e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(1); 807-812

Original Research Article

A Prospective Observational Study to Assess the Impact of Various Childcare Practices on the Development of Microbiota in Neonates

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Received: 01-10-2025 / Revised: 15-11-2025 / Accepted: 21-12-2025
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Conflict of interest: Nil

Abstract

Introduction: The human microbiota develops from newborn time period as a neonate is not born with any microbiota. Colonization of the infant gut represents the de novo assembly of a complex microbial community. This process is influenced by several environmental and host factors. Different child rearing practices like early initiation of breastfeeding, administration of colostrum, ghutti, ghasa and prelacteal feed are likely to affect the microbiota.

Aim and Objective: To evaluate impact of different antenatal, natal, postnatal factors and various childcare practices on the development of microbiota in neonates.

Primary Objective: To find out proportion of various organisms that first colonise the neonate.

Secondary Objective: To evaluate whether there is any change in development of microbiota with gestational age, sex, mode of delivery and method of feeding.

Methodology: Type of study was prospective quantitative cross-sectional observational clinical research with a prospective design and was conducted in Department of Paediatrics, Dr S. N. Medical College, Jodhpur, and Rajasthan, India. Samples of 128 newborns were taken. Seven samples (skin of right upper limb, skin of left lower limb, surface of umbilical cord, mucosa of oropharynx, mucosa of conjunctiva, stool sample, air sample) of each baby with swab were taken.

Result: In babies with initiation of feeding less than 24 hours first bacterial growth appeared in within first three days of life in 77 babies in pharynx which was statistically significant (P value - 0.00001), in 78 babies in stool (P value - 0.014958) which was statistically significant. The first microbiota isolated in stool in babies with initiation of breastfeeding in less than 24 hours was E. coli (77.5%), in pharynx streptococcus (65%), in skin nonpathogenic staphylococcus (57.5%).

Conclusion: Our study concluded that early initiation of feeding helps in early establishment of microbiota in pharynx and stool and the first organism isolated in stool, skin and pharynx in babies with early initiation of breastfeeding is E coli, non-pathogenic staphylococcus and streptococcus respectively.

DOI: 10.25258/ijcpr.18.1.135

Introduction

The human microbiota develops from newborn time period as a neonate is not born with any microbiota. Colonization of the infant gut represents the de novo assembly of a complex microbial community [1]. This process is influenced by several environmental and host factors [2]. Different child rearing practices like early initiation of breastfeeding, administration of colostrum, ghutti, ghasa and prelacteal feed are likely to affect the microbiota. Whether or not colostrum is given to the child has an important bearing on development of normal microbiota**.** During the neonatal period, due to immune immaturity, the risk of early or late-onset nosocomial infection is high. Nosocomial sepsis in preterm infants is related to the use of catheters, with Gram-positive microorganisms from the genus Staphylococcus being the main causative agent, followed by Gram-negative bacteria, mostly enterobacteria such as E. coli or Klebsiella etc. Moreover, especially in the case of premature neonates, this sepsis risk is exacerbated as well as

the risk of developing necrotizing enterocolitis (NEC), which is a very serious and often fatal condition. In a significant number of cases, infants who develop NEC will also develop sepsis, commonly caused by a dominant member of the gut microbiota of preterm infants such as enterobacterial [3,4].

There are various things which influence its development like different birthing practices which starts as soon as the baby is born. The examples of this are, whether cord was cut with clean blade or scissor, episiotomy was given or not, whether the delivery is conducted on abdomen or not, whether there is skin to skin contact of the baby and mother or the baby is taken into sheets, whether baby is subjected to bathing or not, whether baby was given to mother for early initiation of breastfeeding, methods of resuscitation used, whether the baby was kept with the mother or was in the tray for long time, whether the baby was shifted to the mother or was in nursery, various practices which are followed in nursery, duration of stay in nursery, iv fluid, mode and duration of oxygen delivery, antibiotics, sampling methods used in nursery. Is there a difference in correlation of microbiota with different feeding methods like breastfeeding verses expressed breast milk, expressed breast milk verses full strength milk, feeding with NG or OG tube.

