

Centile charts of cervical length in singleton and twin pregnancies between 16 and 24 weeks of gestation

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Abstract

Objective: The aim of this study was to determine the standard mid-trimester cervical lengths of singleton and twin pregnancies.

Material and Methods: This study was conducted by retrospective analysis of mid-trimester transvaginal cervical measurements of women with singleton and twin pregnancies that were examined by a single perinatologist in a single center.

Results: A total of 4621 consecutive asymptomatic pregnant women admitting for advanced obstetric ultrasound screening were evaluated. Of these 4340 (93.9%) were second trimester singleton pregnancies and 281 (6.1%) were twin pregnancies and were included. Mean cervical length measurements of singleton and twin pregnancies were 38.2 ± 6.5 mm and 37.6 ± 7.2 mm respectively ($p=0.17$). Overall, the 5th percentile of cervical length measurement after analysing singleton and twin pregnancies together was 29.4 mm at 16 weeks, 30 mm at 17 weeks, 30 mm at 18 weeks, 30 mm at 19 weeks, 30 mm at 20 weeks, 30 mm at 21 weeks, 30 mm at 22 weeks, 31 mm at 23 weeks, 29 mm at 24 weeks.

Conclusion: In our population the 5th percentile value of cervical length which is 30 mm in singletons and 10th percentile cervical length which is 31 mm in twins can be used to follow-up and treat pregnant women at risk for preterm deliveries. (J Turk Ger Gynecol Assoc 2023; 24: 114-9)

Keywords: Normogram, centile charts, cervical length, preterm birth

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Introduction

In the last few decades, developments in obstetric care has led to a considerable decrease in both maternal and perinatal mortality and morbidity. Among these obstetric complications, preterm deliveries create an increased level of burden on the individual pregnant woman, on family and on even on society as a whole, by causing long-term consequences, such as growth retardation, mental retardation, chronic diseases and cognitive impairments (1-3). Nevertheless, preterm delivery

constitutes between 7-11% of all deliveries and so remains one of the leading causes of neonatal morbidity and mortality in developed countries (4,5).

Short cervix is defined as a cervical measurement lesser than 25 mm before 24th week of pregnancy (2nd-3rd percentile) (6,7). A short cervix diagnosed before the 24th gestational week could predict preterm deliveries in later weeks of pregnancy. Risk of preterm delivery significantly increases in presence of a short cervix in women with a history of a previous preterm delivery (8-11). Therapeutic interventions, such as cervical



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cerclage placement, or medical measures, such as progesterone administration, initiated at early phases of pregnancy have been demonstrated to prevent preterm delivery in 30% to 40% of high risk patients (6,7,12). Globally, various values of cervical lengths have been proposed as a threshold level to initiate these therapeutic or prophylactic interventions throughout. Different clinical guidelines suggest cervical length shorter than 15 mm (0.5 percentile) or shorter than 20 mm (1st percentile) as threshold levels. Nonetheless, the American College of Gynecology recommends initiation of therapeutic or prophylactic interventions in case of a cervical length measurement shorter than 20 mm women without a history of preterm birth. Moreover, initiation of therapy was suggested for patients with a cervical length shorter than 25 mm in women with a previous history of preterm delivery before 34th week of pregnancy (13). These variations in optimal cut-off values of cervical lengths in predicting preterm delivery were primarily dependant on methodological discrepancies and different population of patients in the various studies. The level of evidence about models involving prediction of preterm delivery depending on cervical length in twin pregnancies is low. Therefore various modalities of management are applied among clinicians. Cervical length is routinely evaluated trans-abdominally in every pregnant women as a part of detailed fetal anomaly screening sonography that is usually performed between the 18th-22nd gestational week. Inadequate imaging of cervix or a short cervical measurement in this examination warrants transvaginal cervical length measurement that would be repeated once for every two weeks between 16th and 24th weeks of pregnancy (14).

The aim of this study was to evaluate the cervical length of a high number of asymptomatic, consecutive, pregnant women between 16 and 24 weeks of gestation and produce a histogram and percentile charts of cervical length in this patient population.

