Original Article

Frequency maternal and fetal characteristics in large fetuses for gestational age fetuses

Mojgan Barati[1], Razieh Mohammad Jafari[2], Najmieh Saadati[3], Elham Farhadi[4], Sahar Janaki[5]

[1, 2, 3]Department of Obstetrics and Gynecology, School of Medicine, Fertility and Infertility and Fetal Health Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.[2, 4]Clinical Research Development Unit, Golestan Hospital, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. [5]Department of Obstetrics and Gynecology, Faculty of Medicine, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Correspondence: Sahar Janaki, fertility infertility and perinatology research center Department of obstetric and Gynecology Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.Email: Saharjanaki7@gmail.com

ABSTRACT

Pregnancy with large fetus is used to describe infants whose weight is more than normal for the number of weeks of pregnancy. Clavicle fracture, brachial plexus damage, and hypoglycemia are major complications. The present study investigates the frequency and maternal and fetal characteristics in pregnancies with large fetus. In this descriptive-analytical cross-sectional study, 1625 pregnant mothers referring to Imam Khomeini Hospital in Ahvaz during 2019-2021 were included. Maternal and fetal characteristics including maternal age, maternal weight, maternal blood pressure, maternal height, maternal body mass index, gestational age, history of previous childbirth, history of chronic diseases, history of abortion, history of stillbirth, weight gain during pregnancy, shoulder dystocia, and fetal problems after birth were included in the questionnaire. In general, 19379 births were performed in the years 2019 to 2021, of which 1625 were large fetuses, showing a prevalence of 8.3%. The mean age of pregnant mothers was 31.81±6.46 years. The mean body mass index was 27.62±3.91 kg/m2. The history of preeclampsia in pregnant mothers with large fetus was 3.6%. In this regard, 72.1% had cesarean section delivery. Among the maternal underlying diseases, diabetes had the highest frequency with 30% and 58.8% of infants with large fetus were girls. Based on the results, 55 people had dystocia (3 percent), 2 people had Erb's palsy (0.01 percent), 4 people had clavicle fracture (0.02 percent), and 39 people had an Apgar score below 6 (2 percent). Dystocia, low Apgar (below 6), clavicle fracture, and Erb's palsy were significantly different between LGA and severe LGA (P<0.001). Based on the results, the prevalence of large fetuses in Ahvaz city was high (8.3%). Pregnancies with large fetus and macrosomia are associated with serious adverse perinatal outcomes and provide risk estimates that can be used to make decisions about pregnancy management.

Keywords: Large fetus, Pregnancy, Shoulder dystocia

Introduction

Estimating the fetal weight is one of the basic measures in the care of pregnant women, especially at the time of admission for childbirth (Usually, infants whose weight exceeds the 90th percentile for the assumed week of gestational age are used as large for gestational age or LGA) [1]. Also, the term “macrosomia” for the fetal weight above 4000 g or even 4500 g is considered as the threshold of macrosomia. Large fetus is associated with birth and post-birth complications and risks [2].Accurately estimating the fetal weight makes it possible to prevent vaginal delivery in mothers whose delivery will be more likely stopped due to the mismatch between the fetal head and the mother's pelvis. Predicting the birth of an underweight infant or an infant with large fetus requires special care after birth prevents the occurrence of injuries and complications after birth in these infants due to the lack of preparation for adequate care [3]. Sheibani and colleague in a historical cohort study on 8460 cosecutive pregnant women recruited for chromosomal abnormalities screening within the first trimester at fertility infertility and perinatology research center in ahvaz joundishapor university of medical sciences between april 2014 and april 2015 showed that measuring the serum level of MOM PAPP-A during the first trimester can be a valuable marker for predicting adverse outcomes of pregnancy such as SGA PE and abortion. The best cutoff value for this marker to predict the outcome is 0.3 in pregnant Iranian women [4].

