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ORIGINAL ARTICLE

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Early Maternal Skin-to-Skin Contact and Its Role in Reducing Neonatal Sepsis: A Prospective Cohort Study

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ABSTRACT

OBJECTIVE: To assess the impact of maternal-newborn skin-to-skin contact on the incidence of neonatal sepsis by the 28th day of life among mothers delivering at hospitals in Baluchistan and Karachi.

METHODOLOGY: This prospective cohort study was conducted from December to April 2022, including 237 mothers and their neonates from two sites: Civil Hospital Hub, Lasbela District, Baluchistan (SSC/KMC group) and Civil Hospital Karachi (conventional care group). Participants were selected using purposive sampling. Data collected through a structured, pretested questionnaire and by observation from delivery until the 28th day of life to determine the occurrence of neonatal sepsis in both groups. Data were entered into SPSS version 22 and analyzed using binary logistic regression. Variables showing a p-value less than 0.25 in the bivariate analysis were entered into the multivariate logistic regression model to account for potential confounding factors. Statistical significance in the multivariate model was determined at a p-value threshold of <0.05.

RESULTS: Among the 237 neonates, 18.5% developed early-onset sepsis (0–7 days), and 4.2% developed late-onset sepsis (8–28 days), yielding an overall sepsis rate of 22.6%. Significant associations were found between neonatal sepsis and factors such as maternal age, ethnicity, low birth weight, lack of SSC, and delayed initiation of breastfeeding. Attributable risk analysis revealed that 18.76% of sepsis cases in the non-SSC group could have been prevented by early skin-to-skin contact (SSC). Furthermore, 58.26% of the sepsis burden in neonates without SSC was potentially preventable through timely SSC intervention.

CONCLUSION: Early SSC and breastfeeding initiation are simple, cost-effective interventions that significantly reduce neonatal sepsis, morbidity, and mortality. Promoting antenatal and postnatal care awareness, ensuring skilled birth attendance, and adhering to infection prevention protocols are critical steps toward improving neonatal outcomes.

KEY WORDS: Skin-To-Skin Contact, Neonatal Sepsis, Exclusive-Breastfeeding, Sepsis, Incidence

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INTRODUCTION

Skin-to-skin contact (SSC), also known as Kangaroo Mother Care (KMC), involves drying the newborn immediately after birth and placing them on the mother's abdomen, where they are kept warm and in close contact for at least one hour or until successful initiation of the first breastfeeding.[1]

Early SSC is a good practice that is recommended for healthy full-term newborns, because it gives many health advantages to both mothers and their newborns. Early SSC requires placing a dried, unclothed baby, covering the head with a cap, and covering mother and baby with a warm sheet or blanket, attached directly on the mother's chest.[2] This is a very crucial period for programming future psychological, physiological, behavioural, Emotional development, attachment, mother-baby interaction, bonding, decreased crying, grimacing, heart rate surges, temperature stabilisation and successful initiation of breastfeeding.[3]

According to the WHO Baby-Friendly Clinical Guidance (2018) stating that birthing facilities should initiate uninterrupted SSC immediately and help women to start exclusive breastfeeding

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immediately after birth.[4]

Breastfeeding is the strongest and best natural method of newborn nourishing, and effective lactation generally depends on the first introduction of breastfeeding.[5] Unfortunately, the rate of breastfeeding in Pakistan is very low amongst South Asian countries. According to the Pakistan Demographic and Health Survey (2012-2013), barely 58% of mothers start breast-feeding within one hour of the baby's born, as the exclusive breast-feeding rate up to four months of age was just 24% and till six months was only 38% .[6] This is just because of the act of separating the mother immediately after birth, because of hospital policy to keep newborns in a warmer or in nursery ward for a few hours of observation (hospital policies vary), or due to some cultural norms, newborns get separated from mother immediately after birth.[7]

In our context, it has been observed here that the child is handed over to the relatives immediately after the child's birth, and the mother is kept in the labour room for some time.[8] Until then, the baby is either starved, or fed cow's or buffalo's milk, or given a traditional pre-lacteal feed ('ghutti'), which causes many babies to be re-hospitalised with a variety of infections after birth.[9] There are complaints of infections in the chest as well as in the blood, and many children die after a serious illness, leading to an increase in morbidity and mortality.[10] To determine the effects of maternal-infant early Skin-to-Skin Contact influence neonatal sepsis at the 28th day of life at Civil Hospital Hub Chock Balochistan and Civil Hospital Karachi.

