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RESEARCH ARTICLE

MATERNAL- AND FETAL-RISK FACTORS ASSOCIATED WITH LATE PRETERM AND EARLY TERM NEONATECOMPARED TO FULL TERM NEONATE BIRTH IN GARISSA COUNTY

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Abstract

Despite late preterm neonates (LPN) and early term neonates (ETN) constitutingmajority of preterm births globally, the risk factors associated with these preterm births, in Garissa County are largely unexplored. This study aimed to identify maternal and fetal risk factors associated with LPN and ETN births relative to their full-term counterpartsin Garissa County. The study was conducted at Garissa County Referral Hospital. A prospective cohort studythat employed convenience sampling to enroll mother-neonate pairs. Data were collected using pretested and validated questionnaires and analyzed using STATA version 17. Multinomial logistic regression analysis was performed to determine Relative Risk Ratio. The P-value was generated at α=0.05 and P<0.05 was considered statistically significant. related risk factors associated with birth of LPN, ETN and FTN were maternal age (P=0.042), occupation (P=0.024), ethnicity (P=0.021), religion (P=0.016) and absence of previous abortion/still birth/premature deliveries (P=0.015). Birth weight was associated with LPN (P<0.001), while FTN had higher likelihood of delayed initiation of breastfeeding (P=0.038) but were less likely to have feeding difficulties compared to LPN and ETN (P=0.012). A comparison of fit model with the complete set of predictors with an intercept-only, or null modelrevealed that P-values for maternal (P=0.0175) and fetal (P<0.001) related risk factors were less than Fisher's value of 0.05, hence the null hypothesis was rejected. - and fetal-related risk factors associated with LPNs and ETNsare distinct from those of FTNs.

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Introduction: -

Prematurity is often characterized by an array of medical, psychological, and developmental complications as well as huge financial burden to families(1–3). Preterm births, particularly those that occur during the late preterm period, are increasingly gaining attention in maternal and child health discussions globally. Late preterm neonates (LPNs), constitute the majority of preterm neonates worldwide, estimated at between 75 percent to 85 percent of all preterm births(2,4,5). Growing evidence suggeststhat LPNs share an array of risk factors with early term neonates (ETNs), a category of neonates that has also largely been under studied. These factors include complications during pregnancy, maternal socio-demographic factors, lifestyle factors and medical practices as well as environmental factors(6–8).

The rising incidence of preterm births globally has been largely associated with the surge in late preterm birth (LPTB)(4). Yet, the root cause ofthis rise remains unclear due to its multifactorial and complex nature. It has been partly attributed to the broader adoption and utilization of reproductive technologies and advances in obstetric practices(9–15). Spontaneous preterm labor or premature rupture of membranes (PROM) is implicated in about 50% to 75% of LPTBs(2). Approximately 75% of all singleton preterm births occur spontaneously with unknown cause, while the rest predominantly results from provider-initiated interventions due to medical or non-medical reasons(16).

Retrospective studies aimed at unraveling the shared and specific etiologies of late preterm and early term births suggest that while there are converging factors, certain differences do exist(6,7). For instance, preeclampsia, hypertension, diabetes mellitus, previous preterm births, polyhydramnios, oligohydramnios, placental ischemia, hypoxia, small for gestational age and indicated deliveries were found to be strong determinants for both late preterm and early term births in spontaneous delivery(6,8). On the contrary, infections and inflammations were exclusively linked to late preterm births(6), while maternal chronic conditions, anemia, hormonal diseases, and respiratory disease were associated with early term births only(7).

In Garissa County, northern Kenya, there is huge knowledge gap concerning risk factors specifically associated with late preterm and early term births. While there have been efforts to study determinants of preterm births in a broader sense within the Kenyan context(17,18), a targeted exploration specifically focusing on LPNs and ETNs is lacking. Notably, two studies, conducted at Kenyatta National Hospital, demonstrated that factors such as maternal age, hypertension during pregnancy, PROM, alcohol consumption during pregnancy and urinary tract infections weresignificant determinants of preterm births(17,18). With this backdrop, this study sought to bridge this knowledge-gap by investigating maternal and fetal risk factors associated with LPN and ETN births at Garissa County Referral Hospital (GCRH) relative to full-term Neonates (FTNs). We hypothesized that maternal and fetal risk factors associated with LPN and ETN birth, were not significantly different from those of FTN.

