TRANSVAGINAL ULTRASOUND FOR CERVICAL LENGTH MEASUREMENT IN SECOND TRIMESTER TO ASSESS RISK OF PRETERM DELIVERY

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By

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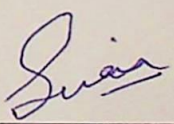
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No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Faculty of Allied Health Sciences, The Superior University, Lahore in partial fulfillment of the requirements for the degree of Master of Sciences in the field of **"Allied Health Sciences"** in Faculty of Allied Health Sciences at The Superior University, Lahore.

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DEDICATION

To,

My exceptional parents, family and adored siblings whose tremendous support and cooperation led me to this wonderful accomplishment.

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In the name of Allah, the most Gracious, the most Merciful.

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Abbreviations

Abbreviation	Full Form
ACOG	American College of Obstetricians and Gynecologists
AI	Artificial Intelligence
AIUM	American Institute of Ultrasound in Medicine
BPD	Biparietal Diameter
CL	Cervical Length
GA	Gestational Age
LUWT	Lower Uterine Wall Thickness
PTB	Preterm Birth
PTD	Preterm Delivery
ROC	Receiver Operating Characteristic
SMFM	Society for Maternal-Fetal Medicine
SPSS	Statistical Package for Social Sciences
TAS	Transabdominal Sonography
TVCL	Transvaginal Cervical Length
TVS	Transvaginal Sonography
TVU	Transvaginal Ultrasound
TVUS	Transvaginal Ultrasonography
UCH	University College Hospital

ABSTRACT

Background: Universally, preterm birth prove to be a major cause of morbidity and mortality in fetus. Transvaginal ultrasound (TVS) seems to be a significant approach to measure cervical length during the second trimester. It estimates the probability of spontaneous preterm birth.

Objective: To analyze the productiveness of transvaginal ultrasound (TVS) as a prognosis method to diagnose the risk of preterm birth by the measurement of cervical length in the mid trimester of pregnancy.

Methodology: A cross-sectional study with the enrollment of 80 pregnant females was designed in the Radiology and Gynecology departments of Services Hospital Lahore which aimed to evaluate any risk for preterm delivery with cervical length measurement in the second trimester of pregnancy. Enrolled women include second trimester of pregnancy having unexplained contractions, a history of pelvic pain and preterm delivery. TVS probe with high-frequency (5–10 MHz) was used to measure cervical length precisely. During procedure position of patient could be either lithotomy or semi-recumbent. Informed consent is mandatory before procedure.

Results: The study assessed cervical length measurements at 14, 21, and 28 weeks of pregnancy in 80 pregnant women. The mean cervical length steadily reduced from 34.85 mm at 14 weeks to 33.76 mm at 21 weeks and 32.97 mm at 28 weeks, with a notable depletion over time ($p < 0.001$). A strong positive correlation was observed between cervical length at 14 and 21 weeks ($\rho = 0.956$, $p < 0.001$) and at 14 and 28 weeks ($\rho = 0.947$, $p < 0.001$). A noticeable variation among cervical lengths throughout three measurements ($p < 0.001$, $\chi^2 = 80.00$) was confirmed with transvaginal ultrasound (TVS). Ultrasound report indicated that cervical length at 21 and 28 weeks was significantly shorter than at 14 weeks ($p < 0.001$).

Conclusion: The study predicts that the use of transvaginal ultrasound proved as an efficient tool for measurement of cervical length in the mid trimester and demonstrate the risk of preterm delivery. A noticeable shortening of cervical length was significantly related with a high risk of preterm delivery.

Keywords: Transvaginal ultrasound, cervical length, preterm birth, second trimester, obstetric ultrasound, pregnancy screening, preterm labor prediction.

Chapter 1

INTRODUCTION

Preterm delivery is a significant public health concern, impacting not only the newborn but also the mothers and healthcare systems. As previously noted, it is defined as the birth of an infant before 37 weeks of gestation. The Global Burden of Disease Study estimates that approximately 15 million infants are born preterm annually, accounting for nearly one in ten of all live births [1]. The implications of preterm birth extend well beyond immediate neonatal factors; preterm infants are at an increased risk for various complications, including respiratory distress syndrome, intraventricular hemorrhage, neonatal sepsis, and long-term disabilities such as cerebral palsy and learning difficulties [2].

Preterm birth is caused by a variety of risk factors that fall into three categories: behavioral, medical, and demographic. Demographic factors include maternal age, community, and socioeconomic status. For example, women younger than 20 or older than 35 are more at risk [3]. In medicine, women with the history of multiple pregnancies, preterm delivery or any other specific uterine abnormalities are more at risk [4]. Behavioral problems, poor prenatal care, substance abuse, and smoking can also lead to risk of preterm birth.

For the evaluation of risk probability of premature delivery, measurement of cervical length prove to be a reliable predictor. According to studies, reduced cervical length seemed as a strong predictor of preterm births. Several studies reveal that cervical length below 25mm in second trimester reflect a greater risk of premature birth [5, 6]. Healthcare providers are able to predict pregnancies at risk of preterm delivery with help of cervical length measurement and hence help to provide prompt therapies and intervention to delay delivery and also increase chance of better neonatal outcomes, this relationship provide a significant implementation for prenatal care [6].

Early diagnosis of preterm risk can be a part of prenatal treatment which can be possible by measuring cervical length routinely. Cervical cerclage or progesterone therapy is prove to be a protective measure to lower the risk of preterm delivery. Maternal and newborn outcomes can be improved by follows regular monitoring and

tailored management regimens [5, 6].

While cervical measurements, there are predictive factors that can also use to customize preventive interventions for pregnant women who are at risk. For example, cervical cerclage, an approach planned to avoid dilatation of cervix in early pregnancy and also to strengthen the cervix, can be suitable for women with cervical length shorter than 20mm in second trimester [7]. Moreover, progesterone treatment exhibits reduction of risk of premature delivery in women with shorter cervical length [8]. Cervical length measurement can also be important in public health to design an initiative for reduction of preterm births [7].

According to current clinical guidelines, women who have been recognized as high-risk for preterm birth especially those who have a history of multiple gestation, preterm deliveries in the past, or specific medical conditions, should routinely have their cervical length measured with TVUS. As part of a thorough risk assessment approach, the American College of Obstetricians and Gynecologists advises measuring cervical length between weeks 18 and 24 of pregnancy [28]. In order to lower the risk of preterm labor, an aberrant cervical length measurement may call for additional intervention, such as progesterone medication or the possibility of cervical cerclage [29].

One of trustworthy technique for measurement of cervical length is known to be transvaginal ultrasound but still there are some gaps and restrictions related to the procedure include nature of measurement, variations in ultrasound equipment settings, operator's expertise, and patient cooperation [10]. Furthermore, maternal obesity and hyper-tonic uterine actions are some factors which make difficult to examine cervix properly and make it tricky to measure precisely [6].

The importance of cervical measurement has been more foreground in recent research related to cervical insufficiency, known as a painless cervical dilatation that cause premature birth. It can be a difficult task to manage cervical insufficiency, especially women with previous obstetric experiences that leads to cervical incompetence. Cervical length monitoring can help with the right medical or surgical procedures, thereby averting preterm births that might otherwise cause serious health problems for the mother and the child [7].

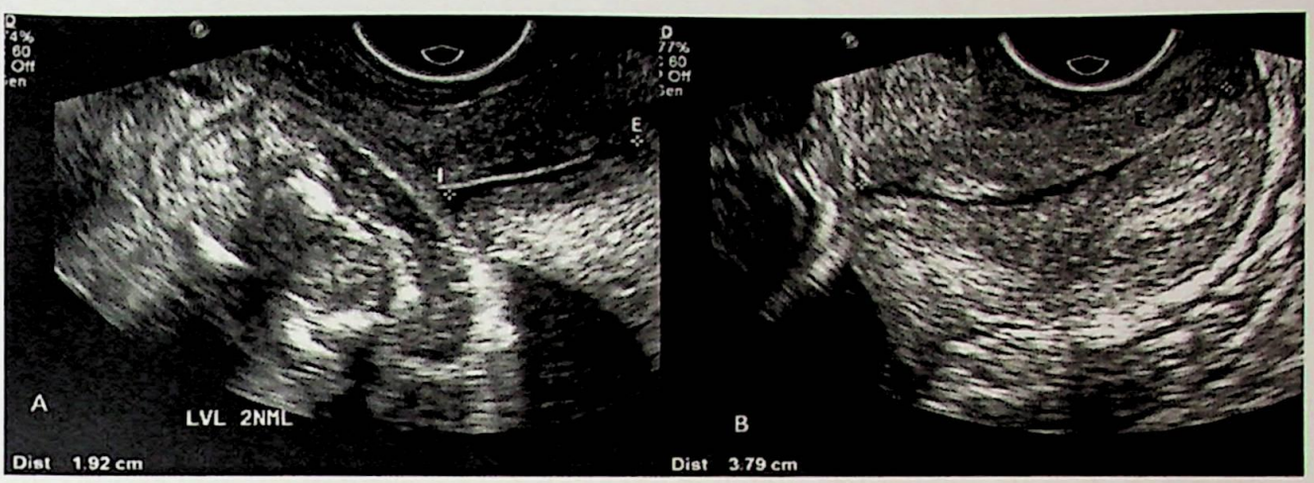


Fig 1.1: Cervical length (CL) is assessed using transvaginal ultrasound images that illustrate the measurement technique, which is taken from the internal os (I) to the external os (E). (A) Another pregnant woman at 19 weeks of gestation with a cervical length less than 25mm, delivered preterm before 37 weeks. (B) A pregnant woman at 20 weeks of gestation with a cervical length greater than 25mm, is subsequently delivered at term [8].