Material and Methods

In this study, trans-vaginal cervical measurement of women, consecutively admitted to a single clinic, were retrospectively evaluated. A single perinatologist (EC) carried out all of the measurements between 2016 and 2021 using transvaginal ultrasound (Voluson E8 4Mhz probe, GE company). Cervical measurements were performed in the lithotomy position following the emptying of the maternal bladder by urinary catheterization to standardize all patients. The cervix was visualized in sagittal axis and endocervical length, appearing as a weak linear echodensity between the internal and external cervical ostia, was measured. All of the measurements were performed without applying excess pressure to cervix and a mean of three measurements obtained from a single patient was recorded as cervical length.

Independent risk factors such as age, body mass index, ethnicity, parity, conception via assisted reproduction, history of previous surgeries, chronic diseases, and secondary obstetrical complications were not taken into account. Mean \pm standard deviation (SD), median (range) and percentile values of cervical lengths were reported, by gestational age in weeks. This study was following approval by Alanya Alaaddin Keykubat University Faculty of Medicine Clinical Research Ethics Committee (approval number: 2022/12, date: 25.05.2022). Informed consents were obtained from all participants.

Statistical analysis

Statistical analysis was performed using IBM SPSS, version 23.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics are expressed as mean \pm SD for normally distributed data and as median (minimum-maximum) for non-normally distributed data. Categorical variables are expressed as numbers and percentages (%).

Results

Overall 4,647 patient records were evaluated. Twenty-one triplet pregnancies and five women with a history of cervical conization or loop electrosurgical excision procedure were excluded from the study. Thus, 4340 singleton pregnancies and 281 twin pregnancies that were eligible were included in the study. The demographic data of the study population is given in Table 1. Women with twin pregnancies were significantly younger, more frequently nulliparous and had in vitro fertilization treatment for the present pregnancy compared with the singleton pregnancy group.

Overall cervical length measurements of singleton pregnancies were 38.3 ± 6.5 (0-67) mm and 37.6 ± 7.3 (9-59) mm respectively ($p=0.17$). Comparison of cervical length measurement between singleton and twin pregnancies across 16-24 weeks are presented in Table 2. The percentiles of cervical length in singleton pregnancies is given in Table 3. The 5th percentile of cervical length was between 29-31 mm throughout the period 16-24 weeks of gestation. The percentiles of cervical length in twin pregnancies is given in Table 4. The 5th percentile of cervical length was 27-30 mm between 16-18 weeks and 21-26 mm between 18-24 weeks. Chart analysis and histogram of

Table 1. The demographic data of the study population

Variable	Singleton, (n=4340)	Twin, (n=281)	P
Age (years)	28.2 \pm 4.7	27.5 \pm 5.1	0.01
Nulliparous	2690 (62%)	221 (78.7%)	<0.001
Multiparous	1650 (38%)	60 (21.3%)	<0.001
In vitro fertilisation	303 (7%)	236 (84%)	<0.001

cervical length in singleton and twin pregnancies are given in Figure 1. Overall cervical length percentiles, including singleton and twin pregnancies together, is given in Figure 2. The 5th percentile was 29.4 mm at 16 weeks, 30 mm at 17 weeks, 30 mm at 18 weeks, 30 mm at 19 weeks, 30 mm at 20 weeks, 30

mm at 21 weeks, 30 mm at 22 weeks, 31 mm at 23 weeks, 29 mm at 24 weeks. When all 4340 singleton pregnancies in the period 16-24 gestational weeks was considered, the 2.5th percentile was 28 mm, the 5th percentile was 30 mm and the 10th percentile was 31 mm. When 281 twin pregnancies during

Table 2. Comparison of cervical length measurements between singleton and twin pregnancies across 16-24 weeks of gestation

