

## The Relationship Between The Weight Of The Placenta And Neonatal Outcome

Salih, SH.A<sup>1(a,b)</sup> & Omar, A.M<sup>2(a, b)</sup>

<sup>1</sup>Assistant professor of obstetrics and gynecological nursing, College of Applied Medical Sciences, Aljouf University, Kingdom of Saudi Arabia<sup>a</sup>

Assistant professor of obstetrics and gynecological nursing, faculty of medical technical science, AL zaiem Alazhari university. Sudan<sup>b</sup>

<sup>2</sup>Assistant professor of Maternity and Neonatal Health Nursing, College of Applied Medical Sciences, Aljouf University, Kingdom of Saudi Arabia<sup>a</sup>

Lecturer of Maternity and Neonatal Health Nursing, Faculty of Nursing, AL fayoum University, Egypt<sup>b</sup>

Corresponding Author: \*Shahenda Ateyat Allah Mohammed Salih

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### Abstract:

**Background:** The Placenta is a dynamic organ, it plays a vital role in normal fetal development, and failure of placenta to gain weight and insufficiency of its function can result in fetal disorders.

**Aims:** To study the Placental Weight in Relation to neonatal Outcome in Sudanese Mothers with Term Singleton Pregnancy and Delivered Vaginally.

**Research design:** A descriptive prospective design adopted for this study.

**Setting:** conducted in Omdurman maternity Hospital, in a period from September 2014 to December 2015.

**Tool:** A structured interview questionnaire was used and placental weight was measured by infant weighing scale.

**Results:** The mean of placental weight (containing its membrane and umbilical cord) equals 636 grams with SD  $\pm 137$  Placental weight increases significantly with maternal age up to 40 years, parity up to 10 babies, diabetes mellitus, increments of neonatal anthropometric measurements ( $p$  value = 0.00) and among male new born. While placental weight decreases significantly in women with low socioeconomic status, hypertensive disorders. When placental weight is below or above the mean it is associated with adverse neonatal outcome.

**Conclusion:** Placental weight is related to important variables influencing some neonatal outcomes, abnormal placenta weight is a warning sign.

**Recommendations:** Examination of the placenta should be performed routinely and should be follow guidelines for placental examination in the delivery rooms to provide valuable information that are important to the care of both mother and new born

**Keywords:** Placenta, Neonatal outcome, Birth Weight

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### I. Introduction

The placenta is a new organ formed in the uterus during pregnancy, creating a vital connection between the developing baby and the mother and it is an important organ for maintaining and continuing healthy pregnancy. It transfers and exchanges oxygen and nutrition needed for fetus. The examination of placenta would demonstrate significant information about whatever has happened in fetus. As fetus grows, many changes happen in placental shape and function that reflects changes in needs of fetus in different growth and development stages. [1]

The ability of the fetus to grow and thrive in utero depends on the placental function and the average weight of the placenta at term is 508 gm [2]. Precise and accurate examination of the placenta can provide insight regarding the in utero environment of the fetus before delivery. Two standard references are endorsed by the College of American Pathologists: absolute placental weight and fetal/placental weight (F/P) ratio. The placental weight (PW) is closely associated with the birth weight [1], and their ratio (F/P), which is often used as an index of placental nutrient efficiency, has been discussed in relation to adverse perinatal outcomes, such as perinatal death, non-reassuring fetal status and low Apgar scores [3]. Generally speaking, unduly heavy placenta, i.e., the placenta heavier than expected from the infant's weight, has been reported to be associated with adverse pregnancy outcome

**Significance of the study:**

Placenta is usually regarded as a fetal organ although it contains maternal and fetal vascular beds that are juxtaposed. It receives the highest blood flow of any fetal organ (40% of fetal cardiac output) and towards the end of pregnancy, competed with the fetus for maternal substrate, consuming the major fraction of glucose and oxygen taken up by the gravid uterus [2]. Examination of the placenta may be helpful in several ways. First, the placenta may be the cause of the adverse outcome due to an inherent abnormality, such as maternal floor infarction, or a primary placental lesion. Second, adverse outcome may be due to disease processes that are not placental in origin but that lead to abnormal placental function[4],

**Aim of the study:**

*The aim of this study was to*

- To measure the relationship between placenta weight and newborn indices
- Find the relationship between placenta weight and new born health condition

**Research design:**

A descriptive prospective design

**Setting:**

The study was conducted at Omdurman maternity hospital which is the main biggest referral and teaching hospital in Sudan. The hospital receives patients from all part of Sudan.