Timely diagnosis of large fetus can protect the mother from the risks of difficult childbirth and its complications, such as extensive tears in the perineum and vagina. Difficult births will cause many risks for the fetus, including damage to the brachial nerve network, and occurrence of Erb's palsy, humerus and clavicle fracture, and spinal cord injuries. If the infant is born before the 20th week of pregnancy, it is considered an abortion, and keeping the fetus in such conditions is impossible [5]. If the infant is born after the 20th week of pregnancy, the birth is premature. As the mother approaches the end of the ninth month of pregnancy, the fetus becomes more mature and develops naturally. After the ninth month of pregnancy, if the infant is born late, he or she will lose weight since his or her nutritional needs are not met by the placenta. Low weight, wrinkled skin, and long nails are signs of an infant born late. The lower the infant's weight, the more premature he or she is. The dangers of premature infants primarily affect the lungs and oxygen supply to the body and brain. This factor causes brain retardation in the infant and increases the possibility of his or her death.

In diabetic mothers, the infant is mostly born with a high weight. The mother's obesity and diabetes may be the causes of the high birth weight of the infant. Other factors of male large fetus are multiple births, long-term pregnancy, racial history, or the hereditary factor of giving birth in the family and giving birth to an infant weighing more than 4 kg. In diabetic mothers, if the infant's weight is more than 4 kg and 500 g, cesarean section should be performed to prevent the risk of permanent paralysis of the infant's brachial plexus due to the infant's shoulder being stuck at birth, clavicle fracture, cephalohematoma, and death. Maternal diabetes during pregnancy often leads to large fetus and difficulty in childbirth. In these cases, performing a cesarean section prevents the problems [6].

Another cause of large fetus is the large body of parents, which affects the size of the infant. Also, in the cases of second and subsequent pregnancies, old age, maternal obesity, or late delivery are other factors involved in this regard. Moreover, if the mother has a history of large fetus, the probability of the next large fetus will increase [7,8]. Also, the rate of stillbirth in the last month of pregnancy is directly associated with maternal obesity. It is almost double in diabetic mothers. This factor causes large fetus. Several studies have been conducted on the prevalence and risk factors affecting large fetus in different countries. The prevalence of macrosomia defined in South African countries varies from 1.9% in Ethiopia to 14.6% in Nigeria and 4.6% in Cameroon [9]. The highest rate of prevalence was reported in the Scandinavian country with 20% in 2008 [10]. Unfortunately, comprehensive epidemiological studies have not been conducted in Iran on the prevalence and risk factors of large fetus and the information in this area is very limited. Thus, this study evaluates the frequency and maternal and fetal characteristics of pregnancies with large fetus in pregnant mothers referring to Imam Khomeini Hospital in Ahvaz City in 2021.

Materials and Methods

In this cross-sectional descriptive study, all pregnant mothers referring to Imam Khomeini Hospital in Ahvaz between 2019 and 2021 were included in the study. The exclusion criteria were the birth of an infant with severe abnormalities based on the ultrasound report, pregnant women with underlying chronic systemic disorders, and a lack of access to the mother during the study. Women who were not willing to participate in the study and those whose gestational age was more than 42 weeks at the time of delivery were also excluded from the study. The weight of infants at birth was examined in all deliveries, and all infants whose birth weight was above the 85th percentile based on their age were included in the study. Also, all infants weighing more than 4500 g were included. The fetal age at birth was determined based on the ultrasound of the first or second trimester until the 22nd week.

The medical records of mothers who had the above cases were reviewed regarding maternal and fetal characteristics, including maternal age, maternal weight, maternal blood pressure, maternal height, maternal body mass index (BMI), gestational age, previous birth history, chronic diseases, history of abortion, history of stillbirth, weight gain during pregnancy, shoulder dystocia, and fetal problems after birth. Accordingly, 1625 pregnant mothers referring to Imam Khomeini Hospital of Ahvaz from 2019 to 2021 were included. In this study, a census sampling method was used. The completed information in the checklist was statistically analyzed with the help of a statistical consultant through the SPSS software.

