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A CROSS-SECTIONAL STUDY TO FIND A CORRELATION OF ULTRASONOGRAPHIC ESTIMATION OF FETAL WEIGHT WITH ACTUAL BIRTH WEIGHT AS SEEN IN A TERTIARY CARE HOSPITAL IN RURAL RAJASTHAN.

DR. RUBAL YADAV[1], DR. SANJEEV SHARMA [2]

Post Graduate Student[1], Professor[2]

Department of Radiodiagnosis, NIMS&R, Jaipur

Corresponding Author: Dr. Rubal Yadav, Post Graduate Student, Department of Radiodiagnosis, NIMS&R, Jaipur

Email ID: Rubalyadav22288@gmail.com

Abstract-

Background/Objectives: Fetal growth is a complex process that involves a myriad of interactions between maternal, fetal, and placental factors. It is a critical aspect of prenatal care, as it is a significant determinant of neonatal survival and can help manage high-risk pregnancies[1]. The accurate assessment of fetal weight is crucial for fetuses with suspected significant deviations of intrauterine growth.

Materials and Methods: Ultrasound was measured sonographically in 97 fetuses between 34 and 42 weeks of gestation. The sonographic examination and delivery were done in singleton pregnancies. The weight of newborns was measured immediately after delivery.

Results: The age distribution of pregnant mothers is found to be highest among 25-35 years at 59.8%, followed by 18-25 years at 38.14% and the least with only two cases above 35 years age group. The mean age is 26.6 years with a standard deviation of ±4.58 years.The mean fetal weight is 2970g ±460.4g with the median for the data set being 2900g . There was a significant positive correlation between the ultrasound estimation of fetal weight and actual birth weight ($r = 0.78$, $P < 0.001$).

Conclusion: Our study reveals a strong positive correlation between estimated ultrasound fetal weight in relation to actual birth weight.

Keywords: Fetal, Macrosomia, Ultrasound, Hadlock, Parity, Kuppuswamy scale

INTRODUCTION:

Fetal growth is a complex process that involves a myriad of interactions between maternal, fetal, and placental factors. It is a critical aspect of prenatal care, as it is a significant determinant of neonatal survival and can help manage high-risk pregnancies[1]. The accurate assessment of fetal weight is crucial for fetuses with suspected significant deviations of intrauterine growth.

The principal determinants of fetal growth are fetal genotype and the in utero environment. Environmental factors include maternal and paternal genetics, maternal size, and the capacity of the placenta to provide nutrients to the fetus. Genetic, nutritional, environmental, uteroplacental, and fetal factors have been suggested to influence fetal growth[1]. Uteroplacental and umbilical blood flow, transplacental glucose, and fetal insulin are major determinants of fetal growth[1].

Ultrasound is the most commonly used technique for fetal growth monitoring and fetal weight estimation[2]. The fetal biometric parameters measured most commonly are biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL)[2]. These parameters are essential for the estimation of fetal weight.