GA (week)	Singleton (n)	Mean (SD)	Median (range)	Twin (n)	Mean (SD)	Median (range)	p
16	78	38.2 (6.1)	37.0 (19-55)	10	40.9 (10.6)	38.0 (27-59)	0.46
17	158	38.7 (6.8)	38.0 (23-59)	19	39.2 (4.8)	37.0 (30-51)	0.73
18	331	37.8 (7.2)	37.0 (2.9-62)	34	38.02 (6.6)	35.5 (30-54)	0.89
19	490	38.4 (7.2)	38.0 (3.3-65)	29	38.5 (7.5)	38.0 (25-54)	0.96
20	907	38.3 (6.3)	38.0 (4.2-60)	62	36.6 (6.7)	35.5 (16.5-58)	0.05
21	914	38.1 (6.3)	38.0 (3-67)	54	37.3 (8.4)	37.0 (9-55)	0.48
22	683	38.5 (5.9)	38.0 (9-60)	42	38.0 (6.7)	38.5 (23-55)	0.58
23	363	38.3 (6.4)	38.0 (0-59)	12	38.5 (7.2)	39.0 (23-51)	0.95
24	416	37.9 (6.5)	37.0 (9-60)	19	35.7 (7.7)	36.0 (24-50)	0.15
Total	4340	38.2(6.5)	37.6 (0-67)	281	37.6 (7.2)	37.1 (9-59)	

GA: Gestational age, n: number of observations. Lengths are given in mm. SD: Standard deviation

Table 3. Percentile values according to gestational week in singleton pregnant

GA (weeks)	n	Percentile (mm)								
		1 st	5 th	10 th	25 th	50 th	75 th	90 th	95 th	99 th
16	78	19	30	31.9	34.7	37	42	46.1	49.2	
17	158	24.1	29.9	30.9	34	38	42	48	52	59
18	331	22	30	30.2	33	37	42	47.8	52.4	58.6
19	490	22.2	30	31	34	38	42	47	52	60
20	907	20.3	30	32	34	38	42	46	49	56
21	914	22.1	30	32	34	38	42	46	49	58
22	683	26	31	32	35	38	43	47	49	54
23	363	17.7	31	32	35	38	42	47	49	55
24	416	21.6	29	30.7	33	37	42	47	49	58

GA: Gestational age

Table 4. Percentile values according to gestational week in twin pregnant

GA (weeks)	n	Percentile (mm)								
		1 st	5 th	10 th	25 th	50 th	75 th	90 th	95 th	99 th
16	10	27	27	27	34.5	38	47.7	58.7		
17	19	30	30	35	36	37	42	46		
18	34	30	30	31	32	35.5	45.2	47	48.7	
19	29	25	25	31	32.5	38	42.5	51	52.5	
20	62	16.5	26.3	31	33.7	35.5	40	45	52.4	
21	54	9	21	31	33	37	44	46.5	49.7	
22	42	23	25	28.2	34.5	38.5	43	44.7	53.5	
23	12	23	23	25.4	33.7	39	44	49.2		
24	19	24	24	24	32	36	39	49		

