Journal of Taibah University Medical Sciences (2017) 12(1), 55–59

Taibah University

Journal of Taibah University Medical Sciences

www.sciencedirect.com

Original Article

Pregnancy outcomes in relation to different types of diabetes mellitus and modes of delivery in macrosomic foetuses in Bahrain

Bedoor S. Al Omran, MBBCh [a,*], Fatima H. Al Ammari, MBBCh [b] and Nawal M. Dayoub, MD [b]

[a] *Department of Radiology, Bahrain Defence Force Hospital, Riffa, Bahrain*
[b] *Department of Obstetrics and Gynecology, Banoon Assisted Conception Unit, Bahrain Defence Force Hospital, Bahrain*

Received 12 June 2016; revised 31 July 2016; accepted 31 July 2016; Available online 14 September 2016

الملخصا

أهداف البحث: إن أسلوب توليد الحوامل من مرضى السكري مختلَف عليه. صُممت هذه الدراسة بغرض تقييم الأنماط المختلفة لتوليد الأطفال كبار الحجوم بسبب ارتفاع معدل انتشار داء السكري في البحرين.

طرق البحث: تم إجراء هذا التحليل الاستعادي على الأمهات اللواتي أنجبن أطفالا ذوي أوزان ≤ ٤.٠ كغم من عام ٢٠٠١م إلى عام ٢٠١١م في مستشفى قوة دفاع البحرين. تم تسجيل البيانات المتعلقة بعمر ووزن وأسلوب التوليد والإصابة بداء السكري من عدمه ومدة الحمل وعدد الولادات السابقة. كان المستخرج الرئيس؛ تأثير داء السكري على قرار السماح بالولادة المهبلية للأطفال كبار الحجوم. وشملت المستخرجات الأخرى عدم نجاح محاولة التوليد الطبيعي، وعدد الولادات السابقة، وأثر عمر الأم، ووزن الجنين على قرار محاولة التوليد الطبيعي، ومضاعفات حديثي الولادة المرتبطة بالولادات المهبلية.

النتائج: نسبة المواليد كبار الحجوم في فترة الدراسة كانت ٢.٢٪ من بين المواليد. لوحظت الإصابة المسبقة بداء السكري في ٣.٩٪ من الخاضعات للدراسة. اختلفت نسبة إجراء عمليات قيصرية مجدولة من ١٢.٥٪ في الأمهات اللواتي لا يعانين من داء السكري إلى ٥٠٪ في اللواتي يعانين منه. أما بالنسبة لإعطاء فرصة ولادة طبيعية، فقد أتم حوالي ٧٠٪ من المرضى اللواتي يعانين من داء السكري ولادة طبيعية ناجحة. كان احتمال الحاجة إلى إجراء اضطراري أقل في اللواتي سبق لهن الولادة مقارنة باللواتي لم يسبق لهن الولادة، إلا أن احتمال القيصرية المجدولة كان متساو بينهما. لم يكن لعمر المريضة ولا لوزن الجنين أي أثر على نجاح محاولة الولادة المهبلية.

الاستنتاجات: كان المعتاد في السابق الإكثار من عرض العملية القيصرية المجدولة على الحوامل ذوات الأجنة كبار الحجم في حال كن يعانين من داء السكري. غالبية المرضى الخاضعات لمحاولة الولادة الطبيعية أتممن ذلك بالقليل من المضاعفات.

الكلمات المفتاحية: الأجنة كبار الحجم؛ تعسر ولادة الكتف؛ العملية القيصرية؛ داء السكري؛ سكري الحمل

Abstract

Objectives: The mode of delivery in diabetic patients is debatable. This study was designed to assess the pattern of delivery of macrosomic babies with a high prevalence of diabetes mellitus in Bahrain.