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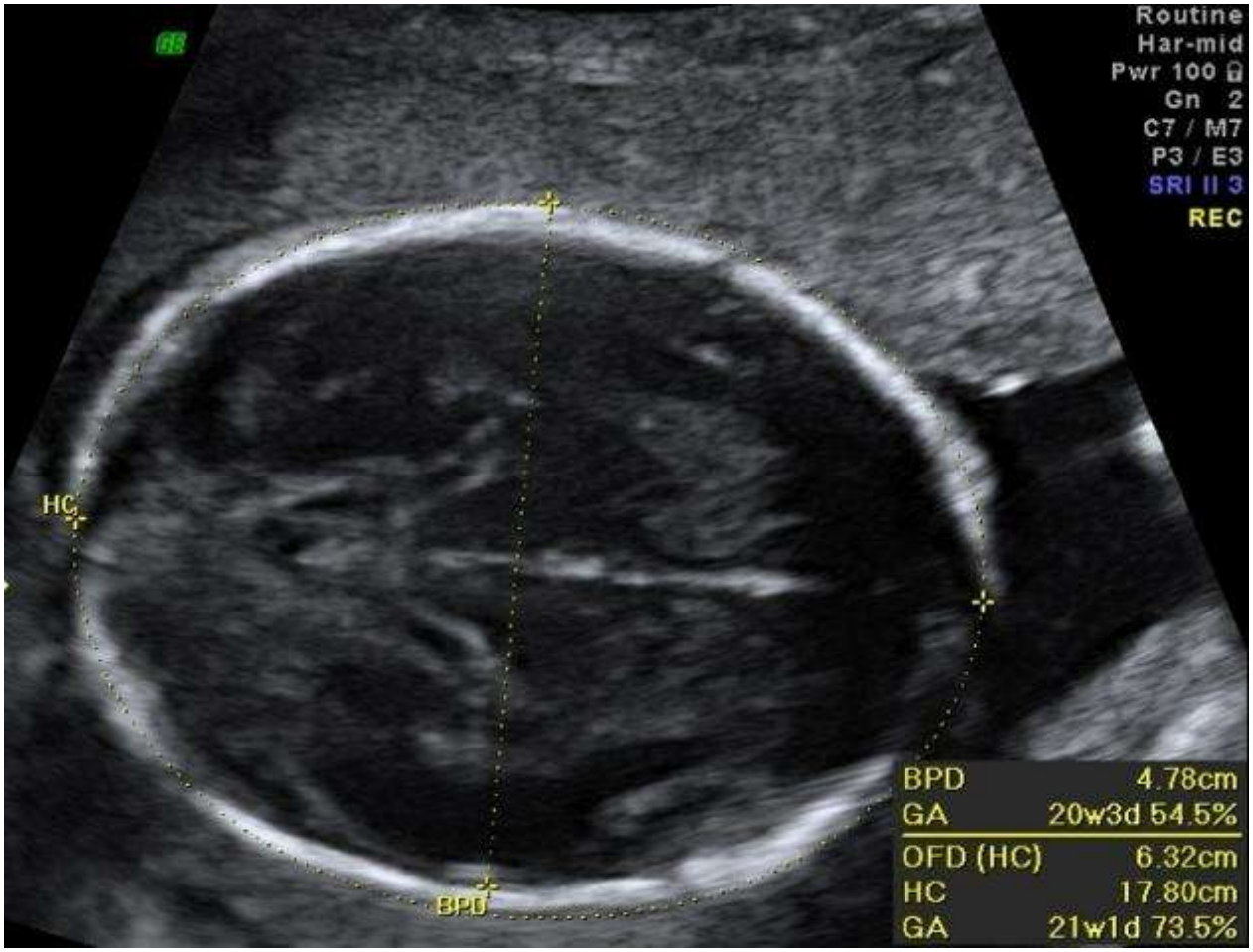
Estimation of Biparietal Diameter and head circumference



Ultrasound estimation of fetal weight is a highly influential factor in antenatal management, guiding both the timing and mode of delivery of a pregnancy[3]. However, ultrasound calculation of fetal weight is commonly overestimated in comparison to actual weight. The Hadlock A formula produced the most accurate results, with the lowest levels of random error[3].

MATERIALS AND METHODS:

The study will be conducted in the Department of Radiodiagnosis, National Institute of Medical Sciences Research & Hospital, Jaipur. The study's sample size was taken using the Convenient sampling technique.

Convenient sampling technique

Inclusion Criteria:

The study encompasses pregnancies that are singular in nature, with the gestational period ranging from 34 to 42 weeks.

Exclusion Criteria:

The study does not include cases with fetal congenital abnormalities. Pregnancies that resulted in delivery beyond a week from the estimated date are also excluded. Additionally, pregnant women who chose not to participate in the study are not considered.

The criteria for inclusion and exclusion were strictly adhered to. Only those patients who fulfilled these criteria and gave their consent were meticulously interviewed and examined.