Ian Donald's in (1950s–1980s) initiate the use of ultrasound in obstetrics and innovative research create the first ultrasound images of the fetus in the late 1950. As compare to transabdominal ultrasound, transvaginal ultrasound was more reliable for thorough study of cervix. First transvaginal image was taken in 1980. It makes possible to assess cervical length more precisely, which is very essential when there's risk of preterm delivery. As transvaginal ultrasound (TVUS) supposed to be more capable than transabdominal ultrasound, it's graded as gold standard for cervical length measurement [10]. As second trimester starts, cervical changes can observe by using TVS which make possible to achieve appropriate interventions and to get suitable results for both maternal and fetus [11]. While using TVS applicably, overall observation regarding cervical morphology and preterm risk can be obtained thoroughly. To ensure precise and useful information specific protocols can follow while performing TVS. Patient position, measurement techniques and probe position are some variables that can impact greatly [6]. Proper training, technique and experience is crucial but necessary in order to minimize variability and improve the dependability of desired measurements [6].

Although, TVS is a safe and trustworthy procedure to obtain desirable measurements of cervix hence there are some key points to keep in mind while performing TVS that are technical confidence as well as patient comfort. To keep patient comfortable

and calm, it's important to guide a thorough procedure, sign consent and describe key points and purpose to perform TVS [12]. To make easy access for the transvaginal ultrasound, the patient must lie in the lithotomy position, which include her legs raised in stirrups while lying on back [13]. As cervix can give better view on empty bladder, it's important to void before scan [14].

A narrow, illuminated probe is inserted into the vagina as part of the procedure, giving a close-up picture of the cervix and enabling accurate measurements. There are various benefits to using TVUS for cervical length assessment, such as decreased artifact interference and enhanced internal os and cervical canal visibility [10].

High resolution ultrasound machine with TVS probe of 5-9MHz used for cervical measurement [15]. To mimic pain and better visualization an adequate amount of ultrasonic gel applied to the transvaginal probe [16]. Probe placed into vagina carefully to avoid any discomfort and pointed in direction of sacrum make possible to align cervix in order to obtain accurate measurements [17]. Probe rotation can provide sagittal view of cervix, helps to take precise measurement [18]. For better and accurate visualization and consideration cervix must cover 75% of screen, anterior and posterior lips thickness must be equal, endocervical canal and internal & external cervical os must be completely visible [19].

Internal os is an opening of cervix into uterus whereas external os is another cervical opening open into vagina. The cervical length measured from the internal os to the external os accurately [20]. Post procedure instruction include rest for a while to feel relaxed, there can be vaginal discharge in 24-hour hours due to gel applied on probe and a little discomfort for short time [24]. Follow-up appointments and procedures scheduled according to cervical measurement and preterm risk incidence [25]. Technological advancements in ultrasound have made improvement for measurement accuracy and image quality by including high-resolution probes and sophisticated ultrasound equipment, it made possible for medical professionals to do more accurately in-depth cervix examination [10].

As we are moving forward, the obstetrical ultrasound feels continuous achievements from advanced study and techniques, specifically regarding cervical measurement. Automated measurement systems and three-dimensional (3D) ultrasound is an advance technique and have potential to improve precision and reduce inter- and

intraobserver variation. In emergence with artificial intelligence (AI), advanced imaging modalities made easy for women to customize treatment according to their incidence of risk [30].

In future with expectations, studies will make possible to investigate through multi model strategies that combine cervical length measure with other supportive indicators to develop detailed risk assessment models so that it can help in more precise focusing on intervention. Prenatal care is most significant for obstetricians, they prioritize some necessary prevention like further increase and also validate monitoring of cervical length to lower the risks of preterm delivery, and improve outcomes for both mother and newborn fetus. Cervical length measurement is still a most concerned point of obstetrics which is still continue to develop [30].

Artificial intelligence-powered automated measurement systems are one recent development that encourages reliable and consistent cervical length measurements across various professionals and environments. Ultrasound technology that incorporates AI has the potential to further standardize procedures and reduce the unpredictability of manual measurements [26]. Incorporating three-dimensional (3D) ultrasound technology has allowed for more thorough evaluations of cervical anomalies and structure, as well as further insights into cervical morphology. The full cervical canal may be seen with 3D ultrasound, which improves the identification of abnormalities like funneling or cervical shortening that might put a patient at risk for preterm birth but are harder to spot with 2D imaging [27].

Predictive models improvement include cervical length with genetic, biochemical, and environmental components is probably the main object of future study. Moreover, research on the social factors of health and how they relate to preterm birth is becoming more popular since it's acknowledged that socioeconomic, cultural, and educational variables can have a great effect on maternal health and also health of fetus. Comprehensive intervention programs that have both medical and non-medical methods of prevent preterm birth may benefit from an understanding of these factors [31].

By enabling continuous monitoring and prompt intervention when risk factors are identified, the potential for remote monitoring of cervical length and other pregnancy-related variables through telemedicine and mobile health application

innovations may improve access to care as technology develops, especially for women in underserved communities [29]. Cervical length measurement has been widely included into obstetric guidelines and clinical practice due to its identification as a significant predictor of preterm delivery. American College of Obstetricians and Gynecologists (ACOG) recommend routine cervical length screening of women who have history of premature delivery or have any other associated factors as part of the comprehensive risk assessment [28].

Cervical length screenings have been used in a variety of ways around the world, but as more and more research demonstrate its therapeutic value, healthcare systems everywhere are beginning to integrate the procedure into standard care. In accordance with major public health community are concerned on maternal and neonatal health, the move to increase maternal health outcomes and reduce the rate of preterm delivery, seeking with evidence-based prenatal care. Moreover, healthcare providers are also optimizing healthcare costs and limit unsuccessful propaganda in low risk populations while making sure that higher risk females have right interventions for the measurement of cervical length as a screening tool for premature delivery [29].

Most of studies on cervical length consider only a single cervical length measurement made between weeks 14 and 28 of the second trimester. But the cervix is an adaptable structure that could alter throughout the pregnancy. For example, during the time some women may have abrupt cervical alterations that may signal an impending risk of preterm birth, others may experience sudden progressive cervical shortening. Because of lack of longitudinal data, timing and intensity of these alterations, and their consequences for preterm birth are not well defined. This gap in study restricts our ability to anticipate more accurately and to deal with preterm birth [30].

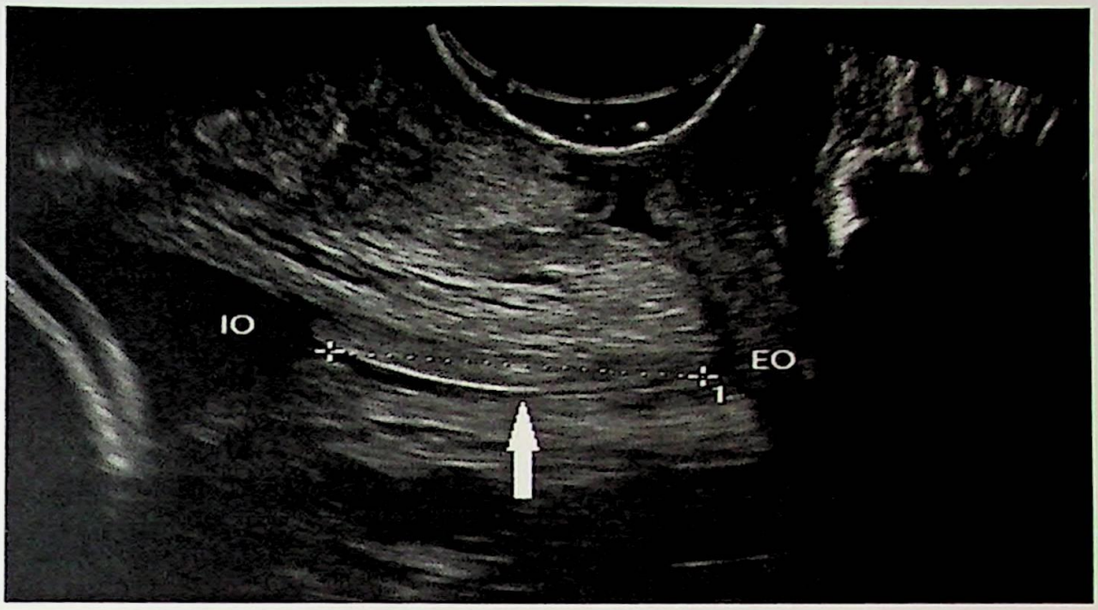


Fig 1.2. CL measurement in straight line technique [31].

Transvaginal ultrasonography in sagittal section. The cervix (arrow) is used as a guide to identify the internal (IO) and external (EO) os. The straight-line technique is presented (dashed line).

Effective identification and management of at-risk pregnancies is hampered by the widespread lack of systematic cervical length screening in many low- and middle-income settings. Furthermore, more research is required to create uniform protocols for cervical length evaluation due to differences in measurement methods and threshold values. By determining clinical value of cervical length measurement in a specific demographic and analyzing cervical length as a productive value for preterm delivery, this study seeks to add to the body of existing literature. This research aims to enhance maternal and newborn outcomes and guide clinical practice by identifying high-risk pregnancies early, thereby lowering the rate of preterm births.

Objective

To evaluate transvaginal ultrasound (TVS) as a functional technique for measurement of cervical length in prediction of the risk of preterm birth in the mid trimester of pregnancy.

Chapter 2

LITERATURE REVIEW

Olaniyan VR *et al.,* (2023) proposed a prospective cohort study for asymptomatic low-risk women who came in for a mid-trimester ultrasound scan between weeks 18 and 24 of pregnancy. This study includes 177 pregnant women at University College Hospital (UCH), Ibadan, where incidence of preterm delivery was 14.1%. Results demonstrated that 7.9% females had short cervical length. Positive predictive value of 44% and a negative predictive value of 97.3% have strong incidence for cervical length cut-off of less than 2.5 cm. The study showed a noticeable relation between cervical length and preterm delivery. This implies that short cervical length can be a good indicator of low-risk women because of large negative predictive value as well as of preterm birth. Early assessment of cervical length can have significant results to manage pregnancies which are at risk of premature delivery and for prompt therapies including cervical cerclage or progesterone supplementation. It's decisive to take extra risk factors to improve preventative measures and accuracy like history of preterm birth or preterm rupture of the membranes [33].