Methods: This retrospective analysis was conducted on mothers who delivered babies weighing ≥4.0 Kgs from 2001 to 2011 at Bahrain Defence Force Hospital. Data regarding patients' age, weight, mode of delivery, diabetic status, gestational age and parity were recorded. The main outcome was the effect of diabetes mellitus on the decision to allow vaginal delivery for macrocosmic babies. Other outcomes were failed trial of labour, parity, maternal age and foetal weight on the trial of labour and neonatal morbidity associated with vaginal births.

Results: The incidence of macrosomic babies was 2.2% of total births. Pre-existing diabetes mellitus was 3.9% of the study cohort. The rate of elective Caesarean section increased from 12.5% in non-diabetic mothers to 50% in patients with pre-existing diabetes. In cases of allowing a trial of labour, approximately 70% of patients with pre-existing diabetes had successful vaginal delivery. Patients with a previous delivery were less likely to undergo emergency procedures, but had the same probability for elective Caesarean compared with primigravida. Patient's age and foetal weight had no influence on successful trial of vaginal birth.

Conclusions: There was a trend to offer more elective Caesarean sections in patients with macrosomic babies in the presence of pre-existing diabetes. The majority of

* Corresponding address: Department of Radiology, Bahrain Defence Force Hospital, Riffa, Bahrain.
E-mail: drbedooralomran@gmail.com (B.S. Al Omran)
Peer review under responsibility of Taibah University.

Production and hosting by Elsevier

 http://dx.doi.org/10.1016/j.jtumed.2016.07.008

patients who were offered a trial of labour achieved vaginal delivery with minimal morbidity.

Keywords: Caesarean section; Diabetes; Foetal macrosomia; Gestational diabetes; Shoulder dystocia

Introduction

Macrosomia is defined by the American College of Obstetricians and Gynecologists (ACOG) as a birth-weight over 4000 g with no correlation to gestational age.[1] Macrosomia affects approximately 3–15% of all pregnancies. The diagnosis can only be confirmed retrospectively after delivery of the neonate.[2] Genetic, ethnic and racial factors are associated with foetal macrosomia.[3] Pre-gestational diabetes results in foetal macrosomia in 40% of pregnancies.[3]

Furthermore, when patients have gestational diabetes, the risk of having macrosomic babies increases to 50%.[4] A KSA study was conducted from 2004 to 2006 and confirmed the prevalence of macrosomic babies to be 5.6% using the same birth weight definition.[4] Another recent large birth cohort Kuwaiti study reported macrosomia in 6.1% of the cohort, and 23.0% of babies were large for their gestational age.[5]

Macrosomia can cause numerous perinatal and maternal complications.[6] Large babies can be traumatized during vaginal birth, especially those with shoulder presentation. Even with an uncomplicated delivery, macrosomic babies, especially those born to diabetic mothers, have an increased incidence of admission to intensive care infant units to regulate their blood sugar levels and electrolytes. Macrosomia can also lead to maternal complications, such as prolonged labour, Caesarean delivery (CSD), labour assisted with oxytocin, postpartum haemorrhage, infection, serious perineal tears of the 3rd and 4th degree, thromboembolic events (DVT) and anaesthetic accidents.[7]

To prevent any chance of birth trauma to mother and baby, some authors suggested induction of labour before 40 gestational weeks, others recommend routine Caesarean section (CS) for the delivery of foetuses >4500 g.[8] Al-Haddabi's group reported that among 7367 deliveries in a three-year study conducted in the Department of Obstetrics and Gynecology, Sultan Qaboos University Hospital, Sultanate of Oman, the CS rates were increased in the macrosomic group compared with the general group (25.8% vs. 13.1%).[9] Ultrasound techniques are not very reliable in detecting and diagnosing macrosomia.[10]

Unfortunately, there are still no clear guidelines governing the management of macrosomia in diabetic patients, and this issue should be given serious consideration due to its consequence.

The present retrospective analysis aims to assess the mode of delivery in patients with large babies associated with different types of diabetes. The analysis also assessed other factors that might influence the clinical decision and final outcome.

