"TO STUDY ROLE OF TRANSVAGINAL CERVICAL LENGTH AT 18 TO 22 WEEKS OF GESTATION IN PREDICTION OF PRETERM LABOUR"

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ABBREVIATIONS

CL- Cervical length

GA - Gestational age

LMP- Last Menstrual Period

EDD- Expected date of delivery

POG- Period of gestation

CRL- Crown Rump Length

FGR- Fetal Growth Restriction

EFW- Estimated Fetal Weight

USG- Ultrasonography

OPD- Outpatient department

SFH- Symphysio – fundal height

DM- Diabetes Mellitus

GDM - Gestational diabetes mellitus

MHz- Mega Hertz

TVS- Transvaginal scan

TAS- Transabdominal scan

ACOG- American College of Obstetricians and Gynecologists

Sl.No.- Serial Number

KLE's- Karnataka Lingayat Educational Society

KAHER- KLE Academy of Higher Education and Research center

JNMC- Jawaharlal Nehru Medical College

ABSTRACT

Background-Preterm birth (PTB) is a common obstetrical complication associated with adverse complications. The diagnosis of an early preterm labour is difficult but has important implications. The current study was aimed to determine the role of transvaginal CL at 18 to 22 weeks of gestation, in the prediction of preterm labour among the singleton pregnant women.

Materials and methods–A prospective clinical study was done on 96 participants form July 2020 to June 2021 in women attending for routine antenatal care . A co-relation was drawn between CL, type of delivery, gestational age and neonatal outcomes. The data was analysed by chi- squared tests, co-relation plots, ROC curve analysis and logistic regression analysis as per indication. The $p<0.05$ were considered for statistical significance in all instances.

Results-Majority of the study participants were within the age group of 21-25 years. It was observed that CL in the range of 3-3.9 centimetres in most of the cases. The mean CL was found to be higher among subjects who had full term delivery (3.4285±0.67372) than those who delivered preterm (3.20±0.38730). A significant correlation (r=0.249) was also seen between type of birth and birth weight. Sensitivity and specificity of CL at a cut-off value of 2.45cms in predicting preterm labour were 96.3% and 97.1% respectively.Negative predictive value is 94.62%. Area under the curve was 0.422 for the prediction of preterm birth. When the risk was estimated, it was observed that the risk of preterm labour is 3.6 times higher when the cervical length during 18-22 weeks was less than 2.5 cm.

Conclusion –

Transvaginalsonography is a useful method in assessing the cervical changes during pregnancy and predicting the preterm birth

Keywords-Cervical Length, preterm labour pregnancy, maternal outcomes, fetal outcomes, obstetric risk factors

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INTRODUCTION

Preterm birth (PTB), defined as “delivery before 37 weeks from the date of conception or Last Menstrual Period (LMP)”, is one of the "great obstetrical syndromes" characterized by multiple etiologies such as a protracted preclinical stage, frequent fetal involvement, clinical symptoms, and environmental variables that may predispose to the condition.[1,2]Based on the gestational age, Preterm Birth was classified as “ 32 to <37 weeks of gestation- moderate to late preterm, 28 to 32 weeks of gestation- Very Preterm and less than 28 weeks of gestation- Extremely preterm,”.[3]

Preterm birth is a global community health issue, with a higher frequency in impoverished nations. PTB prevalence ranged from 4.5 percent in Ireland, 8.3 percent in Australia, 15 percent in the United States, and more than 60 percent in Africa and South Asia.[4,5]In most countries, it is the most common cause of morbidity and death among the newborns that is not caused by chromosomal abnormalities or congenital anomalies. Stillbirth is prevalent in preterm birth with a rate of 82-95 percent, accounting for 35 percent of the global 3.1 million newborn fatalities in 2006.[6,7]In India, the highest number of PTB was around 35.12 million each year. Preterm labor is the leading cause of preterm birth in India, accounting for 12–18% of all births. [3]

Infants born prematurely have a 40–fold greater danger of mortality in year one of life as compared to infants born at term. [5] Preterm infants account for half of all children with cerebral palsy, one in three children with impaired eyesight, one-quarter of children

suffering from chronic lung illnesses, and one in five children suffering from mental retardation. In middle-age, there is an elevated chance of behavioral disorders, poor rate of educational attainment, decreased levels of progenitive success, as well as an increase in the prevalence of second-generation Preterm birth. As a result, the country faces an additional economic burden. In 2006, research done in the United States revealed a significant health care expense (including short and long-term) of $26.2 billion, or $51 600 for each preterm neonate delivered. [(8)]Considering the significant and wide-ranging consequences of preterm birth, it is critical to identify individuals who are at elevated risk of PTB.

PTB can be predicted using cervical length measurement, risk factor evaluation, and biochemical indicators.[(3)] Cervical evaluation has most typically been utilized as a method to prognosticate preterm birth based on the notion that the cervix functions as a physical manifestation of the underlying diseased process that leads to premature birth. In the past, the cervical length (CL) was assessed via a digital examination. [(9)] Ultrasound examination of the cervix has been a major aspect of obstetric diagnostic imaging in recent years, notably with the introduction of transvaginal probes and patients' increased acceptance of transvaginal sonography (TVS) during pregnancy. [(10)]

Andersen et al. identified an increase in the probability of preterm birth that rose as cervical length increased. [(11)]In a low-risk pregnant cohort that was not pre-selected, Iams et al., discovered that

when measures were lower than 26 mm, that was the tenth percentile among the study population, at 24 and 28 weeks, the probability of spontaneous preterm birth rose more than sixfold and nine fold, respectively. [12] In a randomly chosen Finnish population, Taipale and Hilesmaa et al., reported that pregnant women with a shorter cervical length at 18–22 weeks of pregnancy had an eightfold greater risk of spontaneous preterm birth compared to those with a normal cervical length. [13]A prospective cross-sectional research conducted among 210 obstetric patients reporting to a tertiary care hospital in India concluded that a minimum value of ≤2.5 cm cervical length is a better measure of preterm birth.[3]

Early preterm labor is difficult to diagnose and has a high false-positive rate. A false diagnosis of premature labor will need unnecessary and perhaps dangerous therapy. Some studies have shown that measuring CL in the first trimester is effective, [14] while others have found that it is not a definitive indicator of preterm birth. [15,16]On the other hand, lots of studies have indicated that measuring CL at mid-trimester is a good procrastinator of premature birth. [17] As a result, there is a need to understand the changes in cervical length during pregnancy to detect preterm labor early and avoid the implications of premature birth. In addition, there is growing attention to the association between CL variations through time as well as the danger of premature birth.

NEED FOR STUDY :

The aim of this study was to establish the relation between cervical length in a routine population of singleton pregnancies at 18-22 weeks of gestation and risk of spontaneous preterm delivery

OBJECTIVES

1. To assess the correlation between the cervical length measurement and preterm labour.
2. To determine the cervical length by transvaginal sonography at 18 to 22 weeks in a singleton pregnancies.

REVIEW OF LITERATURE

Preterm is defined as births that occur before 37 completed gestation weeks or lesser that 259 days from the first date of last menstrual period (FLMP)[18].Neonatal morbidity and mortality is higher in babies born preterm than those born at term. The primary factor determining preterm births is the estimation of gestational age which is assessed using ultrasound, FLMP and measurement of symphysis-fundal height. An algorithm using the combination of FLMP and ultrasound is used as a best obstetric estimate (BOE) of gestational age[19]. Prediction of gestational age led to differences in preterm birth estimates, as per 2015 United States data, the rate 9.62% when BOE was used and 11.29% when FLMP based calculation was applied. Preterm birth is calculated from the number of live births before 37 completed weeks per 100 live births[20]

Based on the gestational age preterm are classified as extremely preterm (<28 weeks), very preterm (28-32 weeks), moderate preterm (32-36 weeks) and late preterm (37 weeks) whereas preterm births can be classified based on the delivery mode such as spontaneous labor or preterm rupture of membranes or elective cesarean or induction of labor[21]. Maternal complications including preeclampsis, placental abruption and placenta previa or fetal distress situations such as intrauterine growth restrictions can lead to preterm births. Spontaneous labor has been accounted for 70% preterm births with 30% being elective based. This percentage varies with respect to countries, regions and income status of the countries, where 5% preterm births are registered in Europe and 18% in few African countries with sub Saharan African and South Asian countries contributing 60% of cases[22]. The global prevalence of preterm births ranges from 9.6% in the year 2005 to 11.1% in the year 2010. In Indian

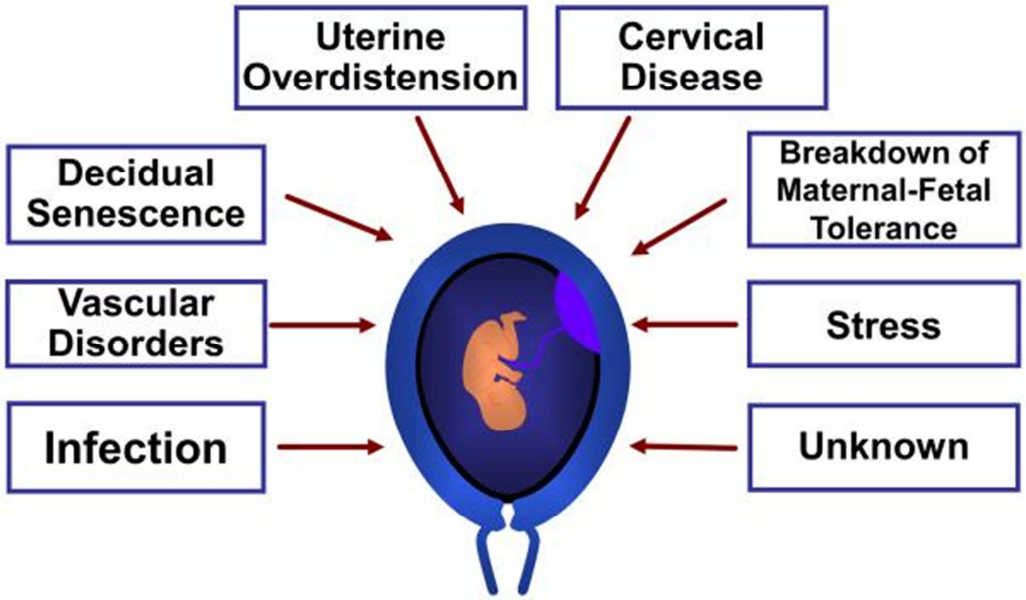
scenario, 3.6 million out of 27 million cases of preterm births are observed with a 13% prevalence. The fetal death due to preterm births is estimated around 300,000 babies in India accounting for 25% of the global preterm death burden[23]. The adverse consequences of PTB extend beyond early infancy into later in life.Estimation of preterm births help in understanding their epidemiology, to develop and implement policies, raise awareness and mobilize resources. Preterm births account for 75% neonatal death and neonatal intensive care admissions in UK. In United States, as per 2001 data 8% of hospitalizations were due to preterm or low birth weight infants. Increased days of hospitalization are also observed in preterm and extremely preterm babies[24]

RISK FACTORS DETERMINING PRETERM BIRTHS

Preterm births occur due to malnutrition, obstetric, medical, environmental, socioeconomic and demographic factors. Countries from high index human development (Newzealand, Slovenic, Czech Republic, Sweden and the US state, California) were included in the study to understand the risk factors of preterm births. In this study involving 4.1 million singleton births 21 risk factos including previous preterm birth, preeclampsia, chronic or gestational diabetes, chronic or gestational hypertension, maternal age, nulliparity, assisted reproductive technology (ART), illicit drug use, ethnicity, smoking, BMI, education, previous cesarean section, male baby, no prenatal care before 20 weeks, married status, employment, migration and poverty were analyzed for its association with preterm births. Previous preterm birth and preeclampsia were strongest risk factors followed by nulliparity and male baby. No biological association was observed in 65% of cases[25]. Maternal race, age, education, pregnancies due to ART, aversion of still births, labor inductions and non-medically

indicated cesarean delivery has been the major risk factors for the increase in preterm births in very high human development index countries.Certain lifestyle and environmental factors, including late or no health care during pregnancy, smoking, drinking alcohol, using illicit drugs, Domestic violence, including physical, sexual, or emotional abuse, lack of social support, stress, long working hours, exposure to certain environmental pollutants are also judged as risk factors for preterm births.

Onset of Preterm Parturition[26]



The predominant cause are:

1. Overdistension of the uterus
2. Feto-maternal distress
3. Infection
4. Premature cervical changes.

1. Overdistension of the Uterus[26]

Multiple pregnancies and hydramnios are the probable reasons causing overdistension of the uterus. Thereby, an increased amount of contraction associated proteins will be detected over the myometrium of the uterus due to stretching. The myometrial stretch induces contractions. In case of premature stretching and feto – placental endocrine activation, there occurs premature cervix ripening with immediate cervical length shortening and dilatation inducing preterm birth.

Multifetal Pregnancy [27]

Mutifoetal pregnancy or multiple pregnancy would result in preterm parturition. Over stretching of myometrium due to multiple pregnancies might result in preterm than in singleton pregnancies.

2. Feto – Maternal Distress[26]

At third trimester, the corticotrophin and adrenocorticotrophic hormones secretions are elevated along with increased cortisol and oestrogen levels. This might end up with premature loss of myometrial quiescence. Studies have proven that corticotrophin is a biomarker of preterm labour.[29,30,31]

3. Infection[26]

Inflammatory changes in the uterus is initiated by microbial infection in turn the lactobacillus count increases. Neonates born to those having infection are prone to sepsis. The infection usually harbours the cervix and vagina, later followed by hematogenous

infection. It might later traverse towards the fallopian tube. There are four stages of microbial invasion. They are:

Stage 1	Bacterial vaginosis
Stage 2	Infection of decidua
Stage 3	Infection of amniotic fluid
Stage 4	Fetal systemic infection

Advancing from stage one to stage four would increase the likelihood of preterm birth among pregnant women.

PPROM - Premature Preterm Rupture of Membranes[26]

The predisposing factors for PPROM are UTI and bacterial vaginosis, habits like smoking, low BMI of the pregnant women and history of preterm rupture membranes. The mechanism involves programmed cell death due to increased proteases and expression on matrix metalloproteinases into the amniotic fluid.

Epidemiology of Preterm Births [29]

According to the WHO, globally 15 million preterm births have been reported so far. Despite limited data, 60 percent of the preterm births were found to be befalling in South Asian and African regions. Moreover, studied have reported a glaring contrast with regard to the incidence of preterm births and causes across pregnant women of varied race, ethnicity, country and origin. India accounts for the greatest preterm births of 3,519,100 than any other country.Neonates having birth weight around 500 – 999 grams had to stay at neonatal

intensive care unit for 44 days and those having birth weight around 1000 – 1500 grams must stay at neonatal intensive care unit for 26 days. Because, neonates born preterm can develop neurodevelopmental impairments, that adds up to the financial burden of their families as well as the country. Therefore, preterm births has been regarded as a global as well as national problem requiring a solution.