After collecting data, appropriate statistics will be used to analyze the data. In this research, qualitative information was articulated in terms of proportions and percentages, whereas quantitative information was depicted through averages and standard deviations. All statistical analysis will be performed in SPSS (statistical package for social sciences) version 23, Microsoft Word and Microsoft Excel software. The correlation graph is made from the Loggerpro version 3.16.2.

RESULTS :

TABLE 1 AGE DISTRIBUTION OF THE PARTICIPANTS

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TABLE 1 AGE DISTRIBUTION OF THE PARTICIPANTS

S.No	Age Distribution	No.of cases	Percentage (%)
1	18-25	37	38.14
2	25-35	58	59.79
3	Above 35	2	2.06
	Total	97	100.00
	MEAN	26.61 Years	
	Standard Deviation	4.58 Years	
	Minimum Age -	18 Years	
	Maximum Age-	37 Years	

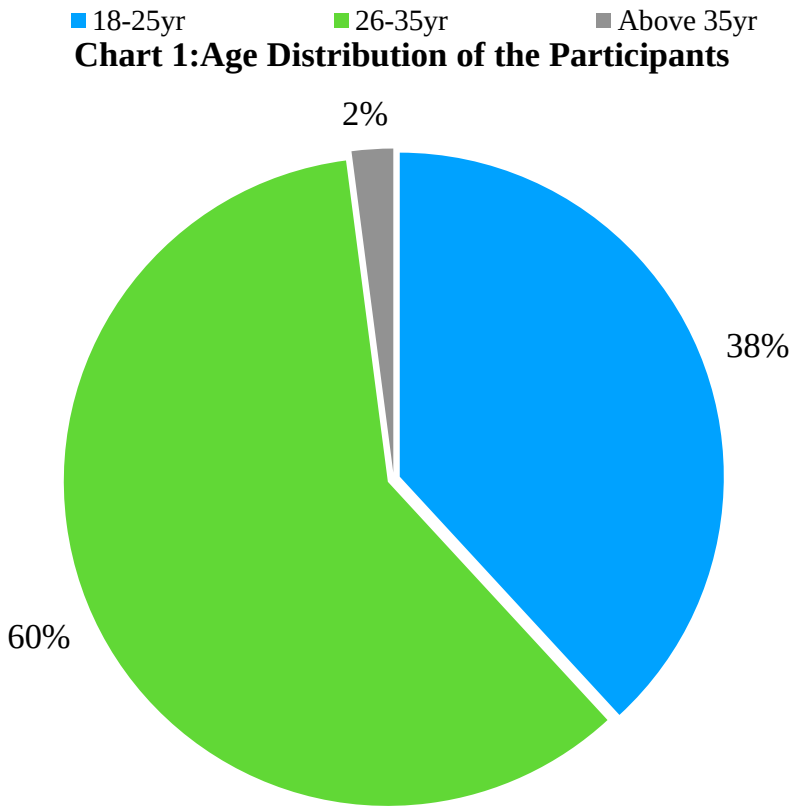

Chart 1:Age Distribution of the Participants

The age distribution of pregnant mothers are found to be highest amoung 25-35 years at 59.8%, followed by 18-25 years at 38.14% and the least with only two cases above 35years age group.
The mean is 26.6 years with a standard deviation of 4.58 years.
The minimum age of the participants was 18 years and the maximum age recorded was 37 years

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TABLE 2 RELIGION DISTRIBUTION OF THE PARTICIPANTS

S.No	Age Distribution	No.of cases	Percentage (%)
1	Hindu	73	75.26
2	Muslim	24	24.74
	Total	97	100.00