Materials and Methods

Data were collected retrospectively at the BDFMH. Patients who gave birth to babies weighing ≥4.0 Kgs were included. Patients' birth records and birth registry were reviewed between 2001 and 2011. The mode of delivery was recorded in the form of vaginal, emergency lower segment Caesarean section (LSCS) and elective LSCS. Cases were divided into three groups: non-diabetic, gestational diabetes and pre-existing diabetes. All pregnant women included in the study were screened with the 50-g glucose tolerance test at approximately 20 weeks of gestation. Patients who screened positive were subject to a full glucose tolerance test. Patients with one abnormal reading were considered to be glucose intolerant. Patients with two abnormal readings were confirmed to have gestational diabetics. In our analysis, BDF Hospital patients with glucose intolerance were included in the gestational diabetic group. All patients with pre-existing diabetes were either induced or had elective Caesarean before reaching full term. Patients with gestational diabetes were offered delivery at term. Failure to progress was diagnosed based on Friedman's curve.

Patient's age, weight, gestational age at delivery, parity and 3rd and 4th degree tears were recorded. Shoulder dystocia was diagnosed when gentle traction failed to deliver the shoulder and additional obstetric manoeuvres were required. Birth trauma, including Erb's palsy and clavicular/humeral fractures in our birth registry, were recorded.

The main outcome was the effect of DM on the decision to allow macrosomic baby vaginal delivery. Other outcomes included the rate of emergency LSCS with trial of labour, effect of previous delivery/maternal age/foetal weight on the trial of labour and neonatal morbidity associated with vaginal birth. Data were analysed using the StatsDirect statistical package. Two-sided Mann–Whitney U tests were used to compare the medians between two groups, and two-sided unpaired t tests were used to compare the means between two groups. Chi square tests were used in crosstabs, and Fisher–Freeman–Halton exact test was employed in crosstabs when any cells had an expectation of less than 5. P-values of less than 0.05 were considered statistically significant.

Results

The incidence of macrocosmic babies represented approximately 2.2% of all recorded deliveries (811 out of 36,827 cases). Approximately 78% (634/811) of patients did not have gestational or pre-existing diabetes. Gestational diabetes was noted in 18% (145/811) of patients, and pre-existing diabetes was only found in 4% (32/811).

Thirty-four patients with glucose intolerance were added to the gestational diabetes group. Approximately 25% of the patients with gestational diabetes (26/111) were managed with insulin during pregnancy, whereas the remaining majority (76.6%) were managed with diet. Three-fourths of patients with pre-existing diabetes (24/32) were type 1, and

the remaining (8/32) were type 2 diabetics. None of the diabetic patients received oral anti-diabetic therapy during pregnancy within the study period.

Trial of normal labour (TOL) was offered to 685 (84.4%) of the total number of patients in this study. Diabetes significantly influenced the mode of delivery (MOD), with a trend of offering more elective LSCS to patients with pre-existing diabetes (Table 1). Only 50% of patients with pre-existing diabetes and large babies were given the trial of vaginal birth. This number increased to 78.6% in the GDM group ($P < 0.0001$) with a linear trend ($P < 0.0001$) (Table 1). Unfortunately, 12.5% of non-diabetic patients with large babies were delivered by elective LSCS.

Out of the 685 patients, 563 (82.1%) had a normal vaginal delivery when allowed a normal trial of labour. The emergency LSCS rates in patients allowing vaginal birth were significantly different between the study groups ($P = 0.018$).

In total, 69% of patients with pre-existing diabetes and large babies underwent successful vaginal birth. The emergency LSCS rate in patients with large babies and non-diabetic was 16% compared with 25% in the gestational diabetic group ($P = 0.01$) (Table 2). The emergency LSCS group included patients who had LSCS due to other obstetric reasons and not necessarily 'failure to progress' in labour.

The present analysis confirmed that patient's age and foetal weight had no effect on successful trial of vaginal birth with macrosomic babies. The mean age of patients who had emergency LSCS was 30.4 years compared with 31.2 for the vaginal delivery group. The median foetal weight was similar for the 2 groups (4.18 Kgs and 4.15 Kgs) (Table 3). There was a trend toward emergency Caesarean for patients with a median gestational age of 39 weeks compared with those at 41 weeks ($P < 0.0001$).