Shreya MS *et al.,* (2018) proposed a prospective observational study in a Karnataka tertiary care teaching institution on 180 pregnant women who were admitted to a labor room for labor induction. Study evaluates the precision of cervical length measurement is more reliable induction of labor through transvaginal ultrasound as compared to standard bishop score. The study include 180 women before 37 weeks of pregnancy was carried out at a tertiary care center in Karnataka. Both procedures were performed that are Bishop Scores and cervical length by transvaginal ultrasound used to predict induction results. Study indicated that there was noticeable success rate was seen in females with cervical length shorter than 2cm and having inductions for labor. Moreover, inductions were proven appreciable for all women having cervical length less than 2cm and Bishop score greater than 4. Study showed results in favor of transvaginal ultrasound than Bishop Score in terms of precise and accurate induction for labor [34].

Reddy SVG *et al.,* (2018) proposed a research to observe transvaginal ultrasound as good predictor of preterm delivery by measuring cervical length. The study include 134 women from which 50% women has history of preterm delivery and also shorter

cervical length that is less than 25mm. Transvaginal ultrasound gave 75% sensitivity, 95.2% specificity, and 94% overall accuracy, while diagnosis for risk of preterm delivery. As transvaginal ultrasound has less negative predictive value that is 98.43%, it's thought to be best predictor to evaluate chance of premature deliveries also. According to the study problems such meconium aspiration syndrome and birth hypoxia lead newborns to hospitalize in the neonatal ICU. It can be a useful step to perform transvaginal ultrasound in 16 to 24 weeks especially on high-risk females as it's a viable approach to confirm such fetal findings so that suitable intervention can be made timely [35].

Fouad K *et al.,* (2022) studied about predictive importance of cervical length measurement between 22 and 24 weeks of pregnancy for risk of premature delivery. About 200 females were involved in this study, among 150 were at high risk of preterm delivery. Cervical length of these women was assessed by using transabdominal as well as transvaginal ultrasound. This study showed that women with history of premature delivery and multiple abortions had high risk about three times more of preterm delivery. High-risk women had noticeably lower cervical lengths and a considerable risk factor for preterm labor. According to the study, cervical length measurement through transvaginal ultrasound in second trimester can help to track such high-risk preterm delivery and make possible to assist accordingly on time [36].

Goel M. *et al.,* (2023) proposed a prospective observational research. This research sought to determine how well transvaginal ultrasound measurements of cervical length can predict preterm birth. Study was conducted in a teaching hospital for tertiary care and last for a year. Pregnant women inclusion criteria depend on the women who were told about the procedure and gave their consent were included. Cervical length was measured using a 2D Mind Ray ultrasonography machine with a 7.5 MHz transvaginal probe and included women were monitored till birth. Mean gestational age 20.56 weeks was taken, 47% women were between 18 and 19 weeks. Measured cervical length was less than 2.5 cm. 65% women undergo premature delivery, 72% delivered normally and 22% women had caesarian section. 36% of infant weighed between 2.1 to 2.5 KGs. Study predicted that, it's useful to measure cervical length to identify any risk or to direct proper intervention. Transvaginal ultrasonography is a gold standard for screening procedure of pregnant women since

its more effective and reliable for diagnosis of cervical length between 18 and 24 weeks of pregnancy [37].

Raval BM. *et al.,* (2020) conduct a study for determination of efficacy of transvaginal ultrasound in measurement of cervical length in 16 to 24 weeks of pregnancy to predict preterm delivery. Study duration was from December 2018 to 2019 with participation of 150 pregnant women at SVPIMSR Hospital in Ahmedabad. Study purpose was to evaluate cervical changes including funneling, internal os dilatation, and cervical length. Results indicated 24% women experience preterm birth. Study demonstrated that transvaginal ultrasonography had a sensitivity and specificity of 80.5% and 94.73% respectively, whereas a positive and negative predictive value of 82.85% and 93.91% for measuring cervical length. Transvaginal ultrasounds suggest being very accurate and efficient mean to predict risk of preterm delivery. Transvaginal ultrasounds prove to be a significant procedure for early identification and management of pregnancy that are at risk of preterm as it's not only safe but also economical and objective. Study concluded that cervical length measurement through transvaginal ultrasound can greatly improve standard prenatal care in females with risk of preterm delivery [38].

Arora *et al.,* (2021) published a prospective study in the Indian Journal of Obstetrics and Gynecology Research to evaluate the predictive efficiency of transvaginal sonography (TVS) in low-risk pregnant women for preterm delivery in 2021. One hundred females were observed in the trial till delivery and have routine cervical evaluation through TVS during their pregnancy. Average cervical length was measured as 30±6.68 mm. Results showed that women with a cervical length lower than 25 mm had 51.72% risk of preterm delivery, whereas women having cervical length greater than 25 mm had 4.22% risk of preterm delivery. It was predicted that women who were more supposed to undergo preterm delivery was prominently highlighted in this study. Early detection of preterm birth or cervical length enable early identification for noticeable outcomes for both maternal and babies which make possible for prompt intervention and more focused prenatal care. Study suggests transvaginal ultrasound in all cases of prenatal care in order to improve better risk assessment [40].

Loke C *et al.,* (2022) conduct a study which highlights the cervical length and funneling as predictors of preterm delivery after assessment of their predictive value.

This prospective study enrolled pregnant women that were at high risk and have gestational age of 20 to 36 weeks. Transvaginal ultrasound using a GE Voluson 730 Pro probe was used to measure cervical length and funneling. Findings showed that 85% of females were belonged to lower socioeconomic backgrounds, and 53% of females were aged between 21 and 25years. In this study 72% of women had short cervical length and vaginal infections experienced preterm delivery and scheduled cases were about 75%. Women who had shorter cervical length experienced preterm delivery with 100% sensitivity, 97.3% specificity and positive predictive value of 92.5%. Moreover, cervical funneling predict preterm birth with 80% and 86.6% sensitivity and specificity respectively and also showed lower positive and negative predictive values. Findings of study suggested that cervical length and funneling are both reliable predictors of preterm delivery. These are highlighting the importance of early detection and treatment to minimize difficulties for both the maternal and the infant [41].

Kamran A *et al.,* (2022) In order to predict preterm delivery, a study was conducted for evaluating the accuracy of cervical length measurement using transvaginal ultrasonography (TVUS). 133 women with ascertain gestational age and to spot anomalies were involved in this study, women underwent regular assessments of cervix. Cervical length was measured at presentation and again four hours later. According the study premature delivery rate was 16 times more likely to occur in women with cervical length was less than 3 cm. For cervical lengths less than 3 cm, diagnostic accuracy measures positive predictive value of 73.16%, sensitivity of 85.48%, specificity of 73.24%, and 85.25% negative predictive value. According to this study, TVUS is a reliable tool for measurement of cervical length in prediction of preterm delivery, which enable to identify females with the risk of preterm delivery and also helps to direct management measures [42].

El-Baradie SM *et al.,* (2022) proposed a prospective cohort research from February to August to predict importance of cervical length for preterm delivery at Fayoum University Hospital. Study included 120 women with low risk of preterm birth and also were asymptomatic primigravida. Single line and double line both methods were used under transvaginal ultrasound to measure cervical length. According to the results, 12.5% that is 15 women of the 120 experienced preterm delivery. Study showed that women with shorter cervical length gave birth at before time that is

preterm as compare to that women who delivered at term. Cervical length and gestational age (GA) measured using the single-line technique showed a somehow a relatable connection ($r = 0.260$, $P = 0.004$), whereas the two-line technique showed a considerable correlation ($r = 0.716$, $P < 0.001$). The effectiveness of both CL measuring techniques in predicting preterm birth was validated by ROC curve analysis. The study confirms that cervical length measurement is a valuable tool to diagnose risk of preterm birth, more accuracy in preterm prediction could be achieve using other variables like obstetric history of women or maternal demographics [43].

Romero *et al.,* (2015) conducted a study to examine how well cervical length shortening in symptomatic women predicts spontaneous preterm birth. Singleton pregnant women who had symptoms of preterm delivery between weeks 22 and 34 weeks of pregnancy were included in this prospective cohort research. The shift in cervical length from an asymptomatic condition that is determined by an anatomic ultrasonography, to a symptomatic which were determined when signs of preterm birth combined, was the main goal of the study. They found that a noticeable increase in the progression of spontaneous preterm birth before 37 weeks, it was relating to a cervical length shortening of more than 10 mm. In particular, 21.2% was the rate of spontaneous preterm birth for women with cervical length less than 10mm. And about 5.3% women were those whose cervical length was shorter than 10mm. With an adjusted odds ratio of 4.71, this relation held true event after narrowing for variables including maternal age and prior spontaneous preterm birth. Its sensitivity and specificity were found as 47.8% and 83.9% respectively. Study concluded that cervical shortening more than 10mm could be a valuable predictor [44].

Peixoto *et al.*, (2016) research to find out whether measuring cervical length (CL) during a mid-trimester ultrasound can predict preterm birth in an unselected risk cohort study which include females before 32, 34, and 37 weeks of gestation. 751 singleton pregnancies between 20 and 24+6 weeks of gestation were included in this retrospective cohort research. The linear distance between the external and internal os was measured, and CL values were gained by using transvaginal ultrasonography. This study suggested that 2.7% of pregnancies had a short cervix of $\leqslant$25 mm, and 13.6% of females delivered preterm birth before 37 weeks. The measurement of CL and gestational age at birth showed a weak connection ($R2=0.01$, $P=0.002$). With

areas under the curve of 0.693, 0.472, and 0.490, respectively, the receiver operating characteristic (ROC) curve analysis evaluated that the CL measurement had a limited predictive capacity for preterm delivery before 32, 34, and 37 weeks of pregnancy. The study concluded that CL measurement screening from 20 to 24+6 weeks of pregnancy may not be fully good predictor of preterm delivery in an unelected group [45].

