The incidence and outcomes of late-term pregnancy

Vahid Mehrnoush
Hormozgan University of Medical Sciences
Amene Ranjbar
Hormozgan University of Medical Sciences
Fatemeh Darsareh (famadarsareh@yahoo.com)
Hormozgan University of Medical Sciences https://orcid.org/0000-0003-2644-792X
Mitra Shekari
Hormozgan University of Medical Sciences
Maliheh Shirzadfard Jahromi
Hormozgan University of Medical Sciences

Research article

Keywords: Late-term, Pregnancy outcome, Risk factors.

Posted Date: July 18th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1836495/v1

Abstract

Background: In low-risk women, it is being debated whether to induce labor at 41 weeks + 0 days or to allow the pregnancy to continue until 42 weeks + 0 days. Post-term pregnancy is linked to poor perinatal and maternal outcomes. However, little is known about the outcomes of late-term pregnancy. In this study, we aim to assess the incidence and adverse prenatal outcomes associated with late-term pregnancy.

Methods: We retrospectively assessed all the singleton pregnant mothers who gave birth at Khaleej-e-Fars Hospital in Bandar Abbas, Iran, between January 2020-2022. All preterm and post-term deliveries were excluded. Mothers were divided into two groups: 1) late-term mothers and 2) term mothers. Term pregnancy was defined as 37 0/7 weeks to 40 6/7 weeks of gestation, and late-term pregnancy was defined as 41 0/7 weeks to 41 6/7 weeks of gestation. Demographic factors, obstetrical factors, maternal comorbidities, and prenatal outcomes were extracted from the electronic data of each mother. The incidence of late-term births was calculated. The Chi-square test was used to compare differences between the groups. Logistic regression models were used to assess the association of prenatal outcome with late-term pregnancy.

Results: There were 8888 singleton deliveries during the study period. 1269 preterm and post-term pregnancies were ruled out. 309 (4.1%) of the 7619 deliveries were late-term, while 7310 (95.9%) were term. There were no sociodemographic differences between term and late-term mothers. The late-term group had a higher prevalence of primiparous mothers, and the term group had a higher prevalence of diabetes. Late-term mothers had a higher rate of macrosomia, meconium amniotic fluid, fetal distress, and a lower rate of LBW. After adjusting for confounders, late-term mothers had a higher risk of macrosomia aOR 2.24 (CI: 1.34-3.01), meconium amniotic fluid aOR 2.32 (CI: 1.59-3.14), and fetal distress aOR 2.38 (CI: 1.54-2.79). When compared to term pregnancy, the risk of LBW was lower in late-term pregnancy aOR 0.69 (CI: 0.36-0.81).

Conclusions: Late-term pregnancy was found to be more likely to be associated with macrosomia, meconium amniotic fluid, and fetal distress, but serious maternal and neonatal adverse events were comparable to term pregnancy.

Background

Gestation lasts an average of 40 weeks (280 days) from the first day of the last menstrual period to the estimated date of delivery in singleton pregnancies (1). Previously, the period from 3 weeks before the estimated date of delivery to 2 weeks after the estimated date of delivery was considered "term," with the expectation that neonatal outcomes from deliveries during this interval would be uniform and good. However, research has increasingly revealed that neonatal outcomes, particularly respiratory morbidity, vary depending on the timing of delivery, even within this 5-week gestational age range (2). The risk of adverse neonatal outcomes is lowest in uncomplicated pregnancies delivered between 39 0/7 and 40 6/7

weeks of gestation (3). In low-risk women, it is being debated whether to induce labor at 41 weeks + 0 days or to allow the pregnancy to continue until 42 weeks + 0 days. Post-term pregnancy is linked to poor perinatal and maternal outcomes (4). However, little is known about the link between late-term pregnancy and poor perinatal and maternal outcomes. In this study, we aim to assess the incidence and adverse prenatal outcomes associated with late-term pregnancy.

Methods

We retrospectively assessed all the singleton pregnant mothers who gave birth at Khaleej-e-Fars Hospital (a tertiary hospital) in Bandar Abbas, Iran, between January 1st, 2020, and January 1st, 2022. All preterm and post-term deliveries were excluded from the study. Using electronic patient records, data were extracted by trained collectors from the "Iranian Maternal and Neonatal Network (IMaN Net)," a valid national system. This study complies with the Declaration of Helsinki and was performed according to ethics committee approval. Statistical analysis was performed with patient anonymity. Mothers were divided into two groups based on gestational age at birth: 1) late-term mothers, and 2) term mothers. Term pregnancy was defined as 37 0/7 weeks to 40 6/7 weeks of gestation, and late-term pregnancy was defined as 41 0/7 weeks to 41 6/7 weeks of gestation (5).