METHODOLOGY

A prospective cohort study was conducted from December 2021 to April 2022 at two public hospitals: Civil Hospital Hub, Lasbela District, Balochistan (intervention site: Skin-to-Skin Contact/Kangaroo Mother Care group), and Civil Hospital Karachi, Sindh (comparison site: Conventional Care group). The study population comprised full-term, healthy mothers aged 15 to 49 years, residing in the catchment areas, who planned normal vaginal delivery and exclusive breastfeeding for at least one month. Mothers with preterm births, unplanned C-sections, diabetes, multiple pregnancies, postpartum complications such as postpartum hemorrhage (PPH), puerperal sepsis, or postpartum depression, and those who declined consent, were excluded

Participants were allocated into two groups. The Skin-to-Skin Contact (SSC) group included mothers from Hub Lasbela who practiced early skin-to-skin contact with their newborns for at least one hour after delivery or initiated successful early breastfeeding. The Conventional Care (CC) group included mothers from Civil Hospital Karachi who received standard newborn care without SSC. Purposive sampling was used to recruit participants. Sample size was calculated by using OpenEpi software, with a sepsis prevalence of 3.9% in the SSC group and 14.8% in the CC group, with 80% power and 95% confidence level. The minimum required sample size was 113 participants per group, totaling 226. However, based on study observations, the actual proportions of neonatal sepsis were 5.9% in the SSC group and 28.6% in the CC group, suggesting sufficient power and validity to detect meaningful differences.

Data were collected at four key time points: (1) at the time of delivery (socio-demographic information, mode of delivery, early SSC, breastfeeding initiation); and postnatal follow-ups on (2) on day 7, (3) on day 21, and (4) on day 28 to identify any clinical symptoms of sepsis, breastfeeding practices, and health facility visits. Sepsis was diagnosed clinically based on symptoms such as fever, lethargy, poor feeding, abnormal cry, and rapid breathing, and was confirmed through physician diagnosis using diagnostic tools such as C-reactive protein (CRP), total leukocyte count (TLC), absolute neutrophil count (ANC), or blood culture results when available.[11] Other potential causes or sources of sepsis (such as congenital anomalies, NICU-acquired infections, or comorbidities) were ruled out by reviewing maternal and neonatal history, excluding high-risk or NICU-admitted neonates, and ensuring no previous infection diagnosis was recorded.

A structured questionnaire adapted from the Mother–Newborn Skin-to-Skin Contact Questionnaire (MSSCQ), previously validated in similar settings, was modified to fit the local context and used for data collection.[12] The questionnaire captured data on demographics, maternal and neonatal health, early SSC practices, breastfeeding patterns, and maternal knowledge. As most participants were reluctant to disclose exact household income due to receiving free healthcare services, economic status was assessed using a composite wealth index derived from household assets and living conditions. This index was adapted from the Pakistan Demographic Health Survey (DHS 2017–18) and categorized into low, middle, and high socioeconomic tiers.[13]

Data were analyzed using SPSS version 16. Continuous variables such as maternal age and infant weight were analyzed using independent sample t-tests, while categorical variables such as sepsis presence or feeding method were analyzed using Chi-square tests. Risk estimates, including relative risk (RR) and attributable risk (AR), were computed with 95% confidence intervals (CI). Binary logistic regression was applied to identify predictors of neonatal sepsis. Crude odds ratios (CORs) were calculated through bivariate analysis, while adjusted odds ratios (AORs) were computed via multivariable logistic regression to evaluate the association between SSC and neonatal sepsis after adjusting for confounders such as maternal age, parity, birth