Results and Discussion

Out of 5676 infants born in 2019, 395 were large fetus. Out of 691 infants born in 2020, 622 were large fetus, and out of 6732 infants born in 2021, 609 were large fetus. The mean age of pregnant mothers was 31.81 years and the standard deviation was 6.46. The minimum age of the participants was 13 years and the maximum age was 56 years. Out of 1625 infants born with large fetus, 956 (58.8%) were girls, and 669 (41.6%) were boys. The frequency of gestational age in pregnant mothers with large fetus is presented. Out of the total sample of 350 people, the highest frequency was related to week 38, and the lowest frequency was related to weeks 22, 23, and 124. In this regard, 308 people had a history of abortion and 1317 people had no history of abortion. The mean body mass index in mothers with large fetus was 27.62 and the standard deviation was 3.91. The lowest score was 18.05 and the highest score was 36.2. The mean weight gain during pregnancy in pregnant mothers with large fetus was calculated. The mean weight gain in mothers with large fetus was 19.08 kg. Forty-one people have intrauterine death of the fetus and 1584 people do not have intrauterine death of the fetus. Regarding the frequency of history of large fetus in previous births in pregnant mothers with large fetus, 72 (4.4%) people had a history of having large fetus in previous births, and 1553 (95.6%) people did not have it. Regarding problems at the time of birth in pregnant mothers with large fetus, 55 people had dystocia (3%), 2 people had Erb's palsy (0.01%), 4 people had clavicle fracture

(0.02%) and 39 people had Apgar below 6 (2%). Regarding the percentiles of weight of fetuses with large fetus, based on the gestational age, 1124 people were in the 90th percentile and 501 people were in the 95th percentile **(Table 1)**.

Comparing the estimated weight of the fetus with large fetus and the weight after birth in pregnant mothers with large fetus showed that the mean estimated weight by ultrasound is 3740±494.35 g and the birth weight of the infant is 3829±594.82 g (P-value>0.05) **(Table 2)**. Also, the risk of neonatal complications in pregnancies with large fetus is in the 90th and 95th percentiles, and comparing them using the chi-score test shows a significant difference at a significant level of less than 0.05 and there is a significant difference between the complications **(Table 3)**. The univariate and multivariate odds ratio (OR) for the risk of neonatal complications in pregnancies with large fetus are presented. This odds ratio is presented for the univariate and multivariate groups **(Table 4)**.

Table 1. Descriptive indices of source weight percentiles in large fetus based on the gestational age

source weight percentiles in large fetus	Frequency	Percentage of frequency
90th	1124	*69*
95 th	501	*31*

Table 2. Comparison of the estimated weight of the fetus with the weight after birth in pregnant mothers with large fetus

Infant problems	Min	*Max*	Mean±SD
Weight estimation by ultrasound	700	6000	494.35±3740
Weight at birth	800	6200	594.82±3829

Table 3. Maternal and pregnancy characteristics in pregnancies with large fetus

		LGA	LGA severe	
		Mean±SD	Mean±SD	P-value
Maternal characteristics	weight before pregnancy	66.94±13.47	68.09 ± 13.38	0.86
	Weight during pregnancy	86.03±10.06	86.96±10.44	0.92
	BMI	27.06±3.91	28.29 ± 3.90	0.75
		Frequency (percentage of frequency)	Frequency (percentage of frequency)	
Neonatal problems	Dystocia	36 (2.3)	19 (37.3)	< 0.001
	Low Apgar (below 6)	34 (2.2)	5 (9.8)	
	Clavicle fracture	0 (0)	4 (7.8)	
	Erb's palsy	0 (0)	2 (3.9)	

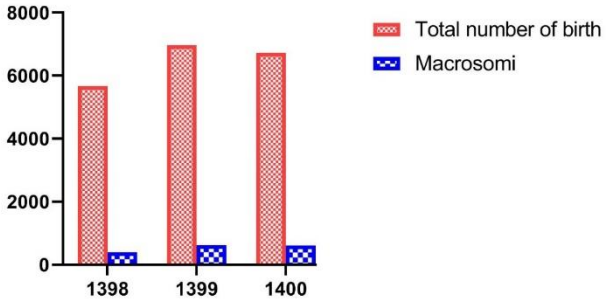

Figure 1: The chart of the frequency of large fetus cases in the studied years

Table 4. Univariate and multivariate odds ratio (OR) for the risk of neonatal complications in pregnancies with large fetus