**Sample:**

Simple random sample of Sudanese women with singleton pregnancy that were delivered vaginally at term with their new born and freshly delivered placenta. who met the inclusion criteria. The study was conducted from September 2014 to December 2015

**Inclusion criteria:**

- All Sudanese Women with singleton pregnancy
- Delivered vaginally at term (37 -42) weeks.
- Freshly delivered placenta
- The gestational age was stated by last menstrual date and confirmed by ultrasound scan in the first trimester.

**Exclusion criteria:**

- Non Sudanese women
- Women with multiple pregnancies
- Caesarean sections
- Unknown gestational age
- Gestational age less than 37 weeks or more than 42 weeks.
- Macerated still birth

**Sample size:**

The sample size equal 770 women with their neonate and freshly delivered placenta calculated by following formula:

$$n = \frac{Z^2 P (1 - P)}{d^2}$$

Where

$n$  = sample size = 770

$Z$  = Z statistic for a level of confidence = 95%

$P$  = expected prevalence of abnormal placenta weight which is estimated to be 50%

$d$  = desire margin of error = 0.05

**Hypotheses:**

There are positive and negative relationship between placental weight and perinatal outcome among Sudanese women with singleton pregnancy and delivered vaginally at term

**Tools of data collection:**

***I: A structured interview questionnaire:*** The questionnaire included four parts.

**Part 1: Included data related to sociodemographic characteristics** (age, mothers educational level, occupation, socioeconomic status, residence, mother habits).

**Part 2:** included data related to obstetrics history (no. of gravidity, no. of parity, no. of abortion and no. of still birth, mode of pregnancy and maternal diseases during pregnancy).

**Part 3: included data related to labour outcome** (intrapartum complications, mode of delivery, placental weight, and macroscopic placenta dysmorphism).

**Part 4: included data related to neonatal outcome** (newborn G/A, - newborn sex, new born Apgar score in first 5 minutes, newborn weight, newborn lengths, newborn head circumference)

***II: Gestational age to Weight percentile chart***

**Procedure:**

**The study was conducted through two phases:**

1. **Preparatory phase:** in which an official permission was obtained from the head of the Director of Omdurman maternity hospital which is the main biggest referral and teaching hospital in Sudan. Then a written consent was obtained from each mother recruited in the study to commence and approve
2. **Implementation phase:** in which the data collected by direct interviewing questioners filled from the mother. Neonate weight, head circumference and length were measured. Neonate Apgar score in 5<sup>th</sup> minutes was calculated the presence of gross congenital anomalies was assessed, gestational age was calculated and weight to gestational age was also assessed by infant weight to gestational age percentile chart. The freshly delivered placenta, cleaned from blood clots, and then weighed by using infant weighting scale to the nearest gram. Placental weight included membranes and umbilical cord, cut approximately 5 cm from the neonate side and then placenta was examined for present of macroscopic dysmorphism. Then all the above data was documented in data collection sheet.

**Content Validity:**

To establish face validity, the questionnaire was piloted on panel of 5 experts of Obstetrics and Gynecological Medical and Nursing professors who reviewed the instruments for clarity, relevance, comprehensiveness, understanding, applicability and easiness.

**Ethical consideration:**

The study protocol was approved by pertinent research and ethical committees. Informed consent was taken from every woman before inclusion in the study. Participants were assured that all their data are highly confidential, anonymity was also assured through assigning a code number for each woman instead of names to protect their privacy. Data was only available to the researchers and the participants.

**Statistical analysis:**

The data were coded for entry and analyzed using Statistical software Package for Social Sciences (SPSS version 18.0). Data was presented in tables, figures and charts ANOVA and Person's r used to test correlation. The significance level was chosen when ( $p < 0.05$ ).

**Results**

**To fulfill the aim of the current study, results presented in the following order:**

**Table 1:** showed the demographic characteristic studied women follow: 57.13% of them their age is ranging between 21-30 years. 95.59% of them are residing in Khartoum state, 2.6% in west state of Sudan, 1.3% in middle state of Sudan, 0.26% in north state of Sudan and 0.26% in east state of Sudan. Regarding mothers educational level 9.9% of them are Illiterate, 20% with Primary educational, 19.2% secondary level education, 27.28% High secondary school education, 23.12% graduates and only 0.52% were post-graduates. 93.50% were housewives, 2.86% clerks, 1.6% workers, 1.29% students and 0.78 were healthcare providers. 33.25% of mothers lived in poor socio-economic status, while 49.4% had moderate level and 15.59% had good level. 36.89% of the mothers were primipara, 40.78% had 2-4babies, 17.4% had 5-7 babies, 4.4% had 8-10 babies and 0.5% had more than 10 babies