Variables	Frequency	Percentage
Mother Age		
16-25	100	42.4%
26-35	104	43.6%
36-45	33	14.0%
Ethnicity/Mother Tongue		
Urdu	27	11.4%
Sindhi	60	25.4%
Punjabi	17	7.2%
Balochi	106	44.7%
Bengali	1	.4%
Pashto	26	11%
Religion		
Muslim	231	97.5%
Christian	4	1.7%
Hindu	2	.8%
Educational Status		
No schooling/illiterate	195	82.3%
primary	7	3%
Secondary	25	10.5%
Middle	6	2.5%
Intermediate	3	1.3%
Graduate	1	.4%
Occupation		
Housewives	237	100%
Wealth Index		
House Ownership		
Variables Categories	**Frequency**	**Percent**
Own House	146	61.4%
Rent	88	37.3%
Hut	3	1.3%
Smart Phone Ownership		
No	96	40.7%
Yes	141	59.3%
Vehicle Ownership		
No	114	48.3%
Motorcycle	84	35.2%
Bicycle	19	8.1%
Auto Rickshaw	5	2.1%
Car	15	6.4%
Fridge Ownership		
No	131	55.3%
Yes	106	44.7%
Air Conditioner Ownership		
	233	98.3%
	4	1.7%
Television Ownership		
No	159	67%
Yes	78	33%

Table 1. Maternal characteristics (sociodemographic and wealth index) of mothers in Civil Hospitals of Hub Chock Lasbela Balochistan and Karachi. (n=237)

Variables	Frequency	Percentage
ANC Visits		
<4 ANC	41	17.4%
>4 ANC	196	82.6%
Parity		
0-1 primi	94	39.7%
2-3 multiparous	72	30.3%
4->4 grand multiparous	71	30%
Pregnancy-Induced Hypertension (PIH)		
Yes	25	10.6%
No	212	89.4%

Table 2. Obstetric characteristics of mothers in Civil Hospitals of Hub Chock Lasbela Balochistan and Karachi. (n=237)

weight, and economic status.

RESULTS

A total of 237 mothers and neonates participated in this study, of which 119 received SSC and 118 did not receive. A substantial percentage of women are young, with a mean age was 28.22 years (±6.51 SD). Out of 43% are below 25, and in the age group 26-35. (Table 1)

A majority of mothers are Balochi speaking (49%) or Sindhi speaking (25%) and belong to a poor socioeconomic background. About(n=195) 83% are illiterate or had no schooling, no one was employed, and most of them. Based on information provided by the respondents on the availability of vehicle, luxury home appliances like (Smart phone, television, fridge, air conditioner), about half of study population could be classified in the low socioeconomic class, 45% to lower- middle class and 5% in the middle or higher class.

Antenatal care follow-up 1-4 ANC visits, and 82.6% had received >4 antenatal care. 100% of mothers were delivered spontaneously. 100% of mothers were assisted by health care professionals (medical officer, midwife, LHV and nurse). 10.6% of them had a history of PIH, pregnancy-induced hypertension. As shown in Table 3, 57.6% of the newborns were male and 42.4% were female. About gestational age, 236 (99.6%) had term (37–42 weeks), and 1.4% had preterm (<37 weeks). 224(94.5%) of them had an APGAR score of >6 in 1 minute, and out of 237 newborns, 98.3% had an APGAR score >8 in 5 minutes, and 199 (84.3%) were normal weight at birth, 2.5-4kg. 223 (94.5%) of the neonates cried at birth, and 84 (35.6%) newborns needed to have their airway by the suctioning; of the 8 (3.4%) newborns had needed resuscitation at birth. The 119(50.2%) newborns had received KMC protocols, and about 130 (54.7%) were initiated early and exclusive breast according to their babies' neonatal characteristics of newborn).

After controlling for all other factors, maternal ethnicity is associated with the risk of neonatal sepsis($p<0.001$). Urdu

Variables	Frequency	Percentage
Weight of the baby at birth		
LBW (1.5–2.5 kg)	37	15.7%
Normal (2.5–4 kg)	200	84.3%
APGAR score in 1 minute		
Less than or equal to 6	13	5.5%
More than 6	224	94.5%
APGAR score in 5 mints		
Less than or equal to 8	4	1.7%
More than 8	233	98.3%
Gestational age		
Less than or equal to 37	1	.4%
More than 37	236	99.6%
Gender of newborn		
Male	136	57.6%
Female	101	42.4%
Exclusive and immediate breastfeeding within 1 hour		
Yes	130	54.7%
No	107	45.3%
Put on Skin-to-Skin contact within 1 hour		
Yes	119	50%
No	118	50%
Resuscitated at birth		
Yes	8	3.4%
No	229	96.6%
Need for suction		
Yes	84	35.6%
No	153	64.4%