RISK FACTORS DETERMINING PRETERM BIRTHS

STUDY DESIGN	RISK FACTOR	IMPACT ON PRETERM BIRTHS	REFERENCE
Systematic review of 45 studies	Ethinicity	increased risk in black women compared to white, no association found for Asian and Hispanic women	(29)
Population based retrospective cohort study	Teenage pregnancy	threefold risk of preterm delivery and stillbirth	(30)
population-based register study	advanced maternal age > 30 years	Increased very preterm births	(31)
	Overweight/obesity	Increased moderately preterm birth	
Prospective cohort data of 75 296 newborns from 12 European countries	low maternal education	Increased preterm risk	(32)
cohort studies conducted in low- and middle-income countries	Nulliparous, age <18 year women	Higher risk compared with women who were parity 1-2 and age 18-<35 years	(33)
Cross country individual participant analysis	Previous preterm birth	Higher odds risk of preterm births	(25)
	Male babies	11–16% of excess population attributable risk	
	Preeclampsia	Higher odds risk of preterm births	
	Nulliparity	25–50% of excess population attributable risk	
Systematic review	Interpregnancy interval	maternal nutritional depletion, folate depletion, cervical insufficiency, and vertical infection transmission increases chances of preterm births	(34, 35)
Systematic review	Short cervical length	length less than 25 mm is associated with greater risk of preterm births	(36)
Metaanalysis of fifty-two cohort studies	Singletons and twins formed through in vitro fertilization	higher risks of preterm birth than spontaneously conceived singleton and twin pregnancies	(37)
Systematic review	Twin pregnancies	Monochorionicity increases preterm risk	(38)
A dose-response analysis of 25	Smoking	maternal smoking during	(39)

million mother-infant pairs		pregnancy, even at a very low level of intensity was associated with an increased risk of preterm delivery	
Analysis of pregnant women living in the Bangkok Metropolitan Region	Illicit drug use	Higher risk of preterm delivery adjusted odds ratio of 2.95	(40)
A cohort study of women at antenatal care at Copenhagen University Hospital, Denmark	Alcohol consumption	Women reporting 1, 2, and ≥ 3 binge drinking episodes had an adjusted hazard ratio for spontaneous preterm birth of 0.88, 1.34 and 0.93 respectively	(41)
Review	Infections	HIV, bacterial vaginosis, *Chlamydia trachomatis* infection, chorioamnionitis, urinary tract infections (particularly pyelonephritis), hepatitis C, malaria, and syphilis increased preterm risk	(21)
Retrospective population-based cohort study in Ontario, Canada	pre-pregnancy diabetes mellitus, obesity and chronic hypertension	Diabetes alone and together with hypertension were strong risk factors of preterm birth	(42)
Systematic Review and Meta-analysis	Thyroidism	risk of preterm birth was higher for women with subclinical hypothyroidism than euthyroid women	(43)
Systematic Review and Meta-analysis	cervical incompetence	causes about 15% of habitual abortion in 16-28 weeks, with 0.1-2.0 % total incidence	(44)
case-control study	periodontal disease	severity of gingivitis or periodontitis increased or tooth loss is linked with preterm birth risk	(45)
Systematic Review and Meta-analysis	maternal anemia	in low- and middle-income countries, 19% of **preterm** births	(46)
population-based cohort study	short stature	Maternal short stature <145 cm associated with preterm birth	(47)
cross-sectional study of women with preterm deliveries	low maternal vitamin D	low maternal vitamin D had an approximately nine-fold higher likelihood of preterm delivery	(48)
Review	Disease conditions	systemic lupus erythematosus, polycystic ovarian syndrome, epilepsy, bipolar disorder, and pregnancy-related depression, stress, and anxiety increased preterm risk	(20)
birth registry based cohort study in northern Tanzania	Placental conditions	placental abruption, placenta previa, polyhydramnios have also been associated with preterm birth	(49)
exposed/unexposed monocentric retrospective cohort study	uterine conditions	uterine anomalies, leiomyoma with premature delivery of 12.0%	(50)
nationwide, registry-based study	Fetal conditions	fetal birth defects such as congenital heart defects increased risk of spontaneous preterm birth with an adjusted hazard ratio 2.1	(51)
Retrospective cohort study	Caesarean birth	emergency caesarean birth at full dilatation (4.5%) was associated	(52)

		with an increase in spontaneous preterm birth compared to vaginal birth (2.3%)	
Case study	Environment	air pollution where particulate matter with an aerodynamic diameter of 2.5 μm or greater is associated with increased preterm birth	(53)
Hospital based prospective study in India	Maternal risk factors	Previous preterm delivery, periodontitis, , presence of Nugent's intermediate vaginal flora, gestational diabetes mellitus, and maternal height <1.50 m	(54)
Prospective cohort of pregnant Indian women	Poor sanitation	Associated with adverse pregnancy outcomes including preterm birth risk	(55)

PREDICTORS OF PRETERM BIRTH

Prediction of preterm births in nulliparity has been a major issue due to the low sensitivity and poor predictability.

Cervical length by ultrasound and biochemical markers of the cervical secretions has been major and positive predictors of preterm birth. Cervical structural changes and consistence assessed by cervical elastography through strain elastography and shear wave elastography techniques have been used as predictors of preterm birth in many studies[54.]The biochemical markers such as fibronectin, relaxin levels, interleukin, Phosphorylated insulin-like growth factor binding protein-1 (phIGFB-1) and placental alpha macroglobulin-1(PAMG-1) have been able to predict preterm births. In multiple instances combination of any of these methods are utilized to enhance the sensitivity, specificity to detect preterm births. Systematic review of 21,614 articles observed thatcervical fibronectin was strongest biomarker, followed by maternal serum alpha fetoprotein, C-reactive protein and interleukin-6 strongly associated with spontaneous preterm births[57.] Newer proteomic, metabolomic techniques have been employed to assess preterm births, but suffer from cost effectiveness and implementation of the method in routine. A proteomic study

revealed that 13 proteins were downregulated and 12 protein upregulated. The proteins belong to a range of functions including cytoskeleton proteins, antioxidant enzymes, cell adhesion molecules, binding and transportation of various ligands, chaperons, and proteins involved in angiogenesis, inflammation processes, proteolysis, and transcription[58].

PREDICTORS OF PRETERM BIRTHS

	Sensitivity (%)	Specificity (%)	Positive predictive value(%)	Negative predictive value(%)	Reference
Salivary progesterone	84	90	89.8	85.9	(59)
cervical length measurement	71.5%	100	100	69.97	
Cervical sonoelastography	70	80	63.6	84.2	(60)
CervicalLength measurement	66.7	82.4	66.7	82.4	
Combinationof cervical sonoelastography and cervical length measurement	90	70	60	93.3	
positive fetal fibronectin at 28 weeks	50	92	62.5	87.3	(61)
Serum relaxin level	63			For false predictive value of 10	(62)
Fetal adrenal gland biometry	76	67			(63)
Phosphorylated insulin-like growth factor binding protein-1 (phIGFB-1)	60			93.3	(64)
placental alpha macroglobulin-1(PAMG-1)	70			98.9	
maternal serum amyloid	96.6	86.2	Positive	Negative likelihood	(65)

A			likelihood ratio (PLR): 7.0	ratio (NLR): 0.039	
interleukin-6 in cervicovaginal	73%	61	PLR: 1.9	-	(66)

CERVICAL LENGTH

Measuring cervical length between 16 and 24 gestation weeks by transvaginal ultrasound has been an accurate predictor of spontaneous preterm birth. Transvaginal ultrasound is highly reproducible method compared to transabdominal ultrasound method. Transabdominal ultrasound is hindered by maternal obesity, obstruction by fetus and cervical position. Transabdominal method has been a failure in 50% cases to visualize the cervix if the bladder is not full, additionally bladder filling enhances the cervical length thereby reducing the reproducibility and goodness of the prediction. In the transvaginal ultrasound, the study is conducted at the semi-recumbent position, the high frequency transducer covered with gel is introduced into the anterior vaginal fornix and positioned to visualize the endocervical canal. The transvaginal ultrasound examination value and shape of the internal os have been positive predictors in threatened women with high risk of preterm births. Women experiencing regular and painful contractions, and women with premature rupture of membrane are included in this high risk group. Women with history of preterm births, miscarriage, uterine malformation, multiple pregnancies and conization have been categorized as high risk group. The transvaginal ultrasound measurements have been shown to yield positive prediction in general pregnant women population.[67]

Cervical length decreases with increase in gestation weeks. Iams et al[68] noted 4% prevalence in preterm birth, where cervical length decreased from 35.2 mm (24 weeks) to 33.7 mm (28 weeks). Decrease in cervical length with gestation age is

supported by Salomon et al[69] where a median cervical length of 43, 42, 40, 37, 34, 31 mm was observed at 16, 20, 24, 28, 32 and 36 gestation weeks respectively. Spontaneous preterm birth can be predicted by the change in cervical length shortening during gestation period. Romero et al.[70] studied a total of 549 women, where 8.3% spontaneous preterm birth was observed. Nearly 19% women showed more than 10 mm cervical length shortening who were at increased risk for spontaneous preterm birth. A stronger association between rate of cervical shortening and risk spontaneous preterm birth was observed in women with short cervix post cerclage. Cervical shortening (1 mm/week) rate increased preterm risk by 22%, whereas for women cerclage (cervical length < 25 mm) at 18–20 weeks and cervical shortening rate of 1 mm/week was linked with 59% risk. Term delivered women with cerclage had a lesser frequency of cervical shortening compared to preterm delivered women.[71]

Nonlinear decrease in the cervical length is observed with increase in gestational age, whereas it remains unchanged until 20 gestation weeks. Nulliparous women have shorter cervical length compared to multiparous women, similarly maternal weight is also non linearly associated with cervical length. Cervical length of less than 25 mm at 20 to 23 6/7 weeks of gestation has been used as a threshold in multiple studies to predict preterm births.[70]

Cervical length is reported to vary among different races and ethnicities, where black patients are observed to have shorter cervical length than white patients. These disparities once assessed by sonographic mid-trimester cervical findings can prevent preterm births efficiently.[59]

In multiple cases, false positive diagnosis of preterm labor results in unnecessary prescription of corticosteroids for fetal lung maturity and tocolysis. In a study involving 41 women receiving antenatal corticosteroids and tocolysis, 14% of the women were unnecessarily treated with corticosteroids. The cervical length was observed to be more than 15 mm in a number of pregnant women. Similarly tocolysis were given to women with cervical length above the threshold.

CERVICAL LENGTH IN PREDICTING PRETERM DELIVERIES

Cervical length changes and cutoff	Gestation weeks	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Reference
Cervical length shortening of >10 mm	between 22 0/7 weeks and 33 6/7 weeks	47.8%	83.9%,	21.2%,	94.7%	(73)
length <25 mm during midgestation	-	71%	98%	91%	94%	(74)
below 25.5 mm	34 weeks predicted late-preterm delivery	80	93.9	52.6	98.2	(75)
above 42.5 mm	34 weeks predicted late-preterm delivery	70.4	93.5	50.0	97.1	
37.64 ± 6.23 mm	22-26 weeks of twin pregnancies	70-80	70-80	-	-	(76)
30 mm in twin pregnancies	16-20 weeks	95	14	-	-	(77)
twin pregnancies.	18-21	33.3%(<28 weeks) 23%(<34 weeks)	-	-	97.3% (<28 weeks) and 86.8 % (<34 weeks) preterm birth	(78)
	22-25	71.4%(<28 weeks) 38.2% (<34 weeks)	-	-	99.1%(<28 weeks) 91.4%(<34 weeks)	

	Cervical length shortening of ≥ 2 mm/week	80% % (<28 weeks) 60.8% (<34 weeks)	-	-	98.9% (<28 weeks) 90.6% (<34 weeks)	
cervical length and obstetric history	20 + 0 to 24 + 6 weeks	80.6% (extreme preterm), 58.5% (early preterm), 53.0% (moderate preterm) and 28.6% (mild preterm)				(79)

PREVENTION OF PRETERM BIRTHS

In order to reduce the preterm birth rates five different interventions such as reducing multiple births due to ART, reducing non-medically indicated cesarean deliveries and labor induction were implemented. When these five interventions were implemented in the 39 very high human development index countries, a relative decrease of 5% was observed. Reduction in non-medically indicated labor inductions and cesarean delivery accounted for half of the impact. But the impact of the interventions varied between countries. For instance, in United States reduction in non-medically indicated labor induction or cesarean delivery played a major role, whereas in Sweden cervical cerclage for prior preterm delivered mothers and short cervix have been the major players in reducing preterm births [80]

Multiple other interventions such as 17-α- hydroxyprogesterone caproate, cervical cerclage, smoking cessation, contraception strategies for best possible interval between births, tocolysis, utilization of single embryo transfers through ART and vaginal progestens have been proposed to reduce preterm deliveries. Many retrospective or case controlled studies use cervical pessary was used as an intervention or prevention strategy against preterm birth risk[21]

Women with a short cervix less than 25 mm were routinely scanned at 20-23 gestation weeks of gestation and assigned to cervical pessary. This intervention was shown to reduce the rate of early preterm delivery (Goya et al., 2012). Twin pregnancies accounted for 25% of preterm births. Insertion of cervical pessary in twin pregnancies during 20+0 to 24+6 gestation weeks and in women with cervical length less than 25 mm showed no benefits Nicholaides, 2016. Similarly cervical pessary in women with singletons and short cervix did not result in reduction of preterm birth rate. [81]

Preterm birth intervention based on new guidelines were implemented in Australian Capital territory for a period of 16 months, a follow up study showed that the preterm birth rates reduced to 10% with averted or reduced delayed preterm births[82].

Table 2 represents multiple intervention programs or trials and their analysis which are shown to reduce the incidence of preterm births.

INTERVENTIONS TO REDUCE PRETERM BIRTHS

Study design	Risk factor	Intervention	Reference
Multistate analysis	Smoking	smoke-free laws was associated with a reduction in racial/ethnic disparities in preterm	(83)
Population based study	Gestational diabetes	Cycling exercise initiated early in pregnancy and performed at least 30 minutes, 3 times per week reduced gestational diabetes and associated risk of preterm delivery	(84)
A cohort study	cerclage, vaginal progesterone or cervical pessary	vaginal progesterone treatment in comparison with treatment with cervical pessary had higher preterm delivery risk	(72)
Trial conducted at 22 hospitals	miscarriage or spontaneous preterm birth at 31^{+6} weeks' gestation	reduced preterm births in progesterone group relative to the placebo group	(85)
large-scale cross-sectional study in Northwest China	Malnutrition	Maternal calcium supplementation during second or third trimester reduces preterm birth risk	(86)
Review	preterm birth in multiples	Cerclage is effective in reducing preterm birth in twin pregnancies Cervical pessary may be beneficial for patients with a short cervix Progesterone supplementation for multifetal gestation alone is not beneficial	(87)

Metaanalysis	Low magnesium	Adequate magnesium intake during pregnancy may help reduce the incidence of preterm birth	(88)
systematic review of preventive interventions	pregnant women with psychosocial vulnerability factors	intervention intensity, initiation, continuity of care, and the healthcare professionals' educational background	(89)
randomised, multicountry, double-masked, placebo-controlled trial of	preterm births in nulliparous women with singleton pregnancies from low-income and middle-income countries	low-dose aspirin (81 mg daily) between 6 weeks and 0 days of gestation and 13 weeks and 6 days of gestation reduced risk	(90)
Multicountry, randomized trial	pregnant women between 26 weeks 0 days and 33 weeks 6 days of gestation who were at risk for preterm birth	dexamethasone resulted in significantly lower risks of neonatal death alone and stillbirth or neonatal death than the use of placebo	(91)

MATERIALS AND METHODS

STUDY SETTING:

The study was conducted in the department of Obstetrics and Gynecology at "KAHER's Dr.Prabhakar Kore Charitable Hospital and Medical research Centre", attached to "Jawaharlal Nehru medical college", Belagavi.

STUDY DESIGN:

A prospective study

STUDY DURATION:

The study was conducted for a duration of 1 and half year

STUDY PERIOD:

January 2020 to July 2021

SOURCE OF DATA:

All the pregnant women seeking antenatal care between 18 to 22weeks, who met the inclusion criteria were enrolled in the study

SELECTION CRITERIA:

INCLUSION CRITERIA

Primigravida with Singleton pregnancy at 18-22 weeks of gestation

EXCLUSION CRITERIA

- Hypertensive Disorders in pregnancy
- Uterine anomalies
- Previous history of any surgery on cervix like conisation
- Women with medical complications like diabetes mellitus,,.renal disorders
- Women with congenital fetal anomalies

All women selected as per inclusion criteria and enrolled in study

ETHICAL CLEARANCE:

The study was approved by "Ethical and Research committee, KAHER's Jawaharlal Nehru Medical College" Belagavi, prior to its commencement. (Annexure-3)

METHOD OF DATA COLLECTION

- All antenatal cases between 18- 22 weeks of gestation attending antenatal OPD were subjected to measure cervical length BY TVS
- EDD and GA was assigned based on LMP or CRL, according to ACOG guidelines,i.e ,

a) In a scan less than 8weeks 6days – if the difference between EDD obtained from LMP and CRL is >5 days then CRL is taken into consideration. If difference is <5days, LMP is taken.

b) In a scan done from 9weeks to 13weeks 6 days scan – if the difference between EDD obtained from LMP and CRL is >7 days, then CRL is taken into consideration.

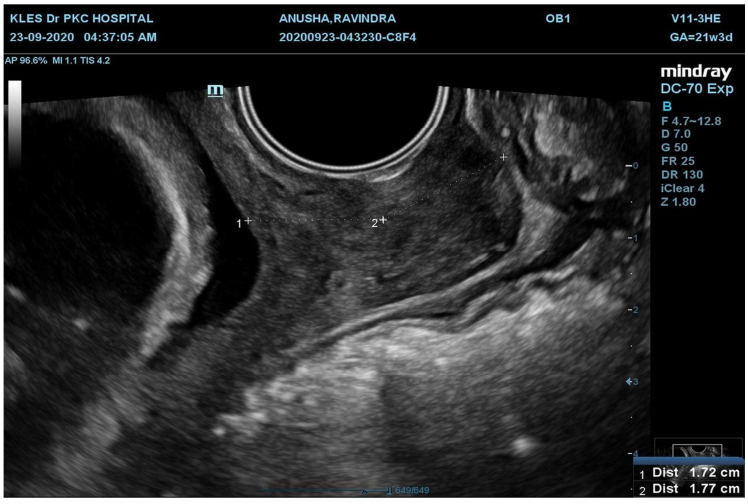
If difference is <7 days, LMP is taken.

Procedure:

All pregnant women attending Antenatal OPD at KLE Dr Prabakar Kore Hospital Hospital, Belagavi between 18-22 weeks of gestation were subjected to measurement of cervical length by transvaginalsonography (TVS).Cervical assessment done with Transvaginal ultrasonography with 5 MHz transducer (voluson s8, Mindray DC-70)

While the women's bladder was empty, Transvaginal ultrasound probe was placed in anterior fornix of the vagina. The appropriate sagittal veiw was identified by location of the triangular area of echodensity at the external os, a V shaped notch at the internal os and faint line of echodensity or echolucency between two. Undue pressure on the cervix that might artificially increase its apparent length was avoided. The cervical length was measured three times along the interface of the mucosal surface .The shortest measurement was recorded as the cervical length.