Materials and Methods: -

Study design and setting

This was a prospective cohort study conducted at the Garissa County Referral Hospital (GCRH). The GCRH is a level 5 hospital that serves as a major referral health facilityinNorth Eastern region, catering to diverse ethnic and socioeconomic populations. The hospital is located in Garissa Town approximately 366 km from Nairobi, the capital city of Kenya and conducts close to 25% of all the deliveries in Garissa County.

Study population

Consisted of all live born singleton late preterm (34-36 weeks), early term (37-38 weeks) and full-term (39-41 weeks) neonates delivered at the hospital during the study period.

Sample size

Sample size was determined based on the aim of comparing risk factors, neonatal outcomes of LPNs, ETNs vis a vis FTNs as well as identification of predictors of their survival using G* Power®(19), F-test ANOVA: Fixed effect, omnibus, one way: using prioiri analysis. Statistical power and level of significance was set 80% and 5%, respectively, and the final sample was adjusted by 20% to cater for attrition during follow up, yielding a total sample size of 192. Data from 5 mother-neonate pair (2.6% of the total sample) were excluded from the analysis due to incomplete records, the study thus achieved a high response rate (97.4%).

Recruitment of study participants
Mother-neonate pairs were consecutively enrolled into the study until the required sample size was obtained using convenience sampling method, upon obtaining written informed consent.

Inclusion and exclusion criteria
Singleton live LPNs, ETNs, and FTNs born at Garissa County Referral Hospital during the research duration were included in the study, upon obtaining written informed consent from the mother or caregiver. However, neonates were excluded if they had major congenital conditions or clinically identified chromosomal syndromes, if they died before gestational age (GA) assessment was done, if they were not born at the facility, or if they were part of twin or multiple pregnancies or if their mother or caregiver refused to provide informed consent for participation.

Data collection procedure
Two nurses M1 and N1 working at the hospital maternity and newborn unit, respectively, were recruited as research assistants, trained on research ethicsdata collection protocols, and used to collect data using pretested and validated questionnaires. Prior to enrolling the mother-neonate pair into the study, the research assistants explained the purpose, objectives, benefits, and risk of the study to the mothers/caregivers of the neonates and sought their informed consent. Data was collected between November 2022 and March 2023.

Data collected
Data was collected using pretested and validated questionnaires administered within 24 hours of delivery and follow up visits. Additionally, research assistants reviewed medical records to document maternal and fetal related information. For maternal related factors, several variables were collected, namely: maternal age, level of education, marital status, religion, occupation, place of residence, ethnicity, serological and tuberculosis status, parity, gravidity, prior history of abortions, still births or premature deliveries, clinical status observed during gestation including morbidities (preeclampsia/eclampsia, diabetes mellitus, hypertension, placenta previa, polyhydramnios, oligohydramnios, anemia, respiratory disease, urinary tract infection), type of pregnancy, history of previous child death, nutrition status, smoking, ingestion of native herbs and illicit drugs during index pregnancy, antenatal clinic (ANC) attendance, receipt of antenatal steroids, onset of labour, duration of labour, mode of delivery, whether delivery was assisted or not, the person who conducted delivery, whether the mother experienced any delivery complication, PROM and abdominal massage. From fetal perspective, the variables that were collected included neonate sex, birth weight, birth length, head circumference, gestational age, birth temperature, whether neonate cried immediately after birth, 1-, 5- and 10-min Apgar scores, PROM; resuscitation in delivery room, newborn complications (asphyxia, respiratory distress after birth, hypothermia, hypoglycemia, and jaundice), initiation of breastfeeding immediately after birth, infant having difficulties breastfeeding, whether Kangaroo Mother Care (KMC) was performed, whether neonate received phototherapy, continuous positive airway passage, admission into Newborn Unit/Intensive care Unit (NBU/ICU)

Data management and analysis
Data was entered, cleaned, and analyzed using Stata version 17. Multinomial logistic regression analysis was performed to determine Relative Risk Ratio (RRR). The p-value was generated at $\alpha=0.05$ and $p<0.05$ was considered statistically significant.

Ethical considerations
Ethical approval was secured from Masinde Muliro University of Science and Technology Institutional Ethics Research Committee Approval No. MMUST/IERC/069/2022 and research permit granted by National Commission for Science, Technology, and Innovation license No. NACOSTI/P/22/18367.

Results: -

Maternal-related risks factors associated with late preterm and early term birth relative for full-term counterparts.

