

Clinical Profile and Outcomes of Late Preterm Neonates in Relation to Gestational Age and Maternal Psychosocial Factors in a Tertiary Care Centre

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ABSTRACT

The relationship between maternal psychosocial factors and outcomes among LPN remains unexplored. Objectives: To determine the morbidity profile of LPN with respect to gestational age and study its association with maternal psychosocial, lifestyle and demographic factors. Methodology: Cross-sectional study on LPNs in a tertiary care centre over one year. Results: Total sample: 263. LPN incidence: 94/1000 live births; Maternal age 20-30 years (p=0.03), high screen time (p=0.02), Caesarean section (p=0.02), moderate Maternal Stress (MS) (p=0.014) was associated with (a/w) births at 35 0/6 to 6/7 weeks of gestation (WOG).Low Birth Weight (LBW) LPN: 66.5% incidence, highest at 35 0/6 to 6/7 WOG; a/w maternal age 20-30 (p=0.002), nulliparity (p=0.02), moderate to severe MS (p=0.012), and Pregnancy Induced Hypertension (PIH) (p=0.04).Small for Gestational Age (SGA): 35%, peaking at 35 0/6 to 6/7 WOG; a/w nulliparity and severe MS. Sepsis 12.2%, highest at 34-35 0/6 to 6/7 WOG (p=0.001); a/w lower-middle socioeconomic status (p=0.05) and multiparity (p=0.02). Respiratory Distress Syndrome (RDS) 5.3%, peaked at 34 0/6 to 6/7 WOG (p=0.044); a/w poor socioeconomic status (p= 0.00). Transient tachypnoea of Newborn (TTN) 49.4%, a/w nulliparity (p=0.02). Neonatal hyperbilirubinemia (NNH) 57.8%, peaking at 34-35 0/6 to 6/7 WOG (p=0.01); a/w nulliparity (p=0.03). Perinatal asphyxia (PA) 6.5%, highest at 35 WOG. Conclusion: NNH and TTN were common in LPN. 35 WOG related to various risk factors and morbidities. LPN born to mothers with moderate MS, PIH, nulliparity, and age 20-30 were LBW. Mother's screen time > 4 hours/day a/w LPNs born at 35 WOG.

1. Introduction

Infants born between 34 0/7 to 36 6/7 weeks of gestation are classified as late preterm new-borns (LPN)¹. According to the WHO statistics; they represent a substantial proportion of all the preterm births across the world. They have been quite often overlooked on account of their gestational age, but in reality they are structurally and physiologically immature in comparison to terms. This group has gained a special attention over the past fifteen years as there is a significant amount of morbidity, mortality, and adverse neuro-developmental outcomes that have been observed in comparison to term infants. The one year mortality ratio of the LPNs is significantly on the higher side in comparison to the term infants². Though the aetiology is multi-factorial and complex, but commonly observed maternal risk factors are spontaneous rupture of membranes, spontaneous pre-term labour, history of a previous pre-term birth, short cervix, multiple gestations, infection, inflammation, maternal stress and / or foetal anomalies². Gestational Hypertension , poorly controlled Gestational Diabetes Mellitus is found to be the major risk factor contributing to the increased risk of late preterm births ². The significant morbidities in LPN include, Respiratory Distress Syndrome (RDS), Transient

Tachypnoea of Newborn (TTN), increased apnoeic or hypoxic episodes, hyperbilirubinemia, feeding difficulties. All of the above lead to increased mortality among this cohort². Though they have appeared to be far better than early and moderate preterm, physiologically, and with respect to outcomes, and they have certain significant areas of physiological insufficiencies that contribute to significant morbidities in this group.

Need for the study

In India there is around 3.6 million preterm births out of which majority are LPNs³. This calls for a study that aims at a deeper understanding and a keener observation as to the morbidities, mortality and the associated maternal and foetal risk factors affecting this group of new-borns. There is a significant research gap as to the morbidity and the mortality of the preterm that are classified as late preterm using Ballard's scoring scale. Hence, there is a need for understanding the relationship between maternal, socio economic factors in Indian landscape. In the Indian scenario, where there is still a notable amount of poverty, lack of proper educational resources, lack of adequate hygiene education, excess screen exposure and reduced amount of physical activity, poor stress management strategies in the mothers and lack of awareness among the mothers and families regarding the clinical outcomes of late preterm births, this study regarding clinical profile of LPN in relation to maternal psychosocial risk factors is the need of the hour for establishing protocols, for creating awareness policies to reduce the incidence of late preterm. Hence we wished to determine the morbidity profile of LPN with respect to gestational age and study its association with maternal psychosocial, lifestyle and demographic factors.