GA: Gestational age

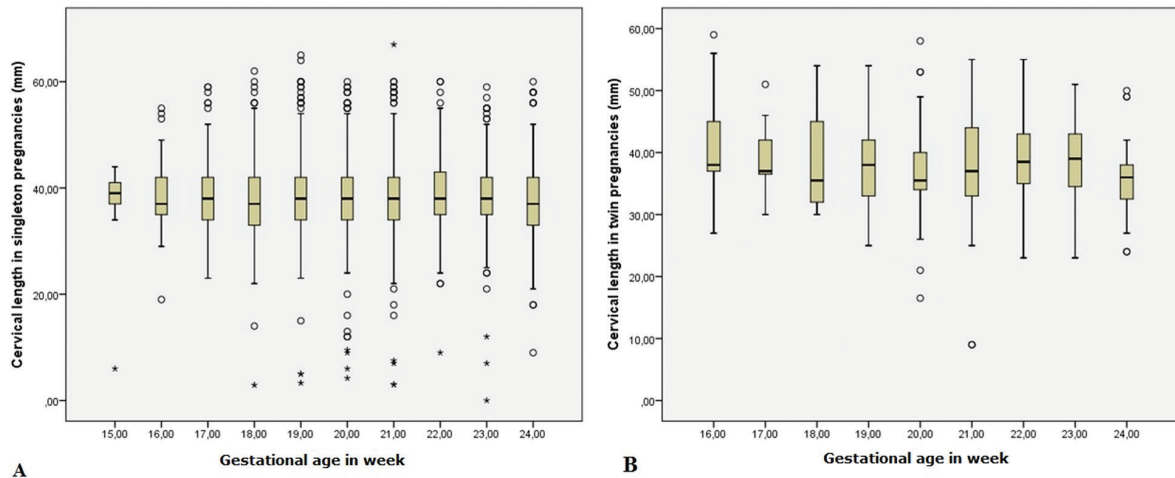


Figure 1. Longitudinal box plots of observed cervical lengths across gestational age. (A) Single pregnancy, (B) Twin pregnancy

****Boxes range from the 25th to the 75th percentile, with the horizontal line inside the box indicating the median**

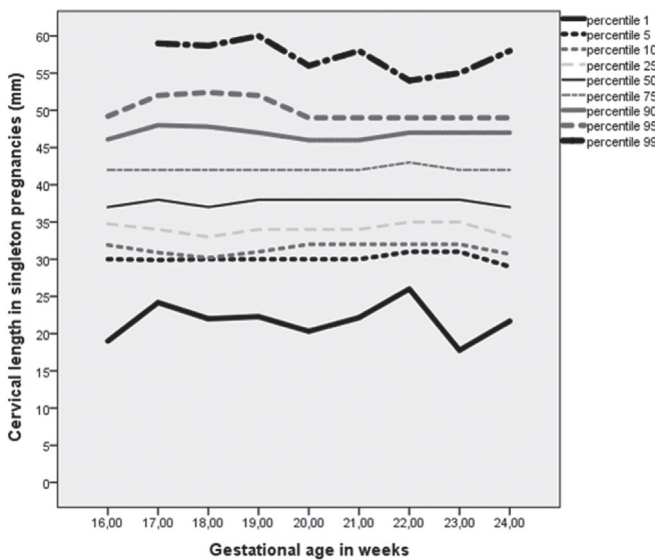


Figure 2. Reference ranges for cervical length across gestation. First to 99th percentiles are indicated

the same period were evaluated, the 2.5th percentile was 24 mm, the 5th percentile was 26 mm and the 10th percentile was 31 mm. Distribution of cervical lengths in singleton and twin pregnancies are shown in Figure 3. Incidence of short cervix increased as the gestation progressed.

Discussion

Contemporary predictive models for preterm delivery includes a comparison of each patients cervical measurement with standard normograms. Reliability of these models partially depends on accurate determination of cervical length percentile and, as normal values for cervical length could be expected to vary in different populations, in this study we

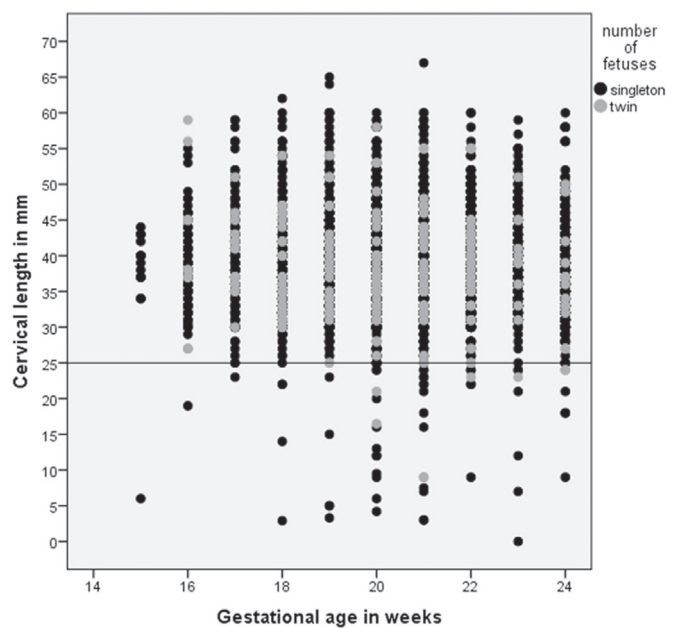


Figure 3. Scatter plot of cervical length measurements obtained from 4340 singleton and 281 twin pregnancy patients

****Solid line: 25 mm with short cervix border**

aimed to evaluate the normal ranges of cervical lengths in a Turkish population and establish a standard cervical length normogram for this specific population.