Demographic factors (age, educational level, living residency, medical insurance, access to prenatal care facilities, smoking status), obstetrical factors (parity, infertility, use of assisted reproductive technology (ART), newborn sex, abnormal placentation (previa/acreta), oligohydramnios, polyhydramnios), maternal comorbidities (diabetes mellitus, chronic hypertension, preeclampsia, cardiovascular disease, thyroid dysfunction, drug addiction, hepatitis, anemia, and COVID-19 at the time of admission), prenatal outcomes (onset of labor, mode of delivery, placenta abruption, intrauterine growth restriction (IUGR), and intrauterine fetal death (IUFD), onset of labor, mode of delivery, shoulder dystocia, perineal laceration, post-partum hemorrhage, intensive care unit (ICU) admission, and maternal death, low birth weight (LBW), macrosomia (newborn weight more than 4000 grams), congenital malformation, meconium amniotic fluid, fetal distress (abnormal fetal heart pattern or rate), asphyxia, childbirth trauma (clavicle fracture, erb palsy, klumpke palsy), need for resuscitation, neonatal intensive care unit (NICU) admission, and newborn death) were extracted from electronic data of each mother.

The IBM Statistical Package for the Social Sciences Statistics, version 25, was used to examine the data (IBM Corp, Armonk, NY). Categorical variables are presented as numbers and frequencies (%). The Chi-square test was used to compare differences between the groups for categorical variables. Logistic regression models were used to assess the association of prenatal outcome with late-term pregnancy. The result was presented as odds ratio (OR) or adjusted odds ratio (aOR) after adjusting for confounders and 95% confidence interval (CI). $P < 0.05$ was considered statistically significant, and all statistical tests were two-tailed.

Results

There were 8888 singleton deliveries during the study period. 1269 preterm and post-term pregnancies were ruled out. 309 (4.1%) of the 7619 pregnancies were late-term, while 7310 (95.9%) were term. Table 1 shows the sociodemographic differences between term and late-term mothers, with no statistically significant differences between the two groups. The Chi-square test was used to compare obstetrical factors and maternal comorbidities between term and late-term mothers. Table 2 shows that the groups differed statistically in terms of parity and diabetes incidence. The late-term group had a higher prevalence of primiparous mothers, and the term group had a higher prevalence of diabetes.

Table 1
Demographic differences of the study population based on gestational age

Demographic characteristics	Term (n = 7310)	Late-term (n = 309)	P-value
Age (Years)	147 (2)	5 (1.6)	0.121
13–19	6021 (82.4)	260 (84.1)	
20–34	1142 (15.6)	38 (12.3)	
35 and above			
Educational level	446 (6.1)	30 (9.7)	0.093
Illiterate	2234 (30.6)	101 (32.7)	
Elementary	3408 (46.6)	128 (41.4)	
High school/Diploma	1220 (16.7)	50 (16.2)	
Advanced			
Living residency	4893 (66.9)	195 (63.1)	0.130
Urban	2417 (33.1)	114 (36.9)	
Rural			
Access to prenatal care	7233 (98.9)	308 (99.7)	0.457
Yes	77 (1.1)	1 (0.3)	
No			
Medical insurance	7304 (99.9)	309 (100)	0.369
Yes	6 (0.1)	0	
No			
Smoking	18 (0.2)	0	0.315
Yes	7292 (99.8)	309 (100)	
No			
Data are presented as n (%).			