2. Methodology

This is a cross-sectional, observational study conducted at Tertiary care centre in Tamil Nadu. Approval was obtained from Institutional ethical committee prior to the beginning of the study. All inborn late pre term neonates who were delivered and/ or admitted to NICU during the study period of one year were included. We have included LPNs with gestational age between 34 to 36 that is (25-30) score as per Ballard's scoring scale. A pre structured, pre validated case record form was used to collect the perinatal case details and postnatal events until discharge. Informed consent was obtained from the mothers of the neonates enrolled in the study before commencing the data collection. The mothers were interviewed within a week after the child's birth in a private room with complete confidentiality and in the absence of other family members. Trimester wise detailed antenatal history, the socio economic details of the mother were taken. The psychological status before the LPN delivery was assessed by using perceived stress scale immediate postpartum. Perceived stress scale classifies the stress levels based on scores as follows: mild (1-14); moderate (14-25) and severe (25-40). Lifestyle history was taken with regards to physical activity and total screen time of the mother during the antenatal period.

All the above data was coded and entered in a master chart in MS Excel sheet. The data was analysed using IBM SPSS Statistics Version 20. Descriptive data was expressed as number and frequency. Categorical variables were taken in the form of frequencies and proportions and column proportions were compared using chi square test. Correlation and Regression analysis was used to assess maternal stress levels and Low birth weight LPN.

Case definitions :

Respiratory distress syndrome :

Signs of respiratory distress (tachypnoea/chest wall retractions/nasal flaring/grunting/cyanosis) due to atelectasis of alveoli attributable to pulmonary surfactant deficiency ⁴.

Transient tachypnoea of the newborn :

Caused due to delayed clearance of lung fluid, characterized by tachypnoea with signs of mild respiratory distress including cyanosis and retractions decreased oxygen saturation ⁵.

Neonatal Sepsis :

Clinical/ Culture proven sepsis : signs of hypothermia, fever, apnea, mottling, hypoglycaemia, convulsions, persistent tachycardia, sclerema, and associated laboratory abnormalities like neutropenia, C Reactive Protein positivity, thrombocytopenia or blood/CSF culture positivity ⁶.

Neonatal Hyperbilirubinemia

It is defined as jaundice affecting the infant staining parts of the body and total bilirubin levels >95 percentile in hour specific Bhutani normogram ⁵.

Neonatal seizures

Paroxysmal alteration in neurological function, that is motor, behaviour or autonomic function. This includes epileptic, non epileptic, EEG seizures ⁶.

Low birth weight (LBW)

Newborns weighing less than 2500 grams ⁹.

NBW (Normal birth weight)

Birth weight between 2.5 to 3.5 kilograms⁹.

VLBW (Very Low Birth Weight)

Birth weight less than 1500 grams⁹.

Intra uterine growth retardation (IUGR)

A fetus with estimated fetal weight <10% for gestational age⁷.

SGA

Birth weight of the neonate falling below 2 standard deviations of the mean or below the 10 th percentile ⁴.

Physical activity

30 minutes of focussed physical activity every day by a healthy antenatal woman⁸.

Screen exposure in pregnancy

Greater than 4 hours ⁹.

3. Results and Discussion

The total incidence of Late Preterm Neonates (LPN) in our setting was 94 per 1000 live births over a period of 6 months. We included a total of 263 late preterm new-borns. Among the LPN, 84 (31.9 %) were delivered at 34 0/6 to 6/7 WOG, 102 (38.8%) at 35 0/6 to 6/7 WOG and 77 (29.3%) at 36 0/6 to 6/7 WOG. A substantial proportion of neonates were Low birth weight (LBW) that is 66.5% (175 out of 263) and 35% of neonates were SGA. We categorized LPN into three groups based on birth weight as per the gestational age (34 0/6 to 6/7, 35 0/6 to 6/7 and 36 0/6 to 6/7 WOG) in which we had 3% VLBW , 58.5% LBW, 37.8% NBW neonates delivered at 34 0/6 to 6/7 WOG. At 35 0/6 to 6/7 WOG we had 27.2% NBW and 71.57% LBW neonates. At 36 0/6 to 6/7 WOG we had 29.8% NBW and 70.1% LBW LPNs.

