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Original article

Examining stillbirth rates and characteristics in an Indian tertiary care hospital: a descriptive study from 2020 to 2022

Usha Yadav[1*], Anita Yadav[1], Shashi Lata Kabra[1], Soma Mitra[1], Monika Suri Grover[1]

[1]Department of Obstetrics & Gynecology, Deen Dayal Upadhyay Hospital, New Delhi, India

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Abstract

Background: Stillbirth represents a significant public health concern in India, yet progress in addressing this issue has been incremental. The objective of this study was to comprehensively investigate and document the incidence and characteristics of stillbirth rates in an Indian tertiary care hospital over the period from 2020 to 2022.

Methods: This descriptive study focused on patients beyond 28 weeks of gestation, excluding cases of intrapartum stillbirth. Data were collected from medical records and analyzed descriptively. Among 12,682 births in an Indian tertiary care hospital from 2020 to 2022, all cases of stillbirth were analyzed.

Results: Throughout the study duration, a cumulative total of 245 births, representing 19.31% of the entire birth cohort, resulted in stillbirth within the examined environment. The mean gestational age at the time of stillbirth was determined to be 34.1 ± 3.7 weeks. Noteworthy characteristics among the stillbirth cases included a substantial proportion being primigravida (44.5%) and having undergone at least one antenatal visit (25.7%). Additionally, it was observed that 10.6% of these cases underwent history of previous stillbirth. Relevant medical histories among the subjects experiencing stillbirth encompassed hypothyroidism in 20.8% of cases and hypertension in 16.7%. Maternal conditions associated with stillbirth included abruption placenta (15.5%), pregnancy-induced hypertension (12.2%), and antepartum hemorrhage (11.4%).

Conclusion: These findings underscore the importance of targeted interventions to reduce stillbirth rates and improve maternal and fetal health outcomes. Further research is needed to understand the determinants of stillbirth and develop effective prevention strategies within the Indian healthcare context.

Keywords: Characteristics, Descriptive study, Indian population, Stillbirth, Tertiary care hospital

Introduction

The occurrence of stillbirth presents a distressing situation for caregivers and constitutes a traumatic event for affected families. Globally, an estimated 3.2 million stillbirths transpire each year, signifying a profound impact on maternal and child health. Despite its substantial toll, stillbirth remains under-recognized within policies, programs, and global health indicators, highlighting the urgency for heightened attention and comprehensive interventions to address this critical public health issue (1, 2). The World Health Organization (WHO) delineates third-trimester still birth as the demise of a fetus weighing 1000g or more at birth, occurring after 28 completed weeks of gestation, or when the fetus reaches a minimum length of 35 cm crown-heel. In 2008, global estimates indicated at least 2.65 million annual stillbirths, with approximately 1.2 million of these fetal deaths transpiring intrapartum. These statistics underscore the magnitude of the issue and emphasize the imperative for comprehensive strategies to address and mitigate the incidence of stillbirths worldwide (3, 4).The occurrence of stillbirths presents a complex and varied landscape, with reported incidences fluctuating notably across studies conducted in diverse geographical regions. These discrepancies are heavily influenced by

*Correspondence author: Specialist, Department of Obstetrics & Gynecology, Deen Dayal Upadhyay Hospital, New Delhi, India

Tel: 09718990207 Email: drusha.yadav98@gmail.com

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the specific definitions employed to characterize stillbirth events (5). Advances in prenatal care have shown promise in mitigating the occurrence of stillbirths, rendering some of these tragic losses preventable. Notably, in developed nations, a decline in the overall incidence of stillbirths over time can be attributed to the implementation of tailored healthcare policies, particularly in managing high-risk pregnancies. However, the accuracy of stillbirth incidence in low and middle-income countries is often compromised by factors such as under-reporting and insufficient documentation, especially in cases of home deliveries, presenting challenges in obtaining reliable data (1, 6).