Table 1 shows results pertaining to maternal-related risk factors associated with LPN and ETN birth, relative to their full-term counterparts. Analysis revealed that maternal age (P=0.042), occupation (P=0.024), ethnicity (P=0.021), religion (P=0.016), and absence of previous abortion/still birth/premature deliveries (P=0.015) were significant risk factors for neonatal birth in Garissa County. Mothers aged 20-29 years, were more likely to give birth to FTNs compared to ETNs and LPNs (RRR= 6.4153, P=0.042). In terms of occupation, self-employed or businesswomen had higher likelihood of delivering FTN compared to LPN and ETN (RRR=30.6934, P=0.024). When religion was

considered, mothers from protestant group exhibited marginal but significant likelihood of giving birth to FTN compared to ETN (RRR=0.0111; P=0.016). The study further revealed that mothers from Luo ethnic group had increased likelihood of giving birth to FTN compared to the other ethnic groups (RRR= 422.167, P=0.021). A finding that points to the fact that ethnicity and possibly related genetic or sociocultural factors may play a huge role in risk of late preterm birth in Garissa County. Lastly, mothers who had no previous history of abortion/still birth/premature deliveries had increased likelihood of giving birth to FTN compared to LPN and ETN (RRR=13.5733, P= 0.015). Apart from these, all other variables were comparable among the groups (P>0.05), demonstrating that they were not risk factors associated with their births. The logistic regression model exhibited statistical significance based on the LR chi-squared test (χ^2 = 111.23, df = 82, P=0.0175). With a P-value of 0.0175 which is less than the Fishers value of 0.05, the study demonstrated that the model containing set of predictors represented some association thus the null hypothesis that maternal-related risk factors associated with late preterm, early term, relative to full-term birth at GCRH are not different was rejected.

Table 1:- Maternal risk factors associated with LPN, ENT and FTN birth.

	RRR	Std. Err.	z	P value	[95% Conf. Interval]		RRR	Std. Err.	z	P Value	[95% Conf. Interval]	
Control variables	**LPN**						**FTN**					
Marriage Type Monogamous (Ref.)												
(Polygamous)	1.4784	1.3347	0.43	0.665	0.1808	9.1301	0.8944	0.8538	-0.12	0.907	0.087251	5.1354
Live with Spouse (No)	6.4E-07	3.1E-03	0	0.998			1.6178	3.1695	0.25	0.806	0.014885	89.310
Maternal Religion 1=Muslim (Ref.)												
2=Catholic	4.15E+07	1.64E+11	0	0.996	0.0000	.	0.0000	0.0000	-0.01	0.995	.	.
3=Protestant	7049718	2.79E+10	0	0.997	0.0000	.	0.0111	0.0209	-2.4	**0.016**	0.000179	0.4525
Ethnicity												
Kamba	9.0E-08	3.6E-04	0	0.997	0.0000	.	26.2985	50.5969	1.7	0.089	0.476974	1213.5
Kikuyu	4.5E-08	1.8E-04	0	0.997	0.0000	.	0.0000	0.0042	0	0.997	.	.
Meru	3.5E-08	1.4E-04	0	0.997	0.0000	.	0.0000	0.0196	0	0.997	.	.
Luo	5.2E-08	2.1E-04	0	0.997	0.0000	.	422.1670	1105.2920	2.31	**0.021**	3.395364	261818
Malakote/Munyoyaya	1.9E-01	3.4E-01	-0.93	0.354	0.0035	13.9296	1.1247	1.3553	0.1	0.922	0.153398	84.765
Others (specify)	4.7E-08	1.8E-04	0	0.997	0.0000	.	12.6161	19.5969	1.63	0.103	0.523321	339.59
County of residence (Others specify)	0.737498	0.6238871	-0.36	0.719	0.1031	4.4933	0.9925	0.7708	-0.01	0.992	0.055557	2.7400
Maternal Age												
20-29	2.044107	1.77068	0.83	0.409	0.3442	14.2347	6.4153	5.8557	2.04	**0.042**	0.866897	42.261
30-39	2.141904	2.551127	0.64	0.522	0.1195	30.6248	1.8399	2.2877	0.49	0.624	0.065624	36.608
40+	2.665429	5.576473	0.47	0.639	0.0026	57.2286	0.0000	0.0008	0	0.998	.	.
Number of ANC Visits												
Two visits	0.450213	0.604221	-0.59	0.552	0.0021	5.0406	0.4837	0.8192	-0.43	0.668	0.003865	22.118
Three visits	0.454757	0.5275279	-0.68	0.497	0.0016	2.0009	0.8034	1.2622	-0.14	0.889	0.00559	16.865
Four visits	0.174799	0.2110488	-1.44	0.149	0.0005	1.0190	0.5446	0.8537	-0.39	0.698	0.003077	11.062
	RRR	**Std. Err.**	**z**	**P value**	**[95% Conf. Interval]**		**RRR**	**Std. Err.**	**z**	**P Value**	**[95% Conf. Interval]**	
Control variables	**LPN**						**FTN**					