Aim

To evaluate impact of different antenatal, natal, postnatal factors and various childcare practices on the development of microbiota in neonates.

Primary Objective: To find out proportion of various organisms that first colonise the neonate.

Secondary Objective: To determine any association of development and type of microbiota with time of initiation of breastfeeding.

Methodology

Type of study was prospective quantitative cross-sectional observational clinical research with a prospective design and was conducted in Department of Paediatrics, Dr S. N. Medical College, Jodhpur, Rajasthan, India. Samples of 128 newborns were taken. As per predesigned proforma maternal information, antenatal, natal, postnatal history and complications were recorded. Seven samples (skin of right upper limb, skin of left lower limb, surface of umbilical cord, mucosa of oropharynx, mucosa of conjunctiva, stool sample, air sample) of each baby with swab were taken at birth, at 24 hours, at 48 hours and if no growth is seen then on seventh day of life. Culture media used were blood agar, mannitol salt agar (selective media for gram positive organism) and macConkey (selective media for gram negative organism).

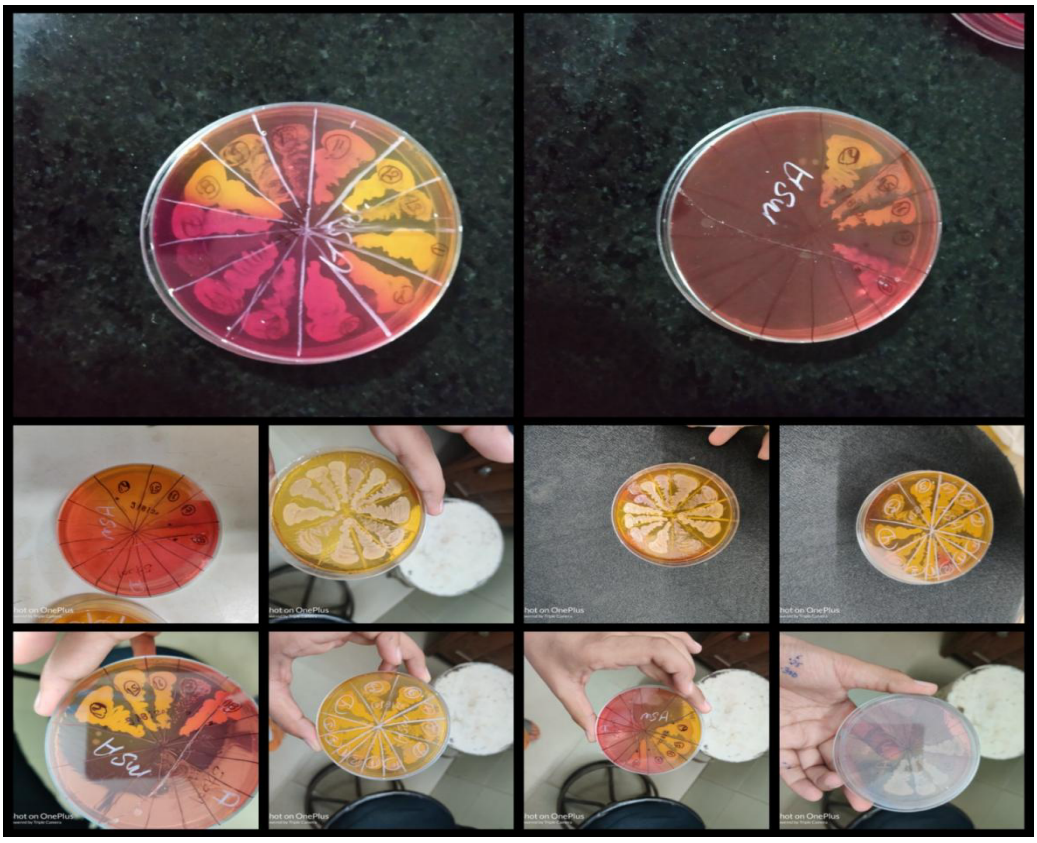

Figure 1:

