International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

Estimation of Anterior Utero Cervical Angle As Measured By Trans Vaginal Sonography for the Prediction of Spontaneous Preterm Birth

Dr. Veena Vijayan, Dr. Jayashree V Vaman
Department of Obstetrics & Gynaecology, SAT Hospital,
Government Medical College, Thiruvananthapuram

Date of Submission: 01-06-2023 Date of Acceptance: 10-06-2023

ABSTRACT
Preterm labour is a type of natural labour process which is often regarded as preterm if in case the painful consistent labour pains are associated with regular contractions. According to recent evidence, measuring a woman's cervical length and uterocervical angle may aid in the identification of those women whose pregnancies are at risk of preterm delivery.

I. INTRODUCTION

Preterm labour is a type of natural labour process which is often regarded as preterm if in case the painful consistent labour pains are associated with regular contractions. According to recent evidence, measuring a woman's cervical length and uterocervical angle may aid in the identification of those women whose pregnancies are at risk of preterm delivery.

II. LITERATURE REVIEW

Infants born before 37 weeks of gestation are referred to as preterm by the WHO. The starting day of the previous menstrual cycle is typically used to calculate gestational age. This particular subset of neonates is particularly vulnerable to higher morbidity and mortality rates. The neonatal era accounts for a higher percentage of mortality in children under the age of five, with preterm births being a major cause of many of these deaths. The rise in preterm births has contributed to an increase in low birth weight as well. Additionally, there is always a significant positive association between low socioeconomic level, IUGR, and preterm birth. (11)

Low birth weight (LBW) refers to babies weighing fewer than 2500g, very low birth weight (VLBW) refers to newborns weighing less than 1500 g, and extremely low birth weight (ELBW) refers to newborns weighing less than 1000g. Birth weight and gestational age classification are two crucial factors to understand because they provide details about the baby and its result. There are three main categories for gestational age; the first is appropriate for gestational age (AGA), where weight is appropriate for gestational age. (12)

The second condition is called small for gestational age (SGA), in which the infant is smaller than anticipated and weighs less than the weight that is considered to be the 5th percentile for the gestational age. The third is large for gestational age (LGA), meaning that the newborn was heavier than anticipated and that the birth weight was above the 95th percentile for the gestational age (3). Preterm deliveries frequently have unclear causes. Although there are a number of factors that might cause preterm labour, including early inducement of labour and cesarean sections, it frequently occurs on its own (13). In low-income settings, half of the babies born at 32 weeks die from a lack of practicable, affordable care, such as warmth, assistance for breastfeeding, and fundamental treatment for infection and breathing problems. Nearly all of these babies survive in high-income countries. (14)

Conditions that affect the mother during pregnancy, such as gestational diabetes, hypertension, heart or kidney issues, and infections of the amniotic membrane, genital, or urinary tracts, might result in preterm birth. additionally, haemorrhage brought on by the placenta's unusual placement. Mother's lifestyle is another potential factor. For instance, poor diet, increasing alcohol consumption while she was pregnant, and smoking. Early deliveries brought on by many pregnancies, young women, or women older than 40 are also quite prevalent (15).

III. MATERIALS & METHODS

We conducted a prospective observational study in the Department of Obstetrics and Gynaecology, Government Medical College, SAT hospital, Thiruvananthapuram between Feb 2021 to August 2022.

Our hospital is a tertiary Multispecialty hospital and a teaching institute. The hospital runs

24*7 emergency services for all major and minor ailments. The OG department runs daily outpatient services and also has around _660s___ beds for inpatient management. The department also has special clinics for fertility and other gynaecological malignancies. The department runs operation theatres on a daily bases and conducted major surgeries for all major gynaecological ailments and runs 24*7 labour rooms and C section services. The department also has a minor OT attached with it which is utilised for day-care procedures. All of the above, round-the-clock, services are provided by well-qualified and trained consultants with the help of Residents.

As a part of this research proposal, we aimed to estimate the anterior uterocervical angle as measured by trans vaginal sonography for the prediction of spontaneous preterm birth among singleton pregnancies of 18-23 weeks of gestation. After institutional Ethics Committee approval and informed written consent, almost 190 patients were diagnosed with 18-23 weeks of gestation.

IV. STATISTICAL ANALYSIS

Data was coded and recorded in the MS Excel spreadsheet program. SPSS v23 (IBM Corp.) was used for data analysis. Descriptive statistics was elaborated in the form of means/standard deviations and medians/IQRs for continuous variables, and frequencies and percentages for categorical variables. Data was presented in a graphical manner wherever appropriate for data visualization using histograms/box-and-whisker plots/column charts for continuous data and bar charts/pie charts for categorical data. Group comparisons for continuously distributed data were made using an independent sample ‘t-test when comparing two groups, and One-Way ANOVA when comparing more than two groups. In the case of non-normally distributed, appropriate non-parametric tests in the form of the Wilcoxon Test/Kruskal Wallis test were used. In the case of comparison of categorical data Chi-squared test was used. Statistical significance was kept at $p < 0.05$. ROC analysis was used to estimate the predictive ability of the anterior uterocervical angle to predict preterm birth and determine its cut-off values.

V. RESULT

Table 1: Sociodemographic characteristics of the study participants (N=190)

Characteristics	Frequency (%)
Age group	
<25 years	47 (24.7)
25-30 years	101 (53.1)
>30 years	42 (22.1)
Education	
Illiterate/Primary school	38 (20.0)
Secondary school	89 (46.8)
Graduate	30 (15.7)
Post graduate/Professional	33 (17.4)
Socioeconomic status	
Lower	59 (31.0)
Middle	93 (48.9)

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

Upper	38 (20.0)
Booking status	
Booked	187 (98.5)
Not booked	3 (1.5)
Parity	
Primi	77 (40.5)
Multiparous	113 (59.5)
Previous history of preterm delivery	
Yes	31 (16.3)
No	159 (83.7)

We could reach around 190 participants who fitted the inclusion criteria (Women with singleton pregnancies between 18-23 weeks of gestation) attending OG OPD of Government Medical College and Hospital, SAT hospital, Thiruvananthapuram. All patients agreed to participate in the study thus accounting for a response rate of 100%. Table 1 depicts the sociodemographic characteristics of the study participants. We could see that more than half (53%) of the study participants were belonging to the age group of 25-30 years, with a mean age of 28.4 (8.3) years. Almost half (47%) of the study participants were educated till secondary school. Almost half of the study participants (48%) belonged to the middle class. Almost everyone (98%) was booked. Almost 3/5th were multiparous. Around 84% of the study participants had a previous history of preterm delivery.