Maternal Education level												
Lower Primary	2.089761	3.735052	0.41	0.68	0.2507	685.4181	1.2754	1.9499	0.16	0.874	0.281452	471.57
Upper Primary	0.421878	0.3464735	-1.05	0.293	0.0891	3.7037	0.4206	0.2983	-1.22	0.222	0.132036	3.1193
Secondary	2.307031	2.150315	0.9	0.37	0.5678	34.1513	0.9757	0.8149	-0.03	0.977	0.15629	5.9970
Post-Secondary	4.11941	6.07506	0.96	0.337	0.1623	82.1960	3.4395	5.0918	0.83	0.404	0.10027	37.590
Maternal Occupation												
Employed (permanent and salaried)	0.379306	0.7432419	-0.49	0.621	0.0149	311.3528	0.0000	0.0001	0	0.997	.	.
Employed (temporary and salaried)	4.983008	10.58463	0.76	0.45	0.0567	862.7838	1.9096	4.0641	0.3	0.761	0.018458	408.18
Self-employed/business	0.903587	1.540235	-0.06	0.953	0.0296	47.4518	30.6934	46.6157	2.25	**0.024**	2.431821	1753.9
Serological Status												
Negative	7236332	2.78E+10	0	0.997	0.0000	.	0.7555	1.4538	-0.15	0.884	0.017974	157.71
Unknown	1.75E+07	6.73E+10	0	0.997	0.0000	.	0.0724	0.1690	-1.12	0.261	0.000278	15.781
Parity												
Para 1	0.197177	0.207536	-1.54	0.123	0.0172	1.8483	1.0935	1.3390	0.07	0.942	0.143736	26.214
Para 2	0.119562	0.1366324	-1.86	0.063	0.0009	0.9077	0.5307	0.6910	-0.49	0.627	0.025318	36.811
Para 3	0.369331	0.4644009	-0.79	0.428	0.0003	1.9547	0.4358	0.6266	-0.58	0.564	0.006216	27.619
Para 4	0.129973	0.1716397	-1.55	0.122	0.0000	0.1615	0.3572	0.5331	-0.69	0.49	2.06E-05	3.7573
Para 5	0.092371	0.1167505	-1.88	0.059	0.0000	0.0506	0.3035	0.4274	-0.85	0.397	5.49E-06	8.3405
Tuberculosis Status (Unknown)	1.476716	0.9044197	0.64	0.524	0.4555	6.3134	1.0558	0.5998	0.1	0.924	0.33532	4.0687
Prior history of abortion/still births/premature deliveries (No)	1.285688	1.00582	0.32	0.748	0.1922	11.9959	13.5733	14.5891	2.43	**0.015**	1.230818	187.68
Presence of any medical problems (No)	0.384236	0.2643631	-1.39	0.164	0.0563	1.3574	0.5685	0.4013	-0.8	0.424	0.104807	2.7291
History of Child death (No)	2.733733	3.714513	0.74	0.459	0.1061	1701.6350	0.4122	0.4527	-0.81	0.42	0.017043	7.5729

	RRR	**Std. Err.**	**z**	**P value**	**[95% Conf. Interval]**		**RRR**	**Std. Err.**	**z**	**P Value**	**[95% Conf. Interval**	
Control variables	**LPN**						**FTN**					
Maternal nutrition Status (MUAC>210 mm)	0.341404	0.3091271	-1.19	0.235	0.0315	1.7446	3.5522	4.7278	0.95	0.341	0.269509	81.190
Mode of delivery (Caesarean	1.655532	1.026606	0.81	0.416	0.3950	5.7019	2.7601	1.7305	1.62	0.105	0.693447	10.589