Cervical length less than 25 mm was considered as high risk for preterm delivery.All the subjects were followed until delivery .The gestational age at delivery ,mode of onset of labour ,obstetric complications and neonatal outcomes were recorded



SAMPLE SIZE

From the study The mean cervical length of the study group at 18-22 weeks was found to be be 3.6±0.5cms, hence at 95% confidence level and 0.1 effect size , the minimum sample size will be

$$n=\frac{Z^2\sigma^2}{E^2}$$

where z=1.96, σ=0.50, and E=0.1hence

$$N=\frac{Z^2\sigma^2}{E^2}=\frac{1.96^2 0.5^2}{0.1^2}=96$$

Minimal sample size required for the study was 96

Statistical analysis:

The IBM SPSS (version 22), and data analysis function of Microsoft Excel was used for statistical analysis. The descriptive analysis was carried out by representation in the form of frequencies and percentages, or mean and standard deviation for quantitative variables as applicable. The chi square test (two tailed), correlation plot tests, ROC curve, and logistic regression models were employed for correlation between CL and risk factors of PTB.

The p value < 0.05 was considered for statistical significance in all instances.

RESULTS

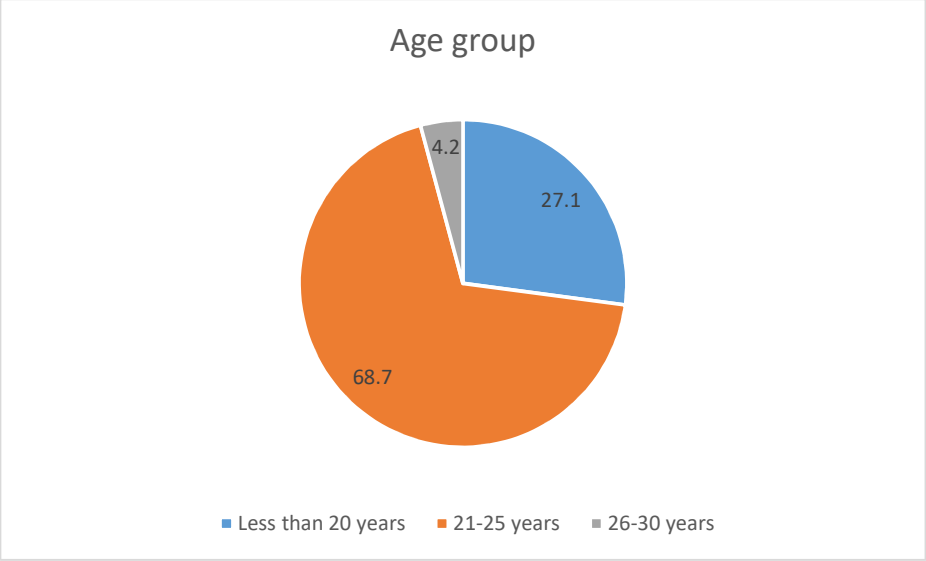
A prospective study was carried out for a duration of one year among 96 singleton pregnant women who attended outpatient department during 18-22 weeks of gestation.

Table 1: Distribution of study participants according to their age

Age of patient in years	Total number of cases N = 96	Percentage
≤20	26	27.1%
21-25	66	68.7%
26-30	4	4.2%

Mean ± SD	22.07± 1.96
Median (Min, Max)	22 (19, 27)

Graph 1: Distribution of study participants according to their age



The above table 1 depicts the distribution of study participants according to age group. Among 96 participants, maximum (66) were between the age group of 21-25 years which was around 68.7%. 26 participants belonged to the age group of ≤20years, accounting to 27.1%. Four participants belonged to 26-30years age group, which is around 4.2%.

Table 2: Distribution of cervical length during 18-22 weeks of gestation

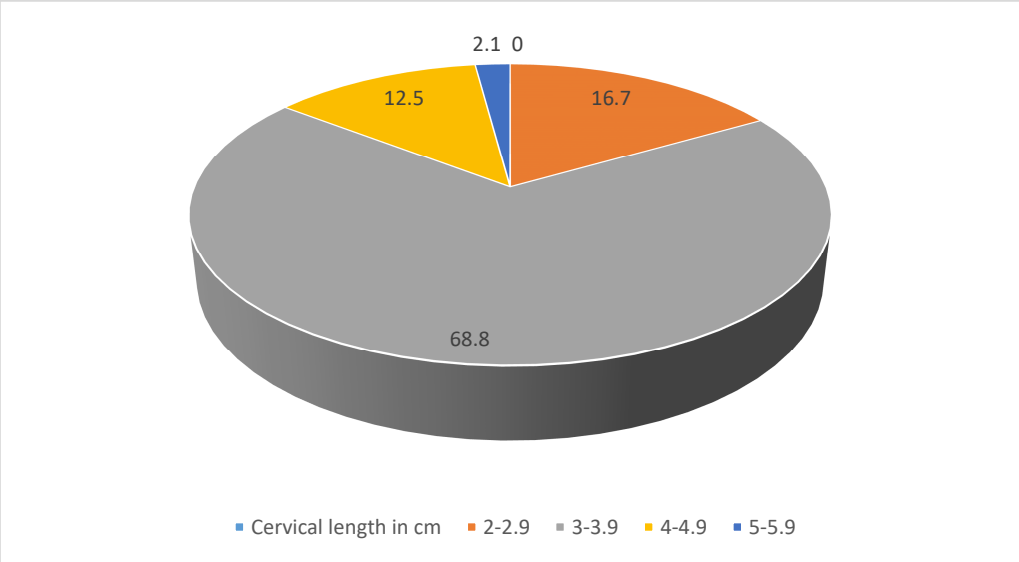
Cervical length in cm	Frequency N= 96	Percent
<1.5	0	0
1.5-1.9	0	0
2-2.9	16	16.7
3-3.9	66	68.8
4-4.9	12	12.5
5-5.9	2	2.1

	Mean ± SD	3.47 ± 0.57
Cervical Length (cm)	Median (Min, Max)	3.4 (2.4, 5.2)

Table 3: Gestational age at which cervical length calculated

GESTATIONAL AGE AT WHICH CERVICAL LENGTH CALCULATED	NO OF PATIENTS	CERVICAL LENGTH (CM)	
18 – 18.6 WKS	13	<1.5	0
		1.5-1.9	0
		2-2.9	01
		3.0-3.9	11
		4.0-4.9	01
		5.0-5.9	0
19– 19.6 WKS	14	<1.5	0
		1.5-1.9	0
		2-2.9	02
		3.0-3.9	10
		4.0-4.9	01
		5.0-5.9	01
20– 20.6 WKS	26	<1.5	0
		1.5-1.9	0
		2-2.9	05
		3.0-3.9	15
		4.0-4.9	05
		5.0-5.9	01
21 – 22WKS	43	<1.5	0
		1.5-1.9	0
		2-2.9	10
		3.0-3.9	29
		4.0-4.9	04
		5.0-5.9	0

Graph 2: Distribution of cervical length during 18-22 weeks of gestation



Among 96 study participants, 16 (16.7%) cases had cervical length of 2-2.9 cms, 66 (68.8%) had 3-3.9 cms, 12 (12.5%) cases had 4-4.9 cms, and the remaining two (2.1%) cases had 5-5.9 cms during 18-22 weeks of gestation. None of the subjects had cervical length less than 1.5 cm and 1.5-1.9cm.

Table 4: Comparing the mean cervical length based on term of birth

	Outcome	N	Mean	Std. Deviation	P-VALUE
Cervical length in cms at 18-22 weeks	Full term	91	3.4385	.67372	0.436
	Preterm	5	3.2000	.38730	

Table 4 depicts the mean cervical length based on the term of birth. The mean cervical length based of term of birth was higher in full term (3.4285±0.67372) than pre term (3.20±0.38730). However, the difference among the groups were not found to be significant statistically.

Table 5: Estimation of risk of preterm delivery with regard to cervical length

Cervical length (cm)	Preterm	Full term	Total	Risk estimate	Confidence interval	
					Upper limit	Lower limit
≤2.5	0	3	3	3.629	13.371	0.805
>2.5	5	88	93	0.807	1.900	0.305

The above table 5 depicts that the risk of preterm birth increases 3.6 times when the cervical length is ≤2.5 cm during 18-22 weeks of gestation.

Table 6: Distribution of subjects with preterm labour based on chronological age and gestational age

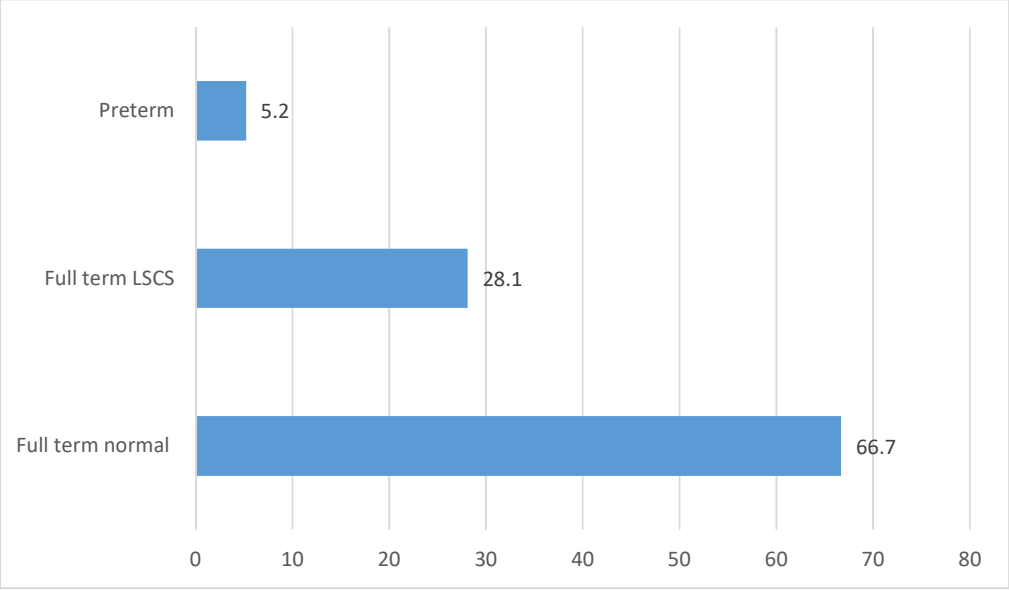
Age in years			Gestational age at the time of CL measurement		Gestational age at the time of delivery	
≤20 n(%)	**21-25 n(%)**	**26-30 n(%)**	**18-20 weeks n(%)**	**20.1-22 weeks n(%)**	**≤35 weeks n(%)**	**35.1-36.9 weeks n(%)**
2 (40)	3 (60)	0 (0)	2 (40)	3 (60)	3 (60)	2 (40)

Out of five cases with preterm delivery, two (40%) belongs to ≤20 years age group and the remaining three (60%) belongs to 21-25 years. With regard to gestational age at the time of cervical length measurement, two (40%) belongs to 18-20 weeks group and the remaining three (60%) belongs to 20.1-22 weeks. With regard to gestational age at the time of delivery, three (60%) belongs to ≤35 weeks group and the remaining two (40%) belongs to 35.1-36.9 weeks.

Table 7: Distribution of study participants based on full term and preterm delivery

Delivery	Frequency N=96	Percent
Full term normal	64	66.7
Full term LSCS	27	28.1
Preterm	5	5.2

Graph 3: Distribution of study participants based on full term and preterm delivery



Among 96 (100%) study participants, 64 (66.7%) had full term normal delivery, 27 (28.1%) had full term LSCS and only 5 (5.2%) subjects had preterm delivery.

Table 8 : Association between cervical length during 18-22 weeks and preterm delivery

Delivery	Cervical length (cm) during 18-22 weeks n(%)						P value
	<1.5	1.5-1.9	2-2.9	3-3.9	4-4.9	5-5.9	
Full term normal	0 (0)	0 (0)	7 (43.75)	46 (69.69)	11 (91.6)	0 (0)	0.042
Full term LSCS	0 (0)	0 (0)	7 (43.75)	17 (25.75)	1 (8.4)	2(100)	
Preterm	0 (0)	0 (0)	2 (12.5)	3 (4.5)	0 (0)	0 (0)	
Total	0 (0)	0 (0)	16 (100)	66 (100)	12 (100)	2 (100)	

Out of 16 (100%) cases with cervical length of 2-2.9 cm, 2 (12.5%) cases had preterm delivery and out of 66 (100%) cases with cervical length 3-3.9 cm, three (4.5%) subjects had preterm delivery. None of the cases with cervical length greater than 4 cm had preterm delivery. These differences were found to be statistically significant (p=0.042).None of the subjects had cervical length less than 1.5 cm and 1.5-1.9cm.

Table 9: Sensitivity, specificity and predictive values

Cervical length (cm)	Preterm	Full term	Total
≤2.5	0	3	3
>2.5	5	88	93
Total	5	91	96

SENSITIVITY	SPECIFICITY	POSITIVE PREDICTIVE VALUE	NEGATIVE PREDICTIVE VALUE
0%	96.7%	0%	94.62%

Sensitivity = 0/5 = 0%

Specificity = 88/91 = 96.7%

Positive predictive value = 0/3 = 0%

Negative predictive value = 88/93 = 94.62%

Figure 1: Comparison of cervical length between subjects who had pre term labor and full term labor

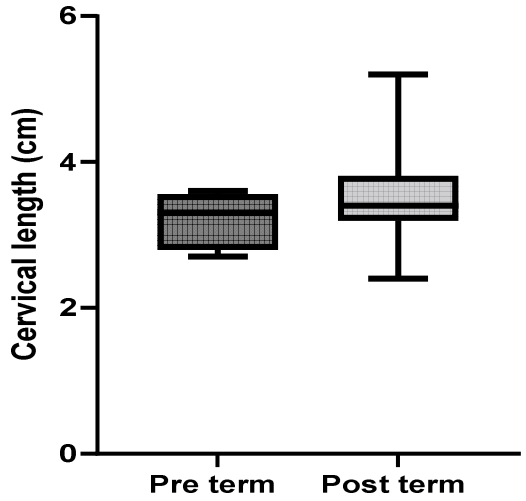


Figure 2 : Comparison of gestational age between subjects who had pre term labor and full term labor

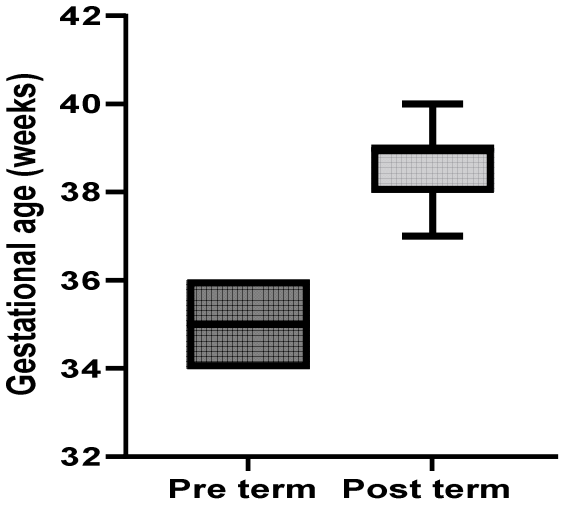
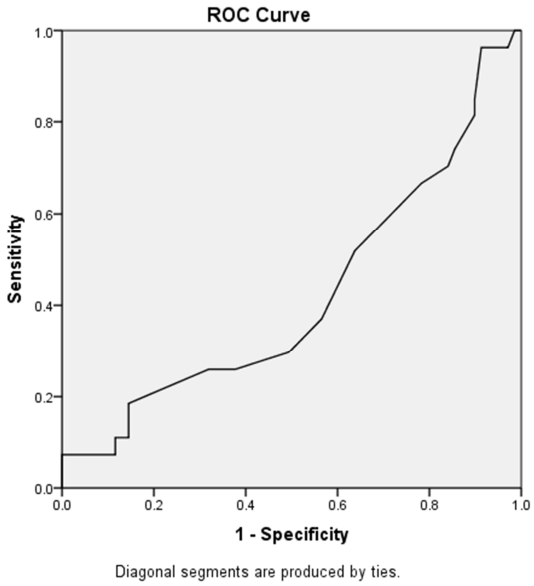


Figure 3: ROC curve for sensitivity and specificity



Area under the curve 0.422

Table 10: Correlation between cervical length at 18-22 weeks of gestation and type of delivery and birth weigth

Outcome	Correlation	Birth weight	Cervical length at 18-22 weeks of gestation
Type of delivery	Correlation Coefficient	-.249**	-.200*
	Sig. (2-tailed)	.004	.039
	N	96	96

In this study, it was observed that type of delivery has significant negative negligible correlation with birth weight and cervical length at 18-22 weeks of gestation. So, it is understood that as the cervical length reduces the chances of preterm delivery increases.

