A review article in:
Relationship between fetal gender and pregnancy and delivery outcomes

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Abstract:

Background: In last 2 decades, bunch of conducted studies have been all reported a correlation between fetal gender and pregnancy outcomes. In addition to the link between advanced maternal age and pregnancy complications

Aim of the study: To find if there is any relationship between fetal gender and maternal or neonatal complications in our province.

Patients and Methods: A cross-sectional study obtained from Department of Obstetrics and Gynecology in Al-Batool Maternity Teaching Hospital for 120 pregnant women presented with diagnosis of labour and delivery and admitted to the labour ward in a period from October 2023 to December 2023, 100 pregnant participated in the study as they fit the inclusion criteria while 20 excluded, all participants accepted to be involved in the study, an interview was done with participants and asked number of questions according to organized questionnaire including socio-demographic criteria.

Results: higher percentage of pregnant women who delivered male fetuses were found in age group(28- 38) years 64.5% compared with age groups (17-27)&(39 and more) who were delivered female fetuses (54% & 83.3% respectively) but it was statistically non-significant (p-value 0.059). Also there were no statistically significant relationship between mothers education, occupation, most cases of placental abruption as obstetrical complications were observed in pregnant with female fetuses 100% comparing with pregnant with male fetuses 0% these finding was statistically significant p-value 0.041, In relation between fetal sex and fetal complications shows that the incidence of females who have been delivered with poor one minute Apgar score was higher than male fetuses (54.5% vs 45.5% respectively) and this was statistically significant (p- value 0.033)

Conclusion: Higher incidence of abruption placenta observed with female deliveries while no medical or obstetrical complications observed in female pregnant with male apart from low 1 minute Apgar score but this cannot be depended because of small sample size and short time of study.
Key words: male:female ratio; singleton; pregnancy outcomes.

Introduction

Biologically, females have two X of sex chromosomes in contract to males that typically have one X and one Y of sex chromosomes .Hence, this biological nature of male enables him to encode the genes on Y chromosomes, however, in females the gene of 2X chromosomes can be encoded until one X chromosomes is permanently inactivated and this has been occurred during the phase of gastrulation. Furthermore, fetal sex differentiation determined during fertilization whereas undifferentiating gonads are driven to differentiate into either ovaries or testicles [1]

It can be observed that prenatal sex- specific interactions between mother, placenta, and fetus affect not only mothers and intrauterine life of fetus during gestation. But also, exposed mothers in the future to potential postpartum consequences. Moreover, hormonal factors play a crucial role in obstetrical outcomes and differences between male and female fetus pregnancies.[2]

In last 2 decades, bunch of conducted studies have been all reported a correlation between fetal gender and pregnancy outcomes. In addition to the link between advanced maternal age and pregnancy complications.[3]

Hence, carrying a male fetus potentially exposed mothers to unescapable obstetric risk of pregnancy such as perinatal outcomes including premature rupture of membranes, pre-term delivery, difficulties in first and second stage of labor due to failure to progress, non-reassuring fetal heart rate patterns, umbilical cord prolapse, true umbilical cord knot, Caesarean delivery and lower Apgar scores. [4,5,6]

It is worth to mention that spontaneous PTB (pre-term birth) considered the prevailing situation in male fetuses while iatrogenic PTB is the dominant in female fetuses. Some studies reported preeclampsia that complicated by PTB is more likely occurred in female fetuses. Other studies published recently showed no sexual dimorphism for overall PIHD (pregnancy induced hypertension disorder), PIHD complicated by PTB, or for gestational diabetes [7,8,9].