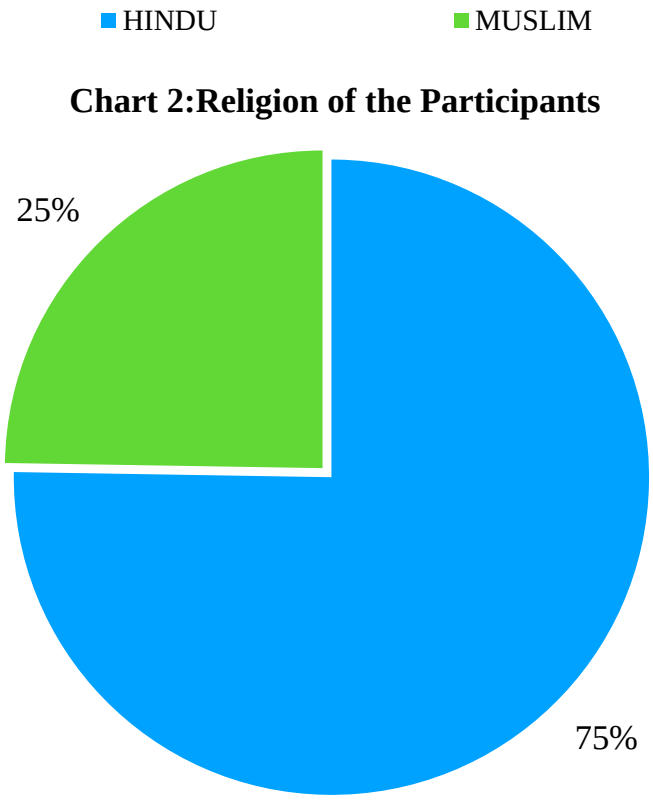

Chart 2:Religion of the Participants

The religious distribution of the participants was dominated by Hindus at 75.26% and Muslims covering the rest 24.74%. This coincides with the 2011 census report about the religious distribution in the rural Jaipur region of Rajasthan, India.

TABLE 3 EDUCATIONAL DISTRIBUTION OF THE PARTICIPANTS

S.No	Age Distribution	No.of cases	Percentage (%)
1	Literate	79	81.44
2	Illetrate	18	18.56
	Total	97	100.00

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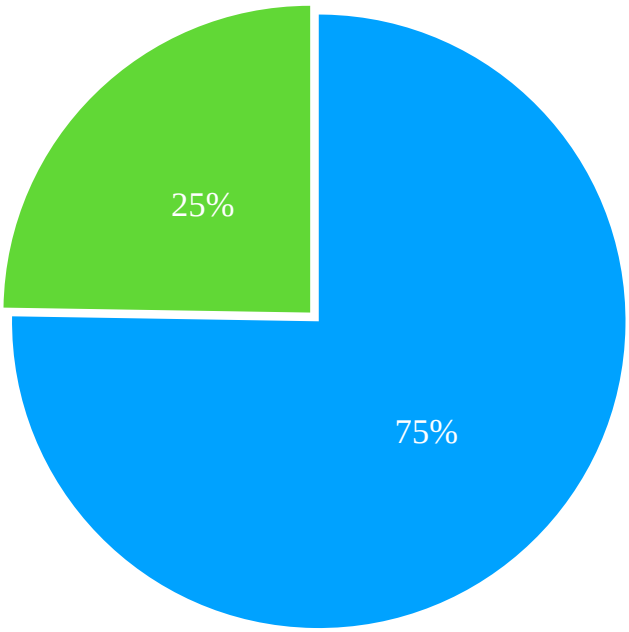
HINDU MUSLIM

Chart 3: Educational Distribution of the Participants



The literacy rate of the participants was noted to be high with 81.44% being educated and only a few illiterate cases of 18.56%.

TABLE 4 REGION WISE DISTRIBUTION OF THE PARTICIPANTS

S.No	Age Distribution	No.of cases	Percentage (%)
1	Rural	82	84.54
2	Urban	15	15.46
	Total	97	100.00