Figure 4: Correlation between cervical length at 18-22 weeks of gestation and type of delivery

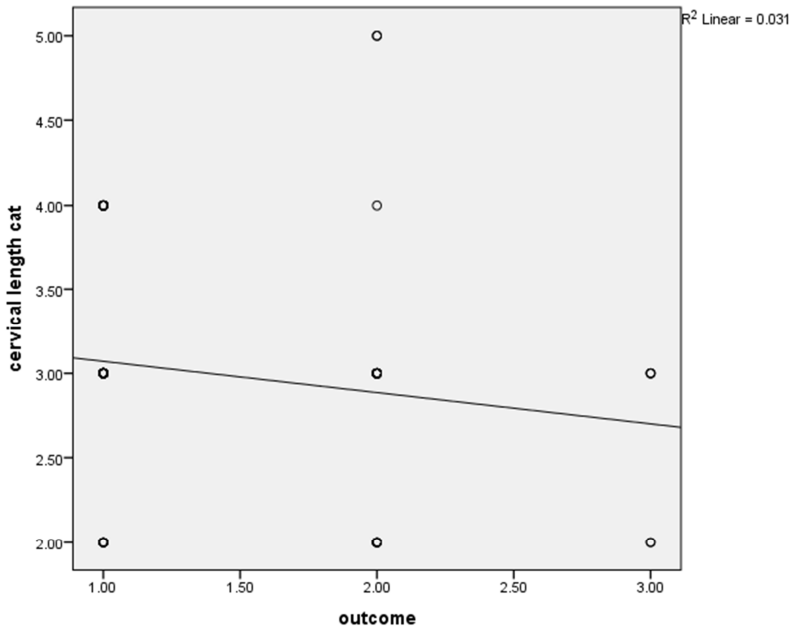
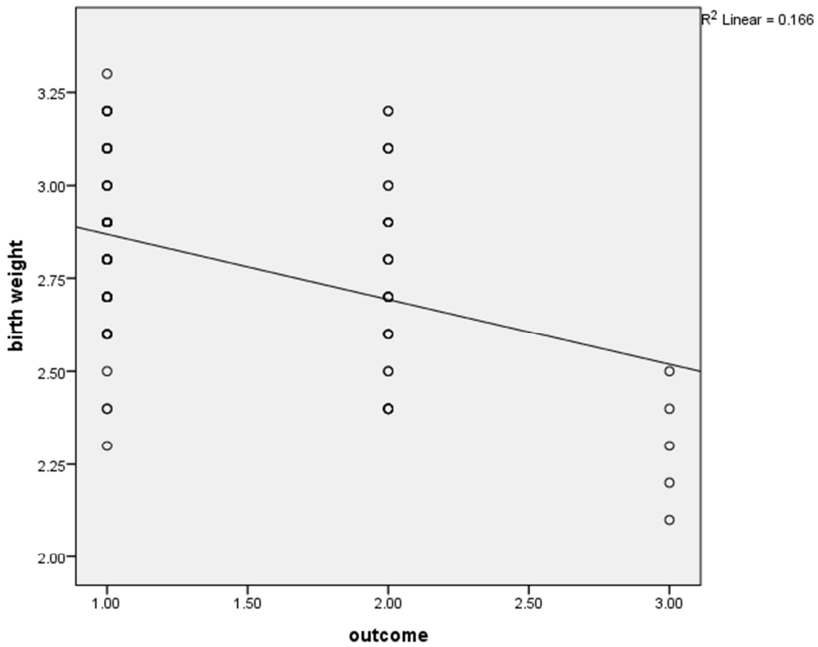
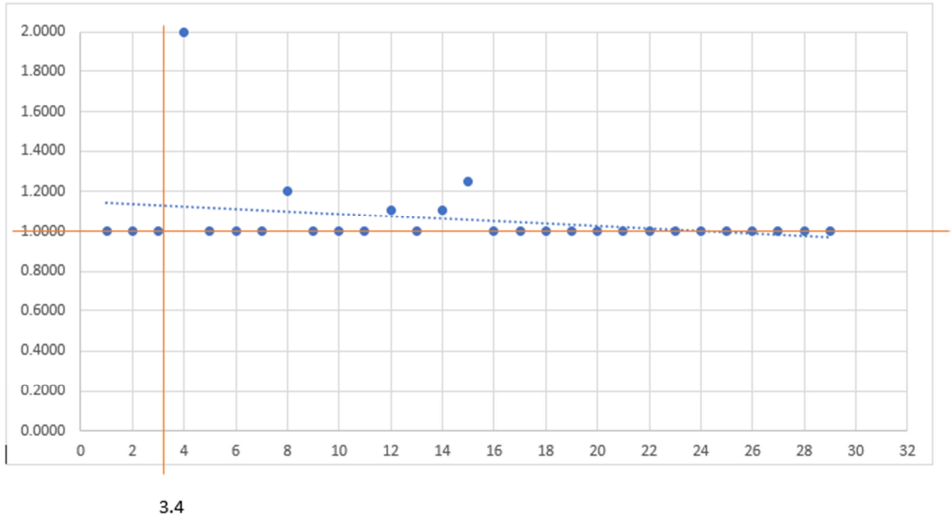


Figure 5: Correlation between birth weight and type of delivery



Graph 4: Logistic regression graph

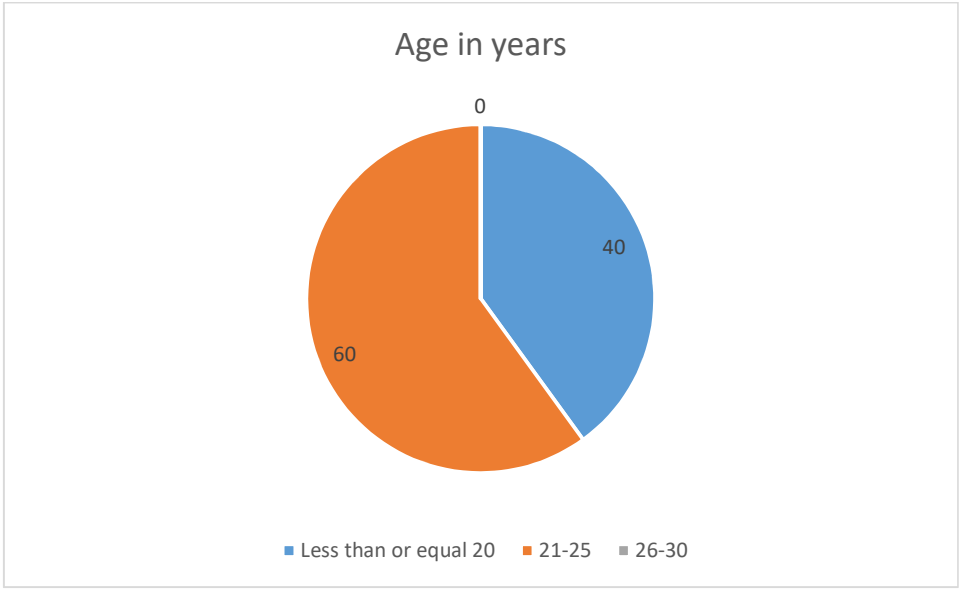


X-axis: Cervical length during 18-22 weeks of gestation

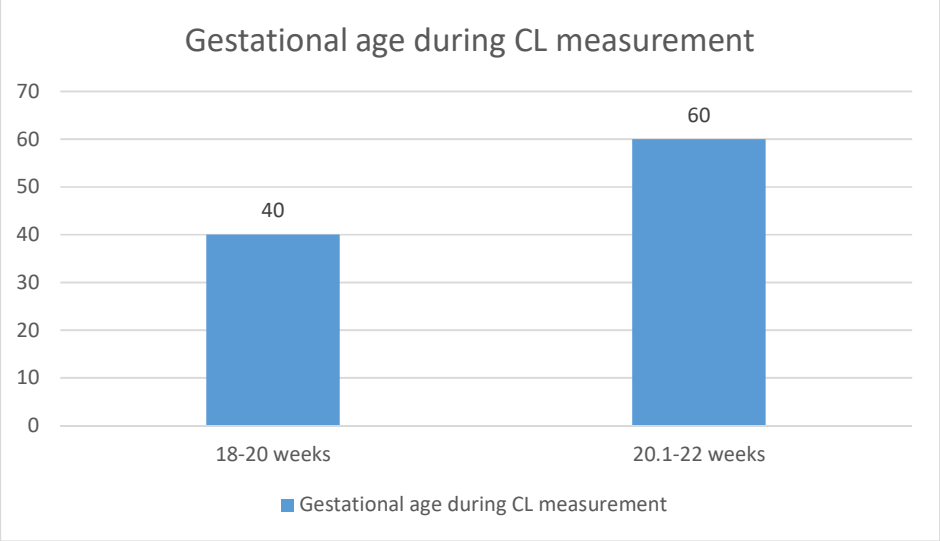
Y-axis: Outcome

Median: 3.4cm

Graph 5: Distribution of subjects with preterm labour based on chronological age



Graph 6: Distribution of subjects with preterm labour based on gestational age at the time of CL measurement



Graph 7: Distribution of subjects with preterm labour based on gestational age at the time of delivery

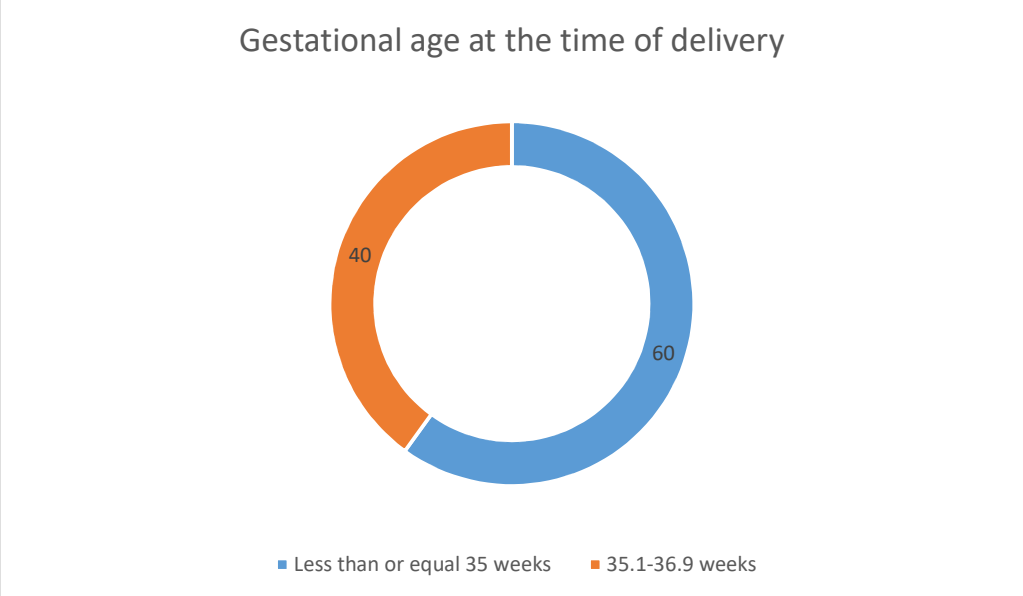


Table 11: Distribution of subjects with preterm labour based on cervical length measurement during 18-22 weeks

Cervical length (cm) during 18-22 weeks n(%)					
<1.5	**1.5-1.9**	**2-2.9**	**3-3.9**	**4-4.9**	**5-5.9**
0 (0)	0 (0)	2 (40)	3 (60)	0 (0)	0 (0)

With regard to cervical length measurement during 18-22 weeks, out of five cases with preterm delivery, two (40%) had cervical length in the range of 2-2.9 cm and the remaining three (60%) had cervical length in the range of 3-3.9 cm.

Graph 8: Distribution of subjects with preterm labour based on cervical length measurement during 18-22 weeks

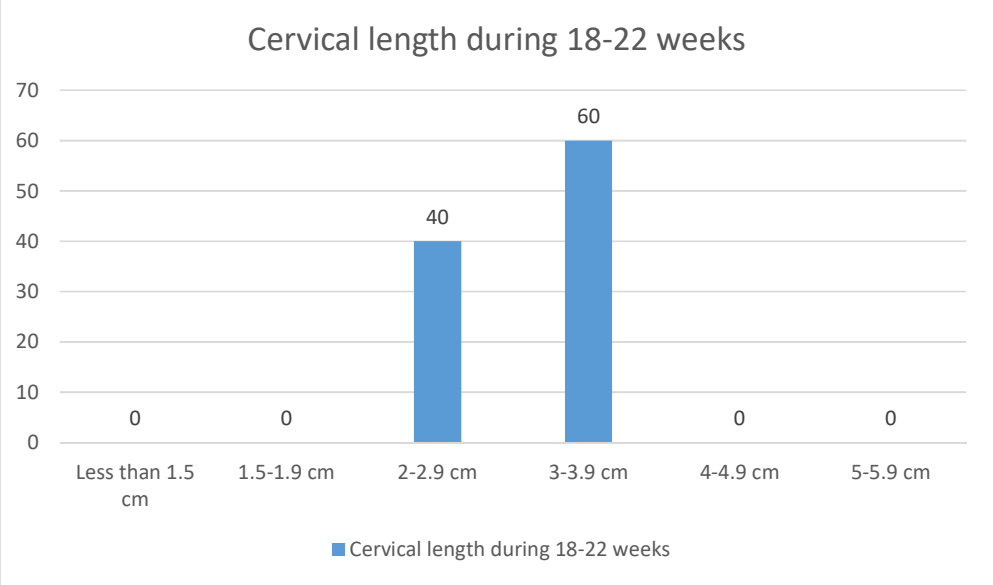
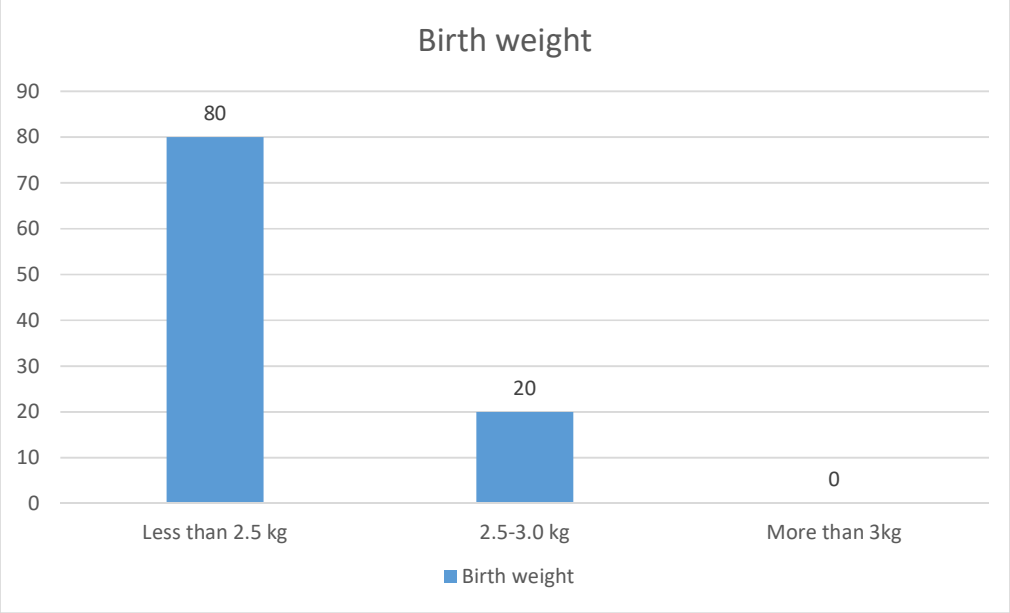


Table 12: Distribution of subjects with preterm labour based on birth weight and NICU admission

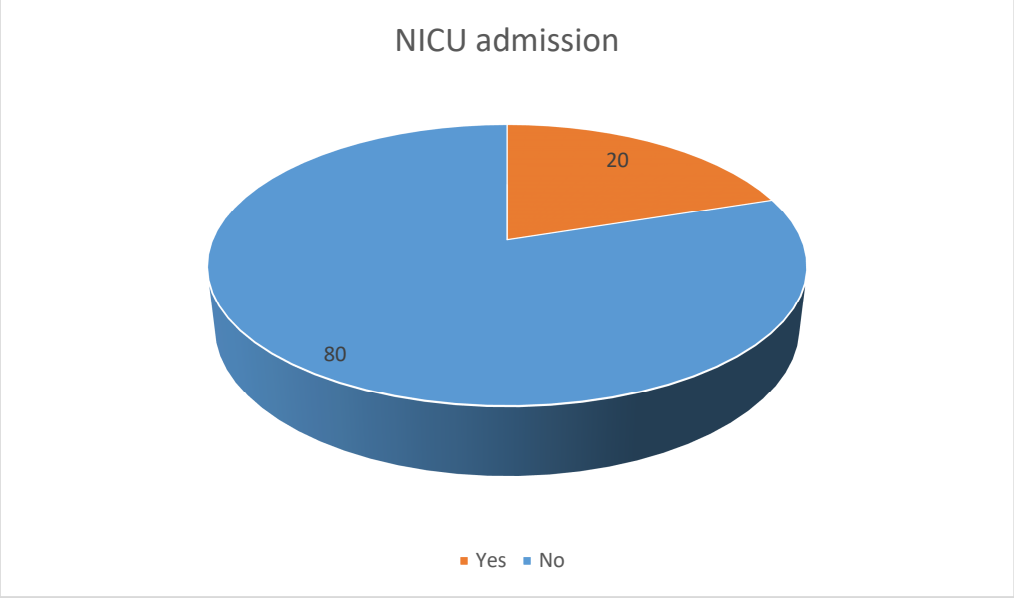
Birth weight			NICU admission	
<2.5kg n(%)	**2.5-3 kg n(%)**	**>3 kg n(%)**	**Yes n(%)**	**No n(%)**
4 (80)	1 (20)	0 (0)	1 (20)	4 (80)

Out of five cases with preterm delivery, four (80%) had baby weighing less than 2.5 kg and the remaining one (20%) had baby within 2.5-3kg group. Out of five preterm babies, only one (20%) was admitted in NICU.