A great deal of studies recently carried out in Western countries regarding the correlation between fetal gender and the pregnancy outcomes that might vary by ethnicity. Also, two studies had been performed on Chinese participants that clearly showed substantial consequences such as increasing rates of C-sections, distortion of the male: female ratio. Actually, other resources should be adopted

in case of conducting replicative studies as what is presented were the only studies recently accomplished in Asia.[9]. With reference to Libya population, it is found that male fetus has different obstetrical complications for pregnancy outcomes such as maternal gestational diabetes, preeclampsia in primigravids, preterm deliveries, cesarean sections, and instrumental delivery. Hence, more efforts recommend to be exerted to see its applicability in clinical practice.[10].
In 2014 a study carried out in Diyala province which found no direct correlation between fetal gender and pregnancy or neonatal outcomes except what is noticed ,as promising connection, between fetal gender and low 1- minute Apgar score [11].
The fact that could not denied that factors affecting fetus and pregnancy outcomes are complicated. Those factors depend on racial, environmental and biological conditions. Most importantly noticed to be decisive factors on fetal growth are race and maternal environment. For instance, infants of African-American mothers are smaller and tend to experience noticeable rate of growth restrictions and preterm deliveries in comparison to infants of white mothers.[12]
Returning to the past, first study conducted in this area was in Scotland in 1982 on mothers experienced CS delivery of either spontaneous onset of labor or labor induced of various indications. Noted that 17 % increase in C-section rate of women bearing male fetuses than women bearing females. This phenomenon attributed to the hypothesis that male fetuses were bigger and therefore justified the higher rates of cephalopelvic disproportion leading to CS delivery. Also, hormonal factors of male fetus have insignificant impact to the stages of labor compared to female hormones and thus causing maternal uterine dysfunction. Accordingly, male fetus might severely or often undergo signs of distress in labor compared to female fetus. [13,6].
Obviously, the aim of this study is to see if there is any correlation between fetal gender and pregnancy complications in addition to delivery outcomes. In case that gender predilection theory confirmed then selection of gender during fertilization could reflect vital improvement in the field of obstetrics which in turn contributes in minimizing pregnancy adverse outcomes[14].

Patient and method

A cross-sectional study obtained from Department of Obstetrics and Gynecology in Al-Batool Maternity Teaching Hospital for 120 pregnant women presented with diagnosis of labour and delivery and admitted to the labour ward in a period from October 2023 to December 2023..
Inclusions criteria were singleton pregnancy that completed 28 weeks of gestation (by last menstrual period or early ultrasound), stillbirth, neonatal death, multiple pregnancy, fetus with congenital anomalies and those whose with missing information were excluded.
Al-Batool Hospital authorities approved the study and the 100 pregnant participated in the study as they fit the inclusion criteria while 20 excluded, all participants accepted to be involved in the study, an interview was done with participants and asked number of questions according to organized questionnaire including socio-demographic such as maternal age, BMI, occupation, medical conditions which are DM, hypertension, preeclampsia , obstetrics complications and birth problems such as placenta previa , placental abruption , low birth weight and 1 and 5 minutes Apgar score.

Statistical analysis

Differences in the study parameters between male and female pregnancies and deliveries were tested using chi-square for independence between variables (spss version 26). A p-value ≤0.05 was considered statistically significant p- value of ≤ 0.001 considered highly significant .

Results

A total of 100 pregnancies were identified, including 50 (50%) pregnant with male fetuses and 50 (50%) pregnant with female fetuses who met our criteria for the study.

Table 1 show that although higher percentage of pregnant women who delivered male fetuses were found in age group(28- 38) years 64.5% compared with age groups (17-27)&(39 and more) who were delivered female fetuses (54% & 83.3% respectively) but it was statistically non-significant (p-value 0.059). Also there were no statistically significant relationship between mothers education, occupation, BMI and whether conception occur spontaneously or induced and delivery of male fetuses.

Table 1 : Sociodemographic variables of pregnant women according to fetal sex.

Variables		Male sex (n (%)	Female sex (n (%)	Total	P value
Maternal age	17-27	29(46%)	34(54%)	63(100%)	0.059
	28-38	20(64.5%)	11(35.5%)	31(100%)	
	39 and more	1(16.7%)	5(83.3%)	6(100%)	
Occupation	Housewife	47(50.5%)	46(49.5%)	93(100%)	0.149
	Employee	1(20%)	4(80%)	5(100%)	
	others	2(100%)	0(0.0%)	2(100%)	
Maternal education	Primary	28(48.3%)	30(51.7%)	58(100%)	0.882
	Secondary	12(54.5%)	10(45.5%)	22(100%)	
	College	10(50%)	10(50%)	20(100%	
Body mass index	Normal weight	31(45.6%)	37(54.7%)	68(100%)	0.147
	Overweight	16(55.2%)	13(44.8%)	29(100%)	
	Underweight	3(100%)	0(0.0%)	3(100%)	
Aided conception	Yes	3(75%)	1(25%)	4(100%)	0.307
	No	49(51%)	47(49%)	96(100%)	