Among all LPNs 57% of them were SGA. The week wise incidence of SGA was 33% at 34 0/6 to 6/7 WOG , 37 % at 35 0/6 to 6/7 WOG, 40 % at 36 0/6 to 6/7 WOG . SGA was more commonly seen in LPN born to mothers who were under moderate stress during pregnancy (p=0.04). LPN born to Nulliparous mothers developed neonatal hyperbilirubinemia (p=0.03) and they were SGA too (0.014). Maternal PIH was significantly associated with SGA LPN births. (Table 4).

Mothers aged between 20 and 30 years (p=0.03), Caesarean section deliveries (p=0.02), high screen

time ($p=0.02$) and moderate maternal stress ($p=0.014$) were significantly associated with LPN birth at 35 0/6 to 6/7 WOG. Gestational age wise comparison with maternal factors showed significant association with many of the maternal factors as given in Table 1.

Neonatal sepsis was found in 32 (12.2%), RDS in 14 (5.3%), TTN in 130 (49.4%), Neonatal hyperbilirubinemia in 152 (57.8 %) and perinatal asphyxia in 17 (6.5%) LPN. A small percentage exhibited neonatal hypoglycaemia (1.9%), and even fewer had neonatal hypocalcaemia (1.5%). A few had congenital anomalies (8.7%) among which renal pelvi-ectasis and PDA were the most common.

Specific neonatal conditions were prominent among different gestational weeks as depicted in Table 2. Neonatal Sepsis ($p=0.001$) and Respiratory Distress Syndrome (RDS) ($p=0.044$) was more common among LPN infants born at 34 0/6 to 6/7 WOG, and RDS was associated with poor socio economic status ($p=0.00$). NNS was linked with lower socio-economic status. Neonatal Hyperbilirubinemia (NNH) was more prevalent among 34 0/6 to 6/7 and 35 0/6 to 6/7 WOG. LPN infants ($p=0.01$). Perinatal Asphyxia (PA) was higher at 35 0/6 to 6/7 WOG ($p=0.022$).

Maternal age between 20-30 years ($p=0.002$), Nulliparous status ($p=0.02$), and pregnancy-induced hypertension ($p=0.04$) were significant risk factors for giving birth to LBW LPN (Table 3). Correlation analysis showed that severe maternal stress had a positive correlation with LBW LPNs ($r=0.87$, $p=0.001$). Regression analysis showed mothers having moderate stress delivered LBW LPN ($p=0.012$).

Table 1: Gestational age wise association of late pre-terms with maternal and neonatal factors.

	34 0/6 to 6/7 N (%)	35 weeks 0/6 to 6/7	36 weeks 0/6 to 6/7	P value
Parity	-	-	-	0.712
Nulliparous	50 (33.3%)	55 (36.6%)	45 (24.3%)	
Multiparous	34 (29%)	47 (40.1%)	32 (27.3%)	
Mode of delivery	-	-	-	0.024*
Normal	49 (36.3%)	48 (35.5%)	38 (28.1%)	
Caesarean	35 (27.34 %)	54 (42.18%)	39 (30.46%)	
Maternal age (years)	-	-	-	0.036*
<20	13 (56.5%)	8 (34.5%)	2 (8.6%)	
20-30	65 (29.4%)	89 (40.27%)	67 (30.31%)	
>30	6 (31.5%)	5 (26.3%)	8 (42.1%)	-
Maternal Socio economic status	-	-	-	
Lower	28 (41.8%)	21 (31.34%)	18 (26.9%)	
Lower middle	55 (28.64%)	78 (40.6%)	59 (30.73%)	-
Upper middle	1 (25%)	3 (75%)	0 (0%)	
Screen time	-	-	-	
Low < 4 hours	32 (44.4%)	23 (32%)	17 (23.6%)	0.028*
High > 4 hours	52 (27.2%)	79 (41.36%)	60 (31.4%)	
Physical activity	-	-	-	
Adequate (< 30 minutes)	19 (24.35%)	36 (46.1%)	23 (29.48%)	0.170
Inadequate (> 30 minutes)	65 (35.13%)	66 (48.8%)	54 (40%)	
Stress score	-	-	-	
Mild	2 (25%)	3 (37.5%)	3 (37.5%)	0.014*
Moderate	74 (32.74%)	86 (38.05%)	66 (29.2%)	
Severe	8 (27.6%)	13 (44.8%)	8 (27.6%)	
Gender of the baby	-	-	-	0.231
Male	57 (34.9%)	57 (34.9%)	49(30.06%)	
Female	27 (27%)	45 (45%)	28 (28%)	