Graph 9: Distribution of subjects with preterm labour based on birth weight



Graph 10: Distribution of subjects with preterm labour based on NICU admission



DISCUSSION

Preterm labour is a serious issue that is linked to a high rate of perinatal mortality and morbidity. It is described as the commencement of labour in women who are less than 37 weeks pregnant. Preterm labour and delivery prevention strategies have centred on educating both physicians and patients about the risks of preterm labour as well as ways for predicting it. Early detection of preterm delivery has been considered as a means of reducing prematurity-related perinatal morbidity in the previous literature. For infants born without congenital abnormalities, preterm delivery is linked to 75% of perinatal morbidity and mortality.[92]

Despite wide efforts to address the issue, the rate of preterm delivery has actually increased in recent years. Early preterm labour is difficult to diagnose and has a high probability of false positives. Thousands of women have been subjected to unneeded and probably unsafe therapy as a result of false positive diagnoses. Improved early detection methods would be a massive step forward in the management of pregnant women who are at risk of premature labour.[93,94] Hence, in our study, we assessed the role of transvaginal cervical length at 18 to 22 weeks of gestation for predicting preterm labour.

Cervical length measurement by transvaginal ultrasound examination has been reported to be a good marker for the detection of patients at increased risk of preterm labor.[92,93,94] The shortest cervical length obtained by transvaginal ultrasound have a better predictive value in assessing the risk for preterm delivery than the average cervical length measurement.[92,93,94] Further, transvaginal sonographic measurement

allows better quality and more accurate visualization of the uterine cervix than the transabdominal approach with fewer limitations. Hence, transvaginal sonographic measurement of cervix has emerged as an alternative method for the assessment of cervical length.[93,95,96,97]) Hence, in our study, we used transvaginal ultrasound technique in the prediction of cervical length measurement in women

Transvaginal ultrasonography-measured cervical length has been found to predict preterm birth in both asymptomatic and symptomatic low-risk women. Although some studies have looked at the use of transvaginal ultrasonography in asymptomatic high-risk women, there are differences in the abnormal cervical length cut-off, the gestational age at which transvaginal ultrasonography was performed, and the gestational age at preterm birth. Previous research has observed the use of transvaginal ultrasonography to predict preterm delivery in asymptomatic women, including those with singleton and multiple gestations, as well as the use of transvaginal ultrasonography to predict preterm delivery in women with multiple gestations and also symptomatic women[95,96]

The majority of clinical guidelines on this area recommended cervical length screening between 16-24 weeks of gestation among asymptomatic women withprevious history of preterm delivery. It is also recommended to not measure before 16 weeks of gestation, because the predictive accuracy of cervical length during first and early second trimester for preterm delivery is low, particularly in asymptomatic women with no previous history. Likewise, cervical length assessment after 24 weeks of gestation is also not recommended

because most of the studies frequently used the same time period of gestation as the maximum bound for screening and initiating interventions to prevent preterm deliveries.[95] It was reported that cervical length, which is an accurate predictor of spontaneous preterm birth, decreases with increase in gestation weeks.[95] Further, the relative risk of preterm delivery increases with decrease in the length of the cervix.[92]

The diagnostic accuracy of short cervical length in predicting preterm birth is primarily determined by the cut off. The reported sensitivity of a cervical length 2.5cm for a preterm delivery in low and high risk pregnant women ranges from 6% to 76%.[96,99] Our study was aimed to assess the predictive value of transvaginal cervical length during 18-22 weeks of gestation in preterm labour.

Among 96 participants, maximum (66) was between the age group of 21-25 years which was around 68.7%. 26 participants belonged to the age group of ≤20 years, accounting to 27.1%. Four participants belonged to 26-30 years' age group, which is around 4.2%.

Among 96 study participants, 16 (16.7%) cases had cervical length of 2-2.9 cms, 66 (68.8%) had 3-3.9 cms, 12 (12.5%) cases had 4-4.9 cms, and the remaining two (2.1%) cases had 5-5.9 cms during 18-22 weeks of gestation. Majority of the subjects had cervical length of 3-3.9cm. The mean cervical length based of term of birth was higher in full term (3.4285±0.67372) than pre term (3.20±0.38730).

With regard to cervical length measurement during 18-22 weeks, out of five cases with preterm delivery, two (40%) had cervical length in the range of 2-2.9 cm and the remaining three (60%) had in the

range of 3-3.9 cm. Similar findings were seen in a study done by Serene thain et al., in which the median cervical length (CL) at 18 to 22 weeks was 3.19 cm. Mukherji et al in 2011 studied around 224 women with singleton pregnancies at a tertiary care hospital in Eastern India and found a mean cervical length of 40.5±1.14 mm at 20 weeks of gestation.

Among 96 (100%) study participants, 64 (66.7%) had full term normal delivery, 27 (28.1%) had full term LSCS and only 5 (5.2%) subjects had preterm delivery. Out of five cases with preterm delivery, two (40%) belongs to ≤20 years age group and the remaining three (60%) belongs to 21-25 years. With regard to gestational age during cervical length measurement, two (40%) subjects belongs to 18-20 weeks' group and the remaining three (60%) belongs to 20.1-22 weeks. A study conducted by Serene Thain et al., among 926 pregnant Asian population reported similar findings in which 6.4% of the subjects delivered preterm.[99]

Out of 16 (100%) cases with cervical length of 2-2.9 cm, 2 (12.5%) cases had preterm delivery and out of 66 (100%) cases with cervical length 3-3.9 cm, three (4.5%) subjects had preterm delivery. None of the cases with cervical length greater than 4 cm had preterm delivery. With regard to gestational age at the time of delivery, three (60%) belongs to ≤35 weeks group and the remaining two (40%) belongs to 35.1-36.9 weeks. These differences were found to have statistical significance (p=0.042). None of the subjects had cervical length less than 1.5 cm and 1.5-1.9cm. In this study, it was observed

that type of delivery has significant negative negligible correlation with birth weight and cervical length at 18-22 weeks of gestation. So, it is understood that as the cervical length reduces the chances of preterm delivery increases. Similar results were obtained in the study conducted by Iams et al., Berghella et al., in 1997 and 2007, Heath et al., and Ozdemir et al., the studies reported that the risk of preterm bith was inversely related to CL.[93,100,101,102,103]

Hence, screening of cervical length during second trimester can serve as an useful and cost-effective technique to identify the risk of preterm delivery [(106,107).] In a systematic review conducted in 2258 women, showed that the shorter the cervical length, higher the risk of preterm delivery and stated cervical length of <25 mm has good prognostic value in predicting pre-term delivery[103]. Similar prospective observational study conducted by Moroz et al among asymptomatic cohort of singleton pregnancies reported that women whose mid-trimester cervical length <25mm also had a decrease in cervical length when measured at third trimester and significantly associated with higher probability of spontaneous preterm birth (OR 1.03 [1.02-1.04])[108]. Also, for every 1 mm of cervical shortening between ultrasounds there showed a 3% increase in odds of spontaneous preterm birth.[108]

In the current study the sensitivity and specificity of cervical length≤ 2.5 cm measured at 18 to 22 week was 0% and 96.7% respectively. Study done by Davis et al., showed a sensitivity and specificity of 57% and 82% respectively for preterm birth, using a 3 cm cut-off at 24 to 28 weeks.[103] In our study, at a cut-off value of 2.45cms the sensitivity and specificity were 96.3% and 97.1% respectively. The study conducted by Esplin et al., reported sensitivity of a CL ≤ 2.5 cm

among high and low risk pregnant women varies from 6% to 76%.[104] A multi-centred prospective study conducted by Iams et al. among 2915 women with a singleton pregnancy who underwent vaginal ultrasonography showed that at 24 weeks' gestation, only 10% of women had CL < 26 mm; a CL < 26 mm at 24 weeks had a better predictive value compared to CL < 26 mm at 28 weeks (RR 6.1 vs. 5.3) for predicting PTB < 35 weeks.[93] In a study done by Leung et al., in 2005 it was reported that the specificity was 99.9% for PTBs at <34 weeks of gestation for a CL cut-off of 20 mm and, this value decreased to 90.1% and 65.5% for a CL threshold of 30 mm and 35 mm, respectively.[94] Currently, most major guidelines suggest using a mid-trimester CL threshold of 25 mm for risk assessment. The cut-off value in our study coincides with this value.

ROC curve analysis showed area under the curve of 0.422 for the prediction of preterm birth. At a cut-off value of Cervical length 2.45cms the sensitivity and specificity were 96.3% and 97.1% respectively. Similar study conducted by Serene thian et al., reported 0.61 as area under the curve for the prediction of preterm birth < 37 weeks' gestation at 18 to 22 weeks. The study also reported an optimal cut-off value of 2.48cm.

The positive predictive value is poor in the study. Only 12.5% of the subjects with CL less than equal to 3 cm delivered preterm. The results were similar to study conducted by Iams et al., In their study, the positive predictive value (PPV) of a short CL, assessed in a normal antenatal population was 18% with CL < 2.5 cm (at 22–25 weeks)

delivered prior to 35 weeks' gestation. In the study conducted by Davis et al., the positive predictive value for preterm birth (<35 weeks) was 4.5%. in the study conducted by Serene thain et al., the positive predictive values when using cervical length as a predictor of preterm birth were relatively low at 12.0% and 11.1% at 18 to 22 weeks and 28 to 32 weeks respectively.[99] The reason for low positive predictive values across all studies was that, the incidence of preterm birth was low in all the studies.

There was good negative predictive value (NPV) of 96.25 which was similar to the study done by Serene thain et al., which showed a NPV of 96.5% at 18 to 22 weeks.[99] This suggests that while cervical length cannot be used to diagnose or confirm at-risk patients, it has a good negative predictive value and relatively good specificity to identify the lower risk patients for preterm birth. By performing cervical length screening at 18 to 22 weeks' gestation to identify patients at lower risk of preterm birth, we may then be able to identify a separate group requiring closer follow-up or intervention for the rest of the pregnancy. The risk of preterm birth increases 3.6 times when the cervical length is ≤2.5 cm during 18-22 weeks of gestation.

In our study, measurement of cervical length did not associate with the gestation week at delivery.

It has been reported that the risk of pre-term delivery is inversely related to cervical length measured at the second trimester. Hence, screening of cervical length during second trimester can serve as an useful and cost-effective technique to identify the risk of preterm delivery[103,104]. In a systematic review conducted in 2258 women,

showed that the shorter the cervical length, higher the risk of preterm delivery and stated cervical length of <25 mm has good prognostic value in predicting pre-term delivery[103,105]. Similar prospective observational study conducted by Moroz et al among asymptomatic cohort of singleton pregnancies reported that women whose mid-trimester cervical length <25mm also had a decrease in cervical length when measured at third trimester and significantly associated with higher probability of spontaneous preterm birth (OR 1.03 [1.02-1.04]).[102] Also, for every 1 mm of cervical shortening between ultrasounds there showed a 3% increase in odds of spontaneous preterm birth.[102] Gudicha et al also reported that cervical length of <25 mm at 20 to 23 weeks of gestation has been used as a threshold to predict preterm births.[106] This cut-off value has been also emphasized in other studies[103,107]. Further all the aforementioned studies evaluated the cervical length measurements in the second trimester and the data consisting of third trimester of cervical length measurements is limited. Hence, in our study, we have chosen <2.5 cm as an threshold value to identify the risk of preterm labor.

STRENGTHS AND LIMITATIONS

Our study has few strengths. The patients included in the study were identified prospectively, thus eliminated the misclassification bias. All the cervical length images of the cases were reviewed for accuracy and adequacy by a well trained principal investigator.

Alike other studies, the present study has few potential limitations that need to be acknowledged. Parous women are excluded in our study, as dynamics of labor and features of cervix uteri may differ from nulliparous women. Hence, future studies including parous women are required to warrant the current findings. As this was a prospective study we cannot recommend on how to treat women with abnormal cervical lengths rather the study might be helpful to select patients for prospective interventional trials to compare the effectiveness of intervention before or after 24 weeks of gestation.

CLINICAL IMPLICATIONS

Our findings have few clinical implications for the management of pregnant women at 18-22 weeks of gestation. The study emphasize that serial measurements throughout gestation should be considered prospectively in other singleton cohorts in order to better capture the rate of cervical length shortening as a predictor of spontaneous preterm labor. Furthermore, Moreover, preterm-delivered neonates have a higher risk for respiratory morbidities, temperature instability, hyperbilirubinemia, hypoglycemia, and feeding difficulties when compared to their term counterparts. Therefore, prediction of cervical length during the gestation weeks predicts the pre term labor and hints the closer monitoring of the preterm neonates at neonatal intensive care unit than those of full term by trained nursing staff for at least in the first 48 h.

CONCLUSION

Prevention of preterm birth still remains as a major challenge in the twenty-first century. Given the magnitude of preterm labour, the cost of treating preterm babies, and the morbidity and mortality associated with it, cervical measurement as a routine screening method at 18 to 22 weeks of gestation is cost effective and should be provided to all pregnant women.

Whatever is the cause of preterm labour, cervix dilation is a common endpoint. Transvaginal cervix scanning is now a good predictor of early preterm delivery among both high and low-risk women. The benefits of transvaginal ultrasonography for cervical measurement include ease of performance, low cost, and availability. Though the incidence of preterm birth cannot be reduced by using predictors, it does help us identify people who are at risk and choose better treatment strategies. It also aids us in avoiding overdiagnosis of preterm labour and overtreatment.

Transvaginal sonography (TVS) is a useful technique in assessing the cervical changes during pregnancy and predicting the preterm birth. Transvaginal sonography when performed between 18- 22 weeks of gestational age could identify all the women having short cervical length

SUMMARY

It was prospective cohort study was conducted for 1 year from January 2020 to June 2021 in KLEs Dr.Prabhakar Kore charitable hospital, Belagavi. The study aimed to determine the role of transvaginal cervical length at 18 to 22 weeks of gestation in prediction of preterm labour among the singleton pregnant women (N =96)

Majority of the study participants that is around 68.7% were within the age group of 21-25 years. It was observed in this study majority of the patients had cervical length in the range of 3-3.9 centimetres. Also, none of them had cervical length in the range of 0-1.9 centimetres. The mean cervical length was found to be higher among subjects who had full term delivery (3.4285±0.67372) than those who delivered preterm (3.20±0.38730). However, statistical comparison was not achieved as the number of women who had preterm labour (5) was very less compared to those who had full term (91).

Cervical length of around 40% of the subjects who underwent preterm labour was in the range of 2-2.9 cm during 18-22 weeks of gestation. It was also observed that none of the participants with cervical length greater than 4cm had preterm delivery. Although negligible, a significant correlation (r=0.200) was observed between type of delivery and cervical length during 18-22 weeks. So, it is understood that as the cervical length reduces the chances of preterm delivery increases. A significant correlation (r=0.249) was also seen between type of birth and birth weight. The chance of having new born with low birth weight increases with preterm delivery.

Sensitivity and specificity of cervical length at a cut-off value of 2.45cms in predicting preterm labour were 96.3% and 97.1% respectively. Area under the curve was 0.422 for the prediction of preterm birth. The positive predictive value of cervical length less than 2.5cm was found to be 0% in this study. But there was a good negative predictive value of 94.62%. When the risk was estimated, it was observed that the risk of preterm labour is 3.6 times higher when the cervical length during 18-22 weeks was less than 2.5 cm.

BIBLIOGRAPHY

1. Romero R, Espinoza J, Kusanovic JP, Gotsch F, Hassan S, Erez O, Chaiworapongsa T, Mazor M. The preterm parturition syndrome. BJOG: An International Journal of Obstetrics & Gynaecology. 2006 Dec;113:17-42.
2. Conde-Agudelo A, Romero R. Predictive accuracy of changes in transvaginal sonographic cervical length over time for preterm birth: a systematic review and metaanalysis. Am J Obstet Gynecol. 2015 Dec;213(6):789-801.
3. Chaudhary S, Sharma S, Garg S. A Comparative Study of Transvaginal Cervical Length at 11–14 Weeks and at 18–22 Weeks of Gestation for the Outcome of Pregnancy. Journal of Mahatma Gandhi University of Medical Sciences & Technology. 2020 Sep;5(3):84.
4. O'Hara, S., Zelesco, M., & Sun, Z. (2013). Cervical length for predicting preterm birth and a comparison of ultrasonic measurement techniques. Australasian journal of ultrasound in medicine, 16(3), 124–134.
5. Rumack CM, Wilson SR, Charboneau W, Levine D. Diagnostic Ultrasound. 4th ed. Philadelphia: Elsevier Mosby; 2011.
6. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, Adler A, Garcia CV, Rohde S, Say L, Lawn JE. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected

countries: a systematic analysis and implications. The lancet. 2012 Jun 9;379(9832):2162-72.