	LGA		LGA severe	
Fetal complications	Univariate OR(95% CI)	Multivariate OR(95% CI)	Univariate OR(95% CI)	Multivariate OR(95% CI)
Dystocia	(48.92, 13.15) 25.36	(17.28, 69.92) 34.51	(39.92, 11.22) 24.23	(17.28, 69.92) 33.42
Erb's palsy	(1.35, 3.62) 2.21	(1.28,2.22)3.25	(1.35, 3.62) 2.21	(1.89, 2.12) 3.11
Low Apgar (below 6)	(10.48, 1297.77) 37.12	(10.25, 1241.56) 38.13	(10.48, 1297.77) 36.34	(11.25, 1125.43) 39.23
Clavicle fracture	(1.35, 3.62) 2.12	(1.85, 5.17) 3.10	(1.18, 2.42) 3.14	(1.91, 4.15) 4.12

Pregnancy large fetus and macrosomia is a subgroup of high-risk pregnancies. There is no consensus on the definition of fetal macrosomia. It is differently defined as a birth weight above 4000, 4500, or 5000 g [10]. A large fetus and macrosomia is associated with a wide range of maternal and perinatal complications. Macrosomic fetuses are more likely to experience adverse outcomes such as shoulder dystocia, branchial network damage, clavicle fracture, birth suffocation, and neonatal mortality [11]. The present study investigates the prevalence and maternal and fetal characteristics in pregnancies with large fetus in pregnant mothers referring to Imam Khomeini Hospital in 2019-2021. The prevalence of large fetus in pregnant mothers referring to Imam Khomeini Hospital in 2019, 2020, and 22021 was 6.9%, 8.9%, and 9% respectively. In the study by Osaikhuwuomwan *et al.*, out of 306 macrocosmic births, the incidence of macrosomia was 3.6% [12], which is lower than our study.

A study by Shafqat *et al.* investigated the frequency of fetal macrosomia among non-diabetic women. The results showed that out of 119 participants, fetal macrosomia was observed in 10

cases (8.4%) in non-diabetic women [13]. Also, Beta *et al.* estimated the risks of maternal and neonatal complications in macrosomic pregnancies. They showed that among 35548 pregnancies, 4522 (12.7%) had macrosomia, of which 643 (1.8%) had severe macrosomia and 31026 (87.3%) had normal BW [14]. Based on a cross-sectional study by Gharibzadeh *et al.*, the prevalence of large fetus and macrosomia in Tehran was estimated at 6.1%. Also, their study revealed that the risk of macrosomia increases with increasing maternal age, previous history of diabetes in mothers, maternal obesity, and PG [15].

In the study by Shafqat *et al.*, the body mass index of the participants was 29.17 ± 2.36 kg/m2 [13]. In our study, the mean body mass index in infants was 27.62±3.91. In the study by Gu *et al.*, the mean body mass index of the mother in early pregnancy was 22.75±2.81 kg/m2. Overweight (BMI: 27.9-24) or obesity (BMI ≥ 28 kg/m2) increases the risk of macrosomia 1.69 times and 1.49 times, respectively (p=0.000). However, underweight women (BMI <18.5 kg/m2) had an approximately 50% reduced risk [16]. Moreover, the study reported that a 25% increase in pre-pregnancy BMI is a very crucial predisposing factor for macrosomia. In other words, the occurrence of macrosomia in cases with high BMI is 200 times higher than in others [17].

