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Pregnancy Outcomes among Adolescents and Young Adults with Diabetes in Kumasi, Ghana

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ABSTRACT

Background: Pregnancy in patients with diabetes is known to be associated with complications. Improving glycaemic control can improve pregnancy outcomes.

Aims: This study assessed pregnancy outcomes among adolescents and young women with diabetes at Paediatric and Adolescent Diabetes Clinic, Komfo Anokye Teaching Hospital, Kumasi, Ghana.

Methods: A clinical review involving eighteen children and young women with diabetes who became pregnant during follow-up care at Paediatric and Adolescent Diabetes Clinic in Ghana. Girls and young women suspected to be pregnant were referred to antenatal clinic for confirmation. Multidisciplinary care including comprehensive antenatal care was given to each participant throughout the pregnancy. Questionnaire was used to gather demographic and clinical information of participants including pregnancy outcomes.

Results: A total of eighteen adolescents and young women got pregnant and were included in the study. They were attending school when they got pregnant, 55.6% were in Senior High School, 33.3% were in Junior High School and 11.1% were in Teacher Training College. The mean age at pregnancy was 18.39 years (SD 2.97). Two pregnancies ended in abortion while 16 resulted in 18 live births (14 singleton and 2 twin deliveries). All deliveries were supervised, 56.3% delivered via cesarean section. Two births were preterm, occurring at 30 and 32 weeks of gestation. Neonatal outcomes were generally favorable: all babies were clinically well, 55.6% had 5-minute APGAR (Appearance, Pulse, Grimace, Activity, and Respiration) score between 8 and 10, while 44.4% had 5-minute APGAR score between 6 and 7. Only one infant (5.6%) had a congenital malformation. One baby died at one month due to septicemia.

Conclusion: Structured multidisciplinary interventions led to positive pregnancy outcomes among young females with diabetes in Ghana.

Keywords: *Adolescents; Diabetes; Pregnancy; Outcomes; Young adults*.

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1. Introduction

According to the 10th Atlas of the International Diabetes Federation (IDF), 21 million live births were affected by hyperglycaemia in pregnancy in 2021 (IDF Atlas, 2024). Pregnancy in women with diabetes is associated with complications such as pre-eclampsia, preterm birth, macrosomia, obstructed labour, congenital malformations, intra-uterine growth restriction, low birth weight and stillbirth (Negrato et al., 2012; Bapayeva et al., 2022). Pregnancy among adolescents is very common, particularly, in Africa (Kassa et al., 2018) and adolescents and young women with diabetes are no exception. It is mostly unplanned and hence accompanied by a myriad of complications such as low birthweight, premature births and neonatal deaths (Ganchimeg et al., 2014; Olausson et al., 1999). Hyperglycaemia is teratogenic so optimal glycaemic control before and during pregnancy can reduce the risk of adverse outcomes for both the mother and the baby (Owens et al., 2016). Moreover, unplanned pregnancies among adolescents girls and young adult women with diabetes coupled with poor social support may reduce opportunities to attain good glycaemic control before and during pregnancy (Rosengard et al., 2004; Lowri et al., 2020).

Ensuring good glycaemic control in adolescent girls and young mothers with diabetes requires a multidisciplinary management approach involving endocrinologists, obstetricians, psychologists, diabetes nurse educators, dietitians, clinical psychologists and midwives. Such comprehensive care can improve maternal and foetal outcomes by ensuring appropriate insulin and diet management, (American Diabetes Association Professional Practice Committee, 2024) and safe exercise practices. It is important that good glycaemic control is maintained for better maternal and fetal outcomes (American Diabetes Association Professional Practice Committee, 2024; Ganchimeg et al., 2014).

Despite substantial global research on the impacts of diabetes in pregnancy, data from Africa remain scarce. Particularly, no data were found from Ghana about pregnancy among adolescents and young women with pregestational diabetes. Ozumba et al., (2003) in a study in Enugu, Nigeria compared pregnancy outcomes among women with and without diabetes. Their findings indicated a comparatively higher incidence of maternal and fetal complications amongst those with pregestational diabetes. Existing studies from high-income countries highlight the clinical risks associated with pregnancy in young populations. A population-based cohort study in Wales on pregnancy in teenage girls diagnosed with type 1 DM by Allen et al., (2020) found poor glycaemic control among them and more hospital admissions of their babies during the first year of life. Klingensmith et al., (2016) in the USA reported poor clinical outcomes such as miscarriages, still births and congenital anomalies among adolescents and young adult women with type 2 DM. Walker et al., (2018) found out that pregnancy among adolescents with diabetes mellitus were at high risk for complications such as cesarean section, preeclampsia and macrosomia.

