Original Research Article

THE EFFECT OF PLACENTAL WEIGHT AND COTYLEDON COUNT TO THE FETAL BIRTH OUTCOME AT A REGIONAL REFERRAL HOSPITAL IN TANZANIA

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ABSTRACT

Background: The placenta is a feto-maternal organ that supports pregnancy. It forms from second week of pregnancy and is fully functional by the fourth month. The quality of placenta greatly influences the pregnancy, labor and postnatal life. In Tanzania studies on the intrauterine growth, the placenta and their effect on birth outcome are scant. The present study aimed at assessing the effect of placental weight and number of cotyledons to the fetal birth outcome as represented by the fetal birth weight and Apgar scores.

Materials and Methods: This involved 102 near term pregnant women and their newborns at the Mwananyamala hospital in Dar es Salaam Tanzania. Expectant mothers within the age 15-49 years with smooth pregnancy and within the gestation age between 37-42 weeks were followed for the birth outcome during labor. At birth the fetal weight, sex, Apgar scores, placental weight and cotyledon count were recorded. A Pearson correlation coefficient R was calculated and a p-value d" 0.05 was considered significant.

Results: Mean fetal birth weight was 3.2kg ± 0.5kg and the mean placental weight was 579.7g ± 142. The average placental-to-fetal weight ratio was 1:5.5. The number of cotyledons ranged between 11 and 26 with a mean count of 17.8 ± 4.0. The mean 1st and 5th minute Apgar scores were 7.8±0.8 and 9.3±0.7 respectively. Placental weight was positively correlated with the fetal weight (R=0.65, p value=0.00) and the heavier the placenta the higher the number of cotyledons (R=0.61, p value=0.00). The gestational age at term did not influence the fetal birth weight (R= 0.06; p= 0.54), the placental weight (R= 0.07; p= 0.49), the cotyledon count (R= 0.01; p= 0.91), Apgar 1st min (R= 0.06; p=0.55) and the Apgar 5th min (R= 0.09, p=0.38). Fetal weight was not associated with both the Apgar 1st min (R= 0.11; p=0.27) and the Apgar 5th min (R= -0.07, p=0.51).

Conclusion: The placental weight and cotyledon count are associated with the birth weight by 65% and 55% respectively and both can be clinically used in the prediction of birth outcomes.

KEY WORDS: Placental weight, cotyledon count, birth weight, Apgar score.

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INTRODUCTION

The placenta is an organ that entirely supports fetal growth particularly for the vital functions of nutrition, respiration and excretion. The formation of the placenta involves both maternal and embryonic components**.** As the pregnancy continues, the placenta increases in weight, area and thickness and it is fully formed by the fourth month. The placental attachment occupies one third of the internal surface of the uterus. In the human placentation the cotyledons are approximately 15-30 separations of the decidua

basalis which receive fetal blood from chorionic vessels and are therefore very essential for exchange of oxygen and nutrients. Studies have shown that an anatomically and functionally normal placenta is the single most key factor for a healthy pregnancy [1]. Placental morphometric features such as weight, volume and cotyledon count are increasingly being studied as predictors of labor outcome. Studies have shown that abnormal placental weight is associated with maternal complications during pregnancy. A high placental weight has been associated with a poor perinatal outcome, a low Apgar score at 1st minute (Apgar 1st min), 5th minute (Apgar 5th min), respiratory distress syndrome and perinatal death [2,3]. The main placental measurements that have been studied for labor outcome predication have been weight, volume, surface area and various derived ratios such as fetal-to-placental weight (FPR). While most of these studies are yet to be usefully applicable in routine clinical settings, recent advances in these studies are developing into potential guidelines for pregnancy monitoring and postnatal care. Fetal weight and volume determined by intrauterine sonographic imaging can now be linked using mathematical models for routine prenatal care [4].

In the sub-Saharan countries, pregnancies are prone to a plethora of infections and nutritional deficits that severely affect both fetal and placental growth. Poor growth of the placenta due to several factors such as nutritional deficiencies, maternal illnesses and metabolic disorders may result into low birth weight and other pregnancy related complications. Studies from Sub-Saharan Africa where infections during pregnancy are commonplace have demonstrated a direct effect of infections such as HIV virus and malaria to the placental size and labor outcome [5,6].

It is also understood that subtle factors such as race and socioeconomic status may also affect the placental weight [7]. While in Tanzania labor-related deaths are very high, studies on the placental morphometry and their effect on birth outcome are scant or entirely absent. The present study aimed at establishing two important placental parameters which are weight and cotyledon count and assessing their effect on fetal birth outcome as signaled by the birth weight and Apgar scores at 1st and 5th minutes. The effect of other related factors such as maternal age and gestation age at term were also assessed.