To avoid the limitations of a trans-abdominal approach in cervical length measurement, such as difficulty in cervical visualization and lengthening of cervix due to a filled bladder, in this study we preferred to assess records of patients that were evaluated solely by a trans-vaginal approach. Although cervical measurements could be performed from the 14th week of pregnancy, measurements made between 16th and 18th

gestational weeks at the time that the cervix separates from the lower uterine segment are considered more consistent and accurate (15). In normal conditions cervical length remains stable between the 14th and 28th gestational weeks and thus changes in cervical length in this period of pregnancy are described with a bell-curve.

The published definitions of short cervix are somewhat obscure. A wide variety of cervical lengths, from 10-35 mm, were studied as empirical cut-off values for prediction of spontaneous preterm birth in singleton pregnancies (16). The same cut-off values were empirically used for twin pregnancies, while a limited number of studies have reported the value of cervical shortening as an important predictor of spontaneous preterm delivery in mathematical models.

Normograms prepared by using specific populations may demonstrate variations and might have a negative impact on prediction of preterm delivery. For instance, in a study conducted in North America, mean cervical length of women in the 24th gestational week was estimated to be 34.0±7.8 mm (17). In contrast, a similar study conducted in Iran demonstrated that mean cervical length was 38.3±5.61 mm and another conducted in Switzerland was found mean cervical length in the 24th week to be 39.1±5.6 (18,19). Considering the discrepancies in these data, normograms prepared based on North American data could be expected to have higher false negativity in prediction of preterm delivery for a patient from Switzerland or Iran. In the present study, the mean cervical length for Turkish women in the 24th gestational week was 37.9±6.5 mm.

Singleton normograms enable comparison of 5th percentile values between the different populations. The 5th percentile for cervical length between 16-24 weeks of gestation was found to be 27 mm in Chicago, 30 mm in an American Hispanic population, 30.6 mm in a Thai population, 28 to 29 mm in South Africa, 25 mm in Switzerland, 32-25 mm in Paris, 30 mm in Iran, and between 30-33 mm in Brasil (9,20-25). In our large cohort, the overall 5th percentile of cervical length was 30 mm between 16-24 weeks of gestation, including both singleton and twin pregnancies. Small variations in different populations result from the sample sizes and the weight of pregnant women between 16-19 weeks or 20-24 weeks. The cervical length tend to be a few millimeters shorter as the pregnancy approaches the 24th week of gestation.

Data involving normal range of cervical length in twin pregnancies is scarce, in comparison to that for singleton pregnancies. A study conducted on 172 patients in Brazil found median cervical length of women with twin gestation to be 39 mm (37-40) (26). In the present study, the estimated median value of cervical length in twin pregnancies was 36 mm (24-50). Normogram data for cervical length in twin gestations are also

rare. As preterm delivery rate of twins are higher, studies tend to take the 10th percentile of cervical length as a cut-off for short cervix (27). The 10th percentile of cervical length was reported to be 30 mm in Canada and 25 mm in Poland (27,28). The 5th percentile of cervical length was 21-25 mm at 18-22 weeks in Brasil (29). In the present study in a Turkish population these values were 26 mm and 31 mm for cervical length at the 5th and 10th percentile in one of the largest twin cohorts so far reported. Cervical length is dynamic throughout the pregnancy. Studies have shown that multiple variable can affect cervical length dynamics and affect preterm delivery (30). Both 25 mm and 30 mm cut-off values may be used in our population to test interventions for preventing preterm births in twin pregnancies.

Study Limitations

The limitation of this study is that not all patients were followed-up until delivery, so the predictive value of the present data was not calculated. However, in two prior studies from our center an empirical 30 mm cervical length cut-off value was used to prevent early preterm delivery <32 weeks of gestation (31,32). In our population weekly follow-up of singleton pregnant women by cervical length, and emergency cerclage when indicated, prevented 62.5% of preterm deliveries earlier than 32 weeks (31). Vaginal progesterone treatment in singleton pregnant women with cervical length less than 30 mm and emergency or ultrasound-indicated cerclage was used when indicated postponed 98.7% of the deliveries beyond 34 weeks of gestation (32). In this context, comparing an individual patients' cervical length with the population-appropriate normal values may assist in increasing the accuracy of preterm delivery prediction.