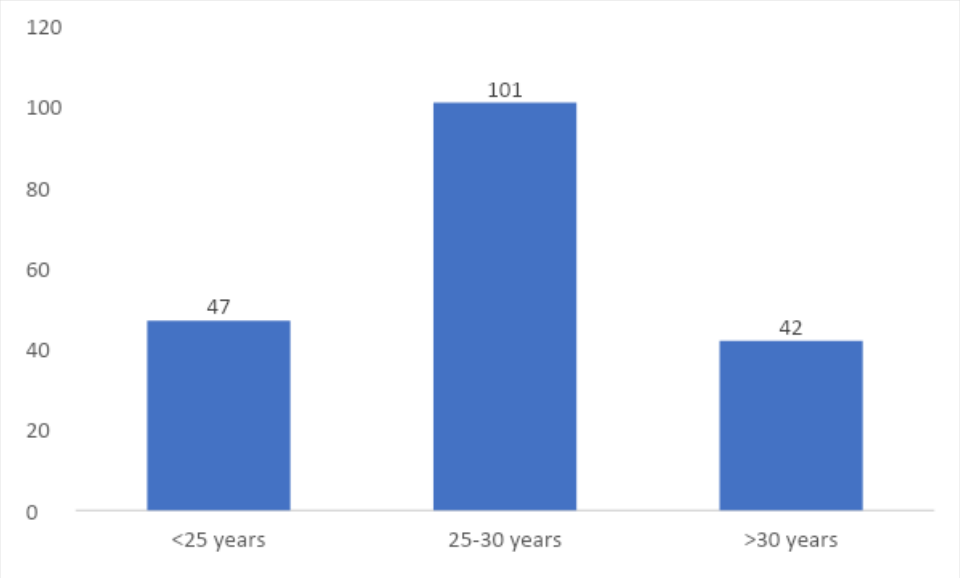

Fig 1: Age distribution of the participants

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

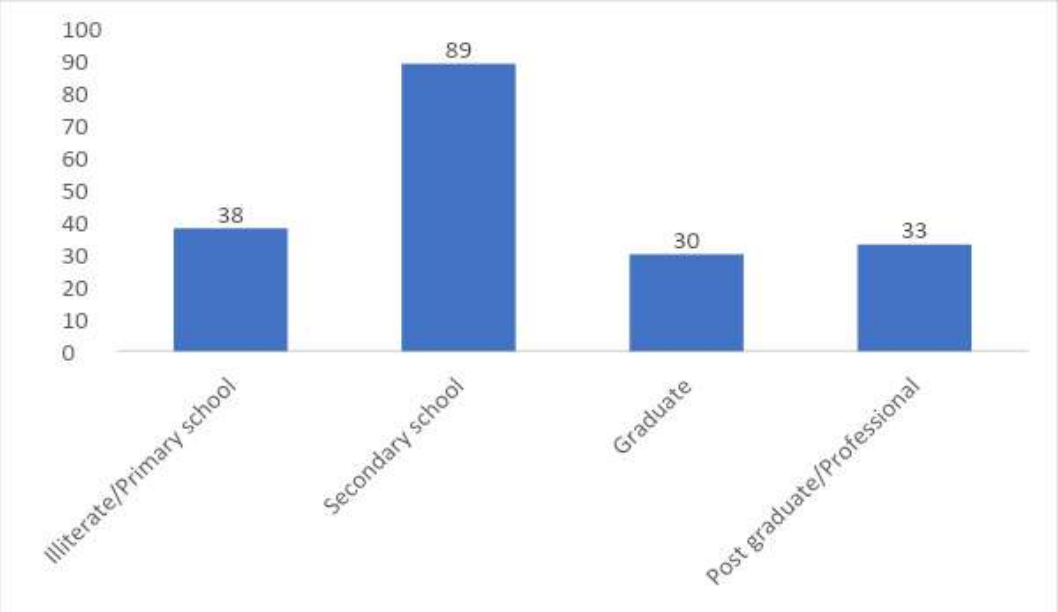

Fig 2: Education status of the participants

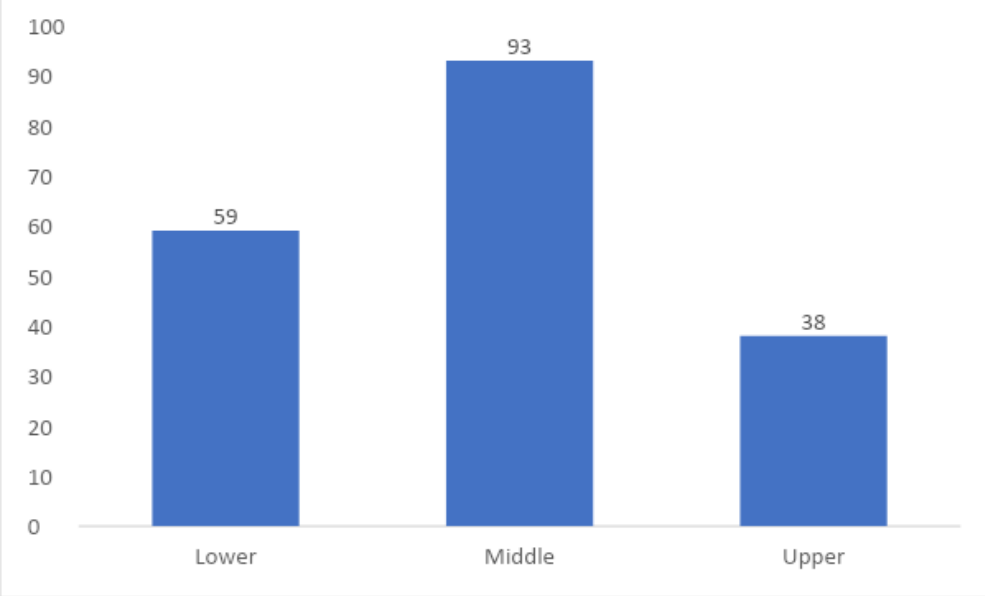

Fig 3: Socioeconomic status of the participants

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

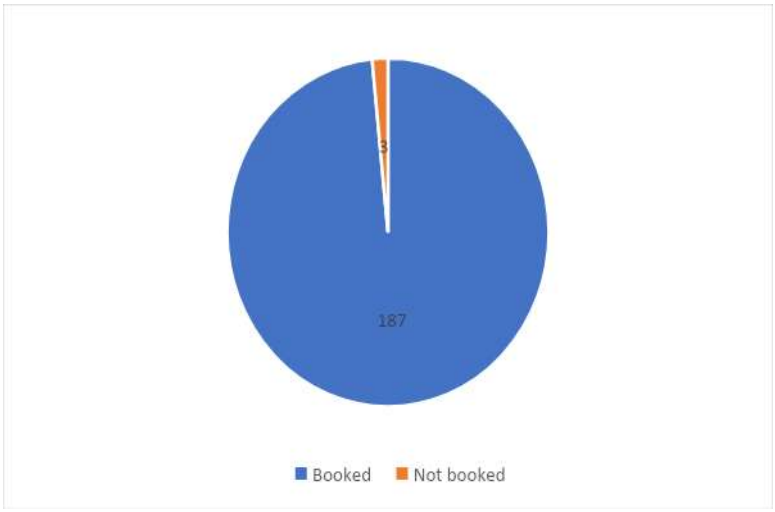

Fig 4: Booking status of the participants

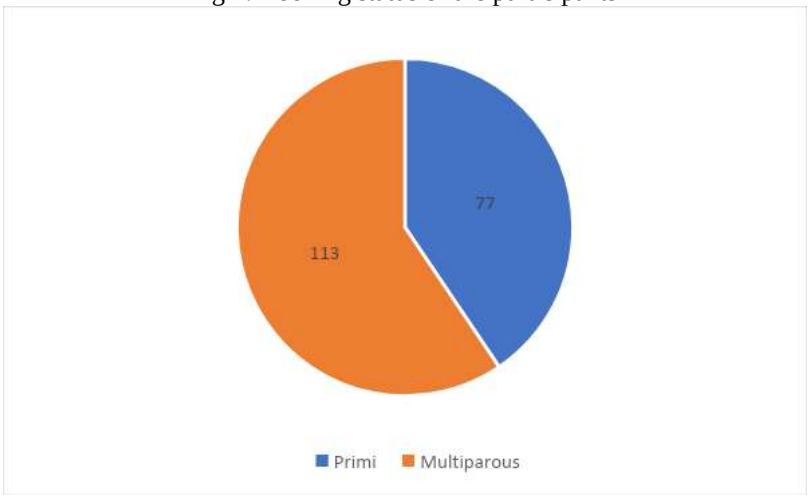

Fig 5: Parity of the participants

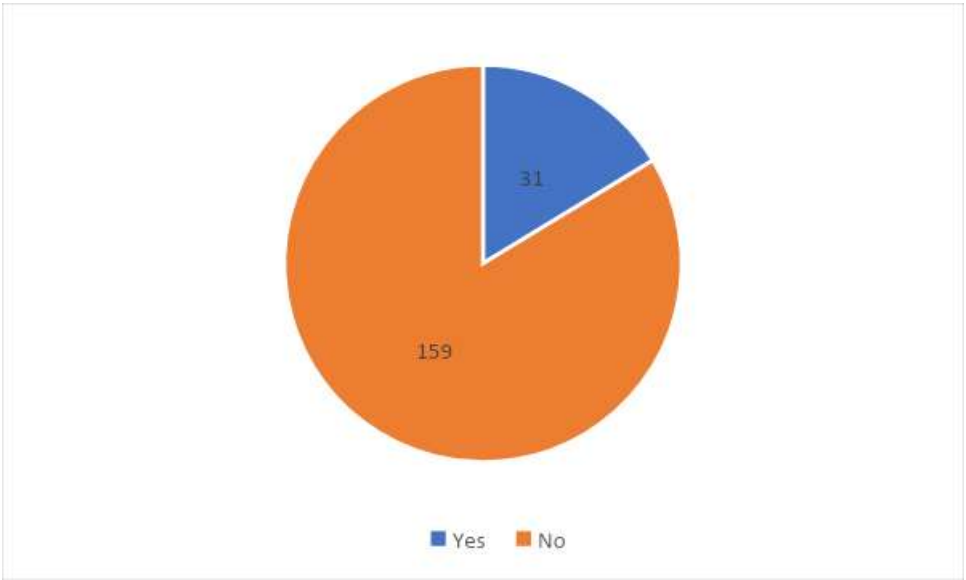

Fig 6: History of previous preterm among study participants

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

Table 2: Distribution of comorbidities among the study participants (N=190)

Comorbidity	N (%)
Anaemia	43 (22.6)
GDM	17 (8.9)
GHTN	31 (16.3)
Hypothyroid	12 (6.3)
No comorbidity	87 (45.7)

With respect to the comorbidity at presentation, we found that around 46% did not have any comorbidity, while the most common comorbidity was anaemia (23%), followed by GHTN (16%)

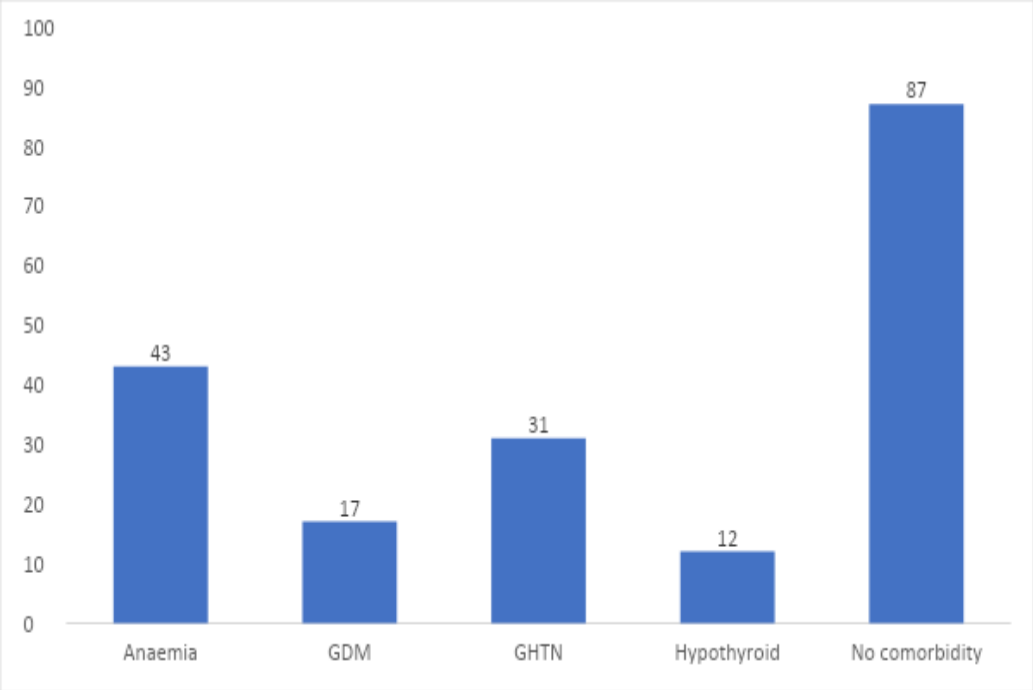

Fig 7: Distribution of comorbidity among the study participants

Table 3: Distribution of preterm labor among the study participants (N=190)

Preterm labour	
Yes	24 (12.6)
No	166 (87.4)

With respect to the incidence of preterm delivery among women who delivered later during follow-up, we observed that around 13% of study participants encountered a preterm delivery.

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

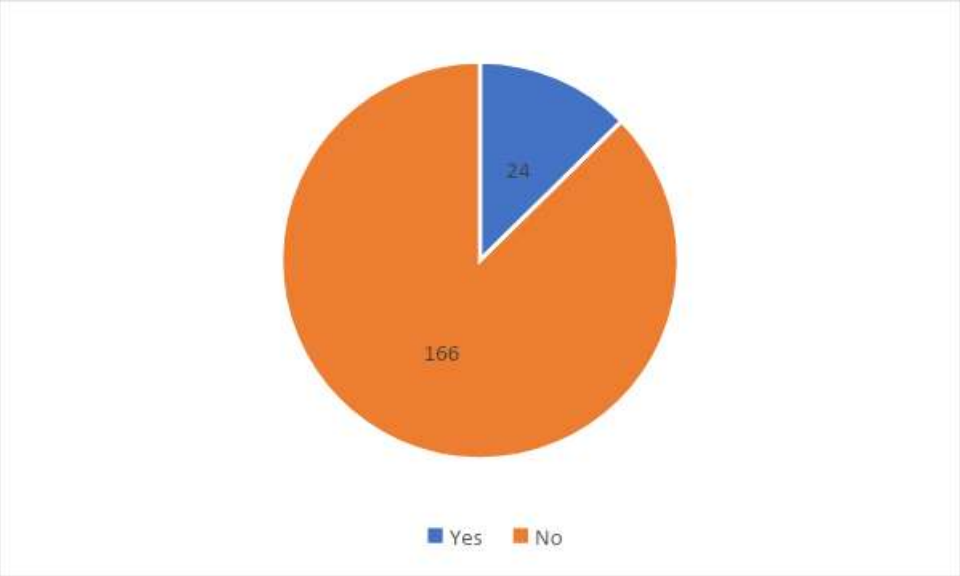

Fig 8: Distribution of preterm labour among the study participants

Table 4: Comparison of clinical characteristics with preterm delivery among the study participants, N=190

Characteristics	Total,	Preterm, n (%) or Mean (SD)	Term neonates, n (%) or Mean (SD)	P value