MATERIALS AND METHODS

This was a prospective cross sectional study at the Mwananyamala Regional Referral Hospital in Dar es Salaam, Tanzania from October 2015 to March 2016. The study involved 102 mothers and their newborns of which 52 were males and 50 were females. All mothers of child bearing age in the range 15-49 years with a smooth pregnancy falling within the standard term gestational age of 37-42 weeks and their neonates qualified for the study. Pregnancies routinely categorized as complicated, multiple pregnancies, severe anemia, HIV infection, hypertension, pre-eclampsia, eclampsia and diabetes in pregnancy were excluded. Informed consent was sought from the participants and ethical clearance had been granted by the participating university and the hospital respectively. Each participant was tagged with a blinded identity number. Data acquisition involved three personnel—a researcher and two assisting midwife nurses. Women in labor were monitored and the Apgar scores were recorded at 1st and 5th minutes at the end of the second stage of labor. At birth the neonate was routinely cleaned by the midwife and weighed using the weighing pan (Hardik Medi– Tech®) and birth weight, sex and Apgar scores of the newborn were recorded into the data sheet by the researcher. The second midwife nurse delivered the placenta. The placenta was collected using plastic bags (Nylon, maker unknown), cleaned off blood by running water and the membranes trimmed apart to expose the cotyledons and the placental weight and cotyledon count were recorded. The association between placental weight and cotyledon count as causal variables against the birth weight and Apgar scores were assessed using the Pearson correlation coefficient. A p-value d" 0.05 was considered statistically significant. All analyses were accomplished using IBM-SPSS (version 20).

RESULTS

Out of 102 neonates delivered, 52 (51.0%) were

males and 50 (49.0%) were females. Maternal age ranged between 18 and 41 (mean of 27.2 ± 6.3) years. The gestational age ranged from 37 to 42 weeks with a mean of 38.5±1.5 weeks. Fetal birth weight ranged between 1.6kg and 4.5kg with a mean of 3.2kg ± 0.5kg. Only 5.8% (n=6) had fetal weight below 2.5kg and hence categorized as underweight although their Apgar 1st min scores were comparable to the normal weight births and all scored 10 on Apgar 5th min assessment. The placental weight ranged between 220g and 860g with a mean of 579.7g ± 142.7. The average placental-to-fetal ratio was 1:5.5. The number of cotyledons ranged between 11 and 26 with a mean count of 17.8 ± 4.0. The 1st Minute Apgar score (Apgar 1st min) ranged between 2 and 9 with an average score of 7.8±0.8 while the 5th Minute Apgar score (Apgar 5th min) was comparatively higher ranging from 4 to 10 at a mean of 9.3±0.7. All the descriptive statistics including the 95% CI, minima, maxima and the ranges are summarized in Table 1.

Table 1: Distribution of the major maternal and fetal parameters during pregnancy.

Variable	Mean ±SD	95 % CI	Min	Max	Range
Maternal age (yrs)	27.2±6.3	26.0-28.4	18	41	23
Gestational age (wk)	38.5±1.5	38.2-38.8	37	42	5
Fetal weight(kg)	3.2±0.5	3.1-3.3	1.6	4.5	2.9
Placental weight (g)	579.7±142.7	552.0-607.4	220	860	640
Cotyledon count (n)	17.8±4.0	17.0-18.6	11	26	15
Apgar score 1st min	7.8±0.8	7.7-8.0	2	9	7
Apgar score 5th min	9.9±0.7	9.8-10.0	4	10	6

Placental weight was positively correlated with the fetal weight (R=0.65, p value=0.00) and the heavier the placenta the higher the number of cotyledons (R=0.61, p value=0.00). The placental weight, however, was neither correlated with the Apgar 1st min (R =0.08, p=0.40) nor Apgar 5th min (R= -0.05, p=0.59). Due to the strong correlation between placental weight and cotyledon count, the later was also positively correlated with fetal weight (R=0.55, p value=0.00). Similar to the placental weight findings, a higher cotyledon count did neither increase the Apgar 1st min (R= -0.03, p value=0.78) nor Apgar 5th min (R= -0.09; p= 0.38). The lower 25th percentile placental weight births had a mean fetal weight of 2.74kg, a mean cotyledon count of 14.0, mean Apgar 1st min of 7.8 and mean Apgar 5th min score of 10.0. The upper 25th percentile placental weight births had a mean fetal weight

of 3.72kg, a mean cotyledon count of 20.8, mean Apgar 1st min of 8.1 and mean Apgar 5th min score of 10.0. The age of the mother was fairly significantly correlated with the fetal weight (R=0.26; p= 0.01) but had a weak and statistically insignificant positive correlations with the placental weight (R=0.17; p=0.09) and the cotyledon count (R=0.10; p=0.33). The age of the mother was neither correlated with the Apgar 1st min (R= 0.07; p=0.46), the Apgar 5th min (R= 0.01, p=0.90) nor the gestational age at term (R= -0.01; p= 0.94). The gestational age at term did not influence the fetal birth weight (R= 0.06; p= 0.54), the placental weight (R= 0.07; p= 0.49), the cotyledon count (R= 0.01; p= 0.91), Apgar 1st min (R= 0.06; p=0.55) and the Apgar 5th min (R= 0.09, p=0.38). Fetal weight was not associated with both the Apgar 1st min (R= 0.11; p=0.27) and the Apgar 5th min (R= -0.07, p=0.51). While most of the variables did, in most of the cases, not affect both the Apgar 1st min and Apgar 5th min , the two Apgar scores were strongly correlated (R=0.78; p=0.00) . All the Pearson associational statistics are summarized in Table 2.