The majority of screened patients (90%) had a previous delivery, including a previous LSCS. No difference was noted in the elective Caesarean rate between primigravida and patients with previous delivery (18% compared with 15%, respectively). Primigravida in the present analysis exhibited an increased rate of emergency LSCS compared with patients with previous delivery (56% vs. 14%) (Table 4).

The emergency Caesarean rate for 'failure to progress' was significantly increased in patients with pre-existing diabetes (31%) compared with patients with no diabetes (9%). For patients with gestational diabetes, the 'failure to progress' rate was 16.7% (Table 5).

None of the patients who delivered vaginally had an extended vaginal tear of the 3rd or 4th degree. Furthermore, there were no reported serious complications, such as a ruptured uterus or hysterectomy for postpartum haemorrhage. None of the 22 cases of shoulder dystocia reported in the study had pre-existing diabetes. Shoulder dystocia was reported in 6 patients (27%) with gestational diabetes, 3 of whom were receiving insulin treatment. The median foetal weight of these patients was 4.2 kgs. Shoulder dystocia also occurred in 8 patients with no diabetic history who delivered after 41 weeks. It is important to note that all diabetic mothers delivered before 40 weeks, yet shoulder dystocia was not prevented. A single case of clavicular fracture was reported in a 4-kg baby whose mother had diet-controlled gestational diabetes. Another case of Erb's palsy was reported for a 4.5-kg baby whose mother was non-diabetic. Fortunately, the injury resolved without any permanent damage.

Table 2: Emergency Caesarean rate in patients allowed a trial of vaginal birth.

	No DM 555	GDM 114	Pre-existing DM 16
Emergency CS 122	88 (16%)	29 (25%)	5 (31%)
SVD 563	467 (84%)	85 (75%)	11 (69%)

Chi-square $P = 0.0187$.

Table 3: Characteristics of patients who were allowed a trial of labour.

	Emergency CS	SVD	P-value
Patient mean age in years	30.4 (29.3–31.5)	31.2 (30.8–31.8)	$P = 0.1605$
Gestational mean age in weeks	39 (35–41)	41 (35–41)	$P < 0.0001$
Foetal mean weight in kg	4.18 (4–5.34)	4.15 (4–5.37)	$P = 0.06$

Discussion

In current obstetric practice, a macrosomic foetus represents a clinical challenge, especially during the process of vaginal delivery. The rate of macrosomia was estimated at (10.19%) in a recent Algerian study; their foetal complications primarily involved neonatal infections (88%), followed by shoulder dystocia.[11]

A number of studies assessed the most appropriate and safe approach to deliver macrosomic babies. Inducing labour prior to 40 weeks of gestation was offered to some women with predicted foetal macrosomia. This approach would help

Table 1: The effect of DM on the decision to allow macrosomic babies a trial of vaginal birth.

	No DM 634	GDM 145	Pre-existing DM 32
Allowed TOL 685	555 (87.5%)	114 (78.6%)	16 (50%)
Elective CS 126	79 (12.5%)	31 (21.4%)	16 (50%)

Chi-square $P < 0.0001$.

Table 4: Mode of delivery and previous birth.

	Primigravida 78	Previous delivery 733
Elective CS 126	14 (18%)	112 (15%)
Emergency LSCS 122	36 (56%)	86 (14%)
SVD 563	28 (44%)	535 (86%)

Chi-square $P < 0.0001$.

Table 5: Emergency Caesarean rate for 'failure to progress' in patients allowed a trial of vaginal birth.

