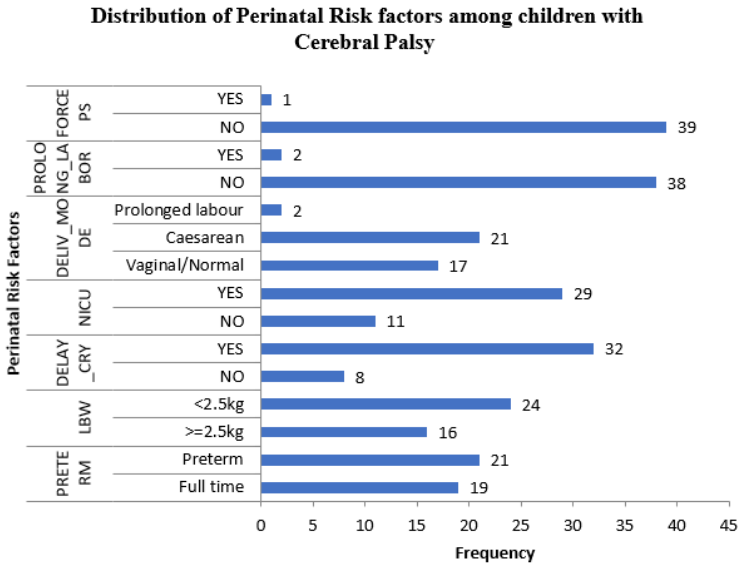
Table 3. Perinatal risk factors of the study participants.

variables	Category	n	%
PRETERM	Full time	19	47.5
	Preterm	21	52.5
LBW	>=2.5kg	16	40.0
	<2.5kg	24	60.0
DELAY_CRY	NO	8	20.0
	YES	32	80.0
NICU	NO	11	27.5
	YES	29	72.5
Mode of Delivery	Vaginal/Normal	17	42.5
	Caesarean	21	52.5
	Prolonged labour	2	5.0
PROLONG_LABOR	NO	38	95.0
	YES	2	5.0
FORCEPS	NO	39	97.5
	YES	1	2.5

Among the 40 study participants, 52.5% were born preterm and 47.5% were born full term. Low birth weight (<2.5 kg) was observed in 60.0% of participants. Delayed cry was reported in 80.0% of participants, while 72.5% required NICU admission. Regarding mode of delivery, 42.5% were delivered vaginally and 52.5% by Caesarean section. Prolonged labour was reported in 5.0% of participants, while forceps delivery was reported in 2.5%.



Graph 3. Distribution of Perinatal Risk factors among children with Cerebral Palsy

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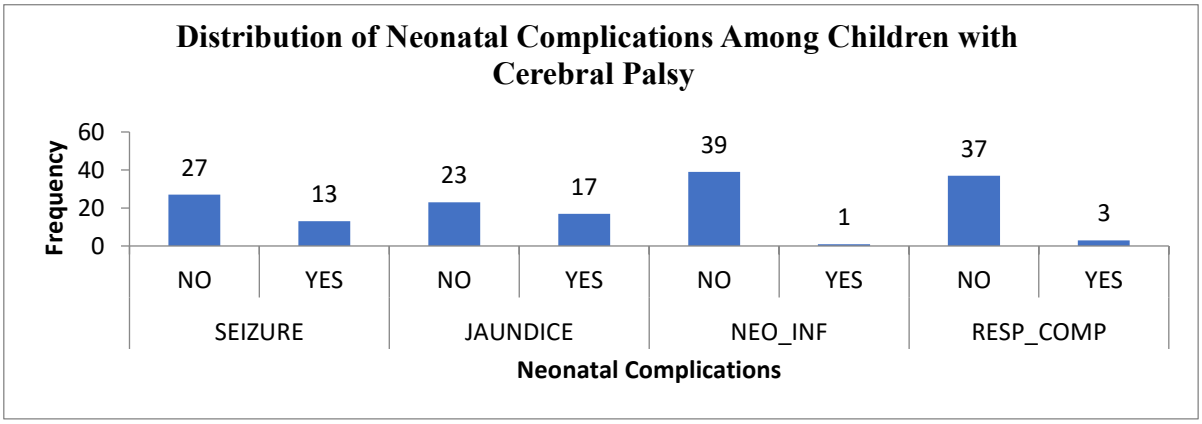
Table 4. Postnatal risk factors

variables	Category	n	%
SEIZURE	NO	27	67.5
	YES	13	32.5
JAUNDICE	NO	23	57.5
	YES	17	42.5
NEO_INF	NO	39	97.5
	YES	1	2.5
RESP_COMP	NO	37	92.5
	YES	3	7.5

Among the study participants, seizures were reported in 32.5% of cases, while 67.5% had no history of seizures. Jaundice was present in 42.5% of participants, whereas 57.5% had no history of jaundice. Neonatal infection was reported in 2.5% of participants. A response to complications was reported in 7.5% of participants.