As regard to newborns characteristics

**Table 2:** demonstrated that 53.25% were males while 46.75% were females'. 90.90% of them were with average for gestational age, 6.23 were with large for gestational age and only 2.86% were small for gestational age. 87.01% of newborns their Apgar score in first 5<sup>th</sup> minute ranged from 10-7 while 11.17% ranged from 6-4 and 1.8% their score ranged from 3-0. The study revealed that the mean of placental weight among Sudanese women with singleton pregnancy and delivered vaginally at term equals 636 grams with SD  $\pm$  137 minimum weight was 350 grams and maximum weight was 1190 grams.

**Table 3:** illustrated that the placental weight to birth weight Ratio (PWR) for male newborn equal 5.3 and for female newborn equal 5.2 and for over all equal 5.25. Placenta coefficient for both male and female new-borns equal 0.198.

**Table 4:** showed that the mean of placental weight among male neonate is (644gm) greater than the mean of placental weight of female neonate (628gm). (P value = 0.001)

As shown in **table 5.** There was statistically significant correlation between placental weight /grams and newborn head circumference, New born weight /grams and New born lengths/cm ( $p$  value=0.00) .But the correlation between newborn GA at term and placental weight in not significant ( $p$ value0.266)

**Table 6:** explained that 12.72% of neonates admitted to NICU their mean of placental weight was 541 grams, while 0.5% were fresh stillbirth their mean of placental weight was 650 grams and 87.02% were born in good condition and their mean of placental weight was 636grams. (P value 0.002)

Concerning the correlation between placental weight and Apgar score in first 5<sup>th</sup> minutes. **Figure 1.** showed that when placental weight is below or above the mean Apgar score is affected but this correlation statistically is not significant. P value = 0.059

As regard to Correlation between new-borns weight for gestational age and the mean of placental weight it's obvious that LGA neonate had large placental weight (756.25 gm), AGA had average placenta weight (630gm) while SGA have small placental weight (541gm) (P value = 0.000) these findings were presented in Figure (5).

**Table(1):** Distribution of studied mother regarding socio-demographic characteristics.

Characteristic	No(N=770)	Percentage%
<b>Age of mothers</b>		
15-20 years	118	15.3
21-25 years	212	27.53
26-30 years	228	29.6
31-35 years	124	16.1
36-40 years	74	9.6
41-45 years	14	1.8
More than 45	0	0.00
<b>Residence of mothers</b>		
North states of Sudan	2	0.26
South states of Sudan	-	0.00
East states of Sudan	2	0.26
West states of Sudan	20	2.6
Khartoum state	736	95.59
Middle states	10	1.3
<b>Mothers Educational level</b>		
Illiterate	76	9.9
Primary	154	20
Secondary	148	19.2
High secondary	210	27.28
Graduate	178	23.12
Post graduate	4	0.52
<b>Mothers occupation</b>		
House wife	720	93.50
Health care provider	6	0.78
Clerk	22	2.86
Worker	12	1.6
Student	10	1.29
<b>Socioeconomic status</b>		
Poor	256	33.25
Moderate	380	49.4
Good	120	15.59
Very good	14	1.8
<b>Parity</b>		
Primipara	284	36.89
2-4 babies	314	40.78
5-7 babies	134	17.4
8-10 babies	34	4.4
More than 10	4	0.5

**Table (2):** characteristics of the new-borns

Characteristic	No(N=770)	Percentage%
Male	410	53.25
Female	360	46.75
<b>Newborn percentile chart findings (gestational age to weight)</b>		
Large for gestational age	48	6.23
average for gestational age	700	90.90
small for gestational age	22	2.86
<b>newborn Apgar score in first 5<sup>th</sup> minutes is</b>		
7-10 (no depression)	670	87.01
4-6 (mild depression)	86	11.17
0-3 ( severe depression)	14	1.8

**Table (3):** Placental weight to birth weight ratio and placental coefficient of studied mother

Newborn sex	Placental weight to birth weight Ratio(PWR)	Placental Coefficient
Male	5.3	.198
Female	5.2	.198
Overall	5.25	.198