Regarding medical complications in relation to fetal sex demonstrated in table 2 it shown that although those who are pregnant with female have higher incidence of most of medical diseases urinary tract infection, hypertension and gestational diabetes(51.6%, 52.4%,100% respectively) comparing with male who had higher incidence of anemia 52.5% than female 47% but those findings were statistically non-significant (p- value >0.05)

Table 2. Association between fetal sex and medical complications.

Medical complications		Male sex (n (%)	Female sex (n (%)	Total	P value
Anemia		31(52.5%)	28(47%)	59(100%)	0.542
Urinary tract infection		31(48.4%)	33(51.6%)	64(100%)	0.677
Hypertension		10(47.6%)	11(52.4%)	21(100%)	0.806
Preeclampsia		2(50%)	2(50%)	4(100%)	1.000
Diabetes Mellitus	Gestational	0(0.0%)	5(100%)	5(100%)	0.072
	Nondiabetic	48(52.7%)	43(47.3%)	91(100%)	
	Pre-gestational	2(50%)	2(50%)	4(100%)	

Table 3 record that most cases of placental abruption as obstetrical complications were observed in pregnant with female fetuses 100% comparing with pregnant with male fetuses 0% these finding was statistically significant p-value 0.041, on the other hand placenta previa and preterm delivery were higher in pregnant with male fetus (54.5%,58.8% vs45.5%, 41.2% respectively) but was statistically non-significant p-value >0.05.

Table3. Association between fetal sex and obstetric complications

Obstetric complications	Male sex (n (%)	Female sex (n (%)	Total	P value
Placenta previa	6(54.5%)	5(45.5%)	11(100%0	0.749
Placental abruption	0(0.0%)	4(100%)	4(100%)	0.041
Preterm delivery	10(58.8%)	7(41.2%)	17(100%)	0.424

In relation between fetal sex and fetal complications shows that the incidence of females who have been delivered with poor one minute Apgar score was higher than male fetuses (54.5% vs 45.5% respectively) and this was statistically significant (p- value 0.033), although there were a higher incidence among female fetuses to have macrosomia, low birth weight and 5 minutes Apgar score but they all were not statistically significant.

Table 4. Relationship between fetal sex and fetal complications

Birth problems		Male sex (n (%)	Female sex (n (%)	Total	P value
Macrosomia		0(0.0%)	2(100%)	2(100%)	0.153
Low birth weight		0(0.0%)	3(100%)	3(100%)	0.079
Apgar score at 1 minute	Normal	1(12.5%)	7(87.5%)	8(100%)	0.033
	Moderate	40(51.9%)	37(48.1%)	77(100%)	
	Poor	5(45.5%)	6(54.5%)	11(100%)	
Apgar score at 5 minutes	Normal	39(49.4%)	40(50.6%)	79(100%)	0.202
	Moderate	4(44.4%)	5(55.6%)	9(100%)	
	Poor	3(37.5%)	5(62.5%)		

Discussion

Male fetal sex is frequently blamed for unfavorable pregnancy and labour outcomes in many civilizations. In the past, these judgments were drawn primarily from experience and observational data rather than from the findings of thorough scientific research. However, a number of studies carried out in western populations in recent years have verified that a fetus's male sex carries an increased risk for outcomes like preterm birth, preeclampsia, and intrapartum and neonatal hypoxia[11].

Our study conducted in a developing country, Iraq, shows although not statistically significant but there were higher female fetuses delivered in women aged (17-27) years and 39 years and over while male fetuses delivered were higher among women aged (28-38) years these findings agree with Lei H. et al.,(2014) who concluded that the number of female fetuses among women aged more than 35 years is higher than male fetuses (10.3% and 9.6% respectively)[12], but disagree with Maconochie N. et al.,(1997) who found that there is no evidence fetal gender difference related to the variation of maternal age [15].