Section)												
Assisted delivery (No)	6.71E-08	0.0002624	0	0.997	.	.	0.0000	0.0001	0	0.996	0	.
Premature Rapture of the membrane (No)	0.219321	0.2961762	-1.12	0.261	0.0525	26.8160	0.3917	0.6299	-0.58	0.56	0.030562	25.137
Had complications during delivery (No)	0.329353	0.3537347	-1.03	0.301	0.0304	4.5430	0.4603	0.5649	-0.63	0.527	0.012272	3.4589
Given abdominal massage (No)	1.469612	2.750063	0.21	0.837	.	.	2.7932	4.0975	0.7	0.484	0.058716	45.032

Reference Outcome = ETN

Log likelihood = -126.51347 LR chi2(82)= 111.23 Prob > chi = 0.0175 Pseudo R2= 0.3054

Multinomial Logistic Regression between outcome variable (LPN, FTN and ETN) and control maternal risks variables

Fetal-related risks factors associated with late preterm and early term birth relative to full term neonates.

Results of fetal related risk factors associated with LPN and ETN birth relative to their term counterparts is shown in Table 2. Only birth weight, time of initiation of breastfeeding and difficulty in feeding were significantly associated with neonatal birth. Specifically, birth weight was significantly associated with LPN (RRR=0.9963, P<0.001), with a marginal but significant decrease in the likelihood of LPN with an increase in birth weight. On the other hand, birth weight was not significantly associated with FTN birth (RRR=1.0012, P=0.053), suggesting that higher birth weights may reduce the risk of late preterm birth. Moreover, FTN had higher likelihood of delayed initiation of breastfeeding (RRR=3.6145, P=0.038) but were less likely to have feeding difficulties compared to LPN and ETN (RRR=0.0146, P=0.012). Apart from these three factors, none of the other factors showed statistically significant differences (P>0.05) demonstrating that they were comparable among LPN, ENT and FTN births. The logistic regression model demonstrated statistical significance (LR chi-squared test: $\chi^2 = 165.91$, df = 34, P<0.001), with a Pseudo R^2=0.4089 suggesting that the model accounted for approximately 41% variability in neonatal birth outcomes, hence the null hypothesis was rejected since P<0.001 is less than the Fishers value of 0.05. The study thus found that fetal-related risks factors associated with late preterm, early term and full-term birth are different.

Table 2:- Fetal-related risk factors associated with LPN, ETN and FTN birth.

Control variables	RRR	Std. Err.	Z	P Value	[95% Conf. Interval]		RRR	Std. Err.	Z	P value	[95% Conf. Interval]	
	LPN						**FTN**					
Infant Sex Male (Ref.)												
Female	1.8309	1.0402	1.06	0.287	0.6012	5.5751	0.6418	0.2804	-1.02	0.31	0.2726	1.5109
Birth weight	0.9963	0.0009	-4.23	**0**	0.9947	0.9980	1.0012	0.0006	1.93	0.053	1.0000	1.0024
Birth Length	0.7991	0.0999	-1.79	0.073	0.6254	1.0209	1.1853	0.1709	1.18	0.238	0.8935	1.5724
Birth Temperature	1.6151	0.9412	0.82	0.411	0.5154	5.0611	2.0265	0.9423	1.52	0.129	0.8146	5.0413
Bag and mask resuscitation after birth (No)	0.7398	1.4121	-0.16	0.875	0.0176	31.1776	2.4668	4.2451	0.52	0.6	0.0846	71.9361
Cried immediately after birth (No)	1.9558	2.5554	0.51	0.608	0.1511	25.3201	1.4876	2.1562	0.27	0.784	0.0868	25.4858
Apgar Score 1st minute	0.6504	0.4183	-0.67	0.504	0.1844	2.2940	0.9606	0.5144	-0.07	0.94	0.3363	2.7441
Apgar Score 5th minute	1.8009	1.3083	0.81	0.418	0.4336	7.4792	0.6542	0.4654	-0.6	0.551	0.1622	2.6378
Apgar_Score_10th minute	1.8155	0.8377	1.29	0.196	0.7349	4.4848	1.9104	1.1074	1.12	0.264	0.6134	5.9504
Perinatal asphyxia after birth (No)	0.2056	0.3481	-0.93	0.35	0.0074	5.6785	1.5529	2.4364	0.28	0.779	0.0717	33.6260
Respiratory distress after birth (No)	0.1841	0.2646	-1.18	0.239	0.0110	3.0774	0.1810	0.2718	-1.14	0.255	0.0095	3.4353
Diagnosed with hypoglycaemia on admission	1.2833	169.2963	0	0.998	6.60E-113	2.50E+112	2.0214	170.2685	0.01	0.993	4.04E-72	1.01E+72

