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Original Research Article

Correlation of Umbilical Cord Weight and Length with Placental and Birth Weight Using Pearson Co-efficient

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Abstract: ***Introduction*:** The relationship between umbilical cord dimensions and placental and birth weight has been a subject of scientific inquiry. Studies suggest that the weight and length of the umbilical cord may serve as indicators for fetal well-being and are often correlated with placental weight and overall birth weight. ***Aim of the study*:** The aim of this study was to assess the correlation of umbilical cord weight and length with placental and birth weight using Pearson co-efficient. ***Methods*:** This cross-sectional study was conducted in Department of Gynaecology, Bangladesh Medical College Hospital and Dhaka medical College Hospital, Dhaka, Bangladesh, during the period from June 2017 to June 2018. Total 150 umbilical cords were collected from women giving birth in our hospital for this study. ***Result:*** The maternal age predominantly ranged between 30-34 years, accounting for 35.3% of the sample. The mean gestational age was 38.8 weeks, with most births occurring at 38 weeks (49.3%). The gender distribution of newborns was balanced, with 52% males and 48% females. The study also revealed a gradual increase in both neonatal and placental weights from 37 to 42 weeks of gestation. Pearson correlation coefficients indicated moderate but significant relationships between umbilical cord weight and placental weight (r=0.2708, P=0.013), and umbilical cord weight and birth weight (r=0.3183, P=0.008). The strongest correlation was observed between placental weight and birth weight (r=0.5156, P<0.0001). ***Conclusion:*** This study found moderate but statistically significant correlations between umbilical cord weight and both placental and birth weights. The strongest correlation was observed between placental weight and birth weight, underscoring the importance of placental health in neonatal outcomes.

Keywords: Correlation, Umbilical Cord, Placental weight, Birth Weight, and Pearson Co-efficient.

I. INTRODUCTION

The study of birth-related parameters such as umbilical cord weight and length, placental weight, and birth weight has been a subject of interest in the medical and scientific community for years. These parameters are often considered as indicators of neonatal health and are associated with various outcomes in both the short and long term [1, 2]. The umbilical cord serves as the lifeline between the fetus and the placenta, providing essential nutrients and oxygen. It is generally composed of one vein and two arteries encased in a gelatinous substance known as Wharton's jelly [3]. The umbilical cord is normally 60 cm in length at term and helical in shape, with a chirality of 1e3 coils per 10 cm of length [4]. Placental weight refers to the weight of the placenta, an organ that connects the developing fetus to the uterine wall to allow nutrient uptake, waste elimination, and gas exchange via the mother's blood supply [5]. Birth weight is the weight of the newborn immediately after birth and is a significant indicator of neonatal health [6]. The growth and well-being of the fetus in the womb are contingent on how well the placenta functions. On average, the weight of a full-term placenta is 508 grams [7]. The weight ratio between the placenta and the newborn is approximately 1:6 [7]. However, the techniques used to measure these weights can differ significantly, mainly because of variations in how the placenta is prepared [8]. The association between

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placental weight and the size of the infant at the time of birth has been a subject of research for over a hundred years [9]. The prevalence of variations in umbilical cord and placental parameters can differ based on various factors such as maternal health, gestational age, and environmental factors [10]. For instance, a study found that thickness, weight, and surface area of the placental disk and non-twist umbilical cord are associated with an increase in birth weight.2 Numerous studies have explored the relationship between these parameters and neonatal outcomes. For example, a study found significant associations between Insulin-like Growth Factors (IGFs) in cord blood and newborn size [1]. Another study suggested that the umbilical vein diameter in the second trimester could be a promising measurement for predicting Large for Gestational Age (LGA) fetuses [5]. Current tables indicating birth weights reveal that the weights of full-term fetuses have been rising over time [11]. A positive relationship exists between the weight of the fetus and that of the placenta [12]. The conventional procedure for weighing the placenta, which involves removing the membranes and umbilical cord from the placental disk, could potentially be simplified. Leary *et al*., posited that the correlation between fetal weight and placental weight remains consistent whether the placenta is weighed after trimming or without trimming [13]. The Pearson Co-efficient is a statistical measure used for assessing the strength and direction of the linear relationship between two quantitative variables. In the context of this study, it will be used to quantify the correlation between umbilical cord weight and length with placental and birth weight. Previous research has shown varying degrees of correlation between these parameters. For instance, one study found no association between the mode of umbilical cord insertion and birth weight, while another study suggested that cord blood lipid profiles are significantly related to neonatal birth weight [3, 6]. Understanding the correlation between these parameters could have significant implications for prenatal care and neonatal health. This study aims to explore this correlation using Pearson Co-efficient, thereby contributing to the existing body of knowledge on this subject.