Table 3. Characteristics of the newborns in Civil Hospitals of Hub Chock Lasbela Balochistan and Karachi. (n=237)

Group	Sepsis (Yes)	Sepsis (No)	Total
Visit 1: At the Time of Delivery			
SSC	0 (0%)	119 (100%)	119
Non-SSC	0 (0%)	118 (100%)	118
Total	0 (0%)	237 (100%)	237
Visit 2: 7th Day of Life			
SSC	13 (10.9%)	106 (89.1%)	119
Non-SSC	31(26.3%)	87 (73.7)	118
Total	44 (18.6%)	193 (81.4%)	237
Visit 3: 21st Day of Life			
SSC	3 (2.5%)	116 (97.5%)	119
Non-SSC	7 (5.9%)	111(94.1%)	118
Total	10 (4.2%)	227 (95.8%)	237
Visit 4: 28th Day of Life			
SSC	0 (0%)	119 (100%)	119
Non-SSC	0 (0%)	118 (100%)	118
Total	0 (0%)	237 (100%)	237

Table 4: Measure of outcome of sepsis in in Civil Hospitals of Hub Chock Lasbela Balochistan and Karachi. (n=237)

speaking mothers are at 2.3 times the more likely risk of having neonates with sepsis (AOR=2.281 95% CI.632 - 8.235) as compared to Pushto-speaking mothers, whereas Panjabi speaking (AOR=.762; 95% CI (.175-3.325) Balochi speaking (AOR=.256; 95% CI (.081–.807), Pashto peaking (AOR=.688; 95% CI (.028–4.273) mothers are at lower risks of having

variables	Bivariate logistic regression		Multivariate logistic regression	
	Crude OR	P-value	Adjusted OR	P-value
Mother's Age				
Up to 21 years	.463 (.153-1.402)	.167	-	-
22- 31 years	1.22(.602-2.489)			
32-45 years	1			
Ethnicity				
Urdu	1.455(.480-4.409)	.001	2.281(.632 - 8.235)	.000
Sindhi	.111 (.035-.355)		.241 (.064 - .901)	
Panjabi	.429 (.123-1.491)		.762 (.175 - 3.325)	
Balochi	.589 (.199-1.749)		.256 (.081 - .807)	
Pashto	1		1	
Newborn Weight				
<2.5kg	3.745(1.789-7.837)	.001	2.988 (1.159 - 7.707)	.024
>2.5	1		1	
Skin To Skin Contact				
Yes	1	.001	1	.066
No	3.058(1.591-5.875)		2.073 (.953- 4.510)	

Table 5. bivariate and multivariate logistic regression on factors associated with new natal sepsis in Civil Hospitals of Hub Chock Lasbela Balochistan and Karachi. (n=237)

Skin-to-Skin Contact	Total Neonates (n)	Neonates with Sepsis (n)	Risk of Sepsis (%)
Yes	119	16	13.44%
No	118	38	32.20%

Attributable Risk (AR) = 32.20% – 13.44% = 18.76%
Attributable Risk Percent (ARP) = (18.76 / 32.20) × 100 = 58.26%

Table 6. Attributable Risk of Neonatal Sepsis Due to Lack of Early Skin-to-Skin Contact (n=237)

neonates with sepsis. Newborns' birth weight is strongly related to the risk of neonatal sepsis($p<0.001$). The risk of developing neonatal sepsis is 3 (CI 1.159-7.707) times higher in low birthweight <2.5kg babies than the babies who were delivered with weight more than 2.5kg. The risk of neonatal sepsis in early skin-to-skin contact was 2(.953-4.510) times less likely to develop neonatal sepsis than the babies who were kept on conventional care, as shown in Table 5

The impact was measured by attributable risk, which showed 20.5% of neonatal sepsis cases in the group not receiving skin-to-skin contact can be attributed to the lack of SSC, suggesting that early SSC could prevent nearly 1 in 5 cases of neonatal sepsis. Moreover, 62% of sepsis cases in the non-SSC group are potentially preventable by implementing early SSC as a standard of care (Table 6).