Hessami K *et al.,* (2024) the study sought to assess the risk of spontaneous preterm birth with or without universal transvaginal ultrasound cervical length screening during the mid-trimester scan. Individuals having singleton pregnancies between 16 and 25 weeks of gestation were included in eligible studies, which contrasted those who underwent cervical length screening with those who did not. Preterm birth before 37 weeks was the main outcome, and preterm birth before 34 and 32 weeks were the secondary outcomes. Eight studies totaling 447,864 pregnancies (213,064 screened and 234,800 unscreened) were included in the meta-analysis. Overall, spontaneous preterm birth rates before 37 weeks (odds ratio, 0.92 [95% CI, 0.84–1.01], P=.07) and 34 weeks (odds ratio, 0.87 [95% CI, 0.73–1.04], P=.12) were not significantly decreased by universal transvaginal ultrasound cervical length screening. Odds ratio: 0.84 [95% CI: 0.76–0.94], P=.002, however it was significantly linked to a decreased risk of spontaneous preterm birth before 32 weeks. Screening indicated a tendency towards lower risk before 32 weeks (odds ratio, 0.82 [95% CI, 0.66–1.01], P=.06) and significantly decreased the risk of spontaneous preterm delivery before 37 weeks (odds ratio, 0.88 [95% CI, 0.79–0.97], P=.01) for those without a history of spontaneous preterm birth. IN summary, compared to no screening, universal transvaginal ultrasound cervical length screening is linked to a significant decrease in spontaneous preterm birth before 37 weeks. This screening is usually conducted before 24 weeks in singletons who have never experienced a spontaneous preterm birth [46].

Chiossi *et al.,* (2018) performed a study on "Lower Spontaneous Preterm Birth Rates among Women with Threatened Preterm Labor," evaluated that how well cervical length measurement predicts and controls the risk of spontaneous preterm birth in women who present with risk of preterm labor. It was noticed that less than 10% of women gave delivery within seven days of presentation, it pays attention to the challenge of properly evaluate women who will give birth prematurely when uterine

contractions start. In order to target interventions like corticosteroids, magnesium sulfate, and maternal transfer to a perinatal center while avoiding needless treatments for those unlikely to deliver preterm, effective risk classification is essential for women having preterm contractions. The researchers correlated the cervical length measurement and fetal fibronectin testing that are two popular techniques for evaluating a woman's risk of preterm delivery if she had symptoms. When compare fetal fibronectin testing with cervical length measurement, cervical length measurement showed high productive precision with noticeably improved neonatal outcomes [47].

Li HR *et al.,* (2019) design a study to predict efficiency of lower uterine wall thickness (LUWT) and cervical length (CL) for preterm birth issue of the Chinese Medical Association Journal. In this prospective investigation Transvaginal sonography (TVS) was used to measure cervical length whereas transabdominal sonography (TAS) was used to measure lower uterine wall thickness in pregnant women whose are at risk of preterm labor. The results expressed a strong relation between short cervical length (less than 30 mm) and a higher risk of premature delivery. Even lower uterine wall thickness also related with preterm birth, cervical length result as more accurate predictor of preterm labor. Findings of study suggested that measuring cervical length is a useful method for the prediction of preterm delivery and addition of another measurement i.e., the thickness of the lower uterine wall can yield more detailed information and improvement in the prediction of overall accuracy. The study shows ultrasound measurements are so critical for controlling and predicting premature delivery, which proved to be a better outcome for pregnancies that are at risk [48].

Pedretti MK *et al.,* (2021) conduct research to assess rate of preterm deliveries in lower Western Australia. The regular measurements of cervical length during mid trimester of pregnancy is one of important components of this study, which initially shown reduction of preterm birth rates. The study was conducted to evaluate attitude and behavioral beliefs of Western Australian women regarding the use of transvaginal cervical length (TVCL) measurement to prevent premature delivery. A self-administered questionnaires was filled before and after their second trimester obstetric ultrasound. Researchers collected essential information on the demographics, health, and views of mothers regarding TVCL screening. In this study

maternal age range of pregnancy in Western Australia was appeared by the 598 women who took part. Refusing ratio was noted as only 2% of the 149 women who were offered. a transvaginal ultrasound (TVU), 1.5% having declined a TVS consent before but singed later on, and 5.7% expressed future worries about having a TVU, the overall study indicated a high acceptance rate for transvaginal imaging. Reasons for refusing TVCL included feeling uncomfortable with the operator and the operating procedure (22% at a prior TVU, 34.4% in the future), some of them want to talk about the procedure with their gynecologists first (11% in the past, 30.7% in the future), and other was unaware of procedure as they were not informed properly (11% in the past, 47.7% in the future). According to the results of study, TVCL screening for the prevention of preterm delivery was generally accepted by pregnant women after clear communication with them about procedure and its outcomes [49].

Weitzner O *et al.,* (2019) proposed a study to differentiate two crucial gestational measurement of cervical length at two different periods i.e., 14-16 weeks and 21-24 weeks which possibly could predict risk of preterm delivery. Pregnant females in this retrospective cohort research had performed transvaginal sonography firstly at 14–16 weeks and second scan at 21–24 weeks of gestation for two consecutive cervical length measures. The study examined both scans and the difference between these values to find out their relationship with preterm delivery. About 20 females (9.3%) of the 216 patients gave birth before the due date (<37 weeks) i.e., preterm delivery and 196 (90.7%) gave birth at term (≥37 weeks). Preterm delivery was not confirmed exactly with the first measurement CL1 ($p = .70$). But second measurement was noticeably effective in terms of predicting preterm birth risk which was generally decreased in some cases ($p < .05$). There was an important relation between preterm delivery and in variation of cervical length between the two scans ($p = .55$). The study concluded that the variation in between the first and second sonographic measurements of CL at 14–16 weeks are not much accurate predictor of preterm delivery. However, cervical length measurement at 21–24 weeks is a robust indicator of preterm delivery in low-risk women[50].

Souka AP *et al.,* (2019) performed a study to assess the viability and results of a uniform screening for preterm delivery (PTD) using mid-trimester cervical length (CL) measurement. Cervical length was measured in singleton pregnancies at 20–24 weeks of gestation by using transvaginal sonography in this retrospective cross-

sectional study. Some females were offered vaginal progesterone medication as their cervical length was 15mm or less. The study predicted the chance of spontaneous preterm delivery (sPTD) on the bases of measured cervical length and contrasted the PTD rates prior to and during the screening implementation of policy. Singleton pregnancies amount 10,506 with a decrease rate of 1.32% were include in the study. Before 32 weeks, the incidence of spontaneous preterm delivery was 0.51%, before 34 weeksthis incidence changed to 0.82% and for delivery before 37 weeks, was noted as 3.90%. The risk of sPTD prior to 34 weeks was 20.4% among women who underwent progesterone therapy and had a CL of 15 mm or less. A 20% decrease in the rate of PTD before 34 weeks compared to the prescreening era was observed after the implementation of mid-trimester CL assessment (odds ratio = 0.81; 95% CI, 0.59–1.13). It is possible and acceptable for pregnant women to undergo universal screening for PTD utilizing transvaginal sonographic assessment of CL at 20–24 weeks. A high-risk population that might profit from focused treatments is successfully identified by this policy [51].

Despite extensive research on the predictive value of cervical length measurement in preterm birth, several gaps remain in the existing literature. Many studies focus on high-risk pregnancies, limiting the generalizability of findings to low-risk populations. Additionally, while transvaginal ultrasound is widely recognized as the gold standard for cervical length assessment, variations in measurement techniques, gestational age at assessment, and threshold values for intervention create inconsistencies in clinical application. Most studies emphasize the role of cervical length as an isolated predictor, often overlooking the combined effects of other risk factors such as cervical funneling, maternal history, and inflammatory markers.

Furthermore, limited research has been conducted in diverse populations, particularly in low and middle-income countries, where access to routine transvaginal ultrasound remains a challenge. The lack of standardized screening protocols also leads to variability in clinical decision-making and intervention strategies. While cervical cerclage and progesterone therapy are established preventive measures, their effectiveness based on different cervical length thresholds remains unclear. There is also a need for longitudinal studies to assess the long-term neonatal outcomes associated with preterm birth prediction and management strategies. Cervical length measurement combined with additional predictive

biomarkers and well-designed, multicenter trials could fill these gaps, improve mother and neonatal health, and increase the accuracy of preterm birth prediction.

Chapter 3

METHODOLOGY

Research Design: This research was a cross-sectional study that will investigate the cervical length in the second trimester of pregnancy.

Clinical Settings: This study was designed in the department of Radiology and Gynecology in the Services Hospital Lahore.

Sample Size:

$N=Z^2p(1-p)$

d^2

Z=confidence interval (5%=1.96)

p=prevalence

d=margin of error (acceptable error level 5%=0.05)

N=80

Sampling Technique: A convenient sampling technique was used for data collection.

Duration of Study: This study was completed in four months after approval of the synopsis.

Selection Criteria:

Inclusion Criteria

- Women with 2nd trimester having history of preterm delivery.
- Pelvic pain and pelvic fullness.
- Unclear contractions.

Exclusion Criteria

- Women whose third trimester start have a high risk of preterm delivery.
- Women who refused to sign consent.

Equipment:

Transvaginal probes on ultrasound machines have a frequency range of 55MHz.Compared to abdominal ultrasound probes, the 5–10 MHz frequency range is higher, enabling improved resolution of nearby structures. For comprehensive imaging of the ovaries, uterus, cervix, and other pelvic tissues, this frequency range is ideal. High-resolution images from higher frequency probes, such as those in the 5–10 MHz range, are essential for accurate measurements and thorough anatomical evaluation. Because of this, they are very useful for cervix evaluation and early pregnancy monitoring [54].

Technique: With the transvaginal ultrasound procedure, pictures of the pelvic organs are obtained by inserting a specialized ultrasound probe into the vagina. This is a broad synopsis of the process:

- **Preparation:** To enhance image clarity, the patient could be urged to empty her bladder prior to the procedure.
- **Insertion of the Probe:** A transvaginal ultrasonography probe that has been lubricated and sterilized is carefully placed into the vagina. This probe can go closer to the pelvic organs since it is longer and smaller than exterior probes.
- **Imaging:** By sending out high-frequency sound waves, the probe creates detailed images on a monitor that reflect off inside structures. To get different perspectives of the uterus, ovaries, and cervix, the technician or doctor adjusts the probe.
- **Assessment:** The images are used to assess the anatomy of the pelvic organs, monitor fetal development, evaluate the cervix, and identify any abnormalities.
- **Completion:** Following imaging, the patient can return to their regular activities after the probe is carefully removed.