Table 2
Obstetrical and medical differences of the study population based on gestational age

Variables	Term (n = 7310)	Late-term (n = 309)	P-value
Parity	2021 (27.6)	127 (41.1)	< 0.001
Primiparous	5107 (69.9)	170 (55)	
Multiparous (2–5 parity)	181 (2.5)	12 (3.9)	
Grand multiparous (6 parity and more)			
Infertility	7200 (98.5)	308 (99.7)	0.356
No	110 (1.5)	1 (0.3)	
Yes			
ART	7291 (99.8)	309 (100)	0.669
No	19 (0.2)	0	
Yes			
Newborn sex	3724 (50.9)	164 (53.1)	0.250
Male	3586 (49.1)	145 (46.9)	
Female			
Abnormal placentation	7287 (99.7)	309 (100)	0.385
No	23 (0.3)	0	
Yes			
Oligohydramnios	7253 (99.2)	309 (100)	0.249
No	57 (0.8)	0	
Yes			
Polyhydramnios	7301 (99.9)	309 (100)	0.883
No	9 (0.1)	0	
Yes			

Data are presented as numbers (%).

ART: Assisted reproductive technology

Variables	Term (n = 7310)	Late-term (n = 309)	P-value
Anemia	7103 (97.2)	307 (99.4)	0.133
No	129 (1.8)	2 (0.6)	
Hemoglobin 7–10	78 (1)	0	
Hemoglobin less than 7			
Cardiovascular disease	7237 (99)	307 (99.4)	0.408
No	73 (1)	2 (0.6)	
Yes			
Drug addiction	7286 (99.6)	306 (99)	0.104
No	24 (0.4)	3 (1)	
Yes			
Chronic Hypertension	7242 (99.1)	307 (99.4)	0.455
No	68 (0.9)	2 (0.6)	
Yes			
Preeclampsia	6962 (95.2)	297 (96.1)	0.292
No	348 (4.8)	12 (3.9)	
Yes			
COVID-19	7208 (98.6)	308 (99.7)	0.074
No	102 (1.4)	1 (0.3)	
Yes			
Diabetes	6221 (85.1)	306 (99.1)	< 0.001
No	11 (0.2)	1 (0.3)	
Overt diabetes	1078 (14.7)	2 (0.6)	
Gestational diabetes			

Data are presented as numbers (%).

ART: Assisted reproductive technology

Variables	Term (n = 7310)	Late-term (n = 309)	P-value
Hypothyroidism	6545 (89.5)	282 (91.3)	0.324
No	765 (10.5)	27 (8.7)	
Yes			
Hepatitis	7281 (99.6)	309 (100)	0.300
No	29 (0.4)	0	
Yes			
Data are presented as numbers (%).			
ART: Assisted reproductive technology			

The Chi-square test was used to compare the adverse maternal and neonatal outcomes of term and late-term mothers. As shown in Table 3, the incidence of LBW, macrosomia, meconium amniotic fluid, and fetal distress differed between groups, with late-term mothers having a higher rate of macrosomia, meconium amniotic fluid, and fetal distress and a lower rate of LBW. However, there was no statistically significant difference between groups in terms of resuscitation rate, asphyxia, or NICU admission.

Table 3
Maternal and neonatal outcomes of the study population based on gestational age

Variables		Term (n = 7310)	Late-term (n = 309)	P-value
Maternal outcome	**Placenta abruption**	7142 (97.7)	304 (98.4)	0.290
	No	168 (2.3)	5 (1.6)	
	Yes			
	IUGR	7117 (97.4)	305 (98.7)	0.304
	No	191 (2.6)	4 (1.3)	
	Yes			
	IUFD	7299 (99.8)	308 (99.7)	0.678
	No	11 (0.2)	1 (0.3)	
	Yes			
	Onset of labor	4069 (55.7)	139 (45)	< 0.001
	Spantenuos	1724 (23.6)	157 (49.2)	
	Labor induction	1516 (20.7)	13 (4.2)	
	Elective cesarean section			
	Mode of delivery	4997 (68.4)	210 (68)	0.421
	Vaginal delivery	74 (1)	4 (1.3)	
	Instrumental delivery (vacuum)	2239 (30.6)	95 (30.7)	
	Cesarean section			
	Shoulder dystocia	7252 (99.2)	306 (99)	0.452
	No	58 (0.8)	3 (1)	
	Yes			
	Perineal lacerations (grade 3 or 4)	7305 (99.9)	309 (100)	0.813
	No	5 (0.1)	0	
	Yes			

Data are presented as numbers (%).