\*PWR = the birth weight in grams ÷ placental weight in grams

\* Placental coefficient =Placental weight in grams ÷ Birth weight in grams

**Table (4)** Correlation between newborn sex and the mean of placental weight

Newborn Sex	N	Mean of weight	Std. Deviation	Minimum	Maximum	Mean of placental weight ± SD (minimum-max)
Male <sup>a</sup>	410	3242.62	413.992	2250	4100	644.89 ± 151.03 (400 - 1190)
Female <sup>b</sup>	360	3168.72	418.196	1900	4000	628.02 ± 122.43 (350 - 1150)

a= consider similar group

b= consider another similar group

**Table (5)** Relation between placental weight and new born indices

Newborn characteristics	placenta weight /grams		
	N	Pearson Correlation	P value
head circumference/cm	770	.332**	.000
weight /grams	770	.457**	.000
lengths/cm	770	.208**	.000
Gestational age/weeks	770	.040	.266

\*\* . Correlation is significant at the 0.01 level (2-tailed).

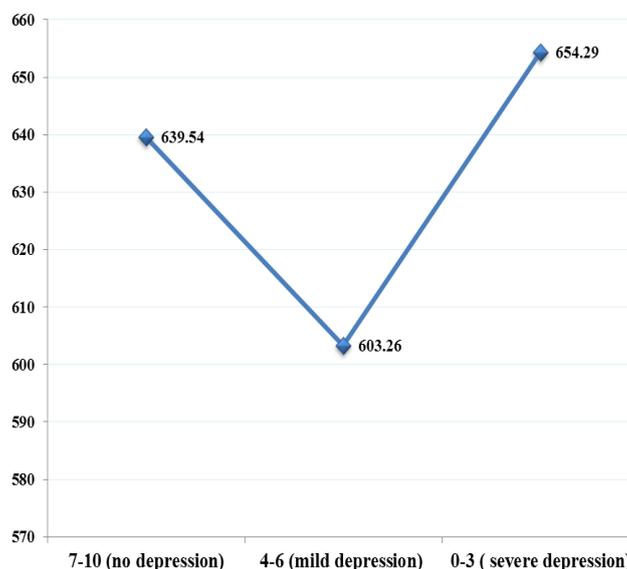
\* . Correlation is significant at the 0.05 level (2-tailed).

**Table (6)** Correlation between mean of placental weight and neonates outcome

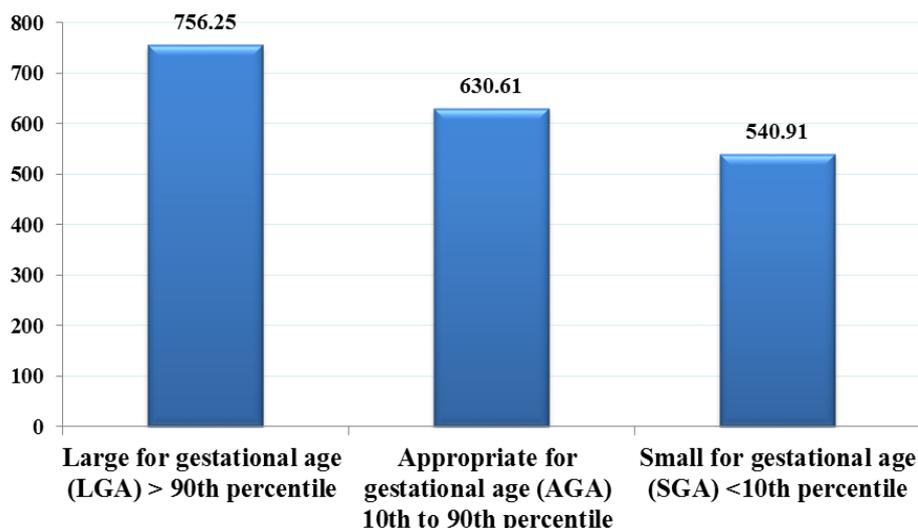
Outcome	frequency	Percent %	Mean of placental weight ± Std. Deviation (min - max)
NICU admission <sup>b</sup>	98	12.7	540.91 ± 213.61 (350 - 1150)
Fresh stillbirth <sup>a</sup>	4	0.5	650.00±150.00 (450-1190)
Good condition <sup>a</sup>	668	86.8	635.81 ± 136.55 (580 - 900)
Total	770	100	635.81 ± 136.55 (350 - 1190)

a = consider similar group

b= consider another similar group



**Figure (1)** :Correlation between placental weight and Apgar score in first 5<sup>th</sup> minutes.P value = 0.059



**Figure (2)** :Correlation between new-borns weight for gestational age and the mean of placental weight P value = 0.000

## II. Discussion

Placenta is the most important organ for maintaining and continuing healthy pregnancy. It transfers and exchanges oxygen and nutrition needed for the fetus .The examination of placenta demonstrates important information about what happens on fetus. [5] The present study revealed that the mean of placental weight (contain membranes and umbilical cord) among Sudanese women with singleton pregnancy were delivered vaginally at term(GAfrom37 to 42 weeks) equal 636 grams with SD  $\pm$  137 and ranged between 350-1190 grams.