Komfo Anokye Teaching Hospital is a 1,200-bed facility and the main referral tertiary hospital for Kumasi metropolis, Ashanti region, northern sector, and middle belt of Ghana. It has 17 directorates including Child Health and Obstetrics and Gynaecology directorates. These two directorates run outpatient clinics and offer a range of in-patient services. The Paediatric and Adolescent Diabetes Clinic, one of the outpatient clinics of the Child Health Directorate, provides supervised care for children and young adults with diabetes. Two paediatric/adolescent endocrinologists and two diabetes nurse educators run the two-day-a-week clinic on Mondays and Thursdays. The Obstetrics and Gynaecology Directorate runs an antenatal clinic on all week days. The Obstetric and Gynaecology directorate performs approximately 6,000 deliveries annually.

This study aimed at assessing pregnancy outcomes among adolescents and young women with diabetes attending Paediatric and Adolescent Diabetes Clinic at Komfo Anokye Teaching Hospital in Ghana and focused on the role of multidisciplinary care in pregnant adolescents and young adults with diabetes.

2. Methods

Study design/research procedures

The study design included clinical review of eighteen (18) adolescent girls and young women who were attending Paediatric and Adolescent Diabetes Clinic at Komfo Anokye Teaching Hospital, Kumasi, Ghana who became

pregnant during supervised care. Participants presenting with clinical features suggestive of pregnancy such as secondary amenorrhea, nausea and vomiting were referred to the antenatal clinic at Komfo Anokye Teaching Hospital for confirmation. All confirmed cases were jointly managed by a multidiscipline team consisting of endocrinologists, obstetricians, midwives, diabetes nurse educators, dieticians and clinical psychologists until delivery. The participants and their families were counselled in the clinic at every visit and also referred to a psychologist for continuous counseling and psychological support to ensure acceptance and social support by their families. The Paediatric and Adolescent Diabetes Clinic at Komfo Anokye Teaching Hospital receives logistic support from Life for A Child (LFAC), Australia for children and young adults with diabetes up to 30 years (LFAC, 2023). So it is common to find patients with diabetes for up to 30 years in the clinic because of free insulin and other supplies.

At every follow-up visit, blood glucose logbooks were brought for inspection of their home blood glucose monitoring records. The blood glucose values in the logbooks were matched against the values in the glucometers memory. This was to ensure that the participants did not fabricate the glucose values. They checked their blood glucose three times daily because of restricted supply of strips. Glycated haemoglobin (HbA1C) was tested for each participant at the time of confirmation of pregnancy, every three months after confirmation and at the time of delivery or immediately after delivery. Participants were allowed to attend antenatal clinics at hospitals or maternity homes closer to their places of residence but they had to come to Paediatric and Adolescent Diabetes Clinic at Komfo Anokye Teaching Hospital for HbA1C testing every three months and also to come to Komfo Anokye Teaching Hospital at term or when in labour for supervised delivery. At delivery, immediate health status of mother and baby were assessed as well as presence of congenital anomalies.

Participant inclusion

Participants were adolescent girls and young women, between 13 and 24 years old, diagnosed with diabetes mellitus, attending Paediatric and Adolescent Diabetes Clinic, Komfo Anokye Teaching Hospital, and confirmed to be pregnant during supervised care. Confirmation of pregnancy was by urine pregnancy test as well as abdominopelvic ultrasound to detect intrauterine pregnancy or gestational sac.

Data management and analysis

Data were checked for errors and coded before entry into a predesigned database using Microsoft Excel and exported onto STATA SE 17.0 for analysis. Variables were represented as means, standard deviations, ranges, and percentages with simple diagrams and tabulations.

Ethical Clearance

The Ethical Committee of Komfo Anokye Teaching Hospital gave ethical approval for the study; reference number KATH IRB/AP/153/20. The study was done in accordance with established ethical standards. Participation was entirely voluntary, and informed consent was obtained from all participants before enrolment into the study. For those under 18 years of age, assent form was signed by the participants and additional consent was obtained from their parents or legal guardians. To ensure patient privacy and confidentiality, all collected data were anonymized.

Operational definitions and abbreviations

Cohabiting: Not married but living with a man in the same room, C/S: caesarean section, Cytotec tab: misoprostol tablet, HbA1C: Glycated haemoglobin, JHS: Junior High School, SHS: Senior High School, TTC: Teacher Training College, SVD: spontaneous vaginal delivery, STOP: Surgical Termination of Pregnancy, T1DM: type 1 diabetes mellitus, T2DM: type 2 diabetes mellitus.