Perinatal mortality, as defined by the World Health Organization (WHO), encompasses the number of stillbirths occurring within the first week of life per 1000 live births and serves as a critical indicator for evaluating the efficacy of healthcare delivery. According to the Perinatal Mortality Surveillance Report, stillbirth is characterized as the delivery of a baby without signs of life after 24 completed weeks of pregnancy, a definition adopted by the Royal College of Obstetricians and Gynecologists in their 2010 Green-top Guideline. Although stillbirth remains a significant contributor to perinatal mortality in developing nations, advancements in antenatal care, perinatal diagnostic techniques, and intrapartum monitoring have led to a reduction in its incidence (7).

Stillbirths can be classified as either antepartum or intrapartum. Antepartum fetal deaths, occurring before the onset of labor, are influenced by a myriad of maternal, fetal, and placental factors (8). Hypertensive disorders of pregnancy, anemia, obesity, diabetes, high parity, and advanced maternal age are widely acknowledged as maternal factors contributing to antepartum fetal deaths. Conversely, fetal factors such as congenital anomalies and intrauterine growth retardation play significant roles. Placental causes, including abruption and antepartum hemorrhage, also contribute to antepartum stillbirths. On the other hand, intrapartum fetal death typically stems from fetal distress and/or obstructed labor, serving as an indicator of suboptimal clinical care quality (9). Cord-related complications, such as a tight cord around the neck, true knot, and cord prolapse, are additional factors contributing to intrapartum stillbirths. These complications further underscore the importance of vigilant monitoring and prompt intervention during labor and delivery to mitigate the risk of adverse outcomes (10).

Maternal infection stands as one of the foremost causes of stillbirth. Ascending infections, whether accompanied by membrane rupture or not, are frequently attributed to pathogens such as Escherichia coli, Klebsiella, Group B Streptococcus, Enterococcus, Mycoplasma/Ureaplasma, Haemophilus influenzae, and Chlamydia. These infections underscore the critical need for effective maternal screening, prevention, and treatment protocols to safeguard against stillbirth occurrences (11, 12).

In developing countries, additional infectious agents such as malaria, syphilis, and HIV pose significant risks for stillbirth. Moreover, various medical conditions including thyroid abnormalities, cholestasis of pregnancy, Diabetes Mellitus, hypertensive disorders, renal disease, systemic lupus erythematosus, sickle-cell disease, anemia, and nutritional deficiencies in the mother are prevalent contributors to stillbirth in low and middle-income countries. These conditions underscore the multifactorial nature of stillbirth occurrences and emphasize the importance of comprehensive healthcare strategies tailored to the specific needs of diverse populations (13, 14).

Therefore, the objective of this study was to comprehensively investigate and document the incidence of stillbirth rates in Indian tertiary care hospital over the period from 2020 to 2022. Through a descriptive analysis, the study elucidated demographic attributes, obstetric condition, past medical histories, maternal and fetal condition of mothers with still birth.

Materials & Methods

This descriptive study was carried out subsequent to obtaining approval from the institutional ethics committee, as indicated by the reference number F.No.2/JSSHS/IEC/ECC-16/2020.

This descriptive study focused on patients beyond 28 weeks of gestation, excluding cases of intrapartum stillbirth. Data were collected from medical records and analyzed descriptively. Among 12,682 births in an Indian tertiary care hospital from 2020 to 2022, 245 cases of stillbirth were analyzed.

Written informed consent was secured from all patients or their next of kin. Participants were admitted through the Antenatal clinic and Obstetrics emergency department. Throughout the study duration, a total of 12,682 births were recorded, encompassing 245 cases of stillbirth, which were included in the analysis. Patients underwent thorough evaluations, encompassing obstetrical history, physical examinations, and pertinent investigations such as hemoglobin levels, blood group, Rh factor, infectious disease screenings, and other specialized tests as warranted by individual cases.

The diagnosis of stillbirth relied predominantly on the absence of fetal heart sounds, which was corroborated by ultrasound examination. Gestational age was established using both the last menstrual period and early ultrasound findings. Comprehensive data, encompassing clinical assessments and investigation results, were meticulously recorded in a standardized Performa specifically designed for this study.

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The primary aim of this study was to evaluate the incidence of stillbirth within the hospital setting. Additionally, the secondary objective sought to elucidate demographic characteristics, obstetric conditions, past medical histories, as well as maternal and fetal conditions among mothers who experienced stillbirth.