It was found that there's no significant correlation between maternal body mass index, occupational state and conception methods with fetal gender this partly agree with Satoru F.et al.,(2020) confirmed that non-significant differences by fetal gender were observed in term of method of conception while disagree with our findings about pre pregnancy BMI and found that women carrying male fetus had a significantly higher pre pregnancy BMI [9]. This study also confirmed although not statistically significant, that hypertension and gestational diabetes occur more frequently among female bearing pregnancies than male bearing pregnancies these results disagree with Mounir M et al.,(2013), Gowda M. et al.,(2014), Alina W. et al.,(2015) and almost all the studies worldwide which assume that male fetal gender is a associated with increased rates of gestational diabetes this difference and disagreement with our study results might be related to the lack of awareness and self-recognition of diabetes among pregnant women in

general which results in undiagnosed cases of gestational diabetes[10,3,14]. It is well known that glucose tolerance deteriorates in human pregnancy, but about 97-98% of all pregnant women retain a normal glucose tolerance and only 2-3% develop gestational diabetes[9].

A large prospective cohort study performed in china by Yingying L. et al.,(2019) showed women with gestational hypertension and preeclampsia both showed significantly decreased probability of giving birth to a boy [16] which is significantly agree with our study while Bart J. et al.,(2019) disagrees with our findings and confirmed that women with male fetuses are more likely to have hypertensive complications of pregnancy compared with women with female fetuses (9.3 vs 9.0% P>0.001) and Petra E. et al.,(2016) also disagrees and found that sexual dimorphism is not a risk factor for pregnancy induced hypertension[7,17]..

We observed in the present study a low gender ratio (male:female ratio) in relation to placental abruption and this result reached the statistical significance (p=0.041) however, the results are not supported by Zoe A. et al.,(2020) and Rachel B. et al.,(2008) which conducted the implication that placental abruption is significantly associated with the presence of a male fetus[18,19]. Nevertheless, there seems to be a scarcity of studies which support our results in increasing placental abruption among female fetuses which is possibly connected to the comparatively small number of samples and the brief timeframe of the study, which may have corresponded with the rise in occurrences of female pregnancies.

By studying the correlation between fetal gender and other obstetrical complications (placenta previa and preterm delivery) we found although statistically not significant that there's increased incidence of both of these complications for male gender and the results was supported by many studies that concluded that male fetal gender was associated with an increased risk of preterm delivery, very preterm, and extremely preterm delivery. Although the etiology of this association remains unclear, several hypotheses have proposed. Mohammed A. et al.,(2017), Myrthe J. et al,.(2016),Beatrice S. et. al.,(2021),Satoru F. et al.,(2020) all show a similar correlation between male fetus and increased spontaneous preterm birth[2,5,9,21]. On the other hand Kitaw D. et al.,(1999) also agreed with our study and showed that there's an increased male: female ratio at birth among women with placenta previa as compared with those without placenta previa[21].

Regarding the relationship between neonatal gender and other neonatal parameters like fetal birth weight we found that male fetuses are at lower risk of low birth weight than in female fetuses Satoru F. et al.,(2020) found that female fetuses are at higher risk of low birth weight[9], a study published 2022 done by Hyunkuk C. found that girls are more likely to be born with low birth weight when son preference is stronger[22].Apgar score <4 at 1 minute we we found that female gender has the predominance of having poor 1 minute Apgar score and this was statistically significant (p=0.033) ,this not consistent with study performed by Sawsan T.et.al, in Diyala, Iraq in 2014 were they found positive correlation between male gender and Apgar score <7 at 1 minute, Lei Hou et al.,(2014) in a cross sectional study done in china also disagreed with our findings and found that male fetuses had higher rates of low Apgar score at 5 minutes [11,12].There were clear association between male newborns and low Apgar score which, mostly due to the study's drawbacks, the hospital's policy not to include instrumental delivery in the

labour and delivery protocol, clearly contradicts the results of our investigation**.** Notwithstanding these restrictions, we were nevertheless able to find a strong correlation between a male fetus and worse possible outcomes.

Conclusion

Higher incidence of abruption placenta observed with female deliveries while no medical or obstetrical complications observed in female pregnant with male apart from low 1 minute Apgar score but this cannot be depended because of small sample size and short time of study.