3. Results

Respondents' socio-demographic characteristics

The socio-demographic characteristics of the participants are shown in **Table 1**. All the participants were attending school while they became pregnant. Most of them (55.6%) were in Senior High School (SHS), 33.3% were in Junior High School (JHS) and 11.1% in Teacher Training College (TTC). Only 16.7% were married, 11.1% were cohabiting, while 72.2% were not married. Only 27.8% received regular financial support from their partners, 16.7% received but irregular support while 55.5% received no financial support from their partners. The mean ages of participants at diagnosis and at pregnancy were 11.00 years (SD: 2.38) and 18.67 years (SD: 2.66) respectively.

Table 1. Socio-demographic characteristics

Variable	*Category*	*Frequency (N)*	*Percentage (%)*
Educational status	JHS	6	33.3
	SHS	10	55.6
	TTC	2	11.1
Marital status	Married	3	16.7
	Cohabiting	2	11.1
	Not married	13	72.2
Financial support	Yes	5	27.8
	Irregular	3	16.7
	No	10	55.5
Age at specific times	***mean***	***SD***	***Range***
At diagnosis	11.00	2.38	7-15
At pregnancy	18.67	2.66	13-24

Respondents' clinical characteristics

Clinical characteristics are shown in **Table 2**. Most of them (88.9%) had type 1 DM and 11.1% had type 2 DM. Attempted abortion was high (83.3% [15/18]) among participants but most were unsuccessful. Nine (60.0%) out of the 15 participants used herbal concoction which all failed, 4 (26.7%) used cytotec (misoprostol) tablets which also failed, while 2 (13.3%) were successful via surgical termination of pregnancy (STOP). Only one participant (5.6%) planned and wanted the pregnancy. All the participants had nausea, vomiting and amenorrhea as clinical features of pregnancy. 56.3% of the participants delivered via caesarean section. Fourteen (87.5%) of the participants had singleton pregnancies while 2 (12.5%) were twins resulting in eighteen (18) live births.

Glycated haemoglobin (HbA1C) levels and control

Glycated haemoglobin (HbA1C) levels are shown in **Table 3**. Most had poor glycaemic control at the time of confirmation of pregnancy, but many improved by delivery. Mean HbA1C at confirmation of pregnancy was 10.71%, (SD 1.96), at three months it was 9.61%, (SD: 1.66) and at term 8.58%, (SD: 1.47).

Pregnancy outcomes

Table 4 demonstrates pregnancy outcomes. Good glycaemic control (HbA1c) reflected on good pregnancy outcomes; all babies were well after delivery with good APGAR scores, most were delivered at term, were of normal birth weight and had short hospital stay. Only one baby had congenital malformation and only one died at one month.

Table 2. Clinical characteristics

Variable	Category	Frequency	Percentage (%)
Type of diabetes	T1DM	16	88.9
	T2DM	2	11.1
Attempted abortion	Yes	15	83.3
	No	3	16.7
Method of abortion used	Concoction	9	60.0
	Cytotec Tab	4	26.7
	STOP	2	13.3
Planned pregnancy	Yes	1	5.6
	No	17	94.4
Signs leading to suspicion of pregnancy	Fatigue	3	16.7
	Excess sleep	7	38.9
	Vomiting	8	44.4
	Amenorrhea	18	100.0
		18	100.0
Mode of delivery	C/S	9	56.3
	SVD	7	43.7
Type of pregnancy	singleton	14	87.5
	twin	2	12.5

Table 3. Glycaemic control of the of participants

Participant	HbA1C at diagnosis (%)	HbA1C 3 month after diagnosis (%)	HbA1C at delivery (%)
1	10.0	8.8	7.2
2	10.0	9.1	8.2
3	12	10	10.2
4	9.2	8	7.4
5	10.7	-	6.9
6	12.5	11.1	9
7	11.2	10	9
8	9.2	7.5	7.1
9	12.6	10.2	9.2
10	14	-	9.5
11	10.2	11.2	10.1
12	14.2	12.1	10.4
13	11.2	9.1	7.2
14	8.2	7.2	7.1
15	8.5	9.1	8.2
16	7.7	7.9	7.5