	No DM 513	GDM 102	Pre-existing DM 16
Emergency CS 68	46 (9%)	17 (16.7%)	5 (31%)
SVD 563	467 (91%)	85 (83.3%)	11 (69%)

Fisher–Freeman–Halton exact P = 0.003, Linear trend P = 0.0006.

mothers to achieve a normal vaginal delivery before the increase in foetal weight, which causes foetal and maternal injuries.[12]

Cheng et al. reported a reduction in the risk of CSD if the foetal weight was known at 39 weeks and labour had been induced.[13] However, Combs' group suggested that induction of labour increases the Caesarean section rate without altering perinatal complications.[14]

Elective CS seems to be safe with regard to preventing most of the complications associated with such a delivery. However, the number of Caesareans required to prevent a single case of permanent injury is so high that it does not justify its use for all cases of macrosomia. In addition, the procedure places the mother and subsequent pregnancies at risk, as noted in a study conducted in the Al-Jouf region, KSA.[15,16] Alsammani and co-workers also reported that the high CS rate observed in their study at the Maternity and Child Hospital, Qassim, KSA was mainly due to elective CS in accordance with hospital policy and not to other risk factors, such as foeto-pelvic disproportion.[17]

In our study, approximately 88% of patients with macrosomic babies were allowed a vaginal trial, and 84% of these achieved their goal. However, we noted a longer gestational age (41 weeks) in the group that achieved vaginal delivery compared with patients who had an emergency Caesarean section (39 weeks). This finding could be due to poor patience compliance or failure to follow-up in the obstetric outpatient clinic. Following the exclusion of other causes of emergency abdominal delivery, the actual rate of 'failure to progress' in those patients was only 9%. Our analysis shows no significant difference in patient age and foetal weight with regard to a successful trial of vaginal birth with a macrosomic baby.

Adding diabetes to the history would dramatically affect the decision regarding the mode of delivery in macrosomic babies. Suspected macrosomic foetuses prompt many clinicians to perform elective CSs in women with diabetes.[18] However, no consensus is available regarding the estimated foetal weight at which elective abdominal delivery is deemed to be necessary in diabetic patients. Menticoglou et al. did not justify a policy of routine CS for all macrosomic babies to prevent mechanical difficulties at delivery.[18]

Instead, these researchers suggest that a prudent supervised trial of vaginal delivery is the preferred approach.[19] They stated that most large babies are delivered without shoulder dystocia. If such a complication is encountered, it could be managed by an experienced obstetrician.

We found that 79% of gestational diabetic patients with a large baby were offered a trial of vaginal birth, which was achieved in 75% of patients. However, 50% of patients with a large baby and pre-existing diabetes were offered elective abdominal delivery immediately. After excluding other indications for elective Caesarean in that group, 30% of patients only had an elective abdominal birth due to macrosomia.

In total, 3.9% of vaginally delivered patients had shoulder dystocia, with neonatal injuries reported in 0.35%. The rate of shoulder dystocia in our cases is less than that reported by Rouse (13.5–52.5%).[20] This finding could be due to under reporting or misdiagnosis in our population. However, our rate is similar to the 4.1% reported by Mulik's group.[21]

The association of a history of previous CS with the current foetal macrosomic state has become a common clinical problem. Previous observations support a policy of trial of labour in this group of women with an estimated foetal weight greater than 4000 g.[22]

Later studies indicate that a previous vaginal birth predicts success in women with macrosomic foetuses undergoing trial of labour after a previous CSD.[22,23] Furthermore, the indication for a previous CSD may affect the success rate of induction. Failure to progress, as an indication for previous CS, seems to be associated with a lower success rate during trial of labour.[23] Obesity appears to be an independent risk factor for failed trial of labour in women with previous CSD.[24]

In our study, there was no difference in the elective Caesarean rate between primigravida and patients with previous delivery (18% vs. 15%, respectively) (Table 4). Of note, 41.2% of patients with previous delivery in the elective list had a previous Caesarean section. However, primigravida patients had a higher rate of emergency LSCS compared with patients with previous delivery (56% vs. 14%) (Table 5). Unfortunately, because the study was retrospective, it was not possible to analyse the mode of delivery in patients who had macrosomic babies with previous CSD and the effect of diabetes on the success of vaginal birth. Additionally, the impact of maternal body mass index (BMI) on clinical and sonographic antenatal assessment is of paramount importance, and it was not possible to address this issue in this analysis.