In the present study, the mean age of pregnant mothers was 31.81±6.46 years. In the study by Gu *et al.*, the mean age of the mothers in the macrosomia group was 24.74±3.32 years [16]. Ekabu *et al.* showed that the mean age of the mothers in the macrosomia group was 27.2 years [18]. In our study, 1172 people had a cesarean section (72.1%) and 453 people had a vaginal delivery (27.9%). In the study by Osaikhuwuomwan *et al.*, the rate of cesarean delivery in macrosomic births was significantly different compared to the control group [13]. In the present study, 956 (58.8%) were girls and 669 (44.2%) were boys. In a prospective study by Gu *et al.*, about 64.6% of macrosomic cases were boys, and the male gender was reported as an independent risk factor for macrosomia [16]. In our study, the mean birth weight of infants was 3829±594.82 gr. In the study by Osaikhuwuomwan *et al.*, the mean weight for macrosomic infants was 4.23 kg [13], which is higher than that of the present study. Another goal of our study was to investigate the frequency of problems at birth. In our study, 55 people had dystocia (3 percent), 2 people had Erb's palsy (0.01 percent), 4 people had clavicle fracture (0.02 percent), and 39 people had an Apgar score below 6 (2 percent).

The present study investigated the risk of neonatal complications in pregnancies with large fetus. Dystocia, low Apgar (below 6), clavicle fracture, and Erb's palsy were significantly different between LGA and severe LGA (P<0.001). In the study by Rao *et al.*, results showed that diabetes is a significant risk factor for LBW. Being a boy, maternal age, gestational age, diabetes, and maternal body mass index were significant risk factors for macrosomia [18].

In the study by Osaikhuwuomwan *et al.*, macrosomic delivery was positively associated with maternal weight, previous history of macrosomic delivery, maternal diabetes, and increased gestational age at delivery. The mentioned risk factors (maternal characteristics) are some of the major factors reported in this study [12]. Another study identified gestational diabetes as a significant risk factor for large fetus [19].

Most of the dangerous complications are related to vaginal delivery. In the study by Osaikhuwuomwan *et al.*, vaginal delivery accounted for 53.9% of all macrosomic deliveries, and there were more adverse outcomes such as shoulder dystocia, birth suffocation, and even stillbirth. Examining the effect of the delivery method on the macrosomic outcome of infants showed that there are four cases of stillbirth. Among them, three were seeking vaginal delivery. Two of the three neonates born with vaginal delivery were due to maneuvers to relieve shoulder dystocia in macrosomic infants [12]. In our study, 72.1% and 27.9% had vaginal delivery. However, the effect of the type of delivery on the outcome of large fetus and macrosomia was not investigated. In total, from 2019 to 2021, 19379 births were performed, of which 1,625 fetuses were macrosomatic, which shows the prevalence of 8% among newborns.

Conclusion

The results revealed that the prevalence of pregnancy with large fetus in the Ahvaz was high during the mentioned period. Also, based on the results, pregnancy with large fetus and macrosomia is associated with a significant increase in the risk of serious adverse outcomes for the infant, including dystocia, Erb's palsy, and clavicle fracture. This increases the risk of adverse outcomes for the infants more than the mother. Also, in infants with severe LGA, maternal body mass index, and weight during pregnancy were higher compared to LGA infants. Among the maternal underlying diseases, diabetes accounted for 30% of cases. Therefore, effective and adequate diet before and during pregnancy, weight management before and during pregnancy, blood sugar monitoring, and government policies are necessary to prevent pregnancy with large fetuses in neonates. Due to the limitations of the cross-sectional nature of the study, it is not possible to make a definite conclusion in this regard. The strengths of this study are the large sample size and the accurate diagnosis of maternal and neonatal adverse outcomes. One of the limitations of the study was the failure to estimate the risks of adverse outcomes after adjusting for maternal, pregnancy, and delivery characteristics. Another limitation was not having a control group. It is recommended that more multicenter studies be conducted to investigate maternal and neonatal risk factors in macrosomic infants.

Acknowledgments: None

Conflict of interest: None

Financial support: None

Ethics statement: The research was conducted based on the tents of the Declaration of Helsinki. The Ethics Committee of Ahvaz Jundishapur University of Medical Sciences approved this study. The institutional ethical committee at Ahvaz Jundishapur University of Medical Sciences accepted all study protocols (IR.AJUMS.HGOLESTAN.REC.1401.060). Accordingly, written informed consent was taken from all participants before any intervention. This study was part of the Obstetrics and Gynecology thesis of Sahar Janaki at this university.