LBW: Low birth weight; IUFD: Intrauterine fetal death; IUGR: Intrauterine growth retardation; ICU: Intensive care unit; NICU: Neonatal intensive care unit

Variables		Term (n = 7310)	Late-term (n = 309)	P-value
	Post-partum hemorrhage	7185 (98.3)	304 (98.4)	0.437
	No	125 (1.7)	5 (1.6)	
	Yes			
	ICU Admission	7291 (99.7)	308 (99.7)	0.938
	No	19 (0.3)	1 (0.3)	
	Yes			
	Maternal death	3708 (100)	309	0.976
	No	2 (0)	0	
	Yes			
Neonatal outcome	**LBW**	6899 (94.3)	306 (99.9)	< 0.001
	No	411 (5.7)	3 (1)	
	Yes			
	Macrosomia	7158 (97.9)	280 (90.6)	< 0.001
	No	152 (2.1)	29 (9.4)	
	Yes			
	Meconium amniotic fluid	6357 (87)	231 (74.8)	< 0.001
	NO	950 (13)	78 (25.2)	
	Yes			
	Fetal distress	6743 (92.2)	256 (82.8)	< 0.001
	No	567 (7.8)	53 (17.2)	
	Yes			
	Congenital malformation	7259 (99.3)	307 (99.4)	0.976
	No	51 (0.7)	2 (0.6)	
	Yes			

Data are presented as numbers (%).

LBW: Low birth weight; IUFD: Intrauterine fetal death; IUGR: Intrauterine growth retardation; ICU: Intensive care unit; NICU: Neonatal intensive care unit

Variables		Term (n = 7310)	Late-term (n = 309)	P-value
	Asphyxia	7288 (99.7)	308 (99.7)	0.911
	No	22 (0.3)	1 (0.3)	
	Yes			
	Childbirth trauma	7293 (99.9)	309 (100)	0.844
	No	8 (0.1)	0	
	Yes			
	Need for neonate resuscitation	6867 (93.9)	287 (92.9)	0.402
	No	443 (6.1)	22 (7.1)	
	Yes			
	NICU Admission	7024 (96.1)	298 (96.4)	0.417
	No	286 (3.9)	11 (3.6)	
	Yes			
	Newborn death	7308 (100)	309 (100)	0.982
	No	2 (0)	0	
	Yes			

Data are presented as numbers (%).

LBW: Low birth weight; IUFD: Intrauterine fetal death; IUGR: Intrauterine growth retardation; ICU: Intensive care unit; NICU: Neonatal intensive care unit

Table 4 shows the risk of adverse prenatal outcomes in late-term pregnancy. Late-term pregnancy was associated with LBW, macrosomia, meconium amniotic fluid, and fetal distress, according to bivariate regression analysis. After adjusting for confounders (sociodemographic factors, obstetrical factors, and maternal comorbidities), late-term mothers had a higher risk of macrosomia aOR 2.24 (CI: 1.34–3.01), meconium amniotic fluid aOR 2.32 (CI; 1.59–3.14), and fetal distress aOR 2.38 (CI; 1.54–2.79). When compared to term pregnancy, the risk of LBW was lower in late-term pregnancy aOR 0.69 (CI; 0.36–0.81).

Table 4
Adverse prenatal outcomes associated with late-term pregnancy

VARIABLES	OR (95% CI)	P-value	aOR (95% CI)	P-value
LBW	0.48 (0.16–0.71)	< 0.001	0.69 (0.36–0.81)	< 0.001
Macrosomia	3.56 (1.98–5.67)	< 0.001	2.24 (1.34–3.01)	< 0.001
Meconium amniotic fluid	3.12 (1.78–4.12)	< 0.001	2.32 (1.59–3.14)	< 0.001
Fetal distress	2.97 (1.12–5.13)	< 0.001	2.38 (1.54–2.79)	< 0.001
OR: Odds Ratio				
aOR: adjusted Odds Ratio				
LBW: Low birth weight				

Discussion

Important pregnancy outcomes, such as neonatal mortality, stillbirth, long-term neurologic problems, and maternal mortality, are linked to the length of gestation or the infant's gestational age at birth (6). This study confirmed that late-term pregnancy was more likely to be associated with macrosomia, meconium amniotic fluid, and fetal distress, however serious maternal and neonatal adverse events were similar to term pregnancy. In terms of demographic data, no differences were observed between late-term and term mothers. Among obstetrical factors parity was the only factor associated with gestational age. The late-term group had a higher prevalence of primiparous mothers. Primiparity is one of the most common identifiable risk factors for the prolongation of pregnancy (7). The late-term group had a lower rate of diabetes in terms of maternal comorbidities. This is due to the recommendation of diabetic guidelines to terminate the pregnancy at 39 weeks gestation (8).