Conclusion

The 5th percentile value of cervical length was 30 mm in singletons, while the 10th percentile cervical length was 31 mm in twin pregnancies in this Turkish population. These values can be used to follow-up and treat pregnant women at risk for preterm delivers.

Ethics Committee Approval: *This study was following approval by Alanya Alaaddin Keykubat University Faculty of Medicine Clinical Research Ethics Committee (approval number: 2022/12, date: 25.05.2022).*

Informed Consent: *Informed consents were obtained from all participants.*

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References

- Bolton CE, Bush A, Hurst JR, Sailesh K, McGarvey L. Republished: Lung consequences in adults born prematurely. *Postgraduate Medical Journal* 2015; 91: 712-8.
- de Jong F, Monuteaux MC, van Elburg RM, Gilman MW, Belfort MB. Systematic review and meta-analysis of preterm birth and later systolic blood pressure. *Hypertension* 2012; 59: 226-34.
- Petrou S. The economic consequences of preterm birth during the first 10 years of life. *BJOG* 2005; 112(Suppl 1): 10-5.
- Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *The Lancet* 2008; 371: 75-84.
- Goldenberg RL, Rouse DJ. Prevention of premature birth. *N Engl J Med* 1998; 339: 313-20.
- Romero R, Conde-Agudelo A, Da Fonseca E, O'Brien JM, Cetingoz E, Creasy GW, et al. Vaginal progesterone for preventing preterm birth and adverse perinatal outcomes in singleton gestations with a short cervix: a meta-analysis of individual patient data. *Am J Obstet Gynecol* 2018; 218: 161-80.
- Berghella V, Rafael TJ, Szychowski JM, Rust OA, Owen J. Cerclage for short cervix on ultrasonography in women with singleton gestations and previous preterm birth: a meta-analysis. *Obstet Gynecol* 2011; 117: 663-71.
- Taipale P, Hiilesmaa V. Sonographic measurement of uterine cervix at 18-22 weeks' gestation and the risk of preterm delivery. *Obstet Gynecol* 1998; 92: 902-7.
- Hibbard JU, Tart M, Moawad AH. Cervical length at 16-22 weeks' gestation and risk for preterm delivery. *Obstet Gynecol* 2000; 96: 972-8.
- Heath VC, Southall TR, Souka AP, Elisseou A, Nicolaidis KH. Cervical length at 23 weeks of gestation: prediction of spontaneous preterm delivery. *Ultrasound Obstet Gynecol* 1998; 12: 312-7.
- Owen J, Yost N, Berghella V, MacPherson C, Swain M, Dildy GA, et al. Can shortened midtrimester cervical length predict very early spontaneous preterm birth? *Am J Obstet Gynecol* 2004; 191: 298-303.
- Romero R, Conde-Agudelo A, El-Refaie W, Rode L, Brizot ML, Cetingoz E, et al. Vaginal progesterone decreases preterm birth and neonatal morbidity and mortality in women with a twin gestation and a short cervix: an updated meta-analysis of individual patient data. *Ultrasound Obstet Gynecol* 2017; 49: 303-14.
- American College of Obstetricians and Gynecologists. Practice bulletin no. 130: prediction and prevention of preterm birth. *Obstet Gynecol* 2012; 120: 964-73.
- Khalil A, Rodgers M, Baschat A, Bhide A, Gratacos E, Hecher K, et al. ISUOG Practice Guidelines: role of ultrasound in twin pregnancy. *Ultrasound Obstet Gynecol* 2016; 47: 247-63. Erratum in: *Ultrasound Obstet Gynecol* 2018; 52: 140.
- Berghella V, Talucci M, Desai A. Does transvaginal sonographic measurement of cervical length before 14 weeks predict preterm delivery in high-risk pregnancies? *Ultrasound Obstet Gynecol* 2003; 21: 140.