Graph 4. Distribution of Neonatal Complications Among Children with Cerebral Palsy

Table 5. Association between socioeconomic status and antenatal, perinatal and postnatal risk factors

Risk factor	Higher SES n (%)	Lower SES n (%)	Test	p-value
Consanguinity	0 (0.0)	3 (12.5)	Fisher's Exact	0.262
Maternal medical history	9 (56.3)	10 (41.7)	$\chi^2 = 0.819$	0.366
Social habits	1 (6.3)	3 (12.5)	Fisher's Exact	0.638
Multiple pregnancy	0 (0.0)	1 (4.2)	Fisher's Exact	1.000
Previous abortion	0 (0.0)	1 (4.2)	Fisher's Exact	1.000
Prolonged labor	0 (0.0)	2 (8.3)	Fisher's Exact	0.508
Forceps delivery	1 (6.3)	0 (0.0)	Fisher's Exact	0.400

Preterm birth	8 (50.0)	13 (54.2)	$\chi^2 = 0.067$	0.796
Low birth weight (<2.5 kg)	11 (45.8)	13 (81.3)	$\chi^2 = 5.017$	**0.025***
Delayed cry	15 (93.8)	17 (70.8)	Fisher's Exact	0.114
Birth asphyxia	4 (25.0)	6 (25.0)	Fisher's Exact	1.000
NICU admission	11 (68.8)	18 (75.0)	Fisher's Exact	0.728
Seizure	5 (31.3)	8 (33.3)	$\chi^2 = 0.019$	0.890
Jaundice	6 (37.5)	11 (45.8)	$\chi^2 = 0.273$	0.601
Neonatal infection	1 (6.3)	0 (0.0)	Fisher's Exact	0.400
Response to complications	1 (6.3)	2 (8.3)	Fisher's Exact	1.000

Note: Pearson's chi-square test was used where expected frequencies were adequate; Fisher's exact test was used where expected frequencies were <5. *$p < 0.05$ considered statistically significant.

A statistically significant association was observed between socioeconomic status and low birth weight ($p = 0.025$). No statistically significant association was found between socioeconomic status and the other antenatal, perinatal, or postnatal risk factors ($p > 0.05$).

Table 5 (i) Test of Normality

Tests of Normality			
	Shapiro-Wilk		
	Statistic	df	p value
ANT_SCORE	.748	40	.000
PERI_SCORE	.886	40	.001
POST_SCORE	.746	40	.000

The Shapiro–Wilk test indicated that antenatal, perinatal, and postnatal risk-factor scores were not normally distributed (ANT_SCORE: $W = 0.748$, $p < 0.001$; PERI_SCORE: $W = 0.886$, $p = 0.001$; POST_SCORE: $W = 0.746$, $p < 0.001$).

4. DISCUSSION

This cross-sectional study was conducted to assess the association of socioeconomic status with the maternal and child birth risk factors among cerebral palsy affected children. The aetiology of cerebral palsy is complex and multifactorial, involving antenatal, perinatal, neonatal and postnatal factors. Socioeconomic conditions, which can impact maternal nutrition, access to prenatal care, the quality of obstetric services, institutional delivery, neonatal care, and early diagnosis and rehabilitation, may also have an impact on the occurrence and outcomes of these risk factors. As a result, evaluating socioeconomic status (SES) in addition to prenatal, perinatal, and postnatal risk factors may offer a more thorough understanding of the variables linked to CP in the study population.

In this study, out of 40 cases the majority belonged to SES Class III (42.5%), followed by Class II (37.5%), Class IV (15.0%), and Classes I and V (2.5% each) according to modified Kuppuswamy scale where 16 (40%) cases belong to upper socioeconomic group and 24(60%) cases belong to lower socioeconomic group. The mean SES score was **14.78 ± 4.796**, with a minimum score of 4 and a maximum score of 27. A study conducted in Taiwan by Sung-hui Tseng et al[15] observed that CP prevalence is more in low-income families. Similarly, a study by Solaski et al[10] in a systematic review of 12 studies, reported that eight studies found low socioeconomic status to be associated with increased prevalence of cerebral palsy. Families with lower

socioeconomic resources may experience poorer maternal nutrition, inadequate antenatal care, delayed recognition of pregnancy complications, limited access to specialist obstetric services and following birth, it may also restrict access to neonatal intensive care, early diagnosis and other rehabilitation services.

In the present study, the majority of mothers (90.0%) were in the age group of 18–35 years, while 2.5% were younger than 18 years and 7.5% were aged ≥36 years. Rather than indicating maternal age as an independent risk factor for cerebral palsy, the prevalence of mothers in the 18–35 age range may be more indicative of the typical reproductive age range in the general population. However, maternal age has been investigated as a potential risk factor of CP with both advanced and young maternal age in the literature. While 92.5% of the mothers reported no consanguineous marriage, 7.5% of mothers reported consanguinity in this study. Despite the small percentage, consanguinity may be significant because cerebral palsy is becoming more widely accepted as a multifactorial neurological disorder involving both environmental and genetic pathways. 12.5% of mothers reported maternal infection during pregnancy, while 87.5% did not. A maternal medical history was reported by nearly half of the mothers (47.5%), whereas 52.5% did not report any such history. This finding implies that when taking into account the prenatal history of infants with cerebral palsy, maternal health issues during pregnancy may be significant. A study by Peng et al.[16] demonstrated that gestational diabetes mellitus was correlated with an increased risk of offspring CP.10% of the mothers reported having social habits, while 90% did not. Multiple pregnancy and previous abortion were reported in 2.5% of mothers of the participants each. In contrast to consanguinity, multiple pregnancies, and prior abortions, the current study shows that a number of maternal and antenatal factors were present in children with cerebral palsy, including maternal medical history (47.5%), maternal infection (12.5%), and social habits (10.0%). These results are in line with the existing knowledge that the aetiology of cerebral palsy is complex, involving interactions between genetic, perinatal, postnatal, and prenatal variables rather than a single causative event.