Results

Throughout the study duration, a cumulative total of 245 births, representing 19.3% of the entire birth cohort, resulted in stillbirth within the examined environment.

Table 1. Obstetric condition of mothers with still birth in an Indian tertiary care hospital (n=245)

	n	%
Antenatal visits		
At least one	63	25.7
4+ visit	37	15.1
8+ visits	6	2. 5
Minimum 4 visits	58	23.7
None	55	22.5
Unknown	26	10.6
Gravida (number)		
Primi	109	44.5
2	90	36.7
3	31	12.7
≥ 4	19	6.1
Parity (number)		
0	122	49.8
1	101	41.2
≥ 2	22	9.0
Abortion (number)		
0	207	84.5
1	26	10.6
≥ 2	12	4.9
Prenatal ultra-sonography		
Anomaly detected	31	12.7
Normal	151	61.6
Not done	63	25.7
Sex of fetus		
Female	116	47.4
Male	129	52.7
SGA/AGA		
Appropriate-for-gestational-age (AGA)	130	53.1
Small-for-gestational age (SGA)	115	46.9
Consanguineous marriage	7	2.9
RH negative	19	7.8
Positive Syphilis screening test	4	1.6
HIV Positive	2	0.8
Induction of labor	132	53.9
Caesarean section	15	6.1

Noteworthy characteristics among the stillbirth cases included a substantial proportion being primigravida (44.5%), having undergone at least one antenatal visit (25.7%), and lacking a history of abortion (84.5%) (Table 1).

Analysis of maternal medical histories unveiled that the majority of mothers had no significant medical history (40.4%). Hypothyroidism emerged as the most prevalent medical condition among mothers experiencing stillbirth, accounting for 20.8% of cases. Following hypothyroidism, hypertension was the second most common medical history, affecting 16.7% of mothers, while gestational diabetes mellitus (GDM) was noted in 9.8% of cases. Additionally, anemia was present in 4.9% of mothers, followed by urinary infections (2.0%), undernutrition (1.2%), and toxoplasmosis, rubella cytomegalovirus, herpes simplex, and HIV (TORCH) infections (0.8%). These findings highlight the spectrum of maternal health conditions associated with stillbirth occurrences, emphasizing the need for comprehensive maternal health assessments during pregnancy to mitigate associated risks (Table 2).

Table 2. Past history of mothers with still birth in an Indian tertiary care hospital (n=245)

	N	%
History of previous stillbirth	26	10.6
Anemia	12	4.9
Gestational diabetes	24	9.8
Hypertension	41	16.7
Hypothyroidism	51	20.8
not significant	99	40.4
TORCH	2	0.8
Under nutrition	3	1.2
Urinary infection	5	2.0

Maternal conditions associated with stillbirth included abruption placenta (15.5%), pregnancy-induced hypertension (12.2%), and antepartum hemorrhage (11.4%). The mean gestational age at the time of stillbirth was determined to be 34.1 ± 3.7 weeks (Table 3).

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Following delivery, the most prevalent fetal causes identified were antepartum hypoxia, accounting for 70.2% of cases, followed by unspecified fetal causes at 11.4%. Additionally, birth defects were identified in 5.3% of cases, while intrauterine growth restriction (IUGR) and meconium-stained liquor (MSL) were observed in 4.5% and 3.3% of cases, respectively. These findings underscore the prominence of antepartum hypoxia as a significant contributor to stillbirth occurrences and highlight the multifaceted nature of fetal factors implicated in these tragic events (Table 4).