II. OBJECTIVES

To assess the correlation of umbilical cord weight and length with placental and birth weight using Pearson co-efficient.

III. METHODOLOGY & MATERIALS

This cross-sectional study was conducted in Department of Gynaecology, Bangladesh Medical College Hospital and Dhaka medical College Hospital, Dhaka, Bangladesh, during the period from June 2017 to June 2018. Total 150 umbilical cords were collected from women giving birth in our hospital for this study. Consent of the guardians were taken before collecting data. After collection of data, all data were checked and cleaned. After cleaning, the data were entered into computer and statistical analysis of the results being obtained by using windows-based computer software devised with Statistical Packages for Social Sciences version 22. After compilation, data were presented in the form of tables, figures and charts, as necessary. Numerical variables were expressed as mean and standard deviation, whereas categorical variables were count with percentage. P value of less than 0.05 was considered statistically significant.

Inclusion Criteria:

- Singleton deliveries
- Gestational age 37 – 42weeks
- Mother giving consent for this study

Exclusion Criteria:

- Multiple deliveries
- Mother with any chronic diseases
- Mother transferred to another hospital

IV. RESULT

Table-I provides demographic characteristics of 150 mothers and their newborns. In this study, 13 mothers are under 25 years (8.7%), 32 are between 25-29 years (35.3%), 53 are between 30-34 years (23.3%), 35 are between 35-39 years (21.3%), and 17 are 40 years or older (11.3%). The mean maternal age is 32.4 years with a standard deviation of 5.6, and the age range is 18-44 years. Regarding gestational age, 7 births occurred at 37 weeks (4.7%), 74 at 38 weeks (49.3%), 38 at 39 weeks (25.3%), 20 at 40 weeks (13.3%), 7 at 41 weeks (4.7%), and 4 at 42 weeks (2.7%). The mean gestational age is 38.8 weeks with a standard deviation of 1.4. The methods of delivery are also included: 89 were vaginal (59.3%) and 61 were Cesarean sections (40.7%). The neonatal gender is almost evenly split with 78 males (52%) and 72 females (48%). The mean neonatal weight is 3225 grams with a standard deviation of 970, the mean placental weight is 594 grams with a standard deviation of 17, the mean umbilical cord weight is 41.7 grams with a standard deviation of 3.5, and the mean umbilical cord length is 52.1 cm with a standard deviation of 5.9. Table-II focuses on the relationship between gestational age and neonatal and placental weights for the same 150 subjects. At 37 weeks, the mean neonatal weight is 2588 grams with a standard deviation of 315, and the mean placental weight is 524 grams with a standard deviation of 80. This trend continues up to 42 weeks, where the mean neonatal weight is 3420 grams with a standard deviation of 511, and the mean placental weight is 628 grams with a standard deviation of 62. Table-III establishes correlations using Pearson's correlation coefficient. The correlation between umbilical cord weight and placental weight is 0.2708 with a P-value of 0.013. The correlation between umbilical cord weight and birth weight is 0.3183 with a P-value of 0.008. Furthermore, the correlation between umbilical cord weight and cord length is 0.3752 with a P-value of less than 0.0001. The correlation between cord length and birth weight is 0.2611 with a P-value of 0.021, and

between cord length and placental weight, it is 0.3204 with a P-value of 0.001. Lastly, the correlation between placental weight and birth weight is notably strong at 0.5156 with a P-value of less than 0.0001.