In addition to producing crisp images and being typically well-tolerated, the treatment is helpful for identifying pelvic problems, tracking cervical length, and evaluating early pregnancy [54, 55].

Ethical Considerations

The rules and regulations set by the ethical committee of Superior University, Lahore were followed while conducting the research, ensuring that the rights of the research participants were respected.

- Written informed consent was obtained from all participants.
- All information and data collected were kept confidential, and participants remained anonymous throughout the study.
- The subjects were informed that there were no disadvantages or risks associated with the procedure of the study.
- They were also informed that they were free to withdraw at any time during the study without any consequences.
- There were no known risks associated with this research.
- There were no direct benefits to the participants resulting from their participation in this study.
- Every effort was made to protect participants' privacy, and their identities were not revealed in any publication resulting from this study.
- Participation in this research was voluntary. Participants had the right to decline participation or withdraw their consent at any time without any penalties.

Data Collection Procedure

The data collection procedure for this study involved the recruitment of eligible patients who were scheduled for ultrasound. A high-frequency transvaginal transducer, typically ranging from 5 to 10 MHz, was used to assess cervical length. The patients were asked to empty their bladders to improve visualization and comfort. They were then lie in the lithotomy position or with slightly bent knees in a semi-recumbent position, similar to a standard gynecological examination. Gently probe inserted into vagina for the assessment of the measurement of cervical length [56]. Informed consent was obtained from participants before procedure, and relevant demographic and clinical information was collected through interviews and medical records.

Data Analysis

The collected data was compiled and analyzed using the Statistical Package for Social Sciences (SPSS) version 26. The mean cervical length was calculated, and statistical analysis were performed using a spearmen's rho, Friedmann and Wilcoxon sign rank test. These statistical methods were used to determine significant associations and variations in cervical length during the second trimester of pregnancy.

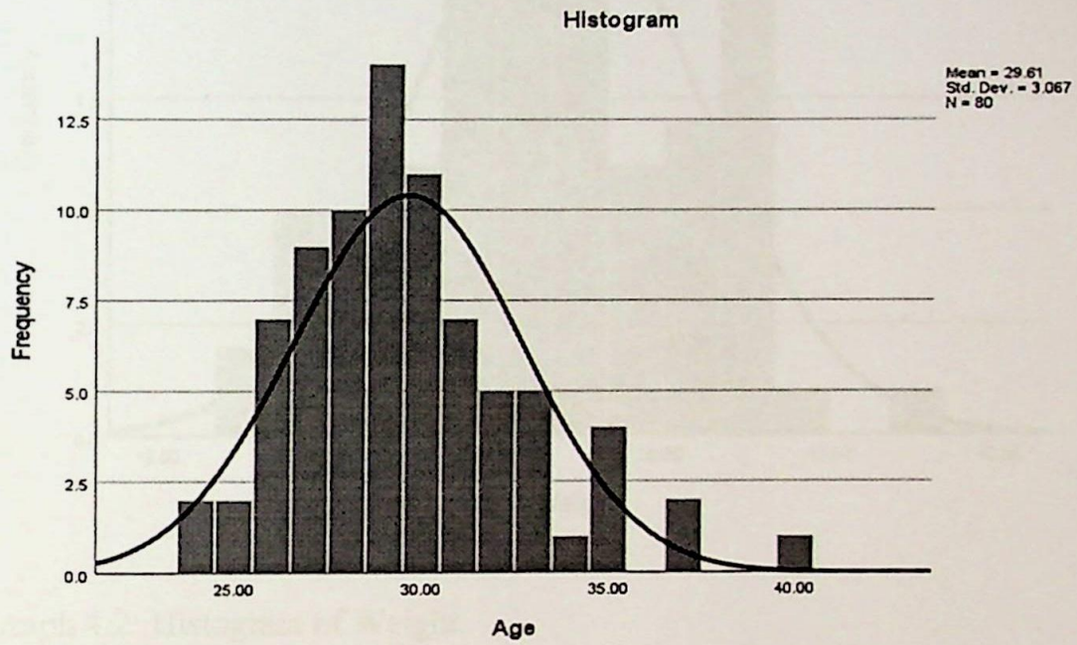
Gantt Chart

Activity		Months		
	Sep24	Oct24	Nov24	Dec24
Data collection				
Data analysis and interpretation				
Thesis presentation and submission				

Chapter 4

RESULTS

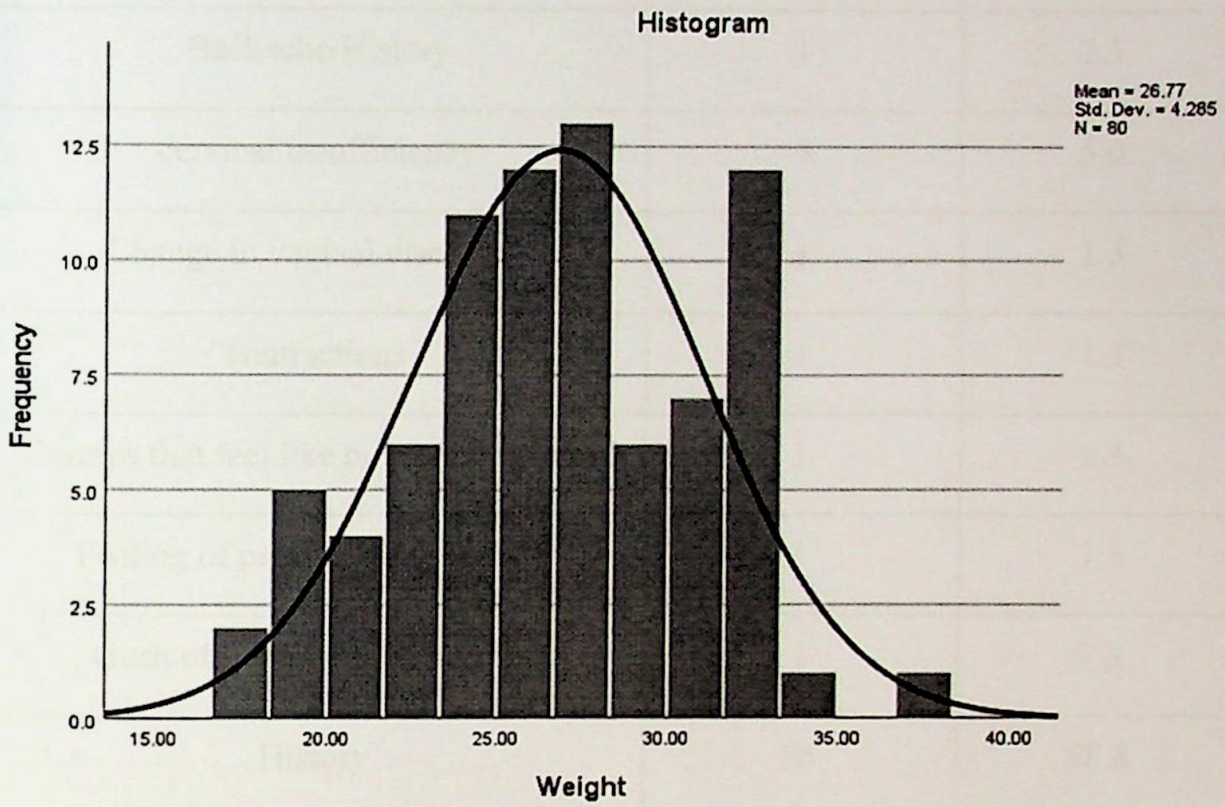
4.1. Demographics of Age



Graph 4.1: Histogram of Age

The age of participants in this study ranged from 24 to 40 years, with a mean age of 29.61 ± 3.07 years. This relatively narrow range suggests that the sample was fairly homogeneous in terms of age distribution, reducing the likelihood that age-related biological variation significantly influenced the outcomes. The histogram (Graph 4.1) shows a mild clustering of participants in their late twenties to early thirties, reflecting a typical reproductive age group for the study population.

4.2. Demographics of Weight



Graph 4.2: Histogram of Weight

Participant weights ranged from 18 kg to 37 kg, with a mean weight of 26.77 ± 4.29 kg. The relatively low weight range is consistent with the demographic and possibly nutritional profile of the studied population. The distribution curve in Graph 4.2 suggests a moderate spread, with most participants' weights falling near the mean, indicating that extreme weight variations were uncommon in this sample.