Conclusions

The assessment of the management approach for more than 800 patients over a 10-year period at the BDFMH confirmed that the rationale for allowing a trial of labour exists based on a patient's preference and data published in the literature. The obstetric history of any given patient with a large baby should be taken into consideration before making any decision. A history of a previous difficult delivery with a mal presentation is one of the factors against operative vaginal delivery. Many patients are multi-parous and want to avoid CSD, especially those who have experienced a previous uncomplicated delivery for a macrosomic infant. Our analysis demonstrated that diabetic patients with a large baby should be assessed on an individual basis and allowed a trial of vaginal birth. Unfortunately, the conclusions drawn from our analysis are limited by the retrospective approach of the study. Further well designed prospective analyses would shed more light on foetuses mislabelled as large for their gestation date due to high BMI and the actual

harm of denying vaginal delivery based on ultrasound findings. In addition, patient perception of a difficult delivery with a large baby and its effect on her choice of accepting a vaginal trial must be taken into consideration.

Conflict of interest

All of the authors have been personally and actively involved in substantive work leading to the manuscript and will hold themselves jointly and individually responsible for its content and declare no conflicts of interest.

Authors' contribution

BSO: Data collection, interpreted data, literature review, designed the work, carried out the research, wrote original draft of manuscript. FHA: Study design. NMD: Study design, research question, statistical analysis and final review. All authors reviewed and approved the final draft of the manuscript and responsible for the content.

Acknowledgements

We would like to thank the BDF Hospital staff and management for willingly providing the data upon which this study is based. We are grateful to Dr Ammar Chiter, Banoon ART and Cytogenetics Centre, for proofreading the manuscript.