In our study, late-term mothers were at double risk of meconium amniotic fluid and fetal distress (abnormal fetal heart tracing) than term mothers. The presence of meconium amniotic fluid may represent the normal maturation of the gastrointestinal tract. It may also be present in cases of fetal distress caused by an acute or chronic hypoxic event, which is hard to distinguish (9). Intrauterine meconium passage in near-term or term fetuses has been linked to fetomaternal stress factors and/or infection, whereas late-term and post-term meconium passage has been linked to gastrointestinal maturation (10). Although meconium amniotic fluid is associated with an increased risk of fetal distress (abnormal fetal heart tracing) (11), the relationship between specific fetal tracing abnormalities and neonatal outcomes in this context remains unknown (12). Prolonged decelerations, severe variable decelerations, bradycardia (baseline FHR 110 beats/min), and tachycardia (baseline FHR 160 beats/min) were found to be independently associated with perinatal mortality and/or neonatal morbidity (13). In our study, despite the increased risk of meconium amniotic fluid and fetal distress, adverse neonatal outcomes such as asphyxia, need for resuscitation, NICU admission, or neonatal death were not significantly higher compared to term mothers. We were unable to extract data on the type of fetal heart

tracing in our study, so we cannot draw any conclusions about the low rate of adverse neonatal outcomes even in the presence of fetal distress. Early management of fetal distress, including the prompt decision for cesarean section, could be one reason.

Based on our findings, the risk of LBW was lower in late-term mothers compared to term pregnant mothers. LBW refers to infants weighing less than 2500 grams who are either born too soon, i.e. preterm birth, or too small, i.e. fetal growth restriction. LBW is a well-established risk factor for infant mortality and morbidity, as well as a recognized proxy for maternal health (14). Garcia et al. discovered a significant difference in infant mean birth weights and gestational age; the greater the gestational age, the greater the infant's weight (15). On the other hand, late-term pregnancy was strongly associated with macrosomia. Macrosomia is associated with an increased risk of several maternal and neonatal complications. Maternal complications include an increase in the number of cesarean sections performed, extensive perineal lacerations, and severe hemorrhage. Shoulder dystocia, hypoglycemia, respiratory distress, and death are all examples of neonatal complications (16). Both diabetic and non-diabetic pregnancies had these negative outcomes (17). However in our study despite the higher rate of macrosomia in late-term mothers the maternal and neonatal adverse events did not increase compared to term mothers. More research is needed to investigate the relationship between newborn weight as an independent factor and adverse prenatal outcomes in late-term pregnancy.

The strength of our study is that our study registers are of high quality and in accordance with childbirth records. We investigated various maternal and neonatal outcomes. Our study was conducted retrospectively, which is still a limitation. The database did not allow for the precise timing of the various events during pregnancy. More data was missing for variables, such as body mass index. However, the fact that the obstetric team entered clinical findings prospectively into the database, as well as the large body of evidence available for analysis, both increase the reliability of the findings.

Conclusions

Late-term pregnancy was found to be more likely to be associated with macrosomia, meconium amniotic fluid, and fetal distress, but serious maternal and neonatal adverse events were comparable to term pregnancy.

Abbreviations

LBW
Low birth weight
IUFD
Intrauterine fetal death
IUGR
Intrauterine growth retardation
ICU

Intensive care unit
NICU
Neonatal intensive care unit
ART
Assisted reproductive technology

Declarations

Ethics approval and consent to participate

This study complies with the Declaration of Helsinki and was performed according to ethics committee approval. The Ethics and Research Committee of the Hormozgan University of Medical Sciences approved the study. The records of all patients who provided informed consent for using their data for research purposes were analyzed. In cases of illiteracy, their legal guardians provided informed consent. Statistical analysis was performed with patient anonymity following ethics committee regulations.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

Hormozgan University of Medical Sciences.

Author contributions

V.M. wrote the proposal. M.S. and M.S.J. contributed significantly to data collection. The findings were analyzed and interpreted by F.D., who wrote the manuscript. V.M. was the primary contributor to the manuscript's commenting and writing. A.R. assessed the manuscript's scientific content critically. The final manuscript for submission was read and approved by all authors.