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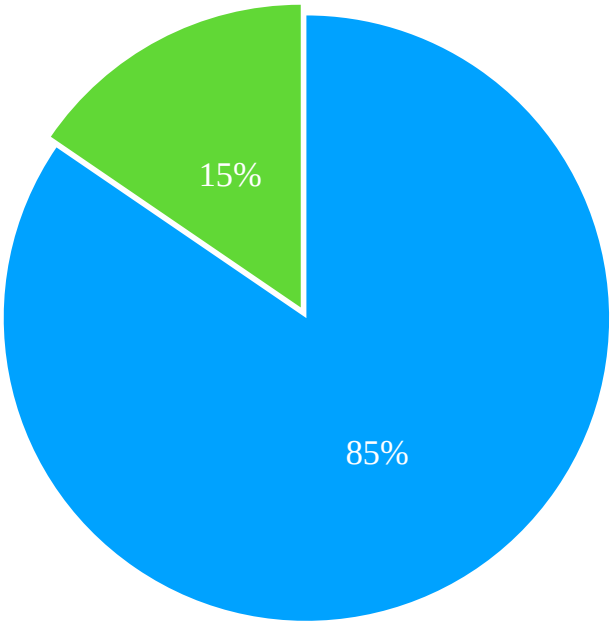
HINDU MUSLIM

Chart 4: Region(Rural/Urban) of the Participants



Coming to the demographic distribution according to the participants residence majority of the patients belong to rural area of Jaipur with 85% dominance. This can be due to the location of the study area i.e. NIMS Hospital being in a rural setting. The remaining 15% of the participants were from nearby urban areas.

TABLE 5 SOCIO-ECONOMIC STATUS OF THE PARTICIPANTS

S.No	Socio-Economic Class	No.of cases	Percentage (%)
1	Upper	6	6.19
2	Upper-Middle	34	35.05
3	Lower-Middle	40	41.24
4	Upper-Lower	5	5.15
5	Lower	12	12.37
	Total	97	100.00

According to the latest Kuppuswamy socio-economic scale, the participants were classified into 5 groups of Upper, Upper-Middle, Lower-Middle, Upper-Lower and Lower classes with 6.19,35.05, 41.24, 5.15, 12.37 per cent respectively.

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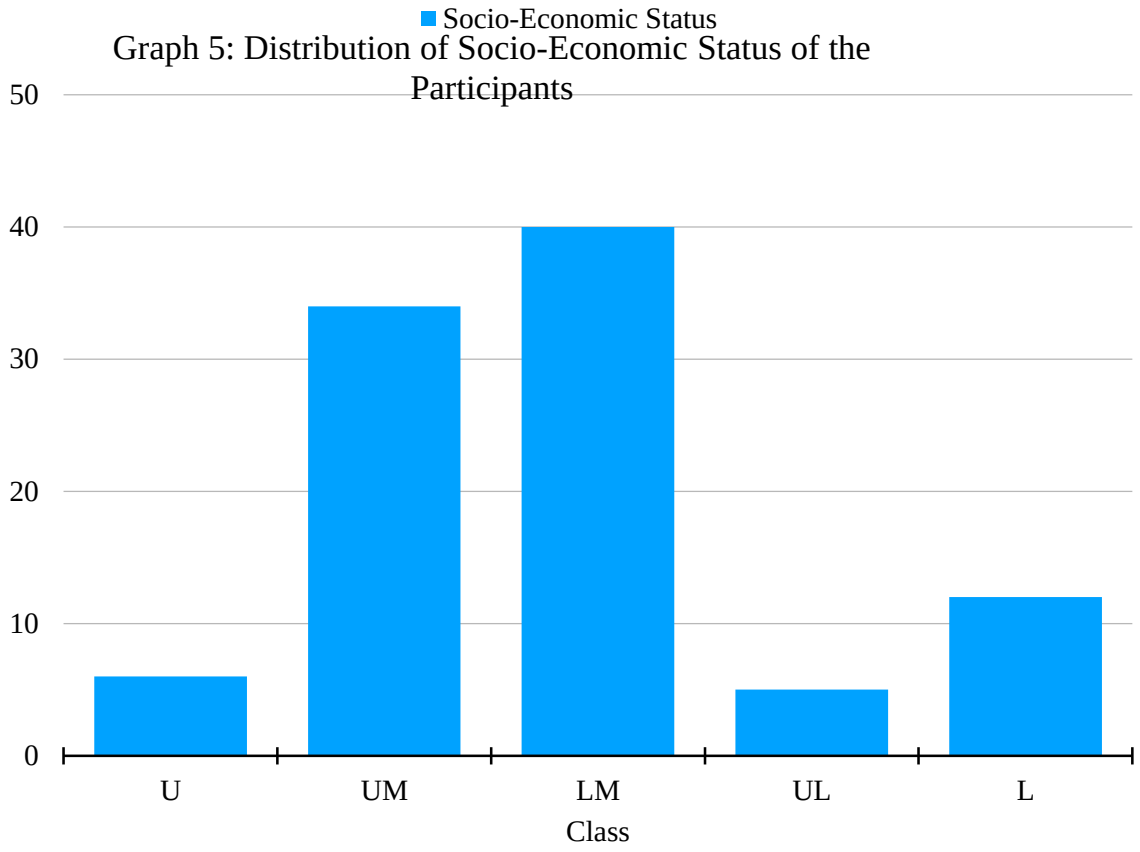