Birth weight (in kgs)	-	-	-	
Normal Birth weight (NBW)	31 (33.6%)	28 (30.43)	23 (25%)	
Low Birth Weight (LBW)	48(27.42%)	73 (42.3%)	54(30.85%)	0.05*
Very Low Birth Weight (VLBW)	3 (100%)	0 (0%)	0 (0%)	
Birth weight according to gestational age	-	-	-	
Appropriate for Gestational Age (AGA)	56 (34.1%)	63(38.41%)	45(27.4%)	0.904
Small for Gestational Age (SGA) /Intra Uterine Growth Retardation (IUGR)	28 (29.16%)	37(38.5%)	31 (32.29%)	

*p < 0.05 is statistically significant

Table 2 : Comparison of morbidities in LPN with gestational age

Morbidities		34 0/6 to 6/7	35 0/6 to 6/7	36 0/6 to 6/7	P VALUE
Neonatal sepsis	Yes	14 (43.75%)	11 (34.37%)	7 (21.8%)	0.001*
	No	70 (30.3%)	91 (38.9%)	70 (30.3%)	
RDS	YES	8 (57.14%)	5 (35.7%)	1 (7.1%)	0.044*
	NO	76 (30.52%)	97 (38.95%)	76 (30.52%)	
TTN	YES	43 (33.07%)	46 (35.38%)	41 (31.53%)	0.853
	NO	41 (30.8%)	56 (42%)	36 (27.06%)	
Hyperbilirubinemia	YES	52 (32.7%)	59(35.8%)	41 (25.8%)	0.011*
	NO	32 (28.8%)	43 (38.7%)	36 (32.4%)	
Perinatal asphyxia	YES	7 (41.17%)	8 (47.05%)	2 (11.76%)	0.022*
	NO	77 (31.3%)	94 (38.2%)	75 (30.48%)	
	TOTAL				

*p < 0.05 is statistically significant

Table 3 : Birth weight wise comparison of LPN with maternal risk factors

		VLBW	LBW	NBW	HBW	P VALUE
Maternal age	<20	4 (17.39%)	16 (69.5%)	2 (8.6)	1 (4.3%)	0.002*
	20-30	72 (32.5%)	147 (66.5%)	0 (0%)	2 (0.9%)	-
	>30	6 (31.5%)	12 (63%)	1 (0.5%)	0	-

Maternal risk factors	Gestational Diabetes Mellitus	27 (60%)	16 (35%)	1 (0.3%)	1 (0.3%)	0.049*
	Pregnancy Induced Hypertension	22 (22%)	76 (76%)	1 (1%)	1 (1%)	
	Hypothyroidism	2 (16.6%)	9 (75%)	1 (8.3%)	0	
Parity	Nulliparous	39 (26%)	109 (72.6%)	2 (1.3%)	0	0.028*
	Multiparous	43 (38%)	66 (58.4%)	1 (0.8%)	3 (2.6%)	
Stress score	Mild	6 (42.8%)	2 (14.28%)	0 (0%)	6 (42.8%)	0.213
	Moderate	68 (30.08%)	152 (67.25%)	3 ((1.3%)	3 (1.3%)	
	Severe	8 (27.6%)	21 (72.41%)	0 (*0%)	0 (0%)	
Physical activity	Adequate	23 (29.8%)	54 (70.12%)	0 (0%)	1 (8.3%)	0.681
	Inadequate	59 (31.9)	121 (65.4%)	3 (1.6%)	2 (1%)	

*p < 0.05 is statistically significant

Table 4: Major morbidities versus maternal factors

		Neonatal sepsis	Transient Tachypnoea of Newborn	Neonatal hyper bilirubinemia	Intra Uterine Growth Retardation/Small for Gestational Age
Maternal risk factors	Gestational Diabetes Mellitus	0.747	0.367	0.290	-
-	Pregnancy Induced Hypertension	-	0.367	-	0.025 *
-	Hypothyroid	-	-	-	-
Maternal Age	<20 years	0.781	0.429	0.324	0.201
-	20-30 years	-	-	-	-
-	>30 years	-	-	-	-
Parity	Nulliparous	0.128	0.457	0.032	0.014*
-	Multiparous	-	-	-	-
Maternal stress score	Mild	0.601	0.282	0.474	0.076*
-	Moderate	0.345	0.597	0.595	0.301
-	Severe	0.764	0.171	1.000	0.045*
Maternal Physical activity	Adequate	0.288	0.835	0.342	0.483
-	Inadequate	0.522	0.343	0.833	-