Observation

Table 1: Day of first appearance of bacterial growth in pharynx and its correlation with time of initiation of feeding by various modes of feeding (NG/OG/Suthee/Breastfeed)

Day	Time of initiation of feeding						P value
	<1 Hour (n= 60)		1-24 Hours(n=20)		>24 Hours (n=48)		
	N	%	N	%	N	%	
Day 1-3	57	95.00	20	100.00	28	58.33	<0.00001
Day 4-7	3	5.00	0	0.00	20	41.67	
Day 42	0	0.00	0	0.00	0	0.00	

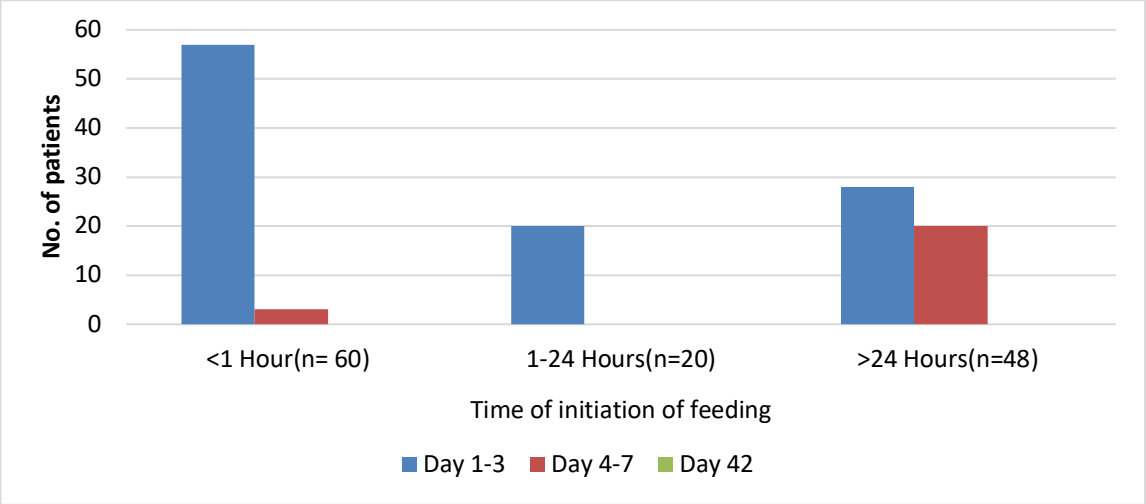

Figure 2:

In 57 babies out of 60 (<1 Hour) bacterial growth appeared in first three days of life as compared to 20 among 20 (1-24) and 28 among 48 (>24 Hours) in first three days of life. Early initiation of feeding helps in early establishment of microbiota in pharynx and was statistically significant (p value- <0.00001).

Table 2: Day of first appearance of bacterial growth in stool and its correlation with time of initiation of feeding by various modes of feeding (NG/OG/Suthee/Breastfeed)

Day	Time of initiation of feeding						P value
	<1 Hour (n= 60)		1-24 Hours(n=20)		>24 Hours (n=48)		
	N	%	N	%	N	%	
Day 1-3	58	96.67	18	90.00	38	79.17	0.014958
Day 4-7	2	3.33	2	10.00	10	20.83	
Day 42	0	0.00	0	0.00	0	0.00	