- Crane JM, Hutchens D. Transvaginal sonographic measurement of cervical length to predict preterm birth in asymptomatic women at increased risk: a systematic review. *Ultrasound Obstet Gynecol* 2008; 31: 579-87.
- Iams JD, Goldenberg RL, Meis PJ, Mercer BM, Moawad A, Das A, et al. The length of the cervix and the risk of spontaneous premature delivery. National Institute of Child Health and Human Development Maternal Fetal Medicine Unit Network. *N Engl J Med* 1996; 334: 567-72.
- Jafari-Dehkordi E, Adibi A, Sirus M. Reference range of the weekly uterine cervical length at 8 to 38 weeks of gestation in the center of Iran. *Adv Biomed Res* 2015; 4: 115.
- Hoesli IM, Strutas D, Tercanli S, Holzgreve W. Charts for cervical length in singleton pregnancy. *Int J Gynaecol Obstet* 2003; 82: 161-5.
- Diken Z, Saad AF, Saade GR, Jacobs S, Khan M, Wang A. 1074 Cervical length nomogram in hispanic patients. *Am J Obstet Gynecol* 2021; 2(Suppl): S664.
- Wanitpongpan P, Sutthritpongsa P, Ronglue S. Cervical length at mid-trimester in Thai women with normal singleton pregnancies. *Siriraj Med J* 2015; 67: 33-6.
- Theron G, Schabot C, Norman K, Thompson M, Geerts L. Centile charts of cervical length between 18 and 32 weeks of gestation. *Int J Gynaecol Obstet* 2008; 103: 144-8.
- Hoesli I, Tercanli S, Holzgreve W. Cervical length assessment by ultrasound as a predictor of preterm labour—is there a role for routine screening? *BJOG* 2003; 110 Suppl 20: 61-5.
- Salomon LJ, Diaz-Garcia C, Bernard JP, Ville Y. Reference range for cervical length throughout pregnancy: non-parametric LMS-based model applied to a large sample. *Ultrasound Obstet Gynecol* 2009; 33: 459-64.
- Andrade KC, Bortoletto TG, Almeida CM, Daniel RA, Avo H, Pacagnella RC, et al. Reference Ranges for Ultrasonographic Measurements of the Uterine Cervix in Low-Risk Pregnant Women. *Rev Bras Ginecol Obstet* 2017; 39: 443-52.
- Fujita MM, Brizot Mde L, Liao AW, Bernáth T, Cury L, Neto JD, et al. Reference range for cervical length in twin pregnancies. *Acta Obstet Gynecol Scand* 2002; 81: 856-9.
- Melamed N, Pittini A, Hirsch L, Yogev Y, Korzeniewski SJ, Romero R, et al. Do serial measurements of cervical length improve the prediction of preterm birth in asymptomatic women with twin gestations? *Am J Obstet Gynecol* 2016; 215: 616.e1-14.
- Huras H, Kalinka J, Dębski R. Short cervix in twin pregnancies: current state of knowledge and the proposed scheme of treatment. *Ginekol Pol* 2017; 88: 626-32.
- Hofmeister C, Brizot Mde L, Liao A, Francisco RP, Zugaib M. Two-stage transvaginal cervical length screening for preterm birth in twin pregnancies. *J Perinat Med* 2010; 38: 479-84.
- Conde-Agudelo A, Romero R. Predictive accuracy of changes in transvaginal sonographic cervical length over time for preterm birth: a systematic review and meta-analysis. *Am J Obstet Gynecol* 2015; 213: 789-801.
- Caliskan E, Cakiroglu Y, Dundar D, Doger E, Caliskan S, Ozeren S. Integrating cervical length measurement into routine antenatal screening and only emergency cerclage when indicated. *Clin Exp Obstet Gynecol* 2009; 36: 40-5.
- Akar B, Ceylan Y, Karadağ C, Çalışkan E. Cervical cerclage application algorithm in continued cervical shortening cases despite vaginal progesterone. *J Gynecol Obstet Hum Reprod* 2021; 50: 101989.