Table 4. Pregnancy outcome

Variable	*Category*	*Frequency N)*	*Percentage (%)*	*P-value*
APGAR score	8-10	10	55.6	0.386
	6-7	8	44.4	
After delivery	Well	17	94.4	
	Died	1	5.6	
Congenital malformation	Yes	1	5.6	0.542
	No	17	94.4	
Birth weight (kg)	Low birth weight	3	16.7	0.003
	Normal birth weight	14	77.8	
	Big baby	1	5.5	
Gestation	Preterm	4	22.2	0.267
	Term	14	77.78	
Hospital stay (days)	2-5	15	83.3	0.542
	6-9	3	16.7	

4. Discussion

This study provides a detailed view of pregnancy outcomes in adolescent girls and young women with diabetes under multidisciplinary care at Komfo Anokye Teaching Hospital in Kumasi, Ghana. By coordinating care between the multidisciplinary teams including Paediatric and Adolescent Diabetes clinic, antenatal clinic and psychology unit from diagnosis of pregnancy to delivery, the teams sought to address the challenges of poor glycaemic control, social support from families and structured, supportive care for this high-risk population which resulted in good maternal and neonatal outcomes.

All the participants were attending school while they got pregnant, 55.6% were in Senior High School (SHS). The mean age at pregnancy was 18.39 years (SD 2.97). No such study had previously been done in Ghana. Ozumba et al., (2003) in a study in Enugu, Nigeria compare pregnancy outcome among women with diabetes and women without diabetes and found out high maternal and fetal morbidity among women with pregestational diabetes than those without diabetes. Two maternal deaths were recorded and both occurred in mothers with type 1 diabetes who were brought into the emergency ward unconscious due diabetec ketoacidosis, having defaulted in their antenatal visits. The youngest patient to become pregnant in this study was 13 years old while the oldest was 24. In a national e-cohort study among pregnant teenagers with type 1 DM the youngest mother was 14 years (Allen et al., 2020). With regard to marital status, 72.2% were not married, 16.7% were married and 11.1% were cohabiting. Only one of the pregnancies (5.6%) was planned and wanted, 94.4% of the pregnancies were unplanned and the mothers had no intention of keeping them. Up to 83.3% (15/18) attempted abortion but only two (11.1%) of them were successful. The rest (16 pregnancies) were carried to term. The reason for high rate of attempted abortion could be multifactorial; all the participants were attending school and so they were not emotionally prepared to carry pregnancy and bear children and combine with their academic work. Besides, most of them (72.2%) did not have regular and adequate financial support from their partners and 83.3% were not married as seen in Figure 1. The main causes of abortion among children and adolescents girls in Ghana include religious, social and economic factors. The two main religions in Ghana are Christianity and Islam, both of which forbid sexual intercourse before marriage. And so when a teenage girl or a young woman who is not married gets pregnant it is considered as an abomination and to avoid the associated stigma, they try as much as possible to abort the pregnancy. Socio-economically, many Ghanaians live in poverty and so teenage girls and young women from these poor families resort to abortion when they get pregnant if they are not married (Martins, 2024).

In a study conducted in Northern California by Rosengard et al., (2004) more than 75% of teenagers who got pregnant did not plan their pregnancies and 35% of the pregnancies ended in abortions. In another study conducted by Witt et al., (1994) in New Jersey on pregnant teenagers with diabetes it was found out that 48% had successful induced abortions while 5% failed attempted abortions.

All the participants received multidisciplinary care which resulted in good glycaemic control reflecting on good pregnancy outcomes. All participants had supervised delivery at Komfo Anokye Teaching Hospital, 56.3 (9/16) delivered via caesarean section and 43.7 (7/16) vaginally. The higher rate of caesarean sections was on the side of caution so as to avoid birth asphyxia due to prolonged labour. Any participant in labour for up to 12 hours had caesarean section delivery. Similarly, in a study by Witt et al., (1994) it was found out that 37% of teenage pregnant patients with diabetes had caesarean section delivery. Allen et al., (2020) also demonstrated that teenage mothers with diabetes had higher rates of caesarean section delivery because of foetal macrosomia. There were no noticed bad maternal outcome in this study such as intrapartum or post-partum haemorrhage, pre or post eclampsia contrary to existing data and recent studies (Albai et al., 2013; Casson et al., 1997; Evers et al., 2004; Penney et al., 2003; Ozumba et., al 2003). In the study by Ozumba et al., (2003) in Enugu, Nigeria two maternal deaths occurred in mothers with type 1 diabetes who were brought to hospital in unconscious state due to diabetic ketoacidosis (DKA) as a result of defaulting in antenatal care appointments. None of the participants in this study from diagnosis of pregnancy to delivery developed diabetes ketoacidosis. Almost all participants kept to their appointments. Any participants who refused to come for their antenatal visits were tracked via telephone calls by a team of nurses.