Age group				
Mean (SD)	27.39 (±5.5)	25.39 (±5.78)	29.64 (±6.11)	0.12
<25 years	47	7 (14.8)	40 (85.2)	0.75
25-30 years	101	12 (11.8)	89 (88.2)	
>30 years	42	5 (11.9)	37 (88.1)	
Education				
Illiterate/Primary school	38	4 (10.5)	34 (90.5)	0.35
Secondary school	89	10 (11.2)	79 (88.8)	
Graduate	30	7 (23.3)	23 (76.7)	
Post graduate/Professional	33	3 (9.1)	30 (90.9)	
Socioeconomic status				
Lower	59	12 (20.3)	47 (79.7)	0.29
Middle	93	6 (6.4)	87 (93.6)	
Upper	38	6 (15.7)	32 (84.23	
Booking status				
Booked	187	23 (12.3)	164 (87.7)	0.07
Not booked	3	1 (33.3)	2 (66.7)	
Parity				
Primi	77	13 (16.8)	64 (83.2)	0.20
Multiparous	113	11 (9.7)	102 (90.3)	
Previous history of preterm delivery				
Primi	31	13 (41.9)	18 (80.0)	0.01
Multiparous	159	11 (6.9)	148 (93.1)	

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

Cervical length				
Mean (SD)	2.7 (1.2)	2.2 (0.9)	2.9 (0.7)	0.001
Anterior cervical angle				
Mean (SD)	101 (23)	109 (18)	92 (19)	0.003

The above table showed the comparison of clinical and sociodemographic characteristics between preterm and term deliveries. We observed that the groups were comparable and did not vary with respect to clinical and sociodemographic characteristics with the exception of the previous history of preterm delivery, where we observed that women with a previous history of preterm had more chances of getting repeated preterm. With respect to the distribution of outcomes such as uterocervical angle and cervical length were statistically different between the groups, where we observed a cervical length had a mean distribution of 2.9 (0.7) and 2.2 (0.9) across preterm and term deliveries (p-value <0.001), whereas anterior cervical angle had 109 (18) and 92 (19) across preterm and term deliveries respectively (p-value <0.003).