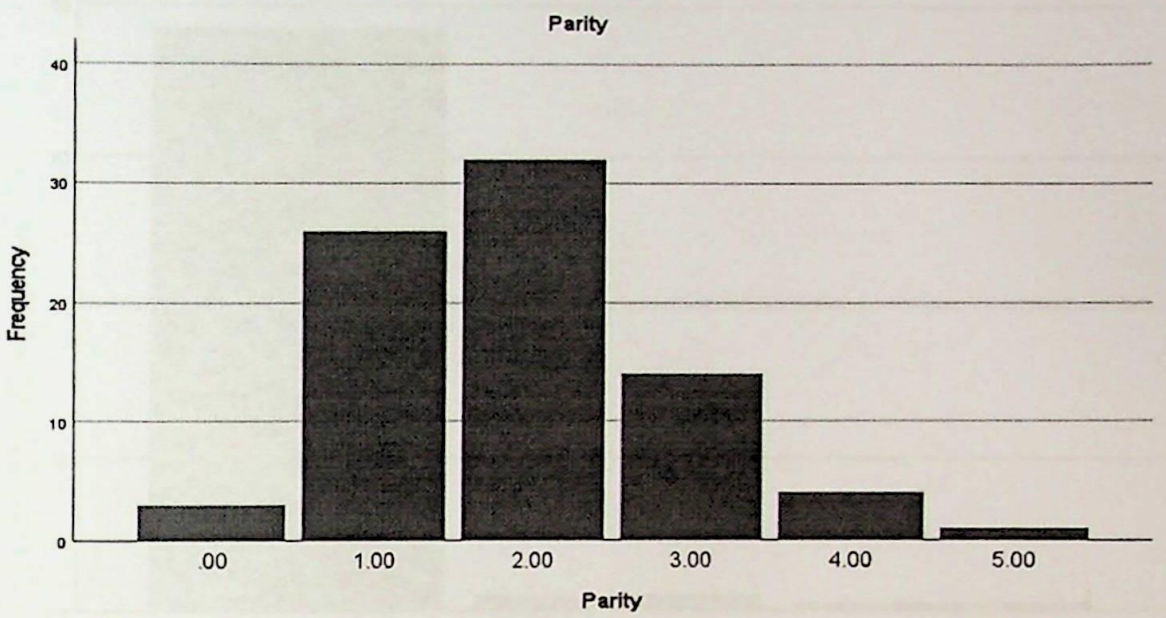
4.3. Descriptive of Clinical Symptoms/Complications

	Frequency	Percent
Backache/History	1	1.3
cervical insufficiency	4	5.0
Change in vaginal discharge	1	1.3
contractions	1	1.3
Cramps that feel like menstrual cramps	1	1.3
Feeling of pressure in the pelvis	1	1.3
Gush of fluid from the vagina	1	1.3
History	55	68.8
History/cervical insufficiency	3	3.8
Low, dull backache	1	1.3
menstrual-type cramps	1	1.3
Menstrual-type cramps	1	1.3
Mild belly cramps	1	1.3
pressure in the lower belly	1	1.3
Pressure in the lower belly	2	2.5
Regular or frequent feelings of belly tightening	1	1.3
Tightening of the uterus/History	1	1.3
vaginal spotting	1	1.3

Vaginal spotting	2	2.5
Total	80	100.0

Table 4.1 presents the range of presenting symptoms and complications reported by participants. The most frequent finding was a prior history of pregnancy-related complications (68.8%), suggesting a high-risk population. Cervical insufficiency was the second most common complication (5.0%), while all other symptoms—such as pelvic pressure, vaginal spotting, contractions, and menstrual-type cramps—were reported by only 1.3% to 3.8% of participants. This distribution highlights that while a majority had a prior adverse obstetric history, acute symptoms at the time of assessment were less common. It also suggests that early identification and surveillance were likely a focus for this group.

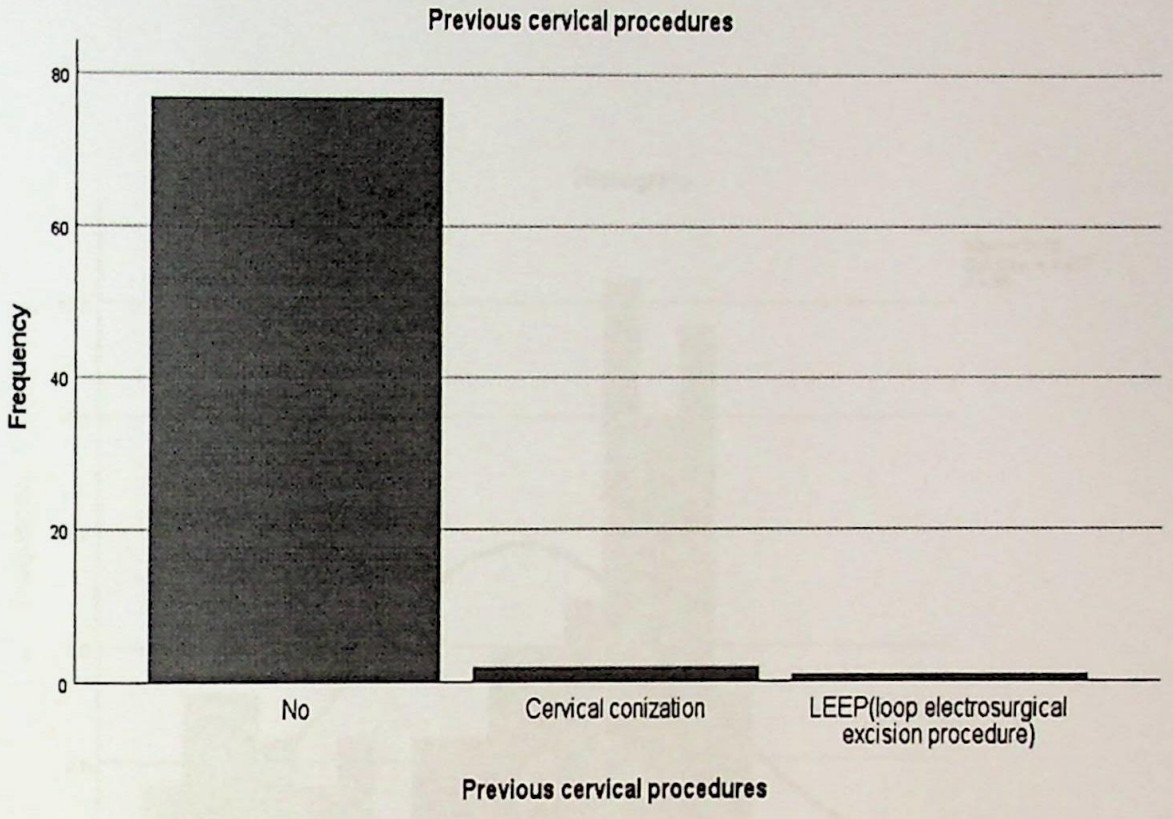
4.4. Descriptive of Parity



Graph 4.3: Bar charts of parity

Parity levels varied across the sample, with the most common being two previous births (40.0%), followed by one previous birth (32.5%). 3.8% of females were nulliparous, and 1.3% females reported as five previous births. This distribution showed that the majority of participants were multiparous, and many of the participants had at least two prior pregnancies, which may have effect on their risk profile for cervical changes.

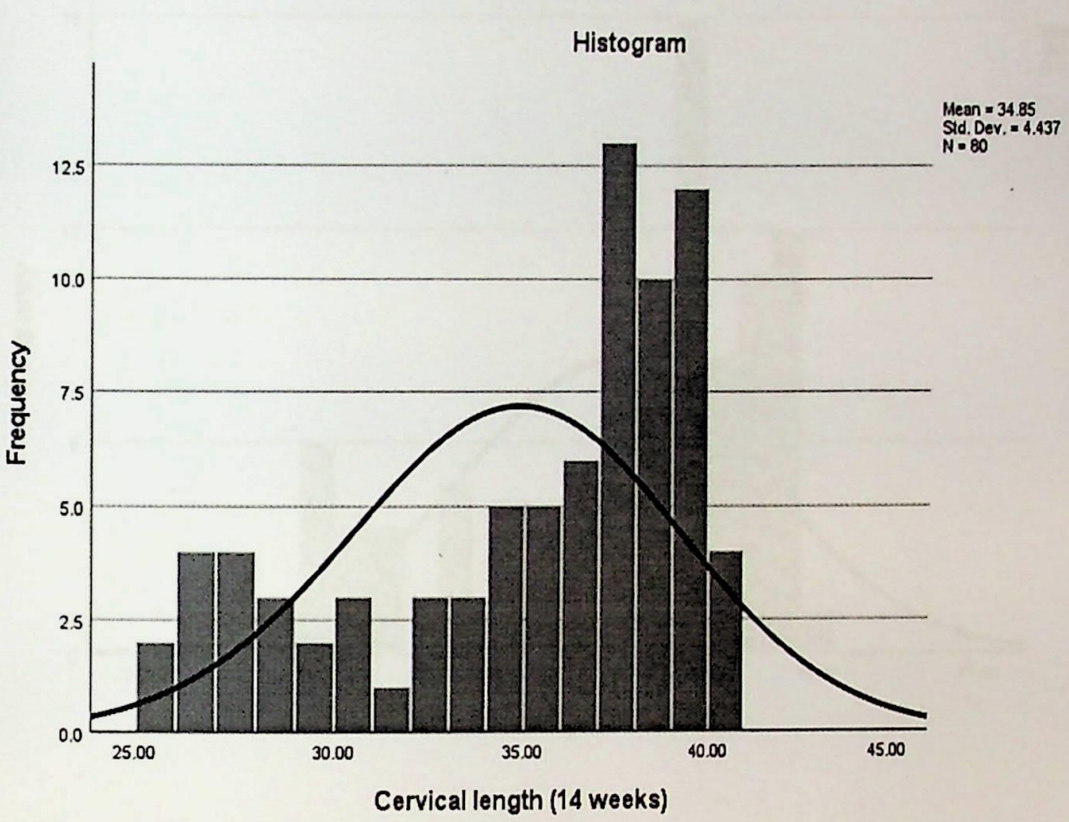
4.5. Descriptive of previous cervical procedures



Graph 4.4: Bar charts of previous cervical procedures

A majority 96.3% of participants reported as no history of any cervical surgical procedures, like conization or LEEP. Only two females (2.5%) had undergone for cervical conization, and one participant (1.3%) had undergone LEEP. This showed that, majorly, surgical intervention for cervical pathology was uncommon and cervical length variations were unlikely to be primarily related to prior procedures.