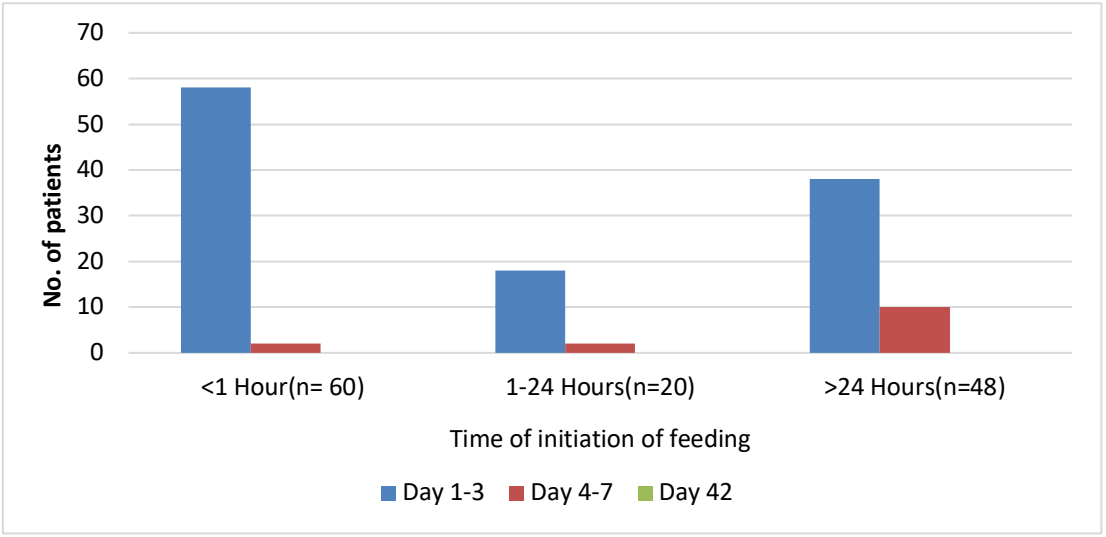

Figure 3:

In 58 babies out of 60 (<1 Hour) bacterial growth appeared in first three days of life as compared to 18 among 20 (1-24) and 38 among 48 (>24 Hours) in first three days of life. Early initiation of feeding helps in early establishment of microbiota in stool which was statistically significant (p value- 0.01495).

Table 3: Distribution of babies by first organism isolated in pharynx on any day of life in babies with initiation of feeding in less than 24 hours

Type of organism	Number of babies (n=80)	Frequency (%)
Streptococci	52	65
Micrococci	**2**	2.5
Nonpathogenic Staph	12	15
Pathogenic Staph	0	0
Diplococci	14	17.5

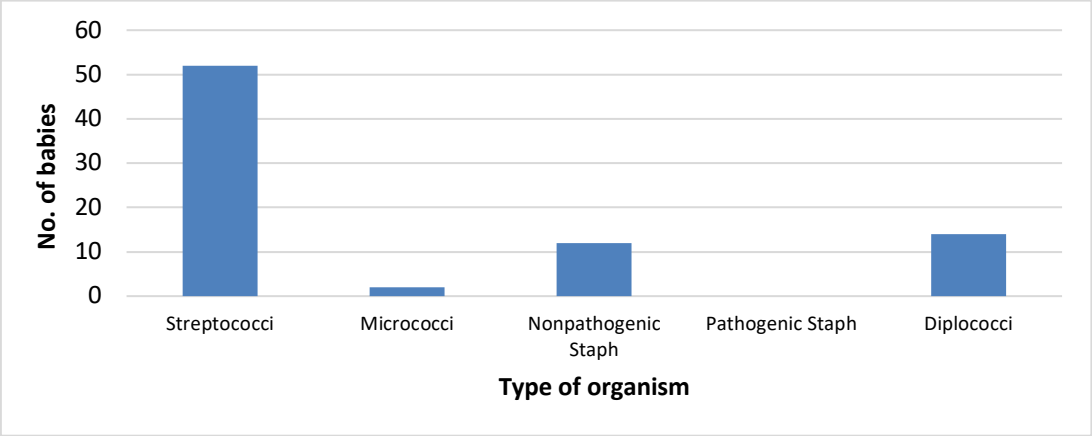

Figure 4:

In 80 babies breastfeeding was initiated in less than 24 hours. Out of them in majority of babies the bacterial growth that first appeared in pharynx was streptococci (65%) which were followed by diplococci (17. 5%), non-pathogenic staph (15%) and micrococci (2.5%).