7. Berghella V, Saccone G. Cervical assessment by ultrasound for preventing preterm delivery. Cochrane Database Syst Rev 2019;9(9):CD007235.
8. Behrman RE, Butler AS, eds. Preterm Birth: Causes, Consequences, and Prevention. Washington, DC: National Academies Press; 2007
9. Lim K, Butt K, Crane JM. SOGC Clinical Practice Guideline. Ultrasonographic cervical length assessment in predicting preterm birth in singleton pregnancies. J ObstetGynaecol Can 2011; 33 (5): 486–99.
10. Carvalho MH, Bittar RE, Brizot ML, Maganha PP, Borges da Fonseca ES, Zugaib M. Cervical length at 11–14 weeks' and 22–24 weeks' gestation evaluated by transvaginal sonography, and gestational age at delivery. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology. 2003 Feb;21(2):135-9.
11. Andersen HF, Nugent CE, Wanty SD, Hayashi RH. Prediction of risk for preterm delivery by ultrasonographic measurement of cervical length. Am J ObstetGynecol 1990;163:859–67.
12. Iams JD, Goldenberg RL, Meis PJ, Mercer BM, Moawad A, Das A, et al. The length of the cervix and the risk of spontaneous premature delivery. N Engl J Med 1996;334:567–72.

13. Taipale P, Hilesmaa V. Sonographic measurement of uterine cervix at 18–22 weeks' gestation and the risk of preterm delivery. ObstetGynecol 1998;92:902–7.
14. Elena G, Lange A, Ushakov F, Calvo JR, Nicolaides KH. Prediction of spontaneous preterm delivery by endocervical length at 11 to 13 weeks. Prenat Diagn. 2011;31:84-89.
15. Conoscenti G, Meir YJ, D'Ottavio G, Rustico MA, Pinzano R, Fischer Tamaro L, et al. Does cervical length at 13-15 weeks' gestation predict preterm delivery in an unselected population? Ultrasound Obstet Gynecol. 2003;21:128-134.
16. To MS, Skentou CA, Royston P, Yu CK, Nicolaides KH. Prediction of patient-specific risk of early preterm delivery using maternal history and sonographic measurement of cervical length: a population-based prospective study. Ultrasound Obstet Gynecol. 2006;27:362-367.
17. Kagan KO, To M, Tsoi E, Nicolaides KH. Preterm birth: the value of sonographic cervical length measurement. BJOG. 2006;113:52-56.
18. WHO: recommended definitions, terminology and format for statistical tables related to the perinatal period and use of a new certificate for cause of perinatal deaths. Modifications recommended by FIGO as amended October 14, 1976. Acta ObstetGynecol Scand. 1977;56(3):247–53.
19. Papageorghiou AT, Ohuma EO, Altman DG, Todros T, Cheikh Ismail L, Lambert A, et al.International standards for fetal growth based on serial ultrasound measurements: the Fetal Growth Longitudinal Study of the

INTERGROWTH-21st Project. Lancet (London, England). 2014 Sep;384(9946):869–79.

20. Martin JA, Hamilton BE, Osterman MJK, Driscoll AK. Births: Final Data for 2018. Natl vital Stat reports from Centers Dis Control Prev Natl Cent Heal Stat Natl Vital Stat Syst. 2019 Nov;68(13):1–47.

21. Vogel JP, Chawanpaiboon S, Moller A-B, Watananirun K, Bonet M, Lumbiganon P. The global epidemiology of preterm birth. Best Pract Res Clin ObstetGynaecol. 2018;52:3–12.

22. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller A-B, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. Lancet. 2012 Jun 9;379(9832):2162–72.

23. Bhatnagar S, Majumder PP, Salunke DM. A Pregnancy Cohort to Study Multidimensional Correlates of Preterm Birth in India: Study Design, Implementation, and Baseline Characteristics of the Participants. Am J Epidemiol. 2019;188(4):621–31.

24. Russell RB, Green NS, Steiner CA, Meikle S, Howse JL, Poschman K, et al. Cost of Hospitalization for Preterm and Low Birth Weight Infants in the United States. Pediatrics. 2007;120(1):e1--e9.

25. Ferrero DM, Larson J, Jacobsson B, Di Renzo GC, Norman JE, Martin JNJ, et al. Cross-Country Individual Participant Analysis of 4.1 Million Singleton Births in 5 Countries with Very High Human Development Index Confirms Known Associations but Provides No Biologic Explanation for 2/3 of All Preterm Births. PLoS One. 2016;11(9):e0162506.

26. National Collaborating Centre for Women's and Children's Health

(UK). Multiple Pregnancy: The Management of Twin and Triplet Pregnancies in the Antenatal Period. London: RCOG Press; 2011 Sep. (NICE Clinical Guidelines, No. 129.)

27. Holzman, C., Leventhal, J. M., Qiu, H., Jones, N. M., Wang, J., & BV Study Group (2001). Factors linked to bacterial vaginosis in nonpregnant women. *American journal of public health*, *91*(10), 1664–1670

28. Kvalvik, L. G., Wilcox, A. J., Skjærven, R., Østbye, T., & Harmon, Q. E. (2020). Term complications and subsequent risk of preterm birth: registry based study. *BMJ (Clinical research ed.)*, *369*, m1007

29. Schaaf JM, Liem SMS, Mol BWJ, Abu-Hanna A, Ravelli ACJ. Ethnic and racial disparities in the risk of preterm birth: a systematic review and meta-analysis. Am J Perinatol. 2013 Jun;30(6):433–50.

30. Smith GC, Pell JP. Teenage pregnancy and risk of adverse perinatal outcomes associated with first and second births: population based retrospective cohort study. BMJ. 2001 Sep;323(7311):476.

31. Waldenström U, Aasheim V, Nilsen ABV, Rasmussen S, Pettersson HJ, Shytt E. Adverse pregnancy outcomes related to advanced maternal age compared with smoking and being overweight. Obstet Gynecol. 2014 Jan;123(1):104–12.

32. Ruiz M, Goldblatt P, Morrison J, Kukla L, Švancara J, Riitta-Järvelin M, et al. Mother's education and the risk of preterm and small for gestational age birth: a DRIVERS meta-analysis of 12 European cohorts. J Epidemiol Community Health. 2015 Sep;69(9):826–33.

33. Kozuki N, Lee ACC, Silveira MF, Sania A, Vogel JP, Adair L, et al. The

associations of parity and maternal age with small-for-gestational-age, preterm, and neonatal and infant mortality: a meta-analysis. BMC Public Health. 2013;13 Suppl 3(Suppl 3):S2.

34. Wendt A, Gibbs CM, Peters S, Hogue CJ. Impact of Increasing Inter-pregnancy Interval on Maternal and Infant Health. Paediatr Perinat Epidemiol. 2012;26(s1):239–58.

35. Conde-Agudelo A, Rosas-Bermudez A, Castaño F, Norton MH. Effects of birth spacing on maternal, perinatal, infant, and child health: a systematic review of causal mechanisms. Stud Fam Plann. 2012 Jun;43(2):93–114.

36. Barros-Silva J, Pedrosa AC, Matias A. Sonographic measurement of cervical length as a predictor of preterm delivery: a systematic review. J Perinat Med. 2014 May;42(3):281–93.

37. Qin J-B, Sheng X-Q, Wu D, Gao S-Y, You Y-P, Yang T-B, et al. Worldwide prevalence of adverse pregnancy outcomes among singleton pregnancies after in vitro fertilization/intracytoplasmic sperm injection: a systematic review and meta-analysis. Arch Gynecol Obstet. 2017 Feb;295(2):285–301.

38. Marleen S, Dias C, Nandasena R, MacGregor R, Allotey J, Aquilina J, et al. Association between chorionicity and preterm birth in twin pregnancies: a systematic review involving 29 864 twin pregnancies. BJOG. 2021 Apr;128(5):788–96.

39. Liu B, Xu G, Sun Y, Qiu X, Ryckman KK, Yu Y, et al. Maternal cigarette smoking before and during pregnancy and the risk of preterm birth: A dose-response analysis of 25 million mother-infant pairs. PLoS Med. 2020 Aug;17(8):e1003158.

40. Homsup P, Phaloprakarn C, Tangjitgamol S, Manusirivithaya S. Maternal

characteristics and pregnancy outcomes among illicit drug-using women in an urban setting. Taiwan J Obstet Gynecol. 2018 Feb;57(1):83–8.

41. Weile LKK, Hegaard HK, Wu C, Tabor A, Wolf HT, Kesmodel US, et al. Alcohol Intake in Early Pregnancy and Spontaneous Preterm Birth: A Cohort Study. Alcohol Clin Exp Res. 2020 Feb;44(2):511–21.

42. Berger H, Melamed N, Davis BM, Hasan H, Mawjee K, Barrett J, et al. Impact of diabetes, obesity and hypertension on preterm birth: Population-based study. PLoS One. 2020;15(3):e0228743.

43. Korevaar TIM, Derakhshan A, Taylor PN, Meima M, Chen L, Bliddal S, et al. Association of Thyroid Function Test Abnormalities and Thyroid Autoimmunity With Preterm Birth: A Systematic Review and Meta-analysis. JAMA. 2019 Aug;322(7):632–41.

44. Wang S-W, Ma L-L, Huang S, Liang L, Zhang J-R. Role of Cervical Cerclage and Vaginal Progesterone in the Treatment of Cervical Incompetence with/without Preterm Birth History. Chin Med J (Engl). 2016 Nov;129(22):2670–5.

45. Márquez-Corona MDL, Tellez-Girón-Valdez A, Pontigo-Loyola AP, Islas-Zarazúa R, Robles-Bermeo NL, Gonzalez-López BS, et al. Preterm birth associated with periodontal and dental indicators: a pilot case-control study in a developing country. J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2021 Mar;34(5):690–5.

46. Rahman MM, Abe SK, Rahman MS, Kanda M, Narita S, Bilano V, et al. Maternal anemia and risk of adverse birth and health outcomes in low- and middle-income countries: systematic review and meta-analysis. Am J Clin Nutr. 2016 Feb;103(2):495–504.

47. Khanam R, Lee AC, Mitra DK, Ram M, Das Gupta S, Quaiyum A, et al. Maternal short stature and under-weight status are independent risk factors for preterm birth and small for gestational age in rural Bangladesh. Eur J Clin Nutr. 2019 May;73(5):733–42.

48. Oluwole AA, Okunade KS, Okojie OE. Maternal serum vitamin D levels and preterm delivery among low-risk parturientsin Lagos, Nigeria. Int J GynaecolObstet Off organ Int Fed Gynaecol Obstet. 2019 Feb;144(2):216–20.

49. Mboya IB, Mahande MJ, Obure J, Mwambi HG. Predictors of singleton preterm birth using multinomial regression models accounting for missing data: A birth registry-based cohort study in northern Tanzania. PLoS One. 2021;16(4):e0249411.

50. Girault A, Le Ray C, Chapron C, Goffinet F, Marcellin L. Leiomyomatousuterus and preterm birth: an exposed/unexposed monocentric cohort study. Am J Obstet Gynecol. 2018 Oct;219(4):410.e1-410.e7.

51. Matthiesen NB, Østergaard JR, Hjortdal VE, Henriksen TB. Congenital Heart Defects and the Risk of Spontaneous Preterm Birth. J Pediatr. 2021 Feb;229:168-174.e5.

52. Williams C, Fong R, Murray SM, Stock SJ. Caesarean birth and risk of subsequent preterm birth: a retrospective cohort study. BJOG. 2021 May;128(6):1020–8.

53. Padula AM, Yang W, Lurmann FW, Balmes J, Hammond SK, Shaw GM. Prenatal exposure to air pollution, maternal diabetes and preterm birth. Environ Res. 2019 Mar;170:160–7.

54. Tellapragada C, Eshwara VK, Bhat P, Acharya S, Kamath A, Bhat S, et al. Risk Factors for Preterm Birth and Low Birth Weight Among Pregnant Indian

Women: A Hospital-based Prospective Study. J Prev Med Public Health. 2016 May;49(3):165–75.

55. Padhi BK, Baker KK, Dutta A, Cumming O, Freeman MC, Satpathy R, et al. Risk of Adverse Pregnancy Outcomes among Women Practicing Poor Sanitation in Rural India: A Population-Based Prospective Cohort Study. PLoS Med. 2015 Jul;12(7):e1001851.

56. Fruscalzo A, Mazza E, Feltovich H, Schmitz R. Cervical elastography during pregnancy: a critical review of current approaches with a focus on controversies and limitations. J Med Ultrason (2001). 2016 Oct;43(4):493–504.

57. Lucaroni F, Morciano L, Rizzo G, D'Antonio F, Buonuomo E, Palombi L, et al. Biomarkers for predicting spontaneous preterm birth: an umbrella systematic review. J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2018 Mar;31(6):726–34.

58. Gunko VO, Pogorelova TN, Linde VA. Proteomic Profiling of the Blood Serum for Prediction of Premature Delivery. Bull Exp Biol Med. 2016 Oct;161(6):829–32.

59. Costantine MM, Ugwu L, Grobman WA, Mercer BM, Tita ATN, Rouse DJ, et al. Cervical length distribution and other sonographic ancillary findings of singleton nulliparous patients at midgestation. Am J Obstet Gynecol. 2021 Feb;

60. Weichert A, von Schöning D, Fischer T, Thomas A. Cervical Sonoelastography and Cervical Length Measurement but not Cervicovaginal Interleukin-6 Are Predictors for Preterm Birth. Ultrasound Int open. 2016 Sep;2(3):E83-9.

61. Wennerholm UB, Holm B, Mattsby-Baltzer I, Nielsen T, Platz-Christensen J, Sundell G, et al. Fetal fibronectin, endotoxin, bacterial vaginosis and cervical

length as predictors of preterm birth and neonatal morbidity in twin pregnancies. Br J ObstetGynaecol. 1997 Dec;104(12):1398–404.

62. Pantelis A, Sotiriadis A, Chatzistamatiou K, Pratilas G, Dinas K. Serum relaxin and cervical length for prediction of spontaneous preterm birth in second-trimester symptomatic women. Ultrasound ObstetGynecol Off J Int Soc Ultrasound Obstet Gynecol. 2018 Dec;52(6):763–8.

63. Agarwal S, Agarwal A, Joon P, Saraswat S, Chandak S. Fetal adrenal gland biometry and cervical elastography as predictors of preterm birth: A comparative study. Ultrasound. 2018 Feb;26(1):54–62.

64. Barinov S V, Di Renzo GC, Belinina AA, Koliado O V, Remneva O V. Clinical and biochemical markers of spontaneous preterm birth in singleton and multiple pregnancies. J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2021 Feb;1–6.

65. Ibrahim MI, Ellaithy MI, Hussein AM, Nematallah MM, Allam HA, Abdelhamid AS, et al. Measurement of maternal serum amyloid A as a novel marker of preterm birth. J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2021 Aug;34(15):2467–72.

66. Kurkinen-Räty M, Ruokonen A, Vuopala S, Koskela M, Rutanen EM, Kärkkäinen T, et al. Combination of cervical interleukin-6 and -8, phosphorylated insulin-like growth factor-binding protein-1 and transvaginal cervical ultrasonography in assessment of the risk of preterm birth. BJOG. 2001 Aug;108(8):875–81.

67. Son M, Miller ES. Predicting preterm birth: Cervical length and fetal fibronectin. Semin Perinatol. 2017 Dec;41(8):445–51.

68. Iams JD, Goldenberg RL, Meis PJ, Mercer BM, Moawad A, Das A, et al. The

Length of the Cervix and the Risk of Spontaneous Premature Delivery. N Engl J Med. 1996;334(9):567–73.

69. Salomon LJ, Diaz-Garcia C, Bernard JP, Ville Y. Reference range for cervical length throughout pregnancy: non-parametric LMS-based model applied to a large sample. Ultrasound Obstet \& Gynecol. 2009;33(4):459–64.

70. Gudicha DW, Romero R, Kabiri D, Hernandez-Andrade E, Pacora P, Erez O, et al. Personalized assessment of cervical length improves prediction of spontaneous preterm birth: a standard and a percentile calculator. Am J Obstet Gynecol. 2021 Mar;224(3):288.e1-288.e17.

71. Drassinower D, Vink J, Zork N, Pessel C, Vani K, Brubaker SG, et al. Does the rate of cervical shortening after cerclage predict preterm birth? J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2016;29(14):2233–9.

72. Alfirevic Z, Owen J, Carreras Moratonas E, Sharp AN, Szychowski JM, Goya M. Vaginal progesterone, cerclage or cervical pessary for preventing preterm birth in asymptomatic singleton pregnant women with a history of preterm birth and a sonographic short cervix. Ultrasound ObstetGynecol Off J Int Soc Ultrasound Obstet Gynecol. 2013 Feb;41(2):146–51.