There were fourteen singleton and two twin deliveries in this study resulting in 18 live births. Two pregnancies (12.5%) in this study ended in prematurity at 30 and 32 weeks gestation. Evers et al., (2004) found 9 out of 314 pregnancies among women with type 1 DM to be multiple pregnancies. Albai et al., (2013). found a higher proportion of 32% of pregnancies that were preterm deliveries in Timişoara in Romania. Evers et al., (2004) in Netherlands also found 32.2% premature deliveries among women with type 1 DM. There were no still births in our study and up to 55.6% of the babies had APGAR score between 8 to 10 in the 5^{th} minutes after delivery and the remaining 44.4% had APGAR score of 6 to 7 in the 5^{th} minute. Contrary to our findings, still births and asphyxia are common among babies of mothers with diabetes (Casson et al., 1997; Bapayeva et al., 2022). Fraser et al., (1995) in another study in Utah among teenage and young mothers, with type 1 diabetes, aged between 13 to 24 years found an increased risk of adverse pregnancy outcomes that was independent of sociodemographic factors. Younger teenage and adolescent girls between 13 and 17 years of age had a significantly higher risk than young adult women between 20 and 24 years old of delivering babies with low birth weight who was delivered prematurely or who was small for gestational age. Older teenage mothers (18 or 19 years of age) also had a significant risks.

The outcome of this study is more likely due to the fact that all the participants were keenly followed up at the antenatal and the Paediatric and Adolescent Diabetes Clinics from time of diagnosis till delivery coupled with emotional and psychological support from psychologists. They were counselled and educated at every clinic visit, it was ensured that they had insulin at all times, their logbooks were reviewed at every visit to the clinic and HbA1C was done at every three months. They were also advised and educated on diet and moderate exercise. It was also ensured that they had good social support from their immediate family members by counseling their caregivers who accompanied them to the clinic at every visit. Iwanowicz-Palus et al., (2022) reported in a study conducted in Poland that young women with diabetes during pregnancy with psychological, social and emotional support had better pregnancy outcomes such as no or few pre-eclampsia, no pre-, intra- or post partum haemorrhage, term delivery, few caesarean section deliveries, normal weight and healthy babies with shorter hospital stay compared with those who had poor social, psychological and emotional support.

Almost all the participants in this study had improvement in glycaemic control that reflected improvement in HbA1c levels (Tables 3) although some could not achieve the ISPAD target value of ≤ 7% (de Bock et al., 2022).

Limitations and Future Research

The study had small sample size, was retrospective in nature, had no control group and was done in one center. Hence, the results cannot be generalized. However, the observations and outcomes of the study have identified gaps in clinical practice which can improve on the long term treatment of females with diabetes who become pregnant in resourced-constrained regions. A multicenter, multidisciplinary prospective study with a larger sample size should be considered.

5. Conclusion

This study offers important insights into pregnancy outcomes among adolescent girls and young women with diabetes mellitus in Ghana. Contrary to numerous reports indicating predominantly poor outcomes in similar populations, the findings of this study demonstrate that comprehensive and sustained multidisciplinary care including specialist diabetes care, antenatal care, psychological and emotional care as well as social support led to good maternal and neonatal outcomes. This coordinated approach resulted in continuous access to insulin, good compliance by participants resulting in improved glycaemic control, ensuring that all patients had supervised delivery at a well-resourced health facility. There were no maternal deaths, no episodes of diabetic ketoacidosis during pregnancy, no pre-eclampsia, no ante-partum or post-partum haemorrhage, no stillbirths and a short hospital stay for all mothers and babies. There was only one neonatal death attributed to *Staphylococcus aureus* septicaemia and one case of congenital malformation.

These findings reinforce the need for robust sexual and reproductive health education and the establishment of targeted support systems for girls and adolescents with diabetes. Multidisciplinary model of care for pregnant adolescents and young adults with diabetes should be considered in resourced limited countries. This model should ensure effective collaboration among paediatric/adolescent endocrinologists, obstetricians, psychologists, and social workers to optimize health care delivery. With Ghana's universal free education policy, all girls and young women, regardless of socioeconomic background, should be encouraged to attend school so that in the long-term they can be financially and socially independence to make informed decisions about their reproductive health.

Conflict of Interest

The authors declare no conflict of interest.

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