DISCUSSION

In this study, the prevalence of neonatal sepsis was 22.7%, which is lower compared to research done in Egypt (45.9%) (14) and Ethiopia (75.1%).15 However, our finding is similar to three studies conducted in Tanzania (29%, 31.4%, and 38.9%).16 This variance

may be due to differences in health delivery systems, including antenatal education, identification of high-risk pregnancies, infection control protocols, and training of staff in emergency obstetric and neonatal care. Factors significantly associated with reduced neonatal sepsis included maternal age >21 years, as identified in this study, the use of first golden minutes (immediate newborn care), initiation of SSC within one hour of delivery, and successful first breastfeeding were statistically significant, aligning with findings from other studies.14,17 Early SSC enhances bonding, supports breastfeeding, and improves temperature regulation, protecting newborns from infections. Colostrum feeding also offers key health benefits for both mother and baby, including nutritional support, immunity, thermoregulation, and glucose maintenance.18,19 Additionally, the odds of sepsis were lower among Pashto-speaking mothers, which could be due to cultural practices favouring maternal-infant contact and breastfeeding, though further exploration is needed.

In our study, the significant cause for the incidence of neonatal sepsis is the age of the neonate. The most important causes for this may be that many newborns carry infections (harbour) and carry various contagious agents throughout the prenatal period, during delivery, and in the post-natal period, showing signs and symptoms within the early period of life (0–7 days). Neonates are extremely susceptible to various infectious agents during the initial hours related to low resistance and are extremely sensitive as compared to adults.

The weight of newborns was another significant factor in neonatal sepsis in this study. The various studies conducted showed a positive association between low birth weight and neonatal sepsis 20,21 ,this is because of mother did not follow ANC protocols or did not take a healthy diet pattern or Poor prenatal nutrition, smoking, pregnancy-induced hypertension (PIH) or preeclampsia and eclampsia, gestational diabetic mellites, chronic disease like diabetic mellites, diseases of the heart, lung or kidney, and hypertension. low birth weight is caused more often by intrauterine growth retardation than by prematurity. LBW babies are at high risk for sepsis morbidity and mortality.

Study Limitation

- This study was conducted in specific districts and specific communities, so the results may not be generalizable the results.
- It all depends on the mother and their family who meet the inclusion criteria, take part in the study or not.
- The majority of patients from this area belong to very low socioeconomic status and are uneducated. They strongly follow their cultural values

Public Health Implications

This project directly impacts the mother's newborn relationship because she anticipated this moment for nine months. The health care provider applies this evidence-based practice in a routine practice; they can achieve positive outcomes because this critical 1-hour period helps in Psychological and emotional development, attachment, breastfeeding initiation and newborn neurobehavioral development, improved suckling reflexes, stabling temperatures, prevent newborns from infections, promotes uterus involution and decreases the risk of postpartum haemorrhage in the mother, and save the health care provider time, work, and energy.

CONCLUSION

This cohort study was conducted to examine the effect of early skin-to-skin contact (SSC) on the risk of developing neonatal sepsis. The findings indicate that the incidence of neonatal sepsis remains a significant concern. The study further identified key factors influencing the occurrence of neonatal sepsis, including maternal age, ethnicity, timing of SSC initiation (within the first hour of birth), early initiation of exclusive breastfeeding, as well as neonatal age and birth weight.

To reduce the current burden of neonatal morbidity and mortality, there is a critical need to adopt simple, low-cost, and immediately implementable preventive interventions. Early mother-infant SSC is a feasible, low-cost strategy easily initiated by mothers and healthcare providers immediately after birth and holds significant potential in mitigating the risk of neonatal sepsis.

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Conflict Of Interest

The authors declare no conflict of interest.

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CONFLICT OF INTEREST

Author declare no conflict of interest.

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AUTHORS CONTRIBUTIONS

SF: Conception, Design of the work, Data collection, and Drafting, Reviewed, Final approval, Agreement to be accountable.

MK: Conception, Design of the work, Acquistion, Data Analysis, and Drafting, Reviewed, Final approval, Agreement to be accountable.

SAR: Conception, Design of the work, Interpretation of data for the work, and Drafting, Final approval, Agreement to be accountable.

STA: Conception, Design of the work, Reviewed, Final approval, Agreement to be accountable.

DATA SHARING POLICY

The data that support the findings of this study are available from the corresponding author upon reasonable request

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