Table 3. Maternal conditions of mothers with still birth in an Indian tertiary care hospital (n=245)

	N	%
Antepartum hemorrhage	28	11.4
Cord prolapse	3	1.2
Eclampsia	13	5.3
Abruption placenta	38	15.5
Complication of labor &delivery	5	2.0
GDM	8	3.3
Gestational HTN	1	0.4
HELLP Syndrome	1	0.4
Severe oligohydramnios	2	0.8
Hypothyroidism	5	2.0
IHCP	1	0.4
Infection	3	1.2
Mother healthy	75	30.6
Noxious influence	1	0.4
Partial HELLP	1	0.4
Pregnancy induced hypertension	30	12.2
Pre-eclampsia	16	6.5
severe anemia	11	4.5
severe pre-eclampsia	1	0.4
Unexplained	2	0.8

Table 4. Fetal conditions of mothers with still birth in an Indian tertiary care hospital (n=245)

	N	%
Birth defect	13	5.31%
Antepartum hypoxia	172	70.20%
Two loop cord around the neck	3	1.23%
Hydrops fetalis	3	1.22%
Infection	3	1.23%
Birth Trauma	1	0.41%
IUGR*	11	4.49%
MSL**	8	3.3%
True knot	3	1.23%
Unspecified fetal cause	28	11.43%

*IUGR: Intrauterine growth restriction
**MSL: Meconium-stained liquor

Discussion

In our study, we observed a total of 12,682 births, among which 245 cases resulted in stillbirth, corresponding to an incidence rate of 19.3 per 1000 total births. This finding is consistent with the results reported by Makwana et al., who documented a stillbirth proportion of 16.5 per 1000 total births. The similarity in stillbirth rates between our study and previous research underscores the persistent challenge posed by stillbirths in healthcare settings. Further investigation into the factors contributing to stillbirths, as well as the implementation of targeted interventions, is warranted to reduce the incidence of this tragic outcome (15). Nevertheless, the rates observed in both our study and the findings reported by Makwana et al. exceed the target set by the World Health Assembly of achieving 12 or fewer stillbirths per 100,000 people by the year 2030. This discrepancy highlights the urgent need for a substantial increase in the global annual rate of reduction (ARR) from the current 2% to more than twofold in order to meet this ambitious objective. Addressing the persistent challenge of stillbirths

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requires concerted efforts across healthcare systems, emphasizing the importance of implementing effective preventive measures and interventions to reduce the burden of stillbirth worldwide.

Our study revealed a notable predominance of stillbirths among primigravida patients, comprising 44.5% of the cases. This finding aligns with the results reported by Mustufa et al., further corroborating the increased vulnerability of first-time pregnant individuals to stillbirth events. The higher proportion of stillbirths among primigravida patients underscores the importance of targeted interventions and vigilant monitoring during initial pregnancies to mitigate associated risks and improve maternal and fetal outcomes. Additionally, this consistency across studies highlights the need for continued research and implementation of preventive strategies tailored to the specific needs of primigravida individuals (16).

Our study's examination of gestational age distribution among stillbirth cases echoed the findings reported by Mustufa et al., indicating that a considerable proportion of stillbirths occurred within the gestational age range of 32 to 37 weeks, accounting for 46.9% of cases. This consistency in findings underscores the critical period of late preterm and early term gestation as particularly vulnerable to stillbirth events. The concentration of stillbirths within this gestational window highlights the importance of heightened surveillance and targeted interventions during this crucial period to mitigate the risk of adverse outcomes. Understanding the timing and distribution of stillbirths across gestational ages is essential for guiding clinical practice and public health initiatives aimed at reducing the burden of stillbirth. Further research into the underlying factors contributing to stillbirths during this specific gestational period is warranted to inform effective preventive strategies and improve perinatal outcomes (16).

Our study corroborates existing evidence regarding the substantial contribution of hypertensive disorders during pregnancy to stillbirth occurrences, especially in singleton pregnancies. Notably, chronic hypertension and superimposed preeclampsia emerged as significant risk factors for stillbirth in our findings, consistent with prior research. Makwana et al. similarly reported hypertensive disorders in pregnancy as a notable contributor to stillbirths, aligning with our study's observations. These findings emphasize the critical importance of identifying and effectively managing hypertensive disorders during pregnancy to mitigate the associated risk of stillbirth. Comprehensive antenatal care protocols should include vigilant monitoring and timely interventions for hypertensive disorders to optimize maternal and fetal outcomes and reduce the burden of stillbirth. Further research into the underlying mechanisms linking hypertensive disorders to stillbirths is warranted to inform targeted preventive strategies and improve perinatal care practices (15).