Graph 5: Distribution of Socio-Economic Status of the Participants

TABLE 6: SHOWS THE FETAL WEIGHT GROUPS BY VARIOUS METHODS OF ESTIMATION BY ULTRASOUND AND ACTUAL BIRTH WEIGHT

S.No	Weight Groups	Ultrasound estimate	Actual Birth weight	Difference	Percentage Difference
1	≤2.5kg	15	14	1	7.14
2	2.6-3.0kg	46	44	2	4.55
3	3.1-3.5kg	30	29	1	3.45
4	>3.5kg	7	10	3	30.00

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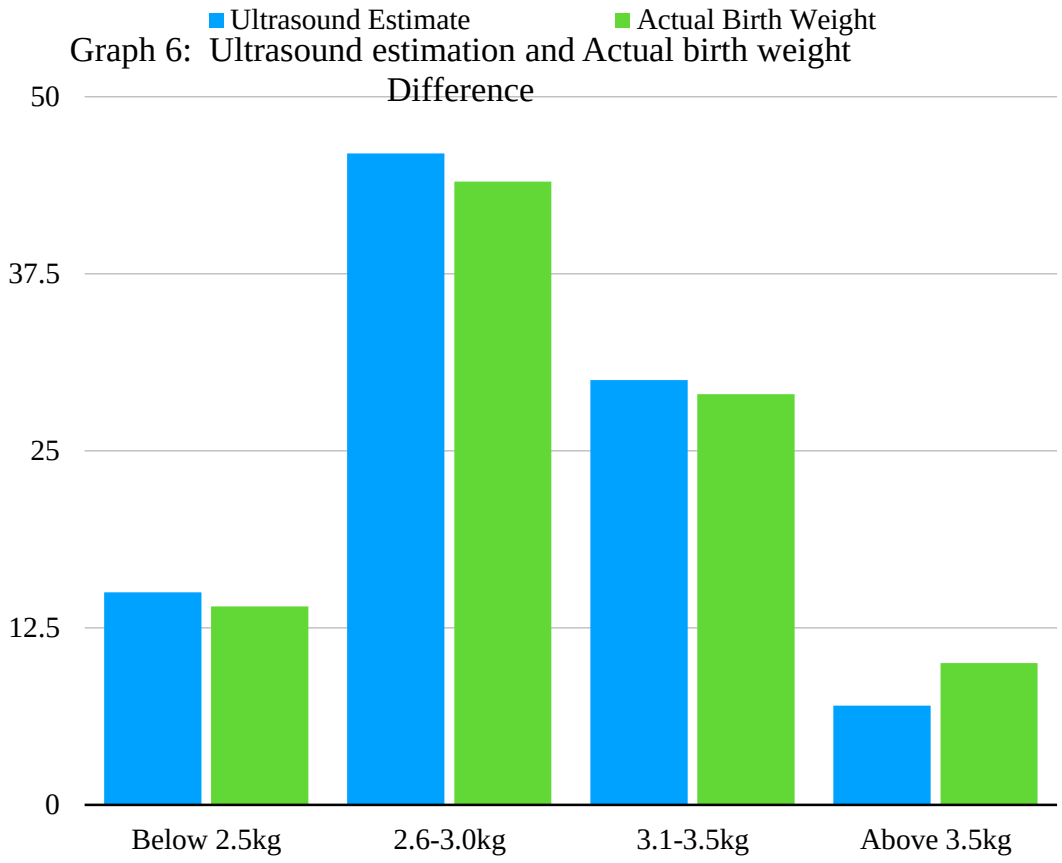
Graph 6: Ultrasound estimation and Actual birth weight Difference