Table 4: Distribution of babies by first organism isolated in stool on any day of life in babies with initiation of feeding in less than 24 hours

Type of organism	Number of babies (n=80)	Frequency (%)
Streptococci	13	16.25
Micrococci	**0**	0
Nonpathogenic Staph	18	22.5
Pathogenic Staph	14	17.5
Diplococci	0	0
E coli	62	77.5
Klebsiella	15	18.75
Enterococci	23	28.75

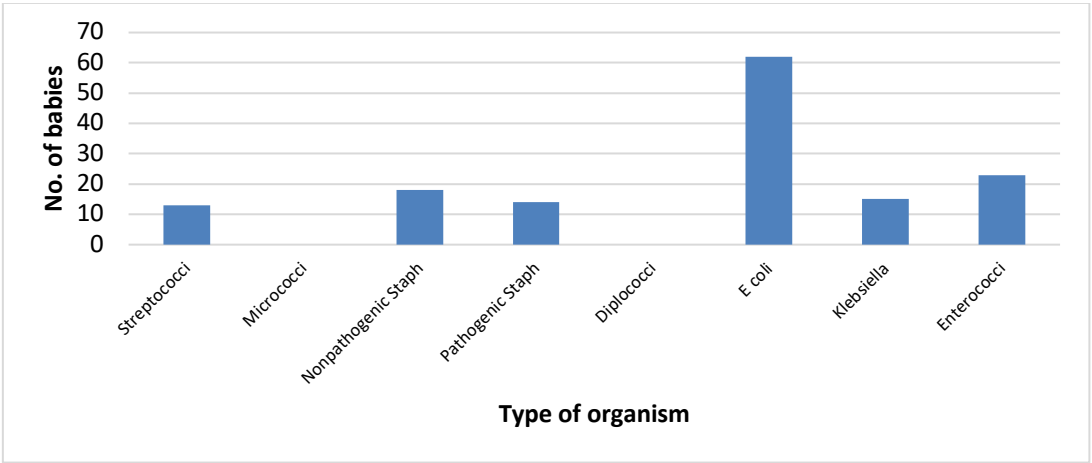

Figure 5:

In 80 babies breastfeeding was initiated in less than 24 hours. Out of them in majority of babies the bacterial growth that first appeared in stool was E coli (77.5%) which were followed by enterococci (28.75%), non-pathogenic staph (22.5%), klebsiella (18.75%), pathogenic staph (17.5%) and streptococci (16.25%).

Table 5: Distribution of babies by first organism isolated in skin on any day of life in babies with initiation of feeding in less than 24 hours

Type of organism	Number of babies (n=80)	Frequency (%)
Streptococci	32	40
Micrococci	**13**	16.25
Nonpathogenic Staph	46	57.5
Pathogenic Staph	16	20
Diplococci	4	5
E coli	11	13.75
Klebsiella	0	0
Enterococci	0	0