Additionally, our study observed that antepartum hemorrhage and congenital malformations contributors to stillbirth, a finding consistent with existing literature (17). Effective antenatal care protocols should include proactive measures to monitor and manage conditions such as antepartum hemorrhage and congenital malformations to minimize the risk of stillbirth and improve perinatal outcomes. Further research into the mechanisms underlying these associations is warranted to inform targeted interventions and optimize maternal and fetal health during pregnancy.

While our study provided valuable insights into stillbirth occurrences, it is essential to acknowledge its limitations. These include a relatively small sample size, single-center focus, and potential hospital bias inherent in a tertiary care hospital setting. The small sample size may limit the generalizability of our findings to broader populations, while the single-center focus may introduce inherent biases specific to the study institution. Additionally, the tertiary care hospital setting may not fully represent the diverse healthcare contexts present in other settings.

Despite these limitations, our findings underscore the ongoing challenges in reducing stillbirth rates and highlight the critical need for targeted interventions and improved maternal healthcare. Addressing preventable causes of stillbirths requires multifaceted approaches, including enhanced prenatal care, early detection and management of risk factors, and community-based interventions. Moreover, efforts to improve access to quality maternal healthcare services, particularly in resource-limited settings, are crucial in reducing the burden of stillbirths. By addressing these challenges and implementing evidence-based interventions, we can work towards reducing the incidence of stillbirths and improving maternal and fetal health outcomes on a global scale.

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Mustufa et al.'s findings, reporting a notably higher proportion of stillbirths (55.47%) occurring between 32 and 37 weeks of gestational age, provide additional insight into the timing of stillbirth occurrences. This observation further emphasizes the critical period of late preterm and early term gestation as particularly vulnerable to stillbirth events. The higher proportion of stillbirths within this gestational window underscores the importance of heightened surveillance and targeted interventions during this crucial period to mitigate the risk of adverse outcomes (16)(18).

In elucidating the etiological factors contributing to stillbirth occurrences, Makwana et al. (15) have ascribed 24.8% of instances to hypertensive disorders manifesting during gestation, a conclusion bolstered by the research of Njoku et al., who similarly identified hypertensive disorders as accountable for 18.9% of cases (19) and Sharma S et al. (19.6%) (20) . Hypertensive disorders such as Pregnancy-Induced Hypertension (PIH) can precipitate vasospasm, thereby diminishing perfusion to vital organs including the placenta, consequently culminating in fetal hypoxia and eventual stillbirth. Our investigation concurred with this assertion, observing that hypertensive disorders during pregnancy accounted for 19.3% of stillbirth incidences. Conversely, PIH may engender placental insufficiency, thereby exacerbating fetal hypoxia and potentially instigating a cascade of maternal and neonatal complications (21).

Furthermore, Pregnancy-Induced Hypertension (PIH) and other hypertensive disorders occurring during gestation are correlated with heightened probabilities of stillbirth, preterm delivery, and low birth weight (22).

Antepartum hemorrhage has emerged as a noteworthy determinant of stillbirth across diverse research endeavors. As illustrated by Makwana et al., antepartum hemorrhage was documented to contribute to 8.2% of instances of stillbirth (15). Similarly, Sharma et al. identified antepartum hemorrhage as the causative factor in 13% of documented stillbirth cases (19).

Moreover, congenital malformations have been associated with occurrences of stillbirth. Makwana et al. observed that three cases of stillbirth were attributed to congenital malformations, accounting for 2.7% of the total cases examined (15). n contrast, Njoku et al. documented a lower rate of stillbirth attributed to congenital malformations, reporting a prevalence of 1% (20). On the contrary, Sharma et al. identified a higher rate of stillbirths associated with congenital malformations, reporting an incidence of 8% (19).

Nevertheless, it is imperative to recognize the constraints inherent in the study, comprising a limited sample size, its execution within a singular institution, and the potential for hospital bias, given its conduct in a tertiary care setting. These limitations possess the capacity to influence the broader applicability of the findings and warrant careful consideration during the interpretation of results.