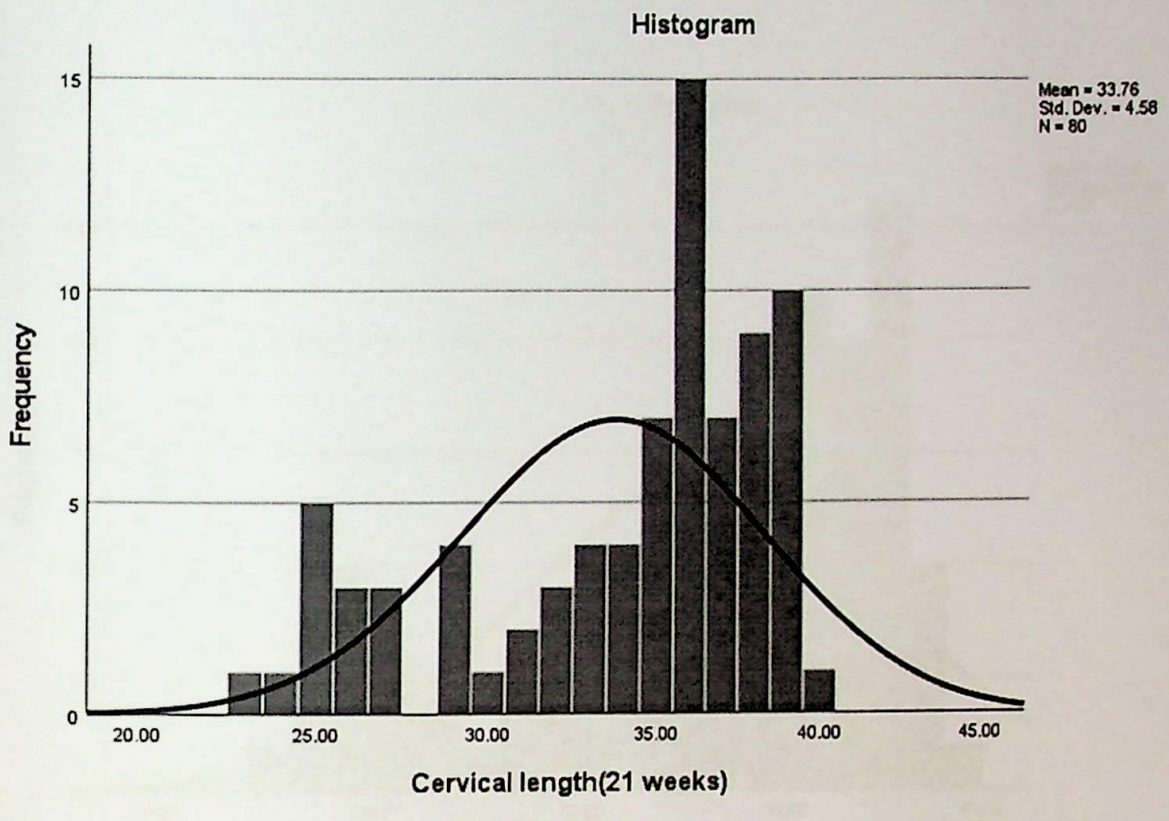
4.6. Descriptive of Cervical length (14 weeks)



Graph 4.5: Histogram of cervical length (14 weeks)

At 14 weeks of pregnancy, the mean cervical length was measured as 34.85 mm, with a median of 36.50 mm and a standard deviation noted as 4.44 mm. These values showed normal mid-pregnancy cervical length values which suggested that the majority of pregnant females had a structurally adequate cervix at this stage. The histogram shows a slight skew toward longer lengths, which may indicate good baseline cervical competence.

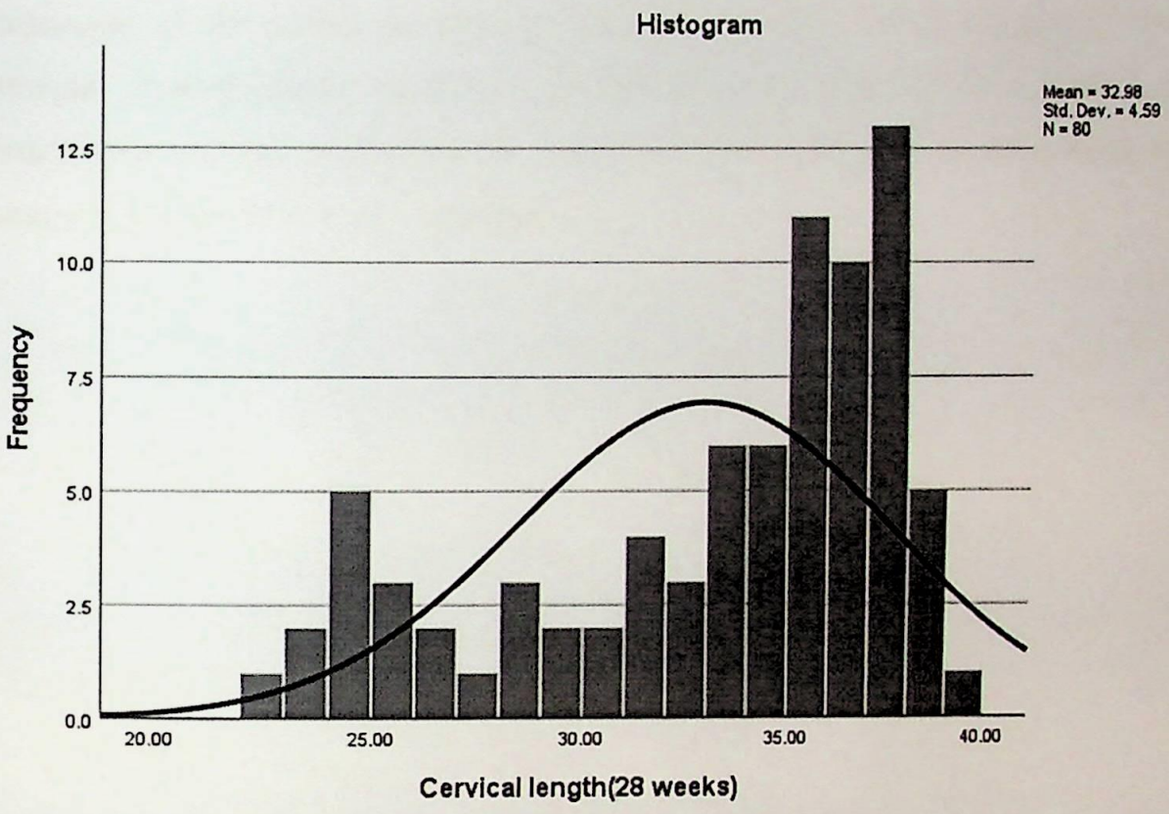
4.7. Descriptive of Cervical length (21 weeks)



Graph 4.6: Histogram of cervical length (21 weeks)

By 21 weeks, the mean cervical length had decreased to 33.76 mm, with a median of 35.50 mm. While still within the normal range, this reduction reflects the physiological shortening that occurs as pregnancy advances. The change from 14 weeks is minimal, suggesting a gradual process rather than an abrupt shortening in the second trimester.

4.8. Descriptive of Cervical length (28 weeks)



Graph 4.7: Histogram of cervical length (28 weeks)

At 28 weeks, the mean cervical length had further decreased to 32.98 mm (median 34.75 mm). This progressive decline over the three measured intervals is consistent with normal pregnancy-related cervical remodeling. However, the degree of shortening remained within expected limits, indicating that pathological shortening was not prevalent in the sample.

Pairwise comparisons revealed a statistically significant reduction in cervical length between all measured intervals: from 14 weeks to 21 weeks ($p < 0.001$), from 14 weeks to 28 weeks ($p < 0.001$), and from 21 weeks to 28 weeks ($p < 0.001$). Nearly all participants demonstrated negative rank changes, indicating a consistent shortening of the cervix as pregnancy progressed. The minimal number of "ties" between measurements suggests that this reduction occurred in a gradual yet measurable manner, reflecting the normal physiological cervical remodeling that takes place over the course of gestation.

Chapter 5

DISCUSSION

This study designs to find out the transvaginal ultrasound (TVS) as a productive technique for the measurement of cervical length during the mid-trimester of pregnancy for the evaluation of the risk of preterm delivery. The study results indicate that average age of included pregnant females was 29.61 years, with a mean weight of 26.77KG. The most common clinical symptom was a history of any complication related to obstetrics reported by 68.8% of females, while 96.3% had no history of cervical procedures. Continuous decrease of cervical length is observed throughout the mid trimester i.e., mean values are 34.85 mm at 14 weeks, 33.75 mm at 21 weeks, and 32.97 mm at 28 weeks, it provide a strong evidence of physiological shortening of cervix during second trimester of pregnancy.

Throughout the time cervical length measurements showed significant changes ($p < 0.001$) in accordance with transvaginal ultrasound reports. Age and parity reveal a significant relation($r = 0.400$, $p = 0.000$) express a strong positive relationship among cervical length measures at different gestational ages. These results highlight how critical it is to measure cervical length in order to evaluate any possible hazards and the course of a pregnancy, especially for women who have history of problems.

Cho and Roh (2016) studied the relationship between transvaginal and transabdominal ultrasound for evaluation of cervical length as well as their capability to predict risk of premature delivery. According to their research, transvaginal sonography (TVS) proved to be the more reliable technique for accurate measurement of cervical length, as both techniques produced results that were comparable [56]. Comparatively, study shows the predictive advantage of TVS in the assessment of pregnant women who are at risk of preterm delivery and supports its efficiency in the measurement of cervical length. By this consistency the utility of TVS as a standardized technique for predicting cervical competency during pregnancy suppose to a great supporting tool.

Hessami *et al.* (2024) a systematical review and meta-analysis on spontaneous preterm birth was performed in order to evaluate the effect of cervical length measurement. They predict the conclusion that timely interventions, routine cervical

length screening impressively lowers the rate of premature births [57]. In a same manner, study showed that measurements taken from TVS at multiple stages of pregnancy provide significant information on cervical changes which can help to predict risk assessment. These outcomes suggested the importance of cervical length measurement in standard obstetric care for the betterment of pregnancy outcomes.

Ho *et al.* (2021) proposed a study to predict efficiency of measuring cervical length measurement in females who are at risk of preterm labour. According to their results, cervical length insufficiency at 21 to 28 weeks leads to preterm delivery which showed the importance of cervical length measurement [58]. In another way, research predict a significant relation between cervical length at 14, 21, and 28 weeks, with gradual decrease in cervical length as a key factor for premature delivery. The significance of continuous cervical length measurement for pregnancy management is further supported by the outcomes obtained by this study.