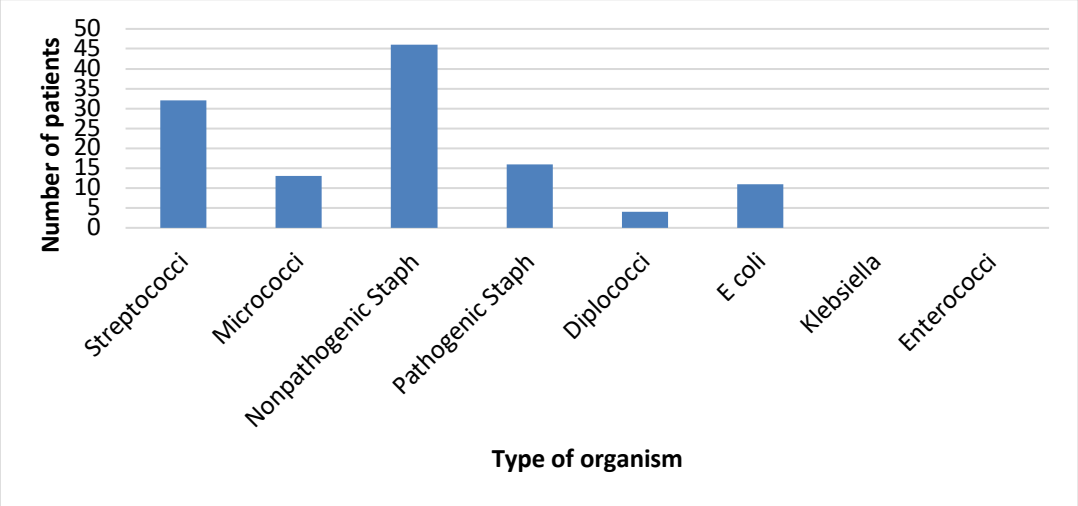

Figure 6:

In 80 babies breastfeeding was initiated in less than 24 hours. Out of them in majority of babies the bacterial growth that first appeared in skin was non-pathogenic staph (57.5%), followed by streptococci (40%) which were followed by pathogenic staph (20%), micrococci (16.25%) and E coli (13.75%).

Discussion

We examined the day of first appearance of bacterial growth at various sites and its correlation with time of initiation of feeding. It was found in our study that early initiation of feeding (n=80) helps in early establishment of microbiota in skin, gut, pharynx and conjunctiva. In babies with initiation of feeding less than 24 hours first bacterial growth appeared in within first three days of life in 77 babies in pharynx which was statistically significant (P value-0.00001), in 78 babies in stool (P value-.014958) which was statistically significant. As per our study, early initiation of feeding helps in early establishment of microbiota in body. In comparison to this Adlerberth and Wold (2009) stated tendencies towards higher levels study of Lactobacillus in partially breastfed babies in comparison with weaned babies, found that staphylococci are more common in breastfed infants, while additionally setting up that higher levels of Klebsiella and Nitrobacteria are seen in formula fed babies [5]. In our study the first microbiota which colonized pharynx in babies with initiation of breastfeeding in less than 24 hours was streptococcus and also diplococci and nonpathogenic staphylococcus less abundantly. The first microbiota isolated in stool in babies with initiation of breastfeeding in less than 24 hours was E coli and followed by enterococci and nonpathogenic staphylococcus less abundantly. The first microbiota which colonized skin in babies with initiation of breastfeeding in less than 24 hours was nonpathogenic staphylococcus.

Conclusion

Our study concluded that early initiation of feeding helps in early establishment of microbiota in pharynx and stool and the first organism isolated in stool, skin and pharynx in babies with early initiation of breastfeeding is E coli, non-pathogenic staphylococcus and streptococcus respectively. Interventions like stomach wash, time of initiation of feeding and separation from mother alters time of first colonization of microbiota in neonate.

Different environmental factor that the baby encounters with during neonatal period influences the microbiota composition of skin but it does not alter the gut microbiota composition according to our study.

The study of impact of childbearing practices and early intervention after birth focuses on postnatal acquisition of gut microbiome and its importance to health as the dysbiosis is linked to increased risk of later onset diseases such as asthma, obesity, inflammatory bowel disease, allergy, neuropsychiatric and autoimmune diseases.

Acknowledgement: The first author conducted this study while undergoing postgraduate studies at the Department of Paediatrics at S.N. Medical College in Jodhpur. Additionally, the second and third authors worked as postgraduate junior residents in the pediatrics department at SMS Medical College and its affiliated group of hospitals in Jaipur, Rajasthan, India.

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