73. Romero JA, Downes K, Pappas H, Elovitz MA, Levine LD. Cervical length change as a predictor of preterm birth in symptomatic patients. Am J ObstetGynecol MFM. 2021 Jan;3(1):100175.

74. Serrano-Gómez SG, García-Morales MP. [Cervical length in predicting preterm labor]. GinecolObstet Mex. 2011 Jan;79(1):24–30.

75. Kokanali MK, Çelik H, Kokanali D, Taşçi Y. Predictive role of transvaginal ultrasonographic measurement of cervical length at 34 weeks for late pre-term

and late-term deliveries in nulliparous women. J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2016;29(11):1789–94.

76. El-Gharib MN, Albehoty SB. Transvaginal cervical length measurement at 22- to 26-week pregnancy in prediction of preterm births in twin pregnancies. J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2017 Mar;30(6):729–32.

77. Hester AE, Ankumah N-AE, Chauhan SP, Blackwell SC, Sibai BM. Twin transvaginal cervical length at 16-20 weeks and prediction of preterm birth(). J Matern neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet. 2019 Feb;32(4):550–4.

78. Hofmeister C, Brizot M de L, Liao A, Francisco RP V, Zugaib M. Two-stage transvaginal cervical length screening for preterm birth in twin pregnancies. J Perinat Med. 2010 Sep;38(5):479–84.

79. Celik E, To M, Gajewska K, Smith GCS, Nicolaides KH. Cervical length and obstetric history predict spontaneous preterm birth: development and validation of a model to provide individualized risk assessment. Ultrasound ObstetGynecol Off J Int Soc Ultrasound Obstet Gynecol. 2008 May;31(5):549–54.

80. Chang HH, Larson J, Blencowe H, Spong CY, Howson CP, Cairns-Smith S, et al. Preventing preterm births: analysis of trends and potential reductions with interventions in 39 countries with very high human development index. Lancet (London, England). 2013 Jan;381(9862):223–34.

81. Nicolaides KH, Syngelaki A, Poon LC, Picciarelli G, Tul N, Zamprakou A, et al. A Randomized Trial of a Cervical Pessary to Prevent Preterm Singleton Birth. N Engl J Med. 2016;374(11):1044–52.

82. Orefice R, Smythe J, Doherty DA, Lim B. Preventing early births in a regional tertiary maternity unit: Evaluating preterm and early term birth rates before and after implementation of the Preterm Birth Prevention Initiative in the Australian Capital Territory. Aust N Z J ObstetGynaecol. 2021 Mar;

83. Ji X, Cox S, Grosse SD, Barfield WD, Armour BS, Courtney-Long EA, et al. Association of smoke-free laws with preterm or low birth weight deliveries-A multistate analysis. Health Serv Res. 2021 Feb;56(1):61–72.

84. Wang C, Wei Y, Zhang X, Zhang Y, Xu Q, Sun Y, et al. A randomized clinical trial of exercise during pregnancy to prevent gestational diabetes mellitus and improve pregnancy outcome in overweight and obese pregnant women. Am J Obstet Gynecol. 2017 Apr;216(4):340–51.

85. Rehal A, Benkő Z, De Paco Matallana C, Syngelaki A, Janga D, Cicero S, et al. Early vaginal progesterone versus placebo in twin pregnancies for the prevention of spontaneous preterm birth: a randomized, double-blind trial. Am J Obstet Gynecol. 2021 Jan;224(1):86.e1-86.e19.

86. Liu D, Li S, Lei F, Zhao Y, Cheng Y, Dang S, et al. Associations between maternal calcium intake from diet and supplements during pregnancy and the risk of preterm birth in a Chinese population. Eur J Clin Nutr. 2021 Jan;75(1):141–50.

87. Dom AM, Mather A, Seligman NS. Prevention of preterm birth in multiples. CurrOpinObstet Gynecol. 2021 Apr;33(2):72–7.

88. Zhang Y, Xun P, Chen C, Lu L, Shechter M, Rosanoff A, et al. Magnesium levels in relation to rates of preterm birth: a systematic review and meta-analysis of ecological, observational, and interventional studies. Nutr Rev. 2021 Jan;79(2):188–99.

89. Pedersen JF, Kallesøe SB, Langergaard S, Overgaard C. Interventions to reduce preterm birth in pregnant women with psychosocial vulnerability factors-A systematic review. Midwifery. 2021 Apr;100:103018.

90. Hoffman MK, Goudar SS, Kodkany BS, Metgud M, Somannavar M, Okitawutshu J, et al. Low-dose aspirin for the prevention of preterm delivery in nulliparous women with a singleton pregnancy (ASPIRIN): a randomised, double-blind, placebo-controlled trial. Lancet (London, England). 2020 Jan;395(10220):285–93.

91. Oladapo OT, Vogel JP, Piaggio G, Nguyen M-H, Althabe F, GülmezogluAM, et al. Antenatal Dexamethasone for Early Preterm Birth in Low-Resource Countries. N Engl J Med. 2020 Dec;383(26):2514–25.

92. Esplin M.S., Elovitz M.A., Iams J.D., Parker C.B., Wapner R.J., Grobman W.A., Simhan H.N., Wing D.A., Haas D.M., Silver R.M., et al. Predictive Accuracy of Serial Transvaginal Cervical Lengths and Quantitative Vaginal Fetal Fibronectin Levels for Spontaneous Preterm Birth Among Nulliparous Women. *JAMA*. 2017;317:1047–1056.

93. Iams J.D., Goldenberg R.L., Meis P.J., Mercer B.M., Moawad A., Das A., Thom E., McNellis D., Copper R.L., Johnson F., et al. The length of the cervix and the risk of spontaneous premature delivery. National Institute of Child Health and Human Development Maternal Fetal Medicine Unit Network. *N. Engl. J. Med.* 1996;334:567–572.

94. Leung T.N., Pang M.W., Leung T.Y., Poon C.F., Wong S.M., Lau T.K. Cervical length at 18–22 weeks of gestation for prediction of

spontaneous preterm delivery in Hong Kong Chinese women. *Ultrasound Obstet. Gynecol.* 2005;26:713–717.

95. Committee on Practice Bulletins—Obstetrics, the American College of Obstetricians and Gynecologists. Practice bulletin No. 130: Prediction and prevention of preterm birth. *Obstet. Gynecol.* 2012;120:964–973.
doi: 10.1097/AOG.0b013e3182723b1b.
96. McIntosh J., Feltovich H., Berghella V., Manuck T., Society for Maternal-Fetal Medicine (SMFM) The role of routine cervical length screening in selected high- and low-risk women for preterm birth prevention. *Am. J. Obstet. Gynecol.* 2016;215:B2–B7. doi: 10.1016/j.ajog.2016.04.027
97. Okitsu O, Mimura T, Nakayama T, Aono T. Early prediction of preterm delivery by transvaginal ultrasonography. Ultrasound in Obstetrics&Gynaecology
98. Mukherji J, Anant M, Ghosh S, Bhattacharyya SK, Hazra A, Kamilya GS. Normative data of cervical length in singleton pregnancy in women attending a tertiary care hospital in eastern India. The Indian Journal of Medical Research. 2011;133(5):492–496.
99. Thain S, Yeo GSH, Kwek K, Chern B, Tan KH (2020) Spontaneous preterm birth and cervical length in a pregnant Asian population. PLoS ONE 15(4): e0230125. https://doi.org/10.1371/journal.pone.0230125

100. Berghella V, Kuhlman K, Weiner S, Texeira L, Wapner RJ. Cervical funneling: sonographic criteria predictive of preterm delivery. Ultrasound Obstet Gynecol. 1997;10:161–6. pmid:9339522

101. Berghella V, Roman A, Daskalakis C, Ness A, Baxter JK. Gestational age at cervical length measurement and incidence of preterm birth. ObstetGynecol2007;110:311–17. pmid:17666605

102. Heath VC, Southall TR, Souka AP, Elisseou A, Nicolaides KH. Cervical length at 23 weeks of gestation: prediction of spontaneous preterm delivery. Ultrasound ObstetGynecol1998;12:312–7. pmid:9819868

103. Ozdemir I, Demirci F, Yucel O, Erkorkmaz U. Ultrasonographic cervical length measurement at 10–14 and 20–24 weeks gestation and the risk of preterm delivery. Eur J ObstetGynecolReprodBiol2007;130:176–9. pmid:16682111

104. Davies G, Ottenhof C, Woodman M, Farley A, Julien N, Van VD,et al. Cervix length and relaxin as predictors of preterm birth. J ObstetGynaecol Can 2008;30:1124–31. pmid:19175964

105. Crane JM, Hutchens D. Transvaginal sonographic measurement of cervical length to predict preterm birth in asymptomatic women at increased risk: a systematic review. Ultrasound ObstetGynecol2008;31:579–87.

106. Werner Ef, Han Cs, Pettker Cm, Buhimschi Cs, CopelJa, FunaiEf, et al. Universal -length screening to prevent preterm birth: a cost-effectiveness analysis. Ultrasound in obstetrics & gynaecology

107. Universal cervical-length screening and vaginal progesterone prevents early preterm births, reduces neonatal morbidity and is cost saving: doing nothing is no longer an option. Ultrasound in Obstetrics&Gynaecology 2011 Jul;38(1):1–9.

108. Moroz LA, Simhan Rate of sonographic cervical shortening and the risk of spontaneous preterm birth. American Journal of Obstetrics& Gynaecology 2012

ANNEXURE I: ETHICAL CLEARANCE

K.L.E. ACADEMY OF HIGHER EDUCATION AND RESEARCH
(Deemed – to- be- University)
Accredited 'A' Grade by NAAC (2nd Cycle) Placed in Category 'A' by MHRD (GoI)
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu
Phone: (+ 91-(0)831 Office : 2472550
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ 164 **Date: 24/12/2019**

To,

REG. NO. BJ0119012
PG student in Obstetrics and Gynecology,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"A COMPARISON OF PREDICTIVE VALUE OF TRANSVAGINAL CERVICAL LENGTH AT 11-14 WEEKS AND 18-22 WEEKS OF GESTATION IN PRETERM LABOUR",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Anita Dalal)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

5

TO

The Director ,

Academic affairs,

KAHER,

J N Medical college ,

Belguam.

SUB : Permission to change the Methodology of the Thesis

Respected Madam,

I **REG. NO. BJ0119012** postgraduate, Department of obstetrics and Gynaecology would like to inform that the topic for my Thesis is " Comparison Of Predictive value of Transvaginal Cervical Length at 11-14 weeks and 18-22 weeks of gestation in Preterm labour "

Due to ongoing Corona pandemic, it is not feasible to do Transvaginal cervical length at '2' different period of gestation in same individual,

Hence I request you to kindly

1) Give permission to change in Methodology," Predictive value of Transvaginal Cervical Length at 18-22 weeks of gestation in Preterm labour "

2) Give permission to take out side scan reports (In case if I cannot reach the sample size)

3) Reduction in sample size if required.

so that I will be able to collect data for my topic and complete by Thesis efficiently with in stipulated time

I request you to kindly grant me permission for the same

Thanking you,

yours sincerely,

REG. NO. BJ0119012

permitted
As per the rectification
of the university
deen.

(DR KAMAL P PATIL)
GUIDE

(DR M .C. METGUD)
Dissertation Committee Incharge

(DR ANITA DALAL)
H O D OBGYN

ANNEXURE I: CONSENT FOR PARTICIPATION IN THE RESEARCH STUDY

Mrs. _____ we are requesting you to enroll yourself in study titled "**TO STUDY ROLE OF TRANSVAGINAL CERVICAL LENGTH AT 18 TO 22 WEEKS OF GESTATION IN PREDICTION OF PRETERM LABOUR**" conducted by **REG. NO. BJ0119012**, Post Graduate in M.S. Obstetrics and Gynaecology under the guidance of Dr. _____, Department of Obstetrics and Gynaecology, J.N. Medical College, Belgaum under KLE university, Belagavi.

The purpose of research study is to know the role of transvaginal cervical length at 18-22 weeks of gestation in prediction of preterm labour. I will be the investigator for our study. This study is not being funded. I am going to give you information about this research project. Before you decide, you can talk to anyone you feel comfortable with about the research.

Purpose of study:

The purpose of this study is to "to study role of transvaginal cervical length at 18 to 22 weeks of gestation in prediction of preterm labour"

Type of Study

All pregnant women who visit hospital at 18-22 weeks are included in stud.

Participant selection

All women between 18-22 weeks period of gestation attending the outpatient Department of OBG who are sure of their LMP/ have a first trimester dating scan after applying the exclusion criteria.

Voluntary Participation

Your participation in research is voluntary. Your decision whether to participate in the study or not will not change present or future health care services offered to you and will not affect your relationship with J.N. Medical College.

Side effects & Risks

There are no known side effects or risks associated with this study.

Benefits

We want to let you know that there may be no benefits to you at present by participating in this study. By participating you will be helping to ensure that women in future get the best care and outcome.

Your participation being valuable contribution to medical research in the field of estimation of cervical length by ultrasonography

Financial Incentives for participation:

No financial incentives are being offered to enrolled patients. It is purely being done with the idea of research and all the cost of the study will be borne by the investigator.

Privacy and Confidentiality:

The only people who will know that you are the research subject will be the members of the research team. No information about you or information provided by you during the research will be disclosed to others without your written permission except:

1.In emergency to protect your rights and welfare.

2.If required by law.

Authorization to Publish Results:

When the results of the research are published or discussed, in a conference, no information will be displayed that would disclose your identity. Any information that is obtained in connection with this study and that can be identified with you will remain confidential. Results of the study will be used to improve maternal outcome.

Right to refuse or withdraw from study:

You do not have to participate in this research if you do not wish to.You can withdraw at any time from the study. There will be no penalty for withdrawal. Your treatment and care in this hospital will not change irrespective of whether you agree to participate or not. You can be removed from the study if necessary.

Alternative:

You are free to withdraw yourself from this study at any point of time. You will continue to receive the routine care even if you decline to participate in the study. You will be informed about any new information that may affect your decision to participate in the study.

Institutional / sponsor's policy:

In the event of any injury related to the study, treatment will be made available through KLE's Hospital & MRC, Belgaum. There is no compensation or payment for such medical treatment by law. If you are injured you may contact **REG. NO. BJ0119012**, Post graduate student, Department of Obstetrics and Gynaecology, KLE's Hospital& MRC or by Ph. No: _____.

Contact details:

If you have any questions you may ask now or later. If you wish to ask questions later, you may contact the responsible doctor attending you at the moment or you may contact, **REG. NO. BJ0119012** Postgraduate in Department of Obstetrics and Gynaecology, KAHER, Jawaharlal Nehru Medical College, Belagavi.

1. _____

Department of Obstetrics and Gynaecology, KAHER, Jawaharlal Nehru Medical College, Belagavi.

If you have any queries about your rights as a study subject, you may call Dr.Roopa M Bellad, Professor of Paediatrics as Chairperson of J. N. Medical College Institutional Ethics Committee on Human Subjects Research, Phone No.0831 2473777 at J. N. Medical College, Belagavi.

Consent statement:

I, _____ voluntarily agree for participating in this study. By signing this consent form I am not giving up any of my legal rights, I may withdraw from the study anytime. I am signing the consent form after having read or been read form in my own vernacular language, including the risks and the benefits and having all my questions answered.