References

1. Mgbafulu C, Ajah L, Umeora O, Ibekwe P, Ezeonu P, Orji M. Estimation of fetal weight: a comparison of clinical and sonographic methods. J Obstet Gynaecol. 2019;39(5):639-46.
2. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. Ultrasound. 2018;26(1):32-41.
3. Júnior EA, Peixoto AB, Zamarian ACP, Júnior JE, Tonni G. Macrosomia. Best Pract Res Clin Obstet Gynaecol. 2017;38:83-96.
4. Mohamad Jafari R, Masihi S, Barati M, Maraghi E, Sheibani S, Sheikhvatan M. Value of Pregnancy-Associated Plasma Protein-A for Predicting Adverse Pregnancy Outcome. Arch Iran Med. 2019;22(10):584-7.
5. Samuel TM, Sakwinska O, Makinen K, Burdge GC, Godfrey KM, Silva-Zolezzi I. Preterm birth: a narrative review of the current evidence on nutritional and bioactive solutions for risk reduction. Nutrients. 2019;11(8):1811.
6. Sacks DA. Fetal macrosomia and gestational diabetes: what's the problem? Obstet Gynecol. 1993;81(5 (Pt 1)):775-81.
7. Said AS, Manji KP. Risk factors and outcomes of fetal macrosomia in a tertiary centre in Tanzania: a case-control study. BMC Pregnancy Childbirth. 2016;16(1):243.
8. Agudelo-Espitia V, Parra-Sosa BE, Restrepo-Mesa SL. Factors associated with fetal macrosomia. Rev Saude Publica. 2019;53:100.
9. Turkmen S, Johansson S, Dahmoun M. Foetal Macrosomia and Foetal-Maternal Outcomes at Birth. J Pregnancy. 2018;2018:4790136.
10. Ju H, Chadha Y, Donovan T, O'ROURKE P. Fetal macrosomia and pregnancy outcomes. Aust N Z J Obstet Gynaeco. 2009;49(5):504-9.
11. Boulet SL, Salihu HM, Alexander GR. Mode of delivery and the survival of macrosomic infants in the United States, 1995–1999. Birth. 2006;33(4):278-83.
12. Osaikhuwuomwan J, Osemwenkha A, Orukpe G. Macrosomic births in a tertiary public hospital: a survey of maternal characteristics and fetal outcome. Ethiop J Health Sci. 2016;26(1):31-6.
13. Shafqat T Sr, Zeb L 2nd, Yasmin S 2nd. Fetal Macrosomia Among Non-diabetic Women: Our Experience in a Developing Country. Cureus. 2022;14(7):e26763.
14. Beta J, Khan N, Fiolna M, Khalil A, Ramadan G, Akolekar R. Maternal and neonatal complications of fetal macrosomia: cohort study. Ultrasound Obstet Gynecol. 2019;54(3):319-25.
15. Gharibzadeh S., Javaheri H., Asgari Z., Parviz M.. Evaluating Of The Risk Factors Of Macrosomia In Labours Performed In Baharloo Hospital During Two Years (1380-1381). Ann med health sci res. 2005;3(4):709-713.
16. Gu S, An X, Fang L, Zhang X, Zhang C, Wang J, et al. Risk factors and long-term health consequences of macrosomia: a prospective study in Jiangsu Province, China. J Biomed Res. 2012;26(4):235-40.
17. Asplund CA, Seehusen DA, Callahan TL, Olsen C. Percentage change in antenatal body mass index as a predictor of neonatal macrosomia. Ann Fam Med. 2008;6(6):550-4.
18. Rao J, Fan D, Wu S, Lin D, Zhang H, Ye S, et al. Trend and risk factors of low birth weight and macrosomia in south China, 2005–2017: a retrospective observational study. Sci Rep. 2018;8(1):3393.
19. Onyiriuka A. High birth weight babies: incidence and foetal outcome in a mission hospital in Benin City, Nigeria. Niger J Clin Pract. 2006;9(2):114-9.