Control variables	RRR	Std. Err.	Z	P Value	[95% Conf. Interval]		RRR	Std. Err.	Z	P value	[95% Conf. Interval]	
	LPN						**FTN**					
Initiated Breast Feeding after birth (>1 hr)	0.9414	0.6907	-0.08	0.934	0.2235	3.9657	3.6145	2.2415	2.07	**0.038**	1.0719	12.1878
Infant has feeding difficulties (No)	0.0265	0.0510	-1.89	0.059	0.0006	1.1510	0.0146	0.0246	-2.51	**0.012**	0.0005	0.3978
Kangaroo Mother care done (No)	1.6448	1.1986	0.68	0.495	0.3943	6.8610	0.3089	0.1876	-1.93	0.053	0.0939	1.0160
Noenate admitted NBU /ICU (No)	0.5855	0.6840	-0.46	0.647	0.0593	5.7795	3.7729	3.6327	1.38	0.168	0.5716	24.9029

cons	3.0883	818.0195	0	0.997	1.10E-225	9.00E+225	7.87E-18	1.33E-15	-0.23	0.816	3.9E-162	1.6E+127
	Reference Outcome=ETN											
	Log likelihood = -119.90999 LR chi2(34) = 165.91 Prob> chi2=0.0000 Pseudo R2 =0.4089											
	Multinomial Logistic Regression between outcome variable (LPN, FTN and ETN) and control fetal variables											

Discussion: -

In the present study, we investigated the risk factors, both maternal and fetal associated with late preterm neonate and early term neonate births relative to their full-term counterparts. From the maternal perspective, the study identified maternal age, occupation, ethnicity, religion and, absence of previous abortion/still birth/premature deliveries as maternal-related risk factors associated with LPN, ETN and FTN birth. The findings that mothers aged 20-29 years had a significantly higher likelihood of giving birth to FTN compared to ETN and LPN concurs with evidence from previous studies which have reported maternal age <20 years or >31 years increases the risk of preterm births(8,17,20,21). Our resultssuggest that maternal age category of 20-29 years is the most suitable for achieving full-term pregnancies.Contrary to some recent studies where maternal occupation in general has been reported as a risk factor for preterm birth(22,23), in the present study we found that women engaging in self-employment or businesshad increased likelihood of giving birth to FTN compared to LPN and ETN. Intriguingly, this finding that self-employment may positively reduce the riskof late preterm birth has not been widely reported in the existing literature. As such, additional studies are needed to explore this association in more depth to understand and unravel the potential underlying mechanisms.

Further, the study found that among various ethnic groups, Luo ethnicity was significantly associated with an increased likelihood of giving birth to FTN. This aligns with results from previous studies that have reported differences in preterm birth rates among ethnic groups, partly due to genetic, environmental, or socio-economic factors(8).Moreover, in the present study absence of previous abortion, stillbirth, or premature deliveries was found to be associated with giving birth to FTN compared to LPN and ETN. This is consistent with the literature indicating that history of adverse pregnancy outcomes, including preterm birth, is a strong predictor of subsequent preterm births(8,24).

Contrary to previous studies, the present study did not findany association withfactors such as antenatal care visits, mothers level of education, serology (HIV-Status), parity, medical problems, history of child death, maternal nutrition status, mode of delivery, premature rapture of membrane and complications during delivery among others as risk factors for birth among the three neonatal categories(17,18,25–27). This could partly be due to differences in study designs, demographic differences, sample size, or the specific healthcare environment in Garissa County.

Notably, evidence from previous studies on some maternal related factors as risk factors for neonatal birth outcome have been somewhat inconsistent. For example, while some studies did not find maternal parity as significant risk factor, which concurs with the findings in the present study(20,28,29), others have reported it as a significant risk factor.Delnord and Zeitlin (8) and Blencowe and colleagues (30)found that both primi-parity and grand multi-parity were consistently associated with an increased risk of preterm birth. Primi-parity, in particular, has been linked to increased susceptibility to complications like preeclampsia, potentially leading to medically indicated preterm births(7,25). Another study by Reddy et al., (31)reported an increased likelihood of LPN birth in multiparous women. Such inconsistencies highlight the complex nature of parity as a risk factor and suggest that other underlying factors may be at play. The present study contributes to this ongoing discourse and lends credence that the impact of maternal factors such as parity on neonatal outcomes may vary across different populations and settings.