Maternal screen time	< 4 hours (low)	0.537	0.681	1.000	0.479
-	>4 hours (high)	1.000	0.603	0.433	0.815

*p < 0.05 is statistically significant

The incidence of LPNs in our tertiary care centre was around 94 per 1000 live births it coincides with the results from a study done in the Northern part of India by Ghulam Nabi et al.¹⁰ Since both the studies have been conducted in a similar resource setting, the incidence could imply a similar pattern of maternal risk factors associated with LPN births. Comparing the week wise incidence of LPNs in our study with a study done by William Eagle et al¹¹ we had a higher incidence of LPN births at 35 0/6 to 6/7 WOG where as they had highest number at 36 0/6 to 6/7 WOG . Several maternal antenatal and natal risk factors were found to be significant with births at 35 0/6 to 6/7 WOG. We found out that maternal age 20-30 years was statistically associated with 35 0/6 to 6/7 WOG which was similar a study done by Fuchs F Monet ¹² in which women aged 25–29 years had a tendency to have increased risk with preterm deliveries. LPN incidence at 35 0/6 to 6/7 WOG section has an association with Caesarean section. A study by Bettgowda et al.¹³ showed that from 1996 to 2004, there was a surge in the singleton preterm births in the USA from 9.7% to 10.7% most of which were LPNs which was particularly associated with caesarean section. Mothers with high screen exposure (>4 hours/day) delivered babies at 35 0/6 to 6/7 WOG in our study. Which was similar to a study by Col-Araz et al,¹⁴ where mothers who reported the use of mobile phones or computers while pregnant had higher incidence of deliveries before 37 0/6 to 6/7 WOG (p < 0.018 and p < 0.034, respectively) which is longer the exposure to mobile phones or computers, shorter the duration of pregnancy.

Mothers having moderate stress were delivering babies at 35 0/6 to 6/7 WOG . Similar to our study, Julie Bergenon et al¹⁵ found that in the late preterm group , higher levels of emotional distress and life stress were associated with a shorter gestational duration. Exploring the mechanisms relating stress to preterm delivery , we found that chronic stress in pregnancy activates the HPA axis, leading to increased cortisol production, which, in turn, may influence uterine contractions and contribute to preterm labor¹⁶. Chronic maternal stress is a significant risk factor for preterm birth, potentially promoting parturition through neuroendocrine and immune pathways, with potential interactions and multiplicative effects when stress occurs during pregnancy. Maternal stress can induce a pro-inflammatory state, potentially leading to inflammatory cascades that disrupt the balance needed for maintaining pregnancy¹⁷. Stress-related changes in placental function, including altered blood flow and nutrient transport, may contribute to preterm birth¹⁸. Maternal stress during pregnancy can lead to epigenetic changes in the fetal genome, influencing gene expression related to gestational age and birth outcomes ¹⁹. In our study, a substantial proportion (66.5%) of LPNs were low birth weight (LBW). This was in contrast to study by Villar J et al ²⁰ where they found, prematurity was not significantly associated with total LBW incidence.

In our study, nulliparity was significantly associated with LBW LPN births which was similar to a study done by Stefanie N.Hinke²¹. The physiological basis for this may be due to the influence of structural factors that limit uterine capacity for expansion during first pregnancy. With increasing number of pregnancy the uterus becomes more structurally adaptable compared to the previous pregnancies. In our study, PIH was linked to LBW LPNs similar to a study by Xiong X et al,²² which stated that both pre-eclampsia and severe pre-eclampsia increase the likelihood of having a IUGR and LBW. Our study showed a significant association between LBW and maternal perceived stress levels in antenatal period. The study by Lima et al, ²³proved a positive statistical association between stress in the antenatal period and increasing rates of LBW (Odds ratio (OR) 1.68 [95% Confidential Interval (CI) 1.19, 2.38]. Our study population has noticed a peak incidence of SGA at 35 0/6 to 6/7 WOG. It was also statistically significant with nulliparity. Our study findings relate to a study by Rotem et al.²⁴ where nulliparity, maternal age, gestational age, hypertensive disorders of pregnancy, oligohydramnios and pre-gestational diabetes mellitus were found to be independently associated

with SGA. Nulliparous mothers, with limited fetal antigen exposure, exhibit lower complement levels (CH 50) and they are prone to placental lesions, especially chronic villitis due to which there is limited fetal antigen exposure. This immunological imbalance increases the likelihood of SGA infants²⁵.