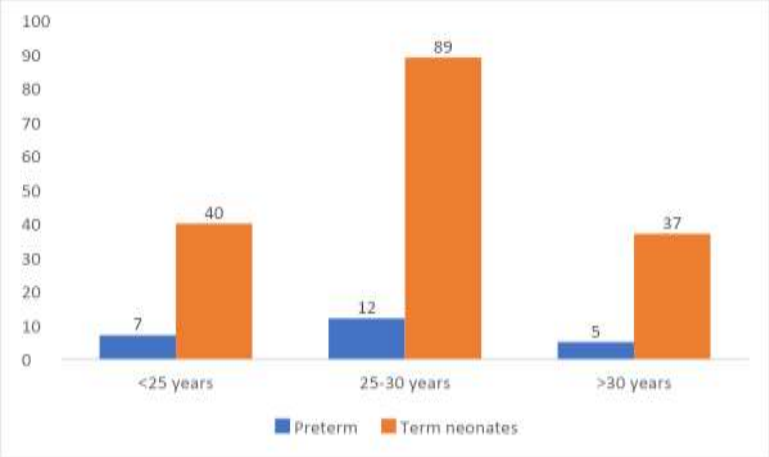

Fig 9: Association between age and preterm delivery among the study participants

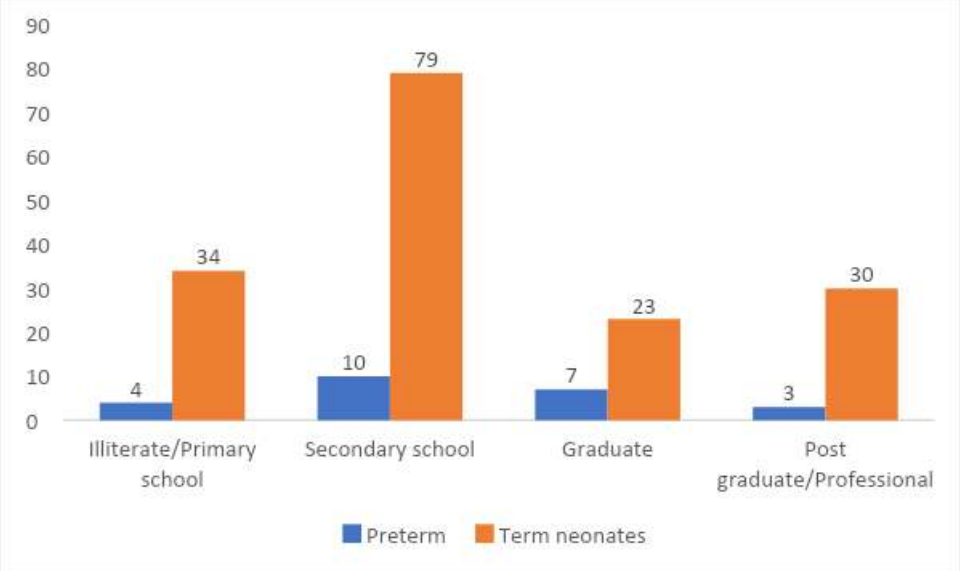

Fig 10: Association between education and preterm delivery among the study participants

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

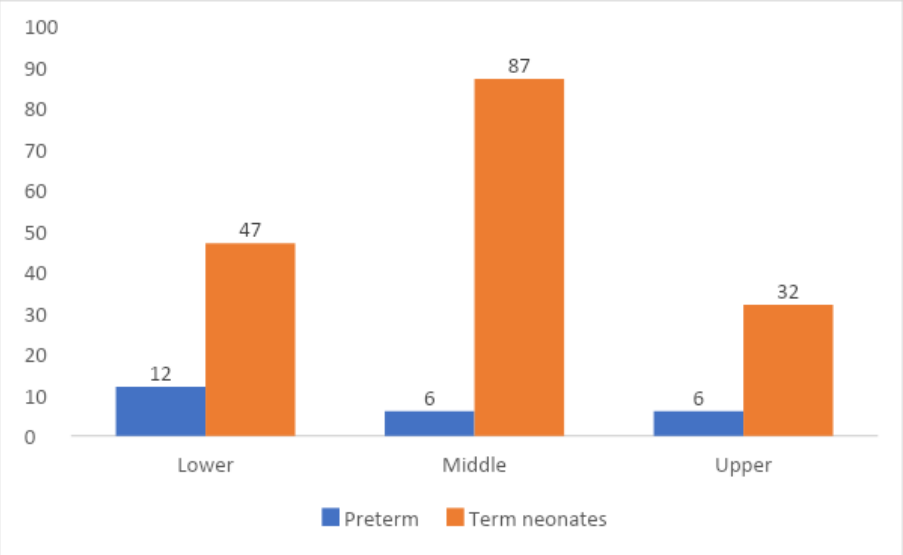

Fig 11: Association between socioeconomic status and preterm delivery among the study participants

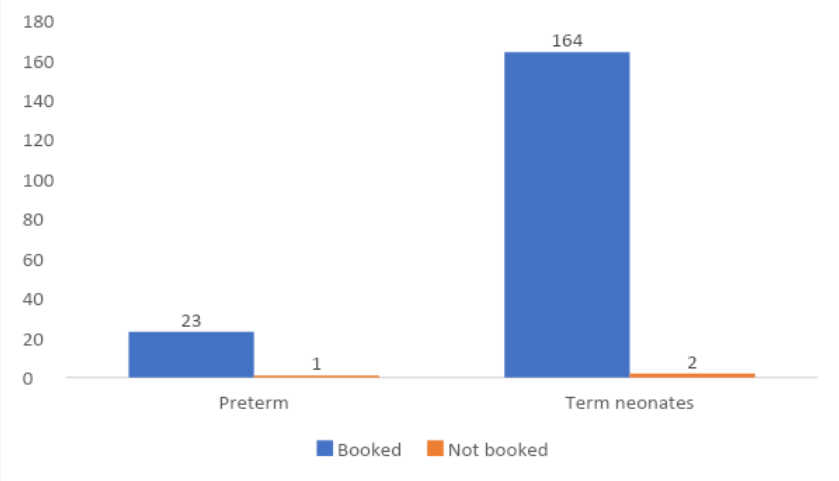

Fig 12: Association between booking status and preterm delivery among the study participants