Table 2: Correlations of major maternal and fetal outcomes.

Variable 1	Variable 2	Persons R	P-value
Placental weight (g) vs	Fetal birth weight (kg)	0.65 *	0.00**
	Cotyledon count (n)	0.61*	0.00**
	Apgar score 1st min	0.08	0.4
	Apgar score 5th min	-0.05	0.59
Cotyledon count (n) vs	Fetal weight (kg)	0.55*	0.00**
	Apgar score 1st min	-0.03	0.78
	Apgar score 5th min	-0.09	0.38
Maternal age (yrs) vs	Gestational age (wks)	-0.01	0.94
	Fetal weight (kg) *	0.26	0.01**
	Placental weight (g)	0.17	0.09
	Cotyledon count (n)	0.1	0.33
	Apgar score 1st min	0.07	0.46
	Apgar score 5th min	0.01	0.9
Gestational age (wks) vs	Fetal birth weight (kg)	0.06	0.54
	Placental weight (g)	0.07	0.49
	Cotyledon count (n)	0.01	0.91
	Apgar score 1st min	0.06	0.55
	Apgar score 5th min	0.09	0.38
Fetal Birth Weight (kg) vs	Apgar score 1st min	0.11	0.27
	Apgar score 5th min	-0.07	0.51
Apgar score 1st min vs	Apgar score 5th min*	0.78*	0.00**

**Statistically significant correlations
*Strong correlations

DISCUSSION

We have established the reference mean placental weight of 579.7±142.7, mean term fetal birth weight of 3.2±0.5kg and mean cotyledon count of 17.8±4.0 among Tanzanian

women. The mean placental weight measurements agree with findings from previous studies [3,8] but higher than those reported elsewhere [9,10] and lower than some few other reports [11]. The mean fetal birth weights at term and cotyledon count were generally in agreement with previous findings [9,11] although other studies reported either much lower [12] or much higher [13] birth weights at term. Whereas most of the differences among the studies fall within the statistical margins of error, there could be actual constitutional variations due to social economic factors such as nutritional status, infections, life style behaviors such as smoking, methodological differences and even racial differences have been observed [6]. The 5.8% underweight cases showed relatively normal Apgar 1st min score and had by the 5th minute attained a 10-point Apgar 5th min score which indicates that low birth weight does not directly affect the Apgar scores. Similar to previous findings, the lower 25th percentile placental weight births were generally associated with lower birth weight, lower cotyledon count, lower Apgar 1st min and lower to normal Apgar 5th min score. Likewise, the upper 25th percentile placental weight births were generally associated with bigger birth weight, higher cotyledon count, higher Apgar 1st min and a normal Apgar 5th min score [14]. In agreement with previous studies, the present study has shown a positive correlation between the placental weight and the cotyledon count with the fetal birth weight [8,12]. The level of association seems grossly variable between studies. Our finding on the correlation between placental weight and birth weight which is approximately 65%, however, is relatively stronger than reports from previous studies [13,15]. This level of robustness coupled with the fetal-placental ratio (FPR) finding of 5.5:1—both putative clinically useful indices—can be applied in routine antenatal procedures in the intrauterine fetal wellbeing assessment and in the prediction of labor outcome as previously proposed [16]. In agreement with the present study, majority of the previous reports established that the positive correlation between placental and fetal weight were generally unaffected by maternal age and fetal age [11]. This is an important feature that makes these

two fetal and maternal anthropometric measurements widely applicable to women of all ages and pregnancies at various gestational ages and hence widely useful clinically. We established positive correlations between cotyledon count against placental weight and birth weight of 61% and 55% respectively but no studies have explored these associations previously. However, we propose that the cotyledon count can also be clinically used to predict labor outcome. In agreement with the majority of previous reports, the Apgar scores were not correlated with any maternal, fetal or placental morphometric variable we examined although other studies reported a positive correlation of either Apgar 1st min [15] or Apgar 5th min with the placental weight [17].

The lack of a clear association between placental and fetal morphometric measurements with Apgar scores is surprising and needs further investigations as it entails that a low birth weight, a very small placenta or even fewer cotyledon counts may have no influence on the Apgar score of the neonate.

CONCLUSION

The placental weight and cotyledon count are associated with the birth weight by 65% and 55% respectively while the cotyledon count accounted for 61% correlation. All the parameters can be clinically used in the prediction of birth outcomes.

ABBREVIATIONS

FPR—fetal to placental weight ratio
CI— confidence interval

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Conflicts of Interests: None

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