Table-I: Maternal and neonatal demographic characteristics (N=150)

Characteristics		n	%
Maternal age (Years)	<25	13	8.7
	25-29	53	35.3
	30-34	35	23.3
	35-39	32	21.3
	≥40	17	11.3
	Mean± SD	32.4±5.6	
	Range	18-44	
Gestational age (Weeks)	37	7	4.7
	38	74	49.3
	39	38	25.3
	40	20	13.3
	41	7	4.7
	42	4	2.7
	Mean± SD	38.8±1.4	
Method of delivery	Vaginal	89	59.3
	Cesarean section	61	40.7
Neonatal gender	Male	78	52
	Female	72	48
Neonatal weight (Gram)	Mean± SD	3225±970	
Placental weight (Gram)	Mean± SD	594±17	
Umbilical cord weight (Gram)	Mean± SD	41.7±3.5	
Umbilical cord length (cm)	Mean± SD	52.1±5.9	

Table-II: Mean neonatal birth weight and placental weight by gestational age at birth (N=150)

Gestational age at birth (weeks)	Neonatal weight (Gram)	Placental weight (Gram)
	Mean± SD	Mean± SD
37	2588± 315	524± 80
38	3226± 376	579± 74
39	3295± 398	587± 75
40	3357± 423	618± 71
41	3391± 462	620± 65
42	3420± 511	628± 62

Table-III: Correlation of umbilical cord weight and length with placental and birth weight using Pearson correlation coefficient (N=150)

Umbilical cord parameters	Correlation (r)	P-value
Cord weight v placental weight	0.2708	0.013
Cord weight v birth weight	0.3183	0.008
Cord weight v cord length	0.3752	<0.0001
Cord length v birth weight	0.2611	0.021
Cord length v placental weight	0.3204	0.001
Placental weight v birth weight	0.5156	<0.0001

V. DISCUSSION

The study presents a comprehensive analysis of the demographic characteristics of 150 mothers and their newborns, focusing on the correlation between umbilical cord weight and length with placental and birth weight. The maternal age distribution shows a higher concentration in the 25-29 age group (35.3%), followed by the 35-39 (21.3%) and 30-34 (21.3%) age groups. This distribution is consistent with global trends indicating that women are increasingly choosing to have children later in life [14]. The mean gestational age was found to be 38.8 weeks with a standard deviation of 1.4, aligning with the typical full-term gestational period. Interestingly, a significant portion of the births occurred at 38 weeks (49.3%), which is slightly earlier than the often-cited 40-week full-term mark. This finding is similar to other studies [15, 16]. This could be indicative of various factors, including medical interventions or natural variations in gestational age [17]. The methods of delivery were almost evenly split between vaginal

(59.3%) and Cesarean sections (40.7%). This ratio is somewhat reflective of global statistics, although the rate of Cesarean sections is generally on the rise [18]. The gender distribution of the newborns was fairly balanced, with 52% males and 48% females, which is in line with other studies [15]. The study also examined the relationship between gestational age and neonatal and placental weights. A gradual increase in both neonatal and placental weights was observed from 37 to 42 weeks, which is consistent with existing literature [19]. For instance, at 37 weeks, the mean neonatal weight was 2588 grams, and the mean placental weight was 524 grams. By 42 weeks, these weights increased to 3420 grams and 628 grams, respectively. Similar findings were seen in another study of Panti AA *et al*., [16] The Pearson correlation coefficients revealed several significant relationships. The correlation between umbilical cord weight and placental weight was 0.2708 (P=0.013), and between umbilical cord weight and birth weight, it was 0.3183 (P=0.008). These findings suggest a moderate but significant relationship between these variables, which has been supported by other studies [21-23]. The strongest correlation was observed between placental weight and birth weight (r=0.5156, P<0.0001), indicating a notably strong relationship between these two parameters [24]. However, it's worth noting that while these correlations are statistically significant, they are not extremely high, suggesting that other factors may also play a significant role in determining these birth parameters. This aligns with existing research that suggests multiple variables, including maternal health and environmental factors, can influence birth outcomes [25, 26].

Limitations of the study

In our study, there was small sample size and absence of control for comparison. Study population was selected from two centers in Dhaka city, so may not represent wider population. The study was conducted at a short period of time.

VII. CONCLUSION AND RECOMMENDATIONS

This study found moderate but statistically significant correlations between umbilical cord weight and both placental and birth weights. The strongest correlation was observed between placental weight and birth weight, underscoring the importance of placental health in neonatal outcomes. However, the moderate strength of these correlations suggests that other factors, possibly maternal health and environmental conditions, could also be influential. Further studies is required with larger sample size to have better understanding.

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