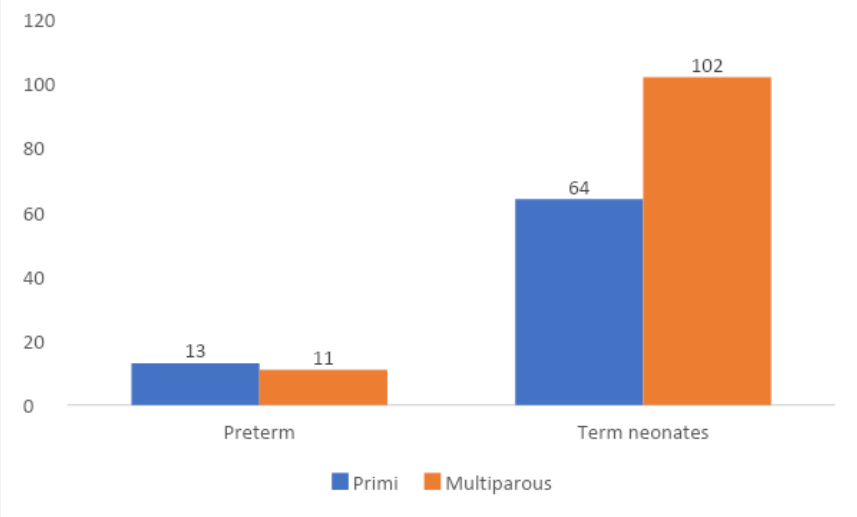

Fig 13: Association between parity and preterm delivery among the study participants

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

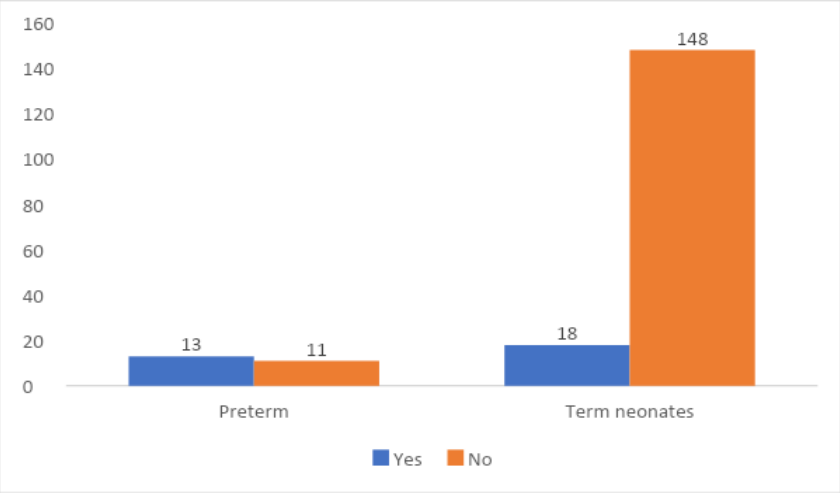

Fig 14: Association between previous preterm delivery and preterm delivery among the study participants

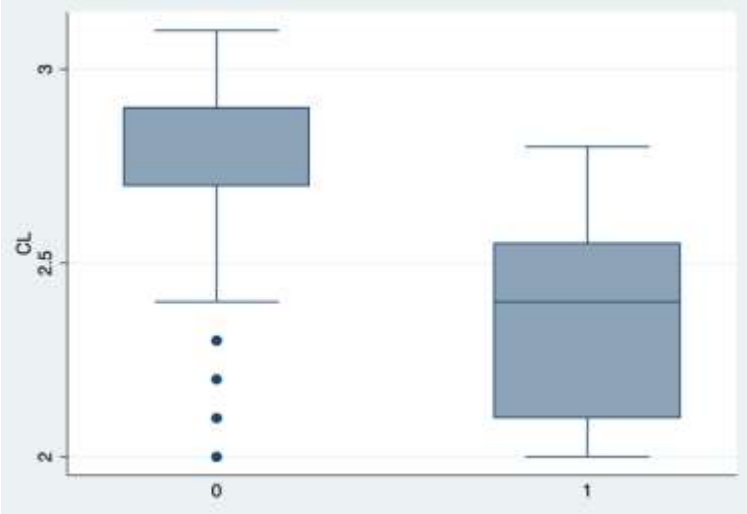

Fig 15: Distribution of Cervical length and preterm delivery among the study participants

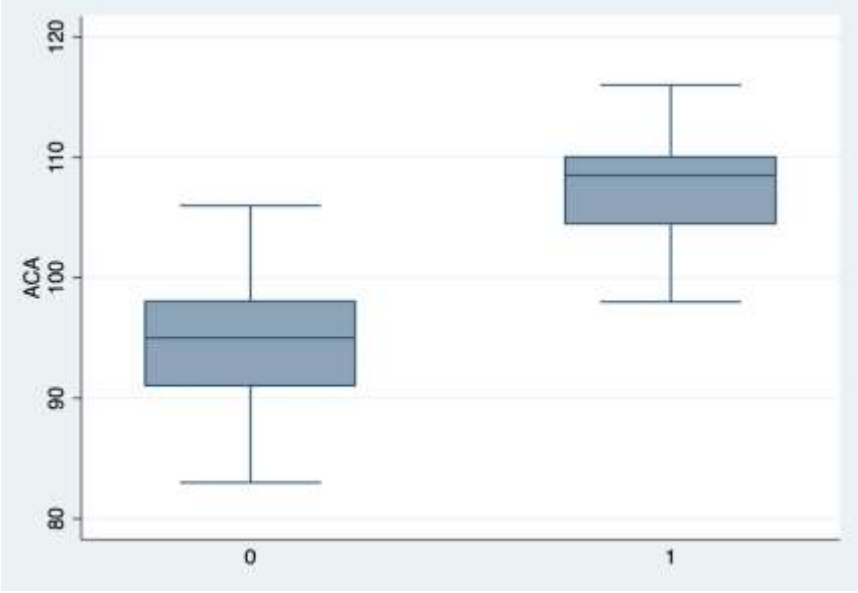

Fig 16: Distribution of ACA and preterm delivery among the study participants

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 446-461 www.ijdmsrjournal.com ISSN: 2582-6018

Table 5: Comparison of sensitivity, specificity, PPV and NPV of CL, UCA in predicting preterm deliveries, N=190

Mean (SD)	Sensitivity	Specificity	PPV	NPV
CL <2.5 cms	26%	98%	41%	92%
ACA >95	86%	53%	17%	96%

We did ROC analysis to obtain the sensitivity, specificity, PPV and NPV of CL and ACA in predicting preterm labour during follow-up of women. We observed an AUC of 0.741 (0.645 – 0.793) and 0.764 (0.649 – 0.810) for cervical length and anterior cervical angle respectively. The sensitivity, specificity, PPV and NPV of CL was observed to be 26%, 98%, 41% and 92% in predicting preterm labour with a cut off of <2.5 cms, whereas the sensitivity, specificity, PPV and NPV of ACA was observed to be 86%, 53%, 17% and 96% in predicting preterm labour with a cut off of >95 degrees.