Comparing our result with previous research conducted in Canada in which they reported that the mean weight of the placentas among Canadian mothers is 675 grams,(containing membranes and umbilical cord) [6]. and our result is also close to another one done in Nigeria which was aimed to measure the mean of placental weight among Nigerian mothers who delivered at term, it revealed that, The mean placental weight also containing membranes and umbilical cord is 623 grams (SD  $\pm$  145.6 grams) [7]. Also in a research done by Peter Kwabina in Ghana they found that the mean placental weight is 613 grams (SD $\pm$ 123.8 grams) with a range of 319- 1266 grams [8] .when comparing our result with other different researches will be confusing due to different types of placenta preparation and storage, however several studies reported that the mean of human placental weight was ranging from 438g to 680g [9,10,11]. So our result is considered reasonable, within the normal range. ]. In the present study the PWR equals 5.25:1(both sexes considered together) In male newborn it was 5.3:1 whereas in female newborn the ratio was 5.2:1 .This result is near to research result done in Tamilnadu, whereby their PWR was 5.35:1(both sexes considered together) in male newborn it was 5.4:1, whereas in female newborn it was 5.3:1 [16]

Our study revealed that there is a strong correlation between fetal anthropometric measurement and the mean of placental weight (p value 0.000)in previous study[15] they mentioned that the placental weight correlates significantly with the weight of the fetal and for every 1g increase in the placental weight, the fetal weight increases by 2g , Since the weight of the placenta correlates positively with the newborn weight, length and head circumference , it then implies that, factors which directly affect the newborn measurements will indirectly affect the weight of the placenta. Such factors could include nutrition, maternal size, maternal hemoglobin gain, altitude, paternal factors, maternal and paternal genetics, gestational age, maternal diabetes mellitus, etc.[15]

However the correlation between newborn GA and placental weight in this study is not significant (p value 0.266) as explained in gestational age is known as a principal and determinant factor of placental weight. Lo YF *et al* .whohave proved that there is no significant correlation between placental weight and gestational age [17]. the study explored that when placental weights were below or above the mean it is associated with Apgar score less than 7 in the first 5<sup>th</sup> minutes but this correlation is statistically not significant. There is study done in Iran in which authors stated that with low weight placenta There were lower Apgar scores , more fetal distresses and more Caesarean section in [5]. Other study done in Pennsylvania they reported that Overweight placentas, is largely a result of villous oedema, and it is associated with the following: neonatal evidences of acute ante natal hypoxia, low Apgar scores, the respiratory distress syndrome, neurologic abnormalities, and neonatal death (P.001).[17] But in significance statistical test may be due to our sample frame which was

targeting the term pregnancy which ended by vaginal delivery only and as we know the severe fetal distress will end by emergency Caesarean section.

The study revealed that LGA newborn has large placenta while SGA newborn has small placenta and AGA newborn has appropriate placental weight. It seems that low birth weight should be related to low functional tissue mass of placenta; and this is accompanied by decrease of the area for exchange between mother and fetus, both at the villi and at foetal capillary surface area. Thus the ability of exchanging oxygen and nutrition from mother to fetus is shortened. On the other hand, previous studies have also demonstrated that SGA infants have a higher proportion of placental weights at both extremes. [19,20] This is postulated to be an indication of an inefficient placenta with a reduced ability to maintain foetal growth.

We found that there is no correlation between placental weight and Presence of newborn apparent congenital anomalies (P value = 0.543).

Regarding neonatal outcome we observed that 12.72% of neonates admitted to NICU their mean of placental weight was 540.91 grams, while 0.5% were fresh stillbirth their mean of placental weight was 650 grams and 87.02% and the 7 were in good condition with mean of placental weight of 635 grams. This correlation is statistically significant and it means that when placental weight is below or above the mean is related with adverse neonatal outcome.

### III. Conclusion

Placental weight is related to important variables influencing some maternal and neonatal outcomes, abnormal placenta weight is a warning sign

### IV. Recommendations

1. Continuous education program regarding using standard guideline for placenta examination should be held in the hospitals to promote knowledge and experience of health care providers toward placental examination.
2. Further studies should be done about relationship between morphology and morphometric of placenta and perinatal outcome.

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