From a foetal perspective, only birth weight, time of initiation of breastfeeding and difficulty in feeding were identified as significant risk factors associated with neonatal birth outcomes. Birth weight had a weak association with LPN, albeit with a marginal but statistically significant decrease in the likelihood of LPN with an increase in birth weight. Conversely, it was not statistically associated with FTN birth, which suggest that higher birth weights may have protective effect against late preterm birth. This finding corroborate theresults from past studies that have reported birth weight to be a risk factor for delivery of neonates in the late preterm period(13,28,32).

Additionally, the present study found that FTN had higher likelihood of delayed initiation of breastfeeding compared to LPN and ETN, but they were less likely to have feeding difficulties. These findings align with several studies(13,28,32). Further, they are in tandem withKarnatiet al., (2), who reported that LPNs often face challenges related to immaturity, leading to difficulty in feeding. This category of neonates often struggle with coordination of suck-swallow-breath reflex, leading to feeding challenges, which is one of their leading cause of re-hospitalization secondary to poor growth and dehydration(2). As such, focus should be carefully put on their oral feed intake, weight gain and milk supply to prevent added morbidity and or re-hospitalization. Moreover, these findings support

the observations by Engle and colleagues that LPNs often display physiological immaturity, leading to increased vulnerability(33).

The observations that APGAR Scores, birth length, asphyxia and respiratory distress were not significant risk factors associated with LPN, ETN and FTN births is somewhat contrary to results from previous studies. Recent studiesby Algameel and colleagues found that LPNs had lower Apgar Scores at 1st and 5th minute compared to their term counterparts but this difference disappeared after 5th minute, suggesting that while neonates born in the late preterm period may face initial challenges, with quick interventions, their outcomes could be improved(28). The same study and previous one by Wang and colleagues found that LPNs had higher prevalence of respiratory distress compared to their term counterparts(28,34). This could largely be attributed to the developmental immaturity of the lungs as well as the reduced levels of surfactant, which is essential for lung function(35). Algameel and colleagues also reportedsignificant association between late preterm birth and perinatal asphyxia and as well as the need for neonatal intensive care admission(28). These observed discrepancies could partly be attributed to variations in study designs, demographic differences, and sample size among others. It is worth noting that while the present study comprised of three distinct categories of neonates LPN, ETN and FTN,Algameel et al.,(28) study comprised of a cohort of 250 neonates divided into LPN (34 to 36 weeks and 6 days) and Full term Neonates (37 to 40 weeks and 6 days) born in two health facilities namely Fayoum University Hospital and Beni Suef General hospital in upper Egypt. Lumping of ETN and FTN in the(28) study, may attenuate results as evidence from previous studies have shown that LPN and ETN share many risk factors including pregnancy complications, maternal socio-demographic and lifestyle characteristics among others(8)

Nevertheless, while this study has identified some maternal and fetal related factors associated with LPN and ETN births, relative to their full-term counterparts, it had some limitations, which calls for the need to validate the findings in different contexts and settings within Kenya. First, this study focused on a single County Referral Hospital, which may limit generalizability of the findings to other settings. Secondly, the study only involved observation of measurements without any intervention. Thirdly, it utilized convenience sampling method to enroll study participants, which is prone to volunteer bias, as those who choose to take part may differ from those who choose not to, and the sample may not be representative of other characteristics. Fourth, gestational age estimation was based on the last menstrual period which can sometimes be inaccurate, as it is prone to error in maternal recall. Despite these limitations the present study has shown that maternal- and fetal-related risk factors associated with LPN and ETN births in Garissa County Referral Hospital compared to their FTN counterparts are different, hence the null hypothesis was rejected. More importantly, this study adds to the current body of knowledge by identifying unique risk factors applicable to Garissa County context. While in agreement in some respects with global research trends, the findings also bring to the fore new perspectives that warrant further research, particularly in the context of low- and middle-income countries settings.

Conclusion and recommendation: -

Maternal- and fetal-related risk factors associated with LPNs and ETNs are different from those of FTNs.

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Conflict of Interest

The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

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