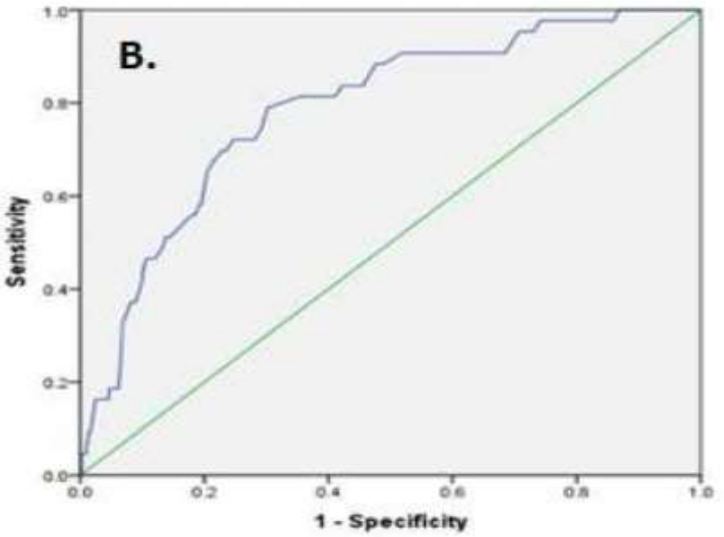

Fig 17: ROC curve of CL and preterm delivery

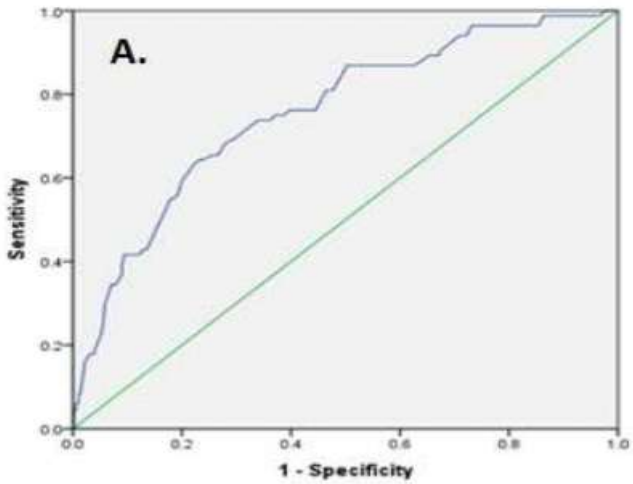

Fig 18: ROC curve of ACA and preterm delivery

International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 373-380 www.ijdmsrjournal.com ISSN: 2582-6018

VI. DISCUSSION

We basically did a prospective follow-up observational study in the Department of Obstetrics and Gynaecology in a tertiary care setting to estimate the anterior uterocervical angle as measured by trans vaginal sonography for the prediction of spontaneous preterm birth among singleton pregnancies of 18-23 weeks of gestation during the study period of 1 year. In our study, we estimated the sociodemographic characteristics of patients who presented with spontaneous preterm birth to our hospital for delivery. The main outcome that we determined was to estimate the anterior uterocervical angle for the prediction of spontaneous preterm birth, where the UC angle was measured using trans vaginal sonography. We also tried to estimate the cervical length as measured by trans vaginal sonography for the prediction of spontaneous preterm birth among singleton pregnancies of 18-23 weeks of gestation. In addition to the above, we also tried to compare the measured anterior uterocervical angle among term and preterm deliveries of the study participants. Existent research on this area is mainly focused in western, and there is a lack of literature from India, specifically from south Indian settings, where the existing literature mainly deals with clinical outcomes of preterm deliveries, and only very few attempts have been made to study the predictive value of anatomical parameters in predicting preterm birth using the available sonographic investigations like the trans vaginal sonography. Thus considering the advances in this field and the increasing use of TVS for prediction and diagnosis of preterm deliveries, we decided to take up this study singleton pregnancies of 18-23 weeks of gestation admitted under the Department of Obstetrics and Gynaecology, Government Medical College, SAT hospital, Thiruvananthapuram between Feb 2021 to August 2022.

In our study we included 190 patients who were fitting our inclusion and exclusion criteria. We noted that more than half (53%) of the study participants were belonging to the age group of 25-30 years, with a mean age of 28.4 (8.3) years. This was observed to be in line with the findings observed from previous studies done from varied study settings. (64) We noted that almost half (47%) of the study participants were educated till secondary school. Almost half of the study participants (48%) belonged to the middle class, which again shows that preterm deliveries are commonly seen among women belonging to lower socioeconomic status and lower levels of education, where lack of knowledge and poor health-seeking behaviour could be a determinant. This finding is shown previously by other studies. (65) We also noted that almost everyone (98%) was booked. Almost 3/5th were multiparous. Around 84% of the study participants had a previous history of preterm delivery. respect to the comorbidity at presentation, we found that around 46% did not have any comorbidity, while the most common comorbidity was anaemia (23%), followed by GTN (16%). This finding was observed to be similar to study findings by Sur et al, who has also shown that the most commonest comorbidity observed among preterm mothers was anemia. (64)

With respect to the incidence of preterm delivery among women who delivered later during follow-up, we observed that around 13% of study participants encountered a preterm delivery. This finding was observed to be similar to findings from Sur et al, who showed a similar prevalence across the study settings. However, our findings were observed to be higher than the study findings from other study settings, done by LLobet et al, who observed a prevalence of 4% of preterm deliveries. This difference could be due to the fact that there are differences in study population, comorbidity pattern, age and health seeking pattern between the two study settings. (67)

We observed that the groups were comparable and did not vary with respect to clinical and sociodemographic characteristics with the exception of the previous history of preterm delivery, where we observed that women with a previous history of preterm had more chances of getting repeated preterm, which was observed to be comparable to findings from previous studies. (67) With respect to the distribution of outcomes such as uterocervical angle and cervical length were statistically different between the groups, where we observed a cervical length had a mean distribution of 2.9 (0.7) and 2.2 (0.9) across preterm and term deliveries (p-value <0.001), whereas mean (sd) anterior cervical angle distribution was observed to be 109 (18) and 92 (19) across preterm and term deliveries respectively (p-value <0.003). This finding was also observed to be comparable to findings obtained from other studies done by Dziadosz et al, who showed that the distribution of cervical length was statistically lower among the preterm group when compared to term neonates. (68)

As our objective was to determine the cut off for UC angle and cervical length in determining preterm labour, we did ROC analysis to obtain the sensitivity, specificity, PPV and NPV of CL and ACA in predicting preterm labour during follow-up of women. We observed an AUC of 0.741 (0.645 –

0.793) and 0.764 (0.649 – 0.810) for cervical length and anterior cervical angle respectively. Findings from Llo et al, showed that the AUC obtained from their studies was observed to be 0.67. (67) We also observed that in our study, the sensitivity, specificity, PPV and NPV of CL was observed to be 26%, 98%, 41% and 92% in predicting preterm labour with a cut off of <2.5 cms, This finding was observed to be in line with findings from Crane et al, who has already established that preterm deliveries are more common among mothers who has a previous history of preterm deliveries. (66)

With

whereas the sensitivity, specificity, PPV and NPV of ACA was observed to be 86%, 53%, 17% and 96% in predicting preterm labour with a cut off of >95 degrees, which is again in line with findings observed by Llobet et al. (67)

VII. CONCLUSION

To conclude, in our study we found that our study groups were comparable with respect to baseline characteristics. During the follow up, we observed that more than half (53%) of the study participants were belonging to the age group of 25-30 years, with a mean age of 28.4 (8.3) years. We observed that around 13% of study participants encountered a preterm delivery. With respect to the distribution of outcomes such as uterocervical angle and cervical length, we observed a cervical length had a mean distribution of 2.9 (0.7) and 2.2 (0.9) across term and preterm deliveries (p-value <0.001), whereas anterior cervical angle had 109 (18) and 92 (19) across preterm and term deliveries respectively (p-value <0.003). ROC analysis showed that cervical length and anterior cervical angle had an AUC of 0.741 (0.645 – 0.793) and 0.764 (0.649 – 0.810) respectively.