Hughes *et al.* (2016) studied the significance of cervical length in the prediction of sudden preterm birth in singleton pregnancies having high risk and they find that cervical shortening before 24 weeks considerably increase the risk of preterm delivery [59]. Our research approximately provide a same picture that cervical length shortening is associated with high preterm birth risk between 14 and 28 weeks. This alignment showed the significance of cervical length as a biomarker to predict preterm birth, especially when it comes to high risk population.

Luechathananon *et al.* (2021) suggested the predictive power of cervical length in relation to uterocervical angle in risk of preterm labour. A study showed that, a shorter cervix and a wider uterocervical angle increase precision to predict risk [60]. However our study, only suggested that cervical length is a strong predictor and determined a robust relationship between the risk of preterm birth and cervical shortening and this implies that adding uterocervical angle in ultrasound data is more likely to enhance risk assessment models even more accurately.

Peng *et al.* (2015) proposed a comparative assessment to predict the accuracy of transabdominal cervical length with TVS in a low-risk obstetric population. They specified that tranvaginal ultrasound is more likely reliable tool for assessment of cervical length as compare to transabdominal [61]. This study showed that TVS measurement is a most effective tool in monitoring changes in cervical length during

pregnancy. The superiority of transabdominal ultrasound in the assessment of cervical integrity, especially in anticipating preterm labour, is further supported transvaginal ultrasound.

Rācene *et al.* (2025) assess at the clinical variables and characteristics of the ultrasound that affect nulliparous women's capacity to influence labour successfully. They declared number of variables which include cervical length, were essential in the prediction of the course of labour [62]. Our study suggested that cervical length provide a significant support in obstetric care as it's an important predictor of the risk of preterm labour. Study showed that cervical length measurement has wider clinical predictor to assess premature birth.

Sethumadhavan *et al.* (2017) composed a study on predictive value of transvaginal cervical length measurement in terms to assess preterm labour in low-risk women. According to the study, a shorter cervical length generally increase the risk of preterm delivery, even though there's a low risk of preterm birth [63]. Similarly, study revealed a strong relashionship between the risk of preterm delivery and cervical length at different gestational ages. Study suggested to take account for cervical length monitoring even if there's a low risk preterm delivery.

Tajeran *et al.* (2024) propose a study to predict outcomes of preterm delivery while assessing the efficiency of cervical length and cervical angle ultrasonography. Study suggest cervical length as one of the most important factor effecting the initiation of preterm delivery [64]. Contrarily, this study also suggested correlation between preterm delivery and cervical length measurement. This study proves cervical length measurement as pregnancy outcome predictor.

Vasudeva *et al.* (2024) proposed a study to show a comparison of TVS-guided cervical strain elastography with cervical length measurement for the prediction of preterm delivery. Study discovered that elastography offered extra predictive value in high-risk pregnancies [65]. This study suggested strong relation with the risk of preterm birth despite only using cervical length measurement. This study suggested that elastography is more recent and reliable imaging method to measure cervical length more accurately.

Chapter 6

CONCLUSION

This study elaborate that transvaginal ultrasound (TVS) is one of productive method to assess cervical length in second trimester for the risk prediction of preterm delivery. A noticeable reduction in cervical length all over the period and its strong relation across various gestational ages showed consistently discovery of the course of pregnancy. In the recognition of high risk pregnancies, frequent TVS monitoring allows proper measures to lower the risk of preterm.

Limitations

- The study was conducted on a limited number of participants, which may affect the generalizability of the findings to a larger population.
- Data was collected from a single healthcare facility, potentially introducing selection bias and limiting the applicability of results across diverse populations.
- The study only assessed cervical length at specific gestational weeks without tracking pregnancy outcomes, such as actual preterm births.

Recommendations

- Future studies should involve a larger and more diverse population to enhance the statistical power and generalizability of findings.
- Conducting the study across multiple healthcare settings will help validate the effectiveness of TVS in different demographic and clinical conditions.
- Future research should track pregnancy outcomes to establish a stronger correlation between cervical length and actual preterm delivery rates.

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CONSENT FORM

Description of the Research and Your Participation

You are invited to participate in a research study conducted by Samia Shahzadi (SU91-MSAHW-S23-156) for Master of Science in Allied Health Sciences. Session (2023-2025) on the topic **"TRANSVAGINAL ULTRASOUND FOR CERVICAL LENGTH MEASUREMENT IN SECOND TRIMESTER TO ACCESS RISK OF PRETERM DELIVERY"**

Risks and Discomforts

There is no risk to patient.

Protection of Confidentiality

We will do everything to protect your privacy. Your identity will not revealed in any publication resulting from this study.

Voluntary Participation

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate any time. You will not be penalized in any way should you decide not you participate or to withdraw from this study.

CONSENT

I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study.

Participant's Signature _____Date: _____

A copy of this consent form should be given to the participant.

SUPERIOR UNIVERSITY

تحقیق میں شرکت کا دعوت نامہ

حمل میں سروائیکل لمبائی کی پیمائش کے لیے ٹرانس ویجینل الٹراساؤنڈ

حمل میں سرویکل لمبائی کی پیمائش کے لیے ٹرانس ویجائنل الٹراساؤنڈ تحقیق کے لیے رضامندی فارم

محترمہ/محترم،

آپ کو ہمارے تحقیقی مطالعے میں شرکت کی دعوت دی جاتی ہے۔ اس تحقیق کا مقصد حمل کے دوران سرویکل لمبائی کی پیمائش کے لیے ٹرانس ویجائنل الٹراساؤنڈ کے طریقہ کار کی مؤثریت کا جائزہ لینا ہے۔

تحقیق کا مقصد

اس مطالعے کا مقصد یہ جانچنا ہے کہ ٹرانس ویجائنل الٹراساؤنڈ کے ذریعے سرویکل لمبائی کی پیمائش کس حد تک درست اور مؤثر ہے، اور یہ حمل کی نگرانی اور پیچیدگیوں کی پیش گوئی میں کس طرح معاون ہو سکتی ہے۔

مطالعے میں آپ کی شرک

اگر آپ اس مطالعے میں شامل ہونے کا انتخاب کرتے ہیں تو آپ کو درج ذیل اقدامات کی پیروی کرنی ہوگی

ٹرانس ویجائنل الٹراساؤنڈ کے ذریعے سرویکل لمبائی کی پیمائش کی جائے گی۔

آپ کو حمل کے دوران مختلف مواقع پر الٹراساؤنڈ کے لیے بلایا جا سکتا ہے۔
مطالعے کی مدت کے دوران آپ کی صحت اور حمل کی صورتحال کی نگرانی کی جائے گی۔

فوائد

اس مطالعے میں شرکت کے ذریعے آپ کو درج ذیل فوائد حاصل ہو سکتے ہیں

حمل کی بہتر نگرانی -

سرویکل لمبائی کی درست پیمائش -

ممکنہ پیچیدگیوں کی بروقت شناخت -

خطرات

اگرچہ ٹرانس ویجائنل الٹراساؤنڈ ایک محفوظ طریقہ کار ہے، اس کے باوجود کچھ ممکنہ خطرات ہو سکتے ہیں

ہلکی بے آرامی یا تکلیف -

نایاب صورتوں میں، ہلکا خون آنا -

رازداری

آپ کی فراہم کردہ تمام معلومات کو خفیہ رکھا جائے گا اور انہیں صرف تحقیق کے مقصد کے لیے استعمال کیا جائے گا۔ آپ کی شناخت کو محفوظ رکھنے کے لیے تمام ضروری احتیاطی تدابیر اپنائی جائیں گی۔

آپ کی مرضی

یہ آپ کا حق ہے کہ آپ اس تحقیق میں شرکت کریں یا نہ کریں۔ آپ کے انکار کا آپ کی طبی دیکھ بھال پر کوئی منفی اثر نہیں ہوگا۔

رضامندی

میں تصدیق کرتا/کرتی ہوں کہ مجھے اس تحقیق کی وضاحت کی گئی ہے، اور میں نے اس کے فوائد اور ممکنہ خطرات کو سمجھ لیا ہے۔ میں رضامندی دیتا/دیتی ہوں کہ میں اس تحقیق میں شرکت کروں۔

دستخط : _____

نام : _____

تاریخ : _____

QUESTIONNAIRE FORM

Patient information:				
Pt. Name:				
Age:		Contact no.		
Email:				
Section 1: General Information				
Gestational Age at Time of Ultrasound:	14-16	17-20	21-24	
How many times have you undergone transvaginal ultrasound during this pregnancy?				
One	2-3	More than 3		
Have you experienced any of the following symptoms in this pregnancy?				
Vaginal bleeding	Pelvic pain	Contraction	Discharge	None
Have you ever undergone any cervical procedures?				
Yes	No			
If yes, (specify):				
Have you ever faced pregnancy complications previously?				
Yes	No			
If yes, (specify):				
Section 2: Cervical Length Measurement				
Was the cervical length measured during your transvaginal ultrasound?				

Yes		No	
If yes, what was the measured cervical length?			
Less than 20mm	25-30mm	More than 30mm	Not sure
How was the result of your cervical length measurement explained to you?			
Risk of preterm delivery	Normal		Not discussed
In case of first TVS scan,			
First scan	Date:	Measurements:	
Comment:(if any)			
Second scan	Date:	Measurements:	
Comment:(if any)			
Third scan	Date:	Measurements:	
Comment:(if any)			
Section 3: Risk Assessment and Management			
Have you been prescribed any treatment or intervention based on the cervical length measurement?			
Yes:(please specify) _____		No	
Section 4: Additional Comments			
Do you have any additional comments or concerns regarding the cervical length measurement and its impact on your pregnancy management?			
(Specify please):			

October 1, 2025

PLAGIARISM CERTIFICATE

For MPhil and PhD

This is certified that the thesis entitled:**Transvaginal Ultrasound For Cervical Length Measurement In The Second Trimester To Assess The Risk Of Preterm Delivery.**

Student Name:Samia Shahzadi

Reg /Roll No:SU91-MSAHW-S23-156

Submitted on date:30.09.2025

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Hassan Khalid
01-10-2025