Acknowledgment

All of the authors acknowledged Hormozgan University of Medical Sciences.

References

1. World Health Organization. ICD-10: International statistical classification of diseases and related health problems, 10th revision. Volume 2. 2nd ed.Geneva: WHO; 2004. Available at: http://www.who.int/classifications/icd/ICD-10_2nd_ed_volume2.pdf. Retrieved August 12, 2013.
2. Definition of term pregnancy. Committee Opinion No. 579. American College of Obstetricians and Gynecologists. Obstet Gynecol. 2013;122:1139–40.
3. Reddy UM, Bettegowda VR, Dias T, Yamada-Kushnir T, Ko CW, Willinger M. Term pregnancy: a period of heterogeneous risk for infant mortality. Obstet Gynecol. 2011;117:1279–87.
4. Galal M, Symonds I, Murray H, Petraglia F, Smith R. Postterm pregnancy. Facts Views Vis Obgyn. 2012;4(3):175–87. PMID: 24753906; PMCID: PMC3991404.
5. Spong CY. Defining "term" pregnancy: recommendations from the Defining "Term" Pregnancy Workgroup. JAMA. 2013 Jun 19;309(23):2445-6. doi: 10.1001/jama.2013.6235. PMID: 23645117.
6. Goldenberg RL. Factors influencing perinatal outcomes. Ann N Y Acad Sci. 2004;1038:227–234.
7. Galal M, Symonds I, Murray H, Petraglia F, Smith R. Postterm pregnancy. Facts Views Vis Obgyn. 2012;4(3):175–87. PMID: 24753906; PMCID: PMC3991404.
8. National Institute for Health and Care Excellence. 2015. Diabetes in pregnancy: management from preconception to the postnatal period. NICE guideline [NG3]. London: National Institute for Health and Care Excellence; 2015.
9. Mitchell S, Chandraharan E. Meconium-stained amniotic fluid. Obstet Gynaecol Reprod Med [Internet]. 2018;28(4):120–4. Available from: https://www.sciencedirect.com/science/article/pii/S1751721418300344.
10. Ahanya SN, Lakshmanan J, Morgan BLG, Ross MG. Meconium passage in utero: mechanisms, consequences, and management. Obstet Gynecol Surv. 2005 Jan;60(1):44–5.
11. Adnan M, Mydam J, Hageman JR, Cohen L. Fetal Heart Tracing Patterns and the Outcomes of Newborns With Meconium-Stained Amniotic Fluid. 2022;14(4):10–7.
12. Hutton EK, Thorpe J. Consequences of meconium stained amniotic fluid: What does the evidence tell us? Early Hum Dev [Internet]. 2014;90(7):333–9. Available from: https://www.sciencedirect.com/science/article/pii/S0378378214000863.
13. Xu H, Mas-Calvet M, Wei SQ, Luo ZC, Fraser WD. Abnormal fetal heart rate tracing patterns in patients with thick meconium staining of the amniotic fluid: association with perinatal outcomes. Am J Obstet Gynecol 2009 Mar;200(3):283.e1-7. doi: 10.1016/j.ajog.2008.08.043. Epub 2008 Dec 25. PMID: 19110226.
14. Joshi KJ, Sochaliya KM, Shrivastav AV. A hospital based study on the prevalence of low birth weight in new born babies and its relation to maternal health factors. Int J Res Med Sci. 2014;3:4–8.
15. Garcia R, Ali N, Guppy A, Griffith M, Randhawa G. Differences in pregnancy gestation period and mean birthweight in infants born to Indian, Pakistani, Bangladeshi and white British mother in Luton, UK. BMJ Open. 2017;7:e017139. DOI: 1136/bmjopen-2017-017139.

16. Weissmann-Brenner A, Simchen MJ, Zilberberg E, Kalter A, Weisz B, Achiron R, Dulitzky M. Maternal and neonatal outcomes of macrosomic pregnancies. Med Sci Monit. 2012 Sep;18(9):PH77–81. doi:10.12659/msm.883340. PMID: 22936200; PMCID: PMC3560660.
17. Esakoff TF, Cheng YW, Sparks TN, Caughey AB. The association between birth weight 4000 g or greater and perinatal outcomes in patients with and without gestational diabetis mellitus. Am J Obstet Gynecol. 2009;200:672.e1–4.