Ethical Clearance:
IEC GOVERNMENT MEDICAL COLLEGE THIRUVANANTHAPURAM.
HEC NO:01/16/221/MCT dated:15/01/2021
Funding: None
Conflict of Interest: None Stated

REFERENCES

[1]. A South Asian Perspective. Arias Practical Guide to high-risk pregnancy and delivery. Editors Arias F, Bhide A, Arulkumaran S, Damania K, Daftary S. (4th Ed); 2015 Chapter 8:135.
[2]. WHO Fact sheet Reviewed November 2016- Available from: http://www.who.int/mediacentre/factsheets/fs363/en.
[3]. National Health Portal Gateway to authentic health information. Available from: www.nhp.gov.in
[4]. Sochacki-Wojcicka N , Wojcicki J , Bomba-Opon D, Wielgos M. Anterior cervical angle as a new biophysical ultrasound marker for prediction of spontaneous preterm birth. Ultrasound Obstet Gynecol.2015;46:376-9.
[5]. Bloom SL. Recurrence of preterm birth in single term and twin pregnancies. Obstet Gynecol. 2001;98:379.
[6]. Yamashita M, Hayashi S, Endo M, Okuno K, Fukui O, Mimura K et al. Obstetric research collaborative in Osaka (ORCO). J Obstet Gynaecol Res. 2015;41(11):1708-14.
[7]. Mazaki-Tovi S, Romero R, Kusanovic JP, Erez O, Pineles BL, Gotsch F et al. Recurrent preterm birth. Semin Perinatol. 2007;31(3):142-58.
[8]. Banicevic AC, Popovic M, Ceric A. Cervical length measured by transvaginal ultrasonography and cervicovaginal infection as predictor of preterm birth risk. Acta Inform Med. 2014;22(2):128-32.
[9]. Boelig RC, Orzechowski KM, Berghella V. Cervical length, risk factors, and delivery outcomes among women with spontaneous preterm birth. J Matern Fetal Neonatal Med. 2016 Sep;29(17):2840-4.
[10]. Iams JD, Goldenberg RL, Meis PJ, Mercer BM, Moawad A, Das A et al. The length of the cervix the risk of spontaneous premature delivery. N Engl J Medicine. 1996;44(3):292-4.
[11]. Quinn JA, Munoz FM, Gonik B, Frau L, Cutland C, Mallett-Moore T, Kissou A, Wittke F, Das M, Nunes T, Pye S. Preterm birth: Case definition & guidelines for data collection, analysis, and presentation of immunisation safety data. Vaccine. 2016 Dec 1;34(49):6047-56.
[12]. Singer LT, Salvator A, Guo S, Collin M, Lilien L, Baley J. Maternal psychological distress and parenting stress after the birth of a very low-birth-weight infant. Jama. 1999 Mar 3;281(9):799-805.
[13]. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. The lancet. 2008 Jan 5;371(9606):75-84.
[14]. Lawn JE, Davidge R, Paul VK, Xylander SV, de Graft Johnson J, Costello A,

Kinney MV, Segre J, Molyneux L. Born too soon: care for the preterm baby. Reproductive health. 2013 Nov;10(1):1-9.

[15]. Sebastiani G, Borrás-Novell C, Alsina Casanova M, Pascual Tutusaus M, Ferrero Martínez S, Gómez Roig MD, García-Algar O. The effects of alcohol and drugs of abuse on maternal nutritional profile during pregnancy. Nutrients. 2018 Aug 2;10(8):1008.

[16]. Michael Cohen-Wolkowiez P. Early and Late Onset Sepsis in Late Preterm Infants. The Pediatric infectious disease journal [Internet]. 2009 [cited 7 January 2016];28(12):1052. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2798577/

[17]. Honnor MJ, Zubrick SR, Stanley FJ. The role of life events in different categories of preterm birth in a group of women with previous poor pregnancy outcome. European journal of epidemiology. 1994 Apr;10(2):181-8.

[18]. Sasidharan K, Dutta S, Narang A. Validity of New Ballard Score until 7th day of postnatal life in moderately preterm neonates. Archives of Disease in Childhood-Fetal and Neonatal Edition. 2009 Jan 1;94(1):F39-44.

[19]. Tucker JM, Goldenberg RL, Davis RO, Copper RL, Winkler CL, Hauth JC. Etiologies of preterm birth in an indigent population: is prevention a logical expectation?. Obstetrics and gynecology. 1991 Mar 1;77(3):343-7.

[20]. Shapiro-Mendoza C, Tomashek K, Kotelchuck M, Barfield W, Nannini A, Weiss J et al. Effect of Late-Preterm Birth and Maternal Medical Conditions on Newborn Morbidity Risk. PEDIATRICS. 2008;121(2):e223-e232.

[21]. Martin JA, Hamilton BE, Osterman MJ, Curtin SC, Matthews TJ. Births: final data for 2013. Natl Vital Stat Rep. 2015 Jan 15;64(1):1-65. PMID: 25603115.

[22]. Haroon A, Ali SR, Ahmed S, Maheen H. Short-term neonatal outcome in late preterm vs. term infants. J Coll Physicians Surg Pak. 2014 Jan;24(1):34-8. PMID: 24411540.

[23]. Engle WA, Tomashek KM, Wallman C, Committee on Fetus and Newborn. "Late-preterm" infants: a population at risk. Pediatrics. 2007 Dec;120(6):1390-401.

[24]. Das R, Palas R, Deb G, Paul P, Yesmin S. An Observational Study on Late Preterm Neonates from a Post- Graduate Teaching Hospital in North East India. Sch J App Med Sci. 2020: 4 (8). 2484-88

[25]. Wang ML, Dorer DJ, Fleming MP, Catlin EA. Clinical outcomes of near-term infants. Pediatrics. 2004 Aug;114(2):372-6. doi: 10.1542/peds.114.2.372. PMID: 15286219.

[26]. Visruthan NK, Agarwal P, Sriram B, Rajadurai VS. Neonatal Outcome of the Late Preterm Infant (34 to 36 Weeks): The Singapore Story. Ann Acad Med Singap. 2015 Jul;44(7):235-43. PMID: 26377057.

[27]. Late preterm infants [Internet]. Uptodate.com. 2016 [cited 11 January 2020]. Available from: http://www.uptodate.com/contents/late-preterm-infants?source=machineLearning&search=morbidity+preterm&selectedTitle=2~150&sectionR ank=1 anchor=H8#H8

[28]. Consortium on Safe Labor, Hibbard JU, Wilkins I, Sun L, Gregory K, Haberman S, Hoffman M, Kominiarek MA, Reddy U, Bailit J, Branch DW, Burkman R, Gonzalez Quintero VH, Hatjis CG, Landy H, Ramirez M, VanVeldhuisen P, Troendle J, Zhang J. Respiratory morbidity in late preterm births. JAMA. 2010 Jul 28;304(4):419-25. doi: 10.1001/jama.2010.1015. PMID: 20664042; PMCID: PMC4146396.

[29]. Ballabh P. Intraventricular hemorrhage in premature infants: mechanism of disease. Pediatric research. 2010 Jan;67(1):1-8.

[30]. Dammann O, Leviton A. Maternal intrauterine infection, cytokines, and brain damage in the preterm newborn. Pediatr Res. 1997 Jul;42(1):1-8. doi: 10.1203/00006450-199707000-00001. PMID: 9212029.

[31]. Ehsan G., Fatemeh M., Fatemeh R. Neonatal Jaundice and Maternal and Neonatal Factors. Iranian Journal of Neonatology. 2016: 7 (1):1 http://ijn.mums.ac.ir/article_6663_9bb7af7d47aa91a1b565c95c961afe37.pdf

[32]. Narvey MR, Marks SD. The screening and management of newborns at risk for low blood glucose. Paediatrics & child health. 2019 Dec 9;24(8):536-44.