Conclusion

In conclusion, this study sheds light on the significant public health challenge posed by stillbirths in India, highlighting the need for ongoing efforts to address this issue. The findings underscore the importance of comprehensive investigations into the incidence and characteristics of stillbirth rates, as conducted within the framework of this study. By analyzing data from an Indian tertiary care hospital over a two-year period, we have identified notable trends and characteristics of stillbirth occurrences. The observed characteristics, including the prevalence of primigravida, antenatal care utilization, and medical histories such as hypothyroidism and hypertension, provide valuable insights for healthcare practitioners and policymakers. These findings emphasize the imperative of implementing targeted interventions aimed at reducing stillbirth rates and improving maternal and fetal health outcomes. Moving forward, further research is warranted to delve deeper into the underlying determinants of stillbirth and to develop effective strategies for prevention and management within the Indian healthcare context. Ultimately, concerted efforts across multiple sectors are essential to mitigate the burden of stillbirths and enhance the overall quality of maternal and neonatal care in India.

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Conflicts of Interest

None declared.

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References

1. American Diabetes A. Diagnosis and classification of diabetes mellitus. Diabetes Care 2010; 33 Suppl 1: S62-69.
2. Xiong X, Saunders LD, Wang FL, Demianczuk NN. Gestational diabetes mellitus: prevalence, risk factors, maternal and infant outcomes. Int J Gynaecol Obstet 2001; 75(3): 221-228.
3. Hirst JE, Tran TS, Do MA, Morris JM, Jeffery HE. Consequences of gestational diabetes in an urban hospital in Viet Nam: a prospective cohort study. PLoS Med 2012; 9(7): e1001272.
4. Deierlein AL, Siega-Riz AM, Chantala K, Herring AH. The association between maternal glucose concentration and child BMI at age 3 years. Diabetes Care 2011; 34(2): 480-484.
5. Aulinas A, Biagetti B, Vinagre I, et al. [Gestational diabetes mellitus and maternal ethnicity: high prevalence of fetal macrosomia in non-Caucasian women]. Med Clin (Barc) 2013; 141(6): 240-245.
6. Katon J, Reiber G, Williams MA, Yanez D, Miller E. Antenatal haemoglobin A1c and risk of large-for-gestational-age infants in a multi-ethnic cohort of women with gestational diabetes. Paediatr Perinat Epidemiol 2012; 26(3): 208-217.
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; 13: 90.
8. Parhofer KG, Hasbargen U, Ulugberdiyewa A, Abdullayewa M, Melebayewa B, Annamuhammedov A, et al. Gestational diabetes in Turkmenistan: implementation of a screening program and first results. Arch Gynecol Obstet 2014; 289(2): 293-298.
9. Di Cianni G, Volpe L, Lencioni C, Miccoli R, Cuccuru I, Ghio A, et al. Prevalence and risk factors for gestational diabetes assessed by universal screening. Diabetes research and clinical practice. 2003; 62(2): 131-137.
10. M KN, S AA, B L. A review on the prevalence of gestational diabetes mellitus (GDM) in different regions of Iran. Journal of Diabetes and Metabolic Disorders 2009.
11. Crete JE, Anasti JN. Diagnosis of gestational diabetes mellitus: can we avoid the glucose challenge test? J Am Assoc Nurse Pract 2013; 25(6): 329-333.
12. Corrado F, Pintaudi B, Di Vieste G, Interdonato ML, Magliarditi M, Santamaria A, et al. Italian risk factor-based screening for gestational diabetes. J Matern Fetal Neonatal Med 2014; 27(14): 1445-1448.
13. Godwin M, Muirhead M, Huynh J, Helt B, Grimmer J. Prevalence of gestational diabetes mellitus among Swampy Cree women in Moose Factory, James Bay. CMAJ 1999; 160(9): 1299-1302.
14. Esmaeilzadeh S, Delavar MA, Amiri M, Khafri S, Pasha NG. Polycystic ovary syndrome in Iranian adolescents. Int J Adolesc Med Health 2014; 26(4): 559-565.
15. Kulshreshtha B, Arora A, Pahuja I, Sharma N, Pant S. Menstrual cyclicity post OC withdrawal in PCOS: Use of non-hormonal options. J Obstet Gynaecol 2016: 1-6.
16. Haver MC, Locksmith GJ, Emmet E. Irregular menses: an independent risk factor for gestational diabetes mellitus. Am J Obstet Gynecol 2003; 188(5): 1189-1191.
17. Heidari T, Kariman N, Afrakhteh M, Alavi Majd H. The study of relationship between menorrhagia and gestational diabetes. koomesh 2008; 9(2): 147-154.
18. Weiss DJ, Charles MA, Dunaif A, Prior DE, Lillioja S, Knowler WC, et al. Hyperinsulinemia is associated with menstrual irregularity and altered serum androgens in Pima Indian women. Metabolism 1994; 43(7): 803-807.
19. Solomon CG, Hu FB, Dunaif A, et al. LOng or highly irregular menstrual cycles as a marker for risk of type 2 diabetes mellitus. JAMA 2001; 286(19): 2421-2426.
20. Sreekanthan K, Belicita A, Rajendran K, Vijayakumar A. Prevalence of Gestational Diabetes Mellitus in a Medical College in South India: A Pilot Study. Indian J Clin Pediatr 2014; 24(4): 341-347.
21. Roumain J, Charles MA, de Courten MP, Hanson RL, Brodie TD, Pettitt DJ, et al. The relationship of menstrual irregularity to type 2 diabetes in Pima Indian women. Diabetes Care 1998; 21(3): 346-349.
22. Chen L, Li S, He C, Zhu Y, Buck Louis GM, Yeung E, et al. Age at Menarche and Risk of