Moderate to severe stress levels in pregnancy were associated with delivering SGA infants in our study which was similar to findings by Khashan et al²⁶. In our study RDS was one of the important respiratory morbidities. The highest incidence was seen at 34 0/6 to 6/7 WOG. The study findings aligned with Lewis et al²⁷ in which the incidence of RDS during the 34 WOG was 14.9% ($p < 0.05$). RDS in our study was associated to poor socio economic class contrary Sunil S Holikar et al,²⁸ in which the upper lower class 198 out of 400 i.e, (49.5%) experienced a higher prevalence of RDS compared to other socioeconomic classes. A study by Tsitoura et al²⁹ suggests that specific SP-A genetic variants may independently influence the susceptibility to RDS in late-preterm infants. Overall, the presence of SP-A1 6A4 and/or SP-A2 1A5 haplotype(s) was observed in 35.7% of newborns with RDS, resulting in a 4.2-fold (1.60–11.0) higher probability of RDS in carriers. TTN was the most common respiratory morbidity that was found in most of the LPN in our study irrespective of WOG. It was associated with nulliparity. This finding coincides with the study done by Akane Takaya.³⁰ Recent studies have associated TTN with lower cortisol, ACTH, and fT3 levels at birth. This may contribute to TTN in LPN and term infants delivered by caesarean section, potentially impacting fetal lung fluid clearance and postnatal pulmonary adaptation.³¹

In our study the incidence of NNH was highest at 34 0/6 to 6/7 and 35 0/6 to 6/7 WOG but in a study by Imekesorn, R et al,³² NNH was higher in 34 to 34 6/7 when compared to 35 – 36 0/6 to 6/7 WOG. It was also associated surprisingly with nulliparity, but further studies are required to establish this association. Neonatal sepsis had association with 34 0/6 to 6/7 and 35 0/6 to 6/7 WOG and was more common in multiparous women and women from lower socio-economic status. The result has coincided with, Cortese et al³³ which stated that premature birth and low socioeconomic status are strongly associated with sepsis, especially early onset sepsis due to immune system immaturity. Factors include altered innate response, gene defects, prematurity, low birth weight, reduced maternal antibody transfer, and immature gastrointestinal barrier.³⁴

Conclusion

In conclusion, this study provided a comprehensive analysis of psychosocial maternal factors associated with LPN births. SGA, NNS, RDS, TTN, NNH, PA were the most common morbidities in LPNs. Mothers having moderate maternal stress, age (20-30 years), were giving birth at around 35 0/6 to 6/7 WOG. Moderate to severe maternal stress and PIH could lead to LBW LPN births. LPN birth at 35 0/6 to 6/7 WOG, RDS and Neonatal sepsis were associated with poor and lower middle socio-economic class respectively. Nulliparity was associated with LBW,SGA,TTN,NNH. Interestingly, mothers' with over 4 hours of screen exposure daily are more likely to deliver babies at 35 0/6 to 6/7.

This shows we need personalized care for LPNs, considering their precise gestational age as well as maternal risk factors like stress levels and lifestyle. Our study urges a holistic approach for better care.

Strengths of the study

There has been a holistic approach in the evaluation of clinical profile of LPNs, etiology in relation to maternal factors and it is a study that is one of a kind that includes so many parameters and has a multidimensional approach. We have included the clinical profile of LPN newborns not only by gestational age but also by Ballard's scoring which gives a deeper understanding about physiological immature LPNs. The study explores the link between LPN births and morbidities. We have also taken into account the high screen time in relation to LPN births which adds a unique and novel direction to the study.

Limitations

The sample size can be larger and the duration of the study can be longer to get a study the morbidities in detail. It was conducted in a single center. Collaborative studies can prove to be more beneficial. Maternal recall bias or inhibition might have hindered them from revealing accurate information about stress levels, physical activity, screen exposure and socioeconomic status. Follow up of LPNs would have given a clearer picture into the clinical outcomes of the LPNs .

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