In this study, 52.5% of the children were born preterm, whereas 47.5% were born full term. Low birth weight (<2.5 kg) was observed in 60% of the participants, while 40% had a birth weight of ≥2.5 kg. 80% of the children had delayed crying after birth, while 72.5% of the children had a history of NICU admission. In terms of delivery methods, 52.5% were Caesarean sections and 42.5% were vaginal births and only 5% of the participants were reported for prolonged labour. Because of the immaturity of the growing brain, preterm newborns are especially susceptible to neurological damage, and the risk of cerebral palsy often rises as gestational age decreases. A meta-analysis study by conducted Chen D et al.[17] reported that premature delivery and Caesarean delivery was significantly associated with CP. Low birth weight is linked to a higher risk of neurological problems and often coexists with preterm. A systematic review has reported a predominantly positive association between low birth weight and the development of CP[18]. The developing brain may experience hypoxia and ischemia as a result of birth asphyxia. Prolonged or severe oxygen deprivation can lead to neuronal damage, cellular energy depletion, and hypoxic-ischemic encephalopathy, which can cause irreversible neurological disability, including cerebral palsy. Zhang et al.[19] suggested that the incidence of cerebral palsy in neonates (≥35 weeks' gestation) with perinatal asphyxia is significantly higher compared to that in the healthy neonate population. In present study, 32.5% of the participants were reported as having seizure, Jaundice was present in 42.5% of participants and 7.5% were suffered from respiratory distress.

In the current study a statistically significant association was observed between socioeconomic status and low birth weight ($\chi^2 = 5.017$, $p = 0.025$). Low birth weight, delayed cry, premature delivery, neonatal seizure and jaundice and NICU admission are established risk factors associated with CP. Similarly, the present study has also found a relatively high prevalence of these risk factors associated with CP.

The current study investigated the relationship between prenatal, perinatal, and postnatal risk variables and socioeconomic status (SES) in children with cerebral palsy (CP). The results demonstrated that the only risk factor that was substantially correlated with socioeconomic class was low birth weight (<2.5 kg). The strong correlation between low birth weight and lower SES ($p = 0.025$) was the most significant finding. Low birth weight was reported in 81.3% of children in the lower-SES group compared with 45.8% in the higher-SES group. The result indicates that low birth weight was more common among children from socioeconomically disadvantaged families in the current sample. Socioeconomic disadvantages can be associated with maternal nutritional deficiencies, poor prenatal care, maternal illness, exposure to the environment, and other conditions that raise the risk of restricted foetal growth or adverse birth outcomes. The significance of socioeconomic factors on birth outcomes is supported by an Indian study Mishra et al.[20] that looked at socioeconomic disparities in low birth weight and found persistent socioeconomic differences in LBW. A systematic review and meta-analysis by Thomson K, et al.[21] lower occupational status

and unemployment were significantly associated with increased risk of multiple adverse pregnancy outcomes such as preterm birth: OR 1.41 (95% CI 1.33–1.50), low birth weight: OR 1.40 (95% CI 1.19–1.61). According to a recent analysis of NFHS-5 data, reduced maternal education and household wealth were linked to higher probabilities of low birth weight in India[22].

Overall, the study found that 60% of the children with cerebral palsy belonged to the lower socioeconomic group**.** Several antenatal, perinatal, and postnatal factors were observed, with prematurity, low birth weight, delayed cry, and NICU admission being relatively common. However, socioeconomic status was not significantly related to the overall antenatal, perinatal, or postnatal risk-factor scores. Among individual factors, only low birth weight showed a significant association with SES ($p = 0.025$**)**.

5. CONCLUSION

The study concluded that low socioeconomic status showed significantly associated with low-birth-weight children with cerebral palsy. Socioeconomic status, however, did not significantly correlate with the other prenatal, perinatal, or postnatal risk factors studied. In order to assist cerebral palsy prevention and early management, these findings emphasize the significance of enhancing maternal nutrition, prenatal care, and early detection of high-risk pregnancies, especially in socioeconomically low-income group in the society.

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AUTHOR CONTRIBUTIONS

Niharika Dihidar: Conceptualization, Investigation.

Dr. B.C Sarma: Supervision.

Shalaka Baidya: Review & Editing.

Dr. Mantu Paul: Review.

Suman Pathak: Review.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

Ethical approval was taken from Assam down town University.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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