[33]. Cohen-Wolkowiez M, Moran C, Benjamin DK, Cotten CM, Clark RH, Benjamin Jr DK, Smith PB. Early and late onset sepsis in late preterm infants. The Pediatric

infectious disease journal. 2009 Dec 1;28(12):1052-6.
[34]. Cleaveland K. Feeding challenges in the late preterm infant. Neonatal Network. 2010 Jan 1;29(1):37-41.
[35]. Åkerström S, Asplund I, Norman M. Successful breastfeeding after discharge of preterm and sick newborn infants. Acta Paediatrica. 2007 Oct;96(10):1450-4.
[36]. Pereira-da-Silva L, Virella D, Fusch C. Nutritional assessment in preterm infants: a practical approach in the NICU. Nutrients. 2019 Aug 23;11(9):1999.
[37]. Berghella V, Saccone G. Fetal fibronectin testing for reducing the risk of preterm birth. Cochrane Database of Systematic Reviews. 2019(7).
[38]. Hubinont C, Debiève F. Prevention of preterm labour: 2011 update on tocolysis. Journal of pregnancy. 2011 Nov 15;2011.
[39]. Herbst A, Nilsson C. Diagnosis of early preterm labour. BJOG: An International Journal of Obstetrics & Gynaecology. 2006 Dec;113:60-7.
[40]. Di Renzo GC, Rosati A, Mattei A, Gojnic M, Gerli S. The changing role of progesterone in preterm labour. BJOG: An International Journal of Obstetrics & Gynaecology. 2005 Mar;112:57-60.
[41]. Haram K, Mortensen JH, Wollen AL. Preterm delivery: an overview. Acta obstetricia et gynecologica Scandinavica. 2003 Jan 1;82(8):687-704
[42]. King JF, Flenady V, Papatsonis D, Dekker G, Carbonne B. Calcium channel blockers for inhibiting preterm labour. Cochrane Database of Systematic Reviews. 2003(1).
[43]. Crowther CA, Hiller JE, Doyle LW. Magnesium sulphate for preventing preterm birth in threatened preterm labour. Cochrane Database of Systematic Reviews. 2002(4).
[44]. Jenkins TM, Troiano NH, Graves CR, Baird SM, Boehm FH. Mechanical ventilation in an obstetric population: characteristics and delivery rates. American journal of obstetrics and gynecology. 2003 Feb 1;188(2):549-52.
[45]. Mesas Burgos C, Svenningsson A, Vejde JH, Granholm T, Conner P. Outcomes in infants with prenatally diagnosed gastroschisis and planned preterm delivery. Pediatric surgery international. 2015 Nov;31(11):1047-53.
[46]. Cescutti-Butler L, Hemingway A, Hewitt-Taylor J. "His tummy's only tiny"–Scientific feeding advice versus women's knowledge. Women's experiences of feeding their late preterm babies. Midwifery. 2019 Feb 1;69:102-9.
[47]. Romero R, Gómez R, Chaiworapongsa T, Conoscenti G, Cheol Kim J, Mee Kim Y. The role of infection in preterm labour and delivery. Paediatric and perinatal epidemiology. 2001 Jul 1;15(s 2):41-56.
[48]. Clement PB, Zubovits JT, Young RH, Scully RE. Malignant mullerian mixed tumors of the uterine cervix: a report of nine cases of a neoplasm with morphology often different from its counterpart in the corpus. International journal of gynecological pathology: official journal of the International Society of Gynecological Pathologists. 1998 Jul 1;17(3):211-22.
[49]. Ayers JW, DeGrood RM, Compton AA, Barclay M, Ansbacher R. Sonographic evaluation of cervical length in pregnancy: diagnosis and management of preterm cervical effacement in patients at risk for premature delivery. Obstetrics & Gynecology. 1988 Jun 1;71(6):939-44.
[50]. Andersen HF. Transvaginal and transabdominal ultrasonography of the uterine cervix during pregnancy. Journal of Clinical Ultrasound. 1991 Feb;19(2):77-83.
[51]. Mahony BS, Nyberg DA, Luthy DA, Hirsch JH, Hickok DE, Petty CN. Translabial ultrasound of the third- trimester uterine cervix. Correlation with digital examination. Journal of ultrasound in medicine. 1990 Dec;9(12):717-23.
[52]. Cook CM, Ellwood DA. A longitudinal study of the cervix in pregnancy using transvaginal ultrasound. BJOG: An International Journal of Obstetrics & Gynaecology. 1996 Jan;103(1):16-8.
[53]. Iams JD, Johnson FF, Sonck J, Sachs L, Gebauer C, Samuels P. Cervical competence as a continuum: a study of ultrasonographic cervical length and obstetric performance. American journal of obstetrics and gynecology. 1995 Apr 1;172(4):1097-106.
[54]. Goldenberg RL, Iams JD, Mercer BM, Meis PJ, Moawad AH, Copper RL, Das A, Thom E, Johnson F, McNellis D, Miodovnik M. The preterm prediction study: the value of new vs standard risk factors in predicting early and all

spontaneous preterm births. NICHD MFMU Network. American journal of public health. 1998 Feb;88(2):233-8.

[55]. To MS, Alfirevic Z, Heath VC, Cicero S, Cacho AM, Williamson PR, Nicolaides KH, Fetal Medicine Foundation Second Trimester Screening Group. Cervical cerclage for prevention of preterm delivery in woman with short cervix: randomised controlled trial. The Lancet. 2004 Jun 5;363(9424):1849-53.

[56]. Zilianti M, Azuaga A, Calderon F, Pages G, Mendoza G. Monitoring the effacement of the uterine cervix by transperineal sonography: a new perspective. Journal of ultrasound in medicine. 1995 Oct;14(10):719-24.

[57]. Hertzberg BS, Kliewer MA, Farrell TA, DeLong DM. Spontaneously changing gravid cervix: clinical implications and prognostic features. Radiology. 1995 Sep;196(3):721-4.

[58]. Watson WJ, Stevens D, Welter S, Day D. Observations on the sonographic measurement of cervical length and the risk of premature birth. The Journal of Maternal- Fetal Medicine. 1999 Jan;8(1):17-9.

[59]. Taipale P, Hiilesmaa V. Sonographic measurement of uterine cervix at 18–22 weeks' gestation and the risk of preterm delivery. Obstetrics & Gynecology. 1998 Dec 1;92(6):902-7.

[60]. Fukami T, Ishihara K, Sekiya T, Araki T. Is transvaginal ultrasonography at mid-trimester useful for predicting early spontaneous preterm birth?. Journal of Nippon Medical School. 2003;70(2):135-40.

[61]. Conoscenti G, Meir YJ, D'Ottavio G, Rustico MA, Pinzano R, Fischer- Tamaro L, Stampalija T, Natale R, Maso G, Mandruzzato G. Does cervical length at 13–15 weeks' gestation predict preterm delivery in an unselected population?. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology. 2003 Feb;21(2):128-34.

[62]. Honest H, Bachmann LM, Coomarasamy A, Gupta JK, Kleijnen J, Khan KS. Accuracy of cervical transvaginal sonography in predicting preterm birth: a systematic review. Ultrasound in obstetrics & gynecology. 2003 Sep;22(3):305-22.

[63]. Rozenberg P. New markers of the risk of preterm delivery. Bulletin de L'academie Nationale de Medecine. 1998 Jan 1;182(7):1455-68.

[64]. Sur B, Misra S, Dash S. Evaluation of the anterior cervical angle of the uterus to predict spontaneous preterm birth. Int J Reprod Contracept Obstet Gynecol. 2017 Jun 1;6(6):2323-7.

[65]. Potijk MR, Kerstjens JM, Bos AF, Reijneveld SA, de Winter AF. Developmental delay in moderately preterm-born children with low socioeconomic status: risks multiply. The Journal of pediatrics. 2013 Nov 1;163(5):1289-95.

[66]. Crane JM, Hutchens D. Use of transvaginal ultrasonography to predict preterm birth in women with a history of preterm birth. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology. 2008 Oct;32(5):640-5.

[67]. Farras Llobet A, Higueras T, Calero IZ, Regincos Marti L, Maiz N, Goya MM, Carreras E. Prospective evaluation of the uterocervical angle as a predictor of spontaneous preterm birth. Acta obstetricia et gynecologica Scandinavica. 2020 Nov;99(11):1511-8.

[68]. Dziadosz M, Bennett TA, Dolin C, Honart AW, Pham A, Lee SS, Pivo S, Roman AS. Uterocervical angle: a novel ultrasound screening tool to predict spontaneous preterm birth. American journal of obstetrics and gynecology. 2016 Sep 1;215(3):376-e1.