Participant Name : _____

Signature of the Left Thumb Print of Participant : _____

Investigators Name: _____ Signature: _____

Witness Name : _____ Signature: _____

Date: _____

ANNEXURE III: SCREENING FORM

Screening number: | | | | | |

Date of screening (dd-mm-yyyy)_____

First name: _____

Middle name: _____

Last name:_____

Husband's name: _____

Age (years): _____

IP number: _____

Address:

H.no-_____

Street-_____

Taluka-_____

District-_____

Phone Number | | | | | | | | | | |

Landline(optional)-

Registered	
Un registerd	

EXCLUSION CRITERIA

		YES	NO
1)	Hypertensive disorders in pregnancy	☐	☐
2)	Polyhydramnios	☐	☐
3)	Previous history of any surgery on cervix likeconization	☐	☐
4)	Women with medical complications likediabetes mellites, renal diseases	☐	☐
5)	Women with congenital fetal anomalies	☐	☐

ANNEXURE IV: PROFORMA

Name	
Age	
Address	
Phone number	
Patient no	

Obstetric history:

Gravida	
Para	
Living	
Abortion	
Still Birth	

Menstrual history:

Last menstrual period	
Expected date of delivery	
Period of gestation	

H/o previous surgeries	
Antenatal complications	

General physical examination- at admission

Pulse rate	
Blood pressure	
pallor	
Icterus	
Pedal oedema	

Systemic examination- P/A

Size of uterus	
Presentation	
Fetal heart sounds	

Date of scan	
Cervical length a) at 18-22 Weeks : b) Onset of Labour: c) Labour outcome: d) Gestational Age : e) Mode of Delivery :	

ANNEXURE V: KEY TO MASTER CHART

SL. No - Serial Number

LMP - Last Menstrual Period

EDD - Expected date of delivery

C-EDD - Corrected Expected date of delivery

CL - cervical length

GA - gestational age

SL. NO.	AGE	LMP	EDD	OBSTETRIC SCORE	GESTATIONAL AGE	CERVICAL LENGTH AT 18-22 WEEKS	OUTCOME	GESTATIONAL AGE	DELIVERED AT	NICU ADMISSION	BIRTH WEIGTH
1)	23 yrs	25-04-2020	30-01-2021	primigravida	20 weeks 3 days	2.6 cm	Full Term Normal Delivery	39 Wks 1 Day	outside delivered		2.8 kg
2)	25 yrs	14-05-2020	18-02-2021	Primigravida	21 weeks 5 days	2.72 cm	Full Term Normal Delivery	39 Weeks	KLE		2.7 kg
3)	22 yrs	27-04-2020	01-02-2021	primigravida	20 weeks 3 days	4.4 cm	Full Term Normal Delivery	38 weeks 2 days	outside delivered		2.9 kg
4)	20 yrs	unknown	30-03-2021	primigravida	18 weeks 2 days	3.6 cm	pre term delivery	35 Weeeks	outside delivered	not admitted ,2.3 kg	2.3 kg
5)	21 yrs	unknown	10-04-2021	primigravida	21 weeks 5 days	3.6 cm	Full Term Normal Delivery	38 Weeks 3 days	KLE		2.6 kg
6)	19 yrs	24-07-2020	30-04-2021	primigravida	20 weeks 3 days	3.5 cm	full term normal delivery	37 Wks 4 days	outside delivered		2.7 kg
7)	23 yys	10-07-2020	16-04-2021	primigravida	18 weeks 5 days	3.5 cm	pre term deivery	34 Weeks 2 days	outside delivered	not admitted , 2.2 kg	2.2 kg
8)	23 yrs	unknown	17-03-2021	primigravida	19 weeks 4 days	3.7 cm	Full term normal delivery	37 weeks	outside delivered		2.6 kg
9)	20 yrs	09-06-2020	19-03-2021	primigravida	21 weeks	4.7 cm	Full term normal delivery	37 weeks	outside delivered		2.7 kg
10)	20 yrs	02-08-2020	12-05-2021	primigravida	19 weeks 4 days	3.8 cm	Full Term Normal Delivery	37 weeks 6days	outside delivered		2.8 kg
11)	25 yrs	03-06-2020	13-03-2021	primigravida	20 weks 2 days	3.4 cm	Full Term Normal Delivery	38 weeks 1 day	KLE		2.9 kg
12)	21 yrs	20-04-2020	28-01-2021	primigravida	21 weeks 2 days	4.6 cm	Full Term Normal Delivery	39 Weeks	outside delivered		3.0 kg
13)	25 yrs	unknown	14-03-2021	primigravida	21 weeks 2 days	3.4 cm	Full Term Normal Delivery	38 Weeks 3 days	outside delivered		3.2 kg
14)	19 yrs	unknown	20-06-2020	primigravida	20 weeks 1day	3.7 cm	full term normal delivery	37 Weeks	KLE		2.8 kg
15)	20 yrs	13-04-2020	18-01-2021	primigravida	21 weeks	2.9 cm	Full Term Normal Delivery	37 Weeks	KLE		2.6 kg
16)	26 yrs	16-04-2020	21-01-2021	primigravida	20 weeks	3.8 cm	Full Term Normal Delivery	40 weeks	outside delivered		2.6 kg
17)	21 yrs	unknown	04-12-2020	primigravida	19 weeks	2.4 cm	Full Term Normal Delivery	39weeks 6 days	outside delivered		2.9 kg
18)	24 yrs	01-05-2020	05-02-2021	primigravida	20 weeks 4 days	3.3 cm	Full Term LSCS	40 Weeks	outside delivered		2.4 kg
19)	22 yrs	04-07-2020	10-04-2021	primigravida	22 weeks	3.1 cm	full Term normal delivery	38 weeks	outside delivered		3.1 kg
20)	20 yrs	15-10-2020	27-07-2021	primigravida	21 weeks 3 days	3.0 cm	Full Term LSCS	39 weeks	delivered outside		2.4 kg
21)	19 yrs	10-07-2020	17-03-2021	primigravida	19 weeks 5 days	3.7 cm	Full term normal delivery	39 weeks	delivered outside		2.6 kg

22)	26 yrs	06-07-2020	12-04-2021	primigravida	21 weeks 4 days	3.2 cm	Full term normal delivery	39 weeks 5 days	delivered outside		2.9 kg
23)	20 yrs	08-07-2020	14-04-2021	primigravida	22 weeks	3.3 cm	Full Term LSCS	38 weeks	delivered outside		2.7 kg
24)	21 yrs	06-08-2020	13-05-2021	primigravida	22 weeks	3.5 cm	Full Term LSCS	38 weeks	KLE		3.2 kg
25)	25 yrs	24-09-2020	01-07-2021	primigravida	20 weeks 1 day	2.9 cm	Full term normal delivery	38 weeks	KLE		3.1kg
26)	22 yrs	08-10-2020	15-07-2021	primigravida	21weeks	3.3 cm	Full term normal delivery	39 weeks 3 days	delivered outside		2.9 kg
27)	21 yrs	02-10-2020	09-07-2021	primigravida	22w	2.5cm	Full term normal delivery	38 weeks 2 days	delivered outside		2.3 kg
28)	20 yrs	10-09-2020	17-06-2021	primigravida	20w	2.8cm	Full Term LSCS	39 weeks	delivered outside		2.4 kg
29)	20yrs	06-10-2020	13-07-2021	primigravida	20 weeks 6 days	4.1cm	Full Term LSCS	38 weeks 4 days	delivered outside		2.5 kg
30)	24 yys	02-10-2020	09-07-2021	primigravida	20weeks 6days	3.2 cm	Full Term LSCS	40 weeks	KLE		2.7 kg
31)	21 yrs	10-08-2020	17-05-2021	primigravida	21 weeks 6 days	3.3cm	Full term normal delivery	37 weeks 5 days	delivered outside		3.0 kg
32)	22 yrs	07-12-2020	13-09-2021	primigravida	21w3days	3.2cm	Full term normal delivery	39 weeks	delivered outside		2.4 kg
33)	22 yrs	01-10-2020	08-07-2021	primigravida	21 weeks 4 days	3.2 cm	Full term normal delivery	38 weeks	delivered outside		2.7 kg
34)	21 yrs	12-11-2020	19-08-2021	primigravida	22 weeks	3.0 cm	Full term normal delivery	40 weeks	delivered outside		3.2 kg
35)	24 yrs	09-11-2020	16-08-2021	primigravida	21 weeks 6 days	3.1 cm	Full term normal delivery	38 weeks	KLE		3.2 kg
36)	21 yrs	04-11-2020	11-08-2021	primigravida	20 weeks 6 days	4.9 cm	Full term normal delivery	39 weeks	delivered outside		3.1 kg
37)	22 yrs	24-08-2020	31-05-2021	primigravida	21 weeks	4.6 cm	Full term normal delivery	40 weeks	delivered outside		2.9 kg
38)	22 yrs	13-10-2019	19-07-2020	primigravida	20 weeks 5 days	3.1 cm	full term normal delivery	39 weeks 2 days	KLE		2.7 kg
39)	23 yrs	18-12-2019	23-09-2020	19 weeks	19 weeks	3.8 cm	full term normal delivery	39 weeks	delivered outside		2.9 kg
40)	25 yrs	01-11-2020	08-08-2021	primigravida	22 weeks	2.87cm	Full Term LSCS	37 weeks	KLE		2.6 kg
41)	19 yrs	unknown	08/08.2020	primigravida	19 weeks 4 days	3.8 cm	full term normal deivery	38 weeks 4 days	delivered outside		2.9 kg
42)	20 yrs	12-11-2020	18-08-2021	primigravida	18 weeks	2.8 cm	Full Term LSCS	38 weeks 4 days	delivered outside		2.7 kg
43)	22 yrs	01-12-2020	06-09-2021	primigravida	22 weeks	4.0cm	Full term normal delivery	39 weeks	KLE		2.7 kg
44)	22 yrs	15-07-2020	21-04-2021	primigravida	20 weeks	3.2 cm	Full term normal delivery	37 weeks	KLE		2.9 kg

45)	20 yrs	02-11-2020	12-08-2021	primigravida	19 weeks 4 days	3.2 cm	Full Term LSCS	39 weeks	KLE		3.0 kg
46)	22 yrs	22-07-2020	28-04-2021	primigravida	18 weeks 6 days	3.8 cm	Full Term Normal Delivery	39 Wks 2 Days	outside delivered		2.9 kg
47)	24 yrs	24-04-2020	29-01-2021	primigravida	19 weeks	3.2cm	Full term normal delivery	38weeks 2days	KLE		2.8 kg
48)	21 yrs	24-07-2020	28-Apr	primigravida	22 weeks	3.5 cm	Full Term Normal Delivery	39 weeks 3days	KLE		2.5 kg
49)	19 yrs	20-11-2019	26-08-2020	primigravida	21 weeks	2.9 cm	pre term delivery	36 weeks 3 days	outside delivered	not admitted , 2.4 kg	2.4 kg
50)	22 yrs	unknown	10-11-2020	primigravida	19 weeks	3.7 cm	Full Term LSCS	39 weeks 3 days	outside delivered		2.9 kg
51)	20 yrs	12-11-2020	19-08-2021	primigravida	21 weeks 4 days	2.8 cm	Full term normal delivery	39 weeks	KLE		2.8 kg
52)	20 yrs	04-09-2020	11-06-2021	primigravida	21 weeks 1 day	3.4 cm	Full Term LSCS	38 weeks 4 days	delivered outside		2.7 kg
53)	24 yrs	unknown	10-10-2020	primigravida	20 Weeks 4 days	3.4 cm	Full term normal delivery	39 weeks 2 days	KLE		2.9 kg
54)	24 yrs	16-04-2020	21-01-2021	primigravida	18 weeks	3.7 cm	Full Term Normal Delivery	38 weeks 2 days	outside delivered		3.1 kg
55)	20 yrs	29-07-2020	05-05-2021	primigravida	18 weeks 6 days	3.5 cm	full Term normal delivery	37 weeks 6 days	KLE		3.2 kg
56)	19 yrs	24-06-2020	31-03-2021	primigravida	20 weeks 3 days	3.3 cm	full term normal delivery	39 weeks	delivered outside		2.7 kg
57)	23 yrs	22-03-2020	27-12-2021	primigravida	18 weeks 4 days	4.2 cm	Full term normal delivery	37 weeks 3 days	KLE		2.9 kg
58)	21 yrs	11-12-2019	16-09-2020	primigravida	21 weeks	3.1cm	Full term normal delivery	39 weeks	KLE		3.0 kg
59)	24 yrs	15-12-2020	21-09-2021	primigravida	21 weeks 3 days	2.9 cm	full term LSCS	39 weeks	delivered outside		2.9 kg
60)	24 yrs	unknown	21-05-2020	primigravida	22 weeks	3.2 cm	full term normal delivery	39 weeks	outside delivered		3.1 kg
61)	20 yrs	06-10-2020	13-07-2020	primigravida	21 weeks 1 day	4.01 cm	Full term normal delivery	38 weeks 2days	outside delivered		3.2 kg
62)	20yrs	09-11-2019	16-08-2020	primigravida	20 weeks 1 day	4.3 cm	Full term normal delivery	37 weeks 4 days	outside delivered		3.3 kg
63)	24 yrs	16-05-2020	20-02-2021	primigravida	21 weeks	2.8 cm	Full Term LSCS	40 weeks	delivered outside		3.2 kg
64)	21yrs	10-10-2019	16-07-2020	primigravida	21w3days	3.7cm	full Term normal delivery	37weeks 5days	delivered outside		3.0 kg
65)	22 yrs	16-09-2020	23-06-2021	primigravida	21 weeks	3.3 cm	Full term normal delivery	39 weeks	KLE		2.9 kg
66)	26 yrs	15-05-2020	19-02-2021	primigravida	22 weeks	3.3 cm	preterm delivery	34wks	in KLE	Admitted for 15 days	2.1 kg
67)	22 yrs	unknown	03-03-2021	primigravida	22 weeks	2.4 cm	Full Term LSCS	37 weeks 4 days	outside delivered		2.4 kg

68)	22 yrs	unknown	30-10-2020	primigravida	21 weeks	2.7 cm	Pre Term Delivery	36weeks 1 day	outside delivered	not admitted , 2.5 kg	2.5 kg
69)	27 yrs	10-08-2020	17-05-2021	primigravida	19 weeks 1 day	4. 5 cm	Full term normal delivery	39 weeks	delivered outside		2.8 kg
70)	20 yrs	26-08-2020	02-06-2021	primigravida	21 weeks 6 days	3.5 cm	Full term normal delivery	39 weeks 3 days	delivered outside		2.9 kg
71)	19 yrs	01-11-2020	08-08-2021	primigravida	18 weeks 1 day	3.6 cm	Full term normal delivery	39 weeks	delivered outside		2.7 kg
72)	22 yrs	unknown	28-09-2020	primigravida	22 weeks	3.8 cm	Full Term LSCS	38 weeks	KLE		2.9 kg
73)	24 yrs	05-05-2020	09-02-2021	primigravida	20 weeks	3.7 cm	Full Term Normal Delivery	38 weeks	outside delivered		2.8 kg
74)	22 yrs	25-04-2020	02-02-2021	primigravida	20 weeks 3 days	3.4 cm	Full term normal delivery	Full Term LSCS	outside delivered		2.9 kg
75)	23 yrs	unknown	04-04-2021	primigravida	20 weeks	5.2 cm	Full Term LSCS	39 weeks	KLE		3.1 kg
76)	25 yrs	12-12-2019	17-09-2020	primigravida	19 weeks 1 day	5.2cm	Full Term LSCS	37 weeks	outside delivered		2.6 kg
77)	25 yrs	25-05-2020	01-03-2021	primigravida	21 weeks 4 days	3.2 cm	Full Term Normal Delivery	38 Weeks	outside delivered		2.9 kg
78)	25 yrs	03-06-2020	13-03-2021	primigravida	20 weks 2 days	3.4 cm	Full Term Normal Delivery	38 weeks 1 day	KLE		2.7 kg
79)	20 yrs	23-01-2020	29-10-2020	primigravida	20 weeks	4.8 cm	Full term normal delivery	39 Weeks	delivered outside		2.8 kg
80)	25 yrs	20-09-2020	26-06-2021	primigravida	18 weeks 4 days	3.2 cm	full term normal delivery	38 weeks	delivered outside		2.6 kg
81)	24 yrs	21-11-2020	28-08-2021	primigravida	18 weeks 5 days	3.5 cm	Full term normal delivery	39 weeks	delivered outside		2.7 kg
82)	23 yrs	unknown	20-05-2021	primigravida	20 weeks	3.3 cm	Full Term LSCS	40 weeks	delivered outside		2.8 kg
83)	23 yrs	23-10-2020	30-07-2021	primigravida	19 weeks	3.5 cm	Full term normal delivery	39 weeks	KLE		2.9 kg
84)	20 yrs	02-11-2020	12-08-2021	primigravida	19 weeks 4 days	3.2 cm	Full Term LSCS	39 weeks	KLE		3.0 kg
85)	22 yrs	12-07-2020	18-04-2021	primigravida	19 weeks	3.2 cm	Full term normal delivery	38 weeks	delivered outside		3.1 kg
86)	21 yrs	16-10-2020	23-07-2021	primigravida	20 weeks 6 days	3.0 cm	Full Term LSCS	39 weeks	delivered outside		3.1 kg
87)	22 yrs	06-08-2020	13-05-2021	primigravida	18 weeks	3.4 cm	Full term normal delivery	38 weeks	KLE YELLUR		2.9 kg
88)	24 yrs	29-05-2020	05-03-2021	primigravida	21 weeks 3 days	3.1 cm	Full Term LSCS	39 weeks	delivered outside		2.8 kg
89)	24 yrs	27-05-2020	03-03-2021	primigravida	21 weeks 3 days	3.5 cm	Full term normal delivery	38 weeks	delivered outside		2.9 kg
90)	20 yrs	05-05-2020	09-02-2021	primigravida	19 weeks 3 days	3.6 cm	Full term normal delivery	39 weeks	delivered outside		2.4 kgs

91)	21 yrs	28-05-2020	04-03-2021	primigravida	18 weeks	3.9 cm	Full Term LSCS	39 weeks 4 days	delivered outside		2.6 kg
92)	22 yrs	09-10-2020	16-07-2021	primigravida	19 weeks 3 days	3.3 cm	Full Term LSCS	38 weeks 1 day	delivered outside		2.5 kg
93)	21 yrs	unknown	03-02-2021	primigravida	22w	3.2cm	full Term normal delivery	39weeks			2.8 kg
94)	22 yrs	unknown	20-07-2020	primigravida	20weeks 2days	2.9cm	Full Term LSCS	40weeks			3.1 kg
95)	23 yrs	unknown	25-07-2020	primigravida	21 weeks 1 day	3.8cm	full term normal delivery	38weeks 2days			2.9 kg
96)	22 yrs	unknown	17-07-2020	primigravida	21w3days	3.9cm	Full Term LSCS	39 weeks			2.8 kg