References

1. Ng SK, Olog A, Spinks AB, Cameron CM, Searle J, McClure RJ. Risk factors and obstetric complications of large for gestational age births with adjustments for community effects: results from a new cohort study. **BMC Public Health 2010**; 10: 460. http://dx.doi.org/10.1186/1471-2458-10-460.
2. 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): 550–554.
3. Okun N, Verma A, Mitchell BF, Flowerdew G. Relative importance of maternal constitutional factors and glucose intolerance of pregnancy in the development of newborn macrosomia. **J Matern Fetal Med 1997**; 6(5): 285–290.
4. Saleh A, Al-Sultan SM, Moria AM, Rakaf FI, Turkistani YM, Al-Onazi SH. Fetal macrosomia greater than or equal to 4000 grams. Comparing maternal and neonatal outcomes in diabetic and nondiabetic women. **Saudi Med J 2008**; 29: 1463–1469.
5. AlSeaidan M, Al Wotayan R, Christophi CA, Al-Makhseed M, Abu Awad Y, Nassan F, et al. Birth outcomes in a prospective pregnancy–birth cohort study of environmental risk factors in Kuwait: the TRACER study. **Paediatr Perinat Epidemiol 2016**; 30: 408–417. http://dx.doi.org/10.1111/ppe.12296.
6. Kerényi Z, Tamás G, Kivimäki M, Péterfalvi A, Madarász E, Bosnyák Z, et al. Maternal glycemia and risk of large-for-gestational-age babies in a population-based screening. **Diabetes Care 2009**; 32(12): 2200–2205.
7. Fuchs F, Bouyer J, Rozenberg P, Senat MV. Adverse maternal outcomes associated with fetal macrosomia: what are the risk factors beyond birthweight? **BMC Pregnancy Childbirth 2013**: 90. http://dx.doi.org/10.1186/1471-2393-13-90.
8. Bérard J, Dufour P, Vinatier D, Subtil D, Vanderstichèle S, Monnier JC, et al. Fetal macrosomia: risk factors and outcome. A study of the outcome concerning 100 cases >4500 g. **Eur J Obstet Gynecol Reprod Biol 1998**; 77(1): 51–59.
9. Mathew M, Machado L, Al-Ghabshi R, Al-Haddabi R. Fetal macrosomia. Risk factor and outcome. **Saudi Med J 2005**; 26(1): 96–100.
10. Declercq ER, Sakala C, Corry M, Applebaum S, Herrlich A. *Listening to mothers lll: pregnancy and childbirth. Report of the Third National U.S. Survey of Women's Childbearing Experiences*; 2013.
11. Mai AH, Abbassia D. The prevalence of fetal macrosomia at the specialized hospital of gynecology and obstetrics of Sidi Bel Abbes (West of Algeria). **J Nutr Food Sci 2014**; 4: 272. http://dx.doi.org/10.4172/2155-9600.1000272.
12. Gonen O, Rosen DJ, Dolfin Z, Tepper R, Markov S, et al. Induction of labor versus expectant management in macrosomia: a randomized study. **Obstet Gynecol 1997**; 89(6): 913–917.
13. Cheng YW, Sparks TN, Laros Jr RK, Nicholson JM, Caughey AB. Impending macrosomia: will induction of labour modify the risk of caesarean delivery? **BJOG 2012**; 119(4): 402–409.
14. Combs CA, Singh NB, Khoury JC. Elective induction versus spontaneous labor after sonographic diagnosis of fetal macrosomia. **Obstet Gynecol 1993**; 81(4): 492–496.
15. Nadir S, Jamil S, Hamid M. The prevalence of macrosomia in newborns and its association with maternal diabetes. **J Med Sci 2015**; 23(1): 3–6.
16. Hankins GD, Clark SM, Munn MB. Cesarean section on request at 39 weeks: impact on shoulder dystocia, fetal trauma, neonatal encephalopathy, and intrauterine fetal demise. **Semin Perinatol 2006**; 30(5): 276–287.
17. Alsammani MA, Ahmed SR. Fetal and maternal outcomes in pregnancies complicated with fetal macrosomia. **N Am J Med Sci 2012 Jun**; 4(6): 283–286. http://dx.doi.org/10.4103/1947-2714.97212.
18. Menticoglou SM, Manning FA, Morrison I, Harman CR. Must macrosomic fetuses be delivered by a caesarean section? A review of outcome for 786 babies 4500 g. **Aust N Z J Obstet Gynaecol 1992**; 32(2): 100–103.
19. Boulvain M, Stan C, Irion O. Elective delivery in diabetic pregnant women. **Cochrane Database Syst Rev** 2001;(2): CD001997.
20. Rouse DJ, Owen J, Goldenberg RL, Cliver SP. The effectiveness and costs of elective cesarean delivery for fetal macrosomia diagnosed by ultrasound. **JAMA 1996**; 276(18): 1480–1486.
21. Mulik V, Usha Kiran TS, Bethal J, Bhal PS. The outcome of macrosomic fetuses in a low risk primigravid population. **Int J Gynaecol Obstet 2003**; 80(1): 15–22.
22. Elkousy MA, Sammel M, Stevens E, Peipert JF, Macones G. The effect of birth weight on vaginal birth after cesarean delivery success rates. **Am J Obstet Gynecol 2003**; 188(3): 824–830.
23. Mahony RM, Walsh CM, Foley MEF, Daly LF, O'Herlihy CM. Outcome of second delivery after prior macrosomic infant in women with normal glucose tolerance. **Obstet Gynecol 2006**; 107(4): 857–862.
24. Goodall PT, Ahn JT, Chapa JB, Hibbard JU. Obesity as a risk factor for failed trial of labor in patients with previous cesarean delivery. **Am J Obstet Gynecol 2005**; 192: 1423–1426.

How to cite this article: Al Omran BS, Al Ammari FH, Dayoub NM. Pregnancy outcomes in relation to different types of diabetes mellitus and modes of delivery in macrosomic foetuses in Bahrain. J Taibah Univ Med Sc 2017;12(1):55–59.