[DOI: 10.22088/caspjrm.9.1.8]

Gestational Diabetes Mellitus: A Prospective Cohort Study Among 27,482 Women. Diabetes Care. 2016 2016-01-22.
23. Seshiah V, Sahay B, Das A, Shah S, Banerjee S, Rao P, et al. Gestational diabetes mellitus-Indian guidelines. Journal of the Indian Medical Association 2009; 107(11): 799.
24. Boriboonhirunsarn D, Talungjit P, Sunsaneevithayakul P, Sirisomboon R. Adverse pregnancy outcomes in gestational diabetes mellitus. J Med Assoc Thai 2006 ; 89 Suppl 4: S23-28.
25. Getahun D, Fassett MJ, Jacobsen SJ. Gestational diabetes: risk of recurrence in subsequent pregnancies. Am J Obstet Gynecol 2010; 203(5): 467 e1-6.
26. Yang X, Hsu-Hage B, Zhang H, et al. Gestational diabetes mellitus in women of single gravidity in Tianjin City, China. Diabetes Care 2002; 25(5): 847-851.
27. Kaaja R, Ronnemaa T. Gestational diabetes: pathogenesis and consequences to mother and offspring. Rev Diabet Stud 2008; 5(4): 194-202.
28. Tabak AG, Tamas G, Peterfalvi A, et al. The effect of paternal and maternal history of diabetes mellitus on the development of gestational diabetes mellitus. J Endocrinol Invest 2009; 32(7): 606-610.
29. Al-Rowaily MA, Abolfotouh MA. Predictors of gestational diabetes mellitus in a high-parity community in Saudi Arabia. East Mediterr Health J 2010; 16(6): 636-641.
30. Zargar AH, Sheikh MI, Bashir MI, et al. Prevalence of gestational diabetes mellitus in Kashmiri women from the Indian subcontinent. Diabetes research and clinical practice 2004; 66(2):139-145.
31. Sivakumar V, Rajasekeran A, Arummugam A. Assesment of Risk Factors for the Early Detection of Gestational Diabetes Mellitus. Int J of Pharma Sciences and Research 2014; 5(3): 114-118.
32. Hadaegh F, Tohidi M, Harati H, Kheirandish M, Rahimi S. Prevalence of gestational diabetes mellitus in southern Iran (Bandar Abbas City). Endocr Pract 2005; 11(5): 313-318.

[DOI: 10.22088/caspjrm.9.1.8]