Estimation of fetal weight by Ultrasound and Actual birth weight is deferring in all the different weight groups. The study found that the Ultrasound method overestimated one case out of 14 to be underweight and underestimated 3 cases out of 10 who were actually born above 3.5kg weight at birth.

The greatest difference is seen in large babies above 3.5kg with a difference of 30%. The least is seen among the 3.1kg to 3.5kg group with 29 babies born with a difference of only 3.45%.

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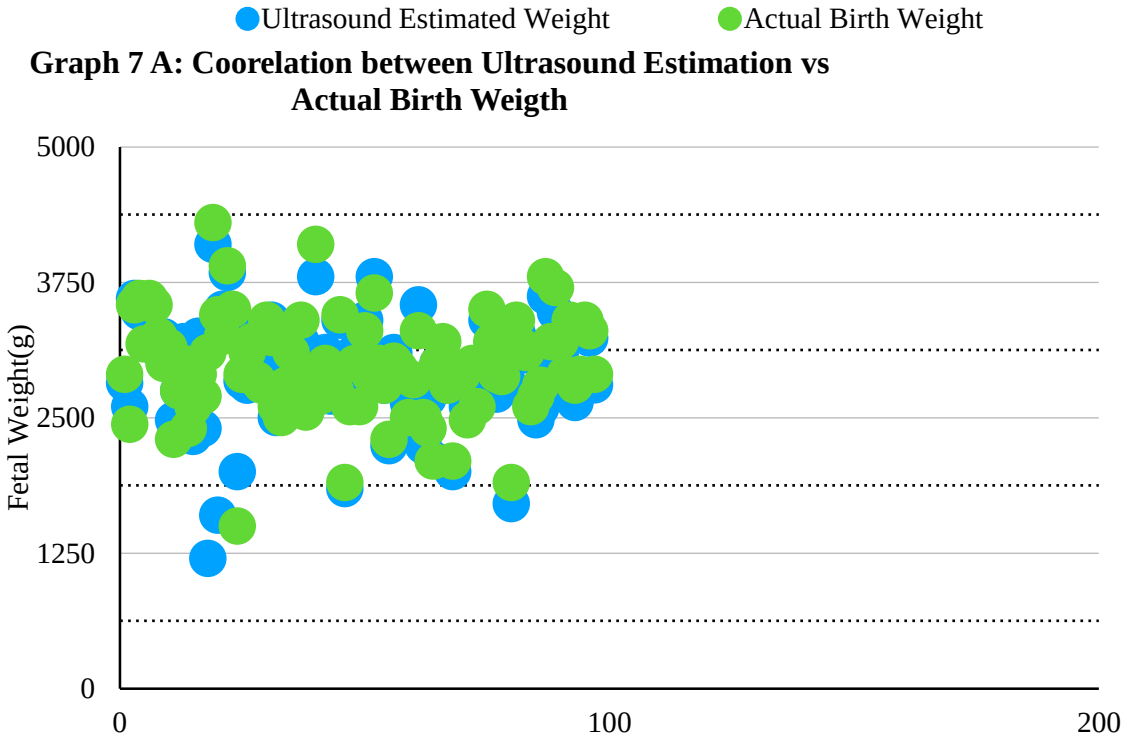
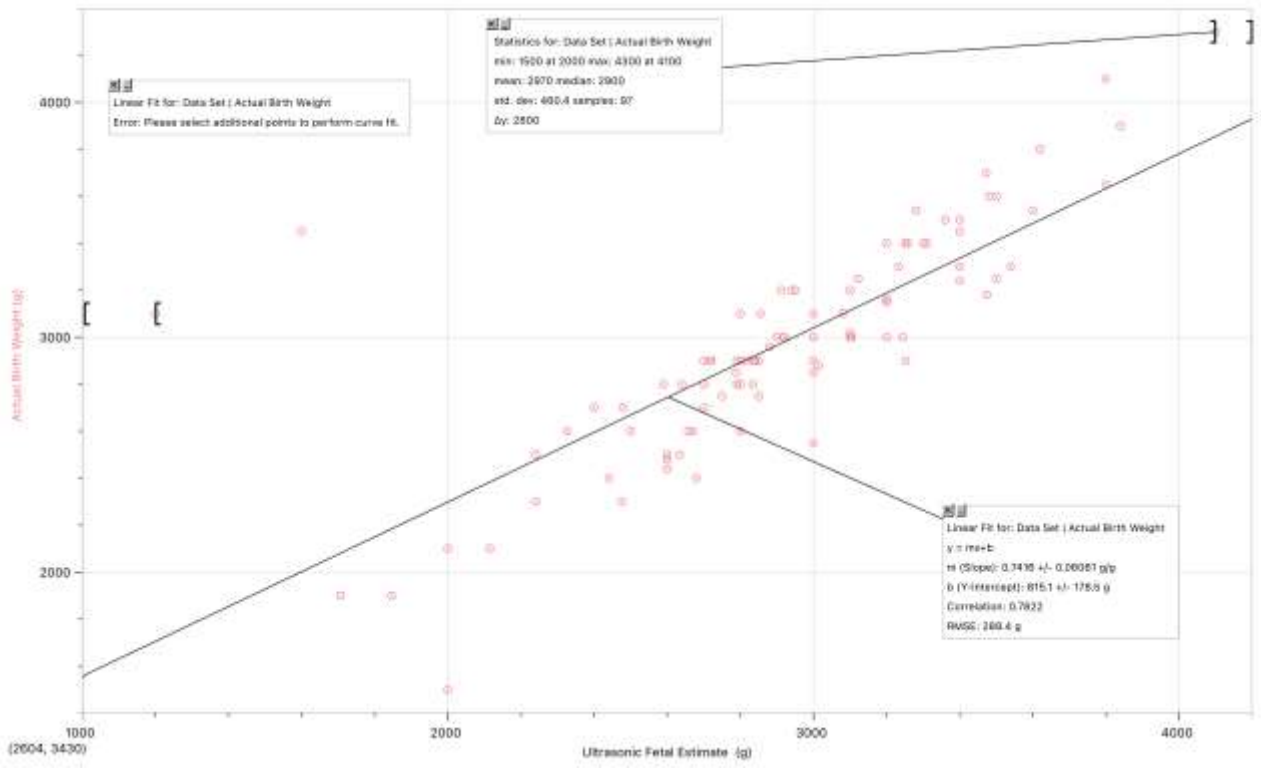


Graph 7 A: Coorelation between Ultrasound Estimation vs Actual Birth Weigth



Graph 7 B: Coorelation between Ultrasound Estimation vs Actual Birth Weigth

The Above graphs depict the correlation between Ultrasound estimation vs Actual Birth Weight.
The mean measured for the study data set is 2970g with a Standard deviation of 460.4g.The median for the above data set is 2900g.
The correlation is 0.7822 which is a strong positive relationship between the above two variables.
P Value is <0.001 which proves a significant relationship with both the values.

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DISCUSSION:

Our study coincides with the results found by various researchers trying to estimate or find out the accuracy of ultrasound formulas in estimating fetal weight with respect to actual birth weight.

In 2009, Charles Ugwoke Eze and his colleagues conducted a study to assess the accuracy of various ultrasound formulas in estimating fetal weight. The study involved 412 women with singleton pregnancies and employed 12 commonly used ultrasound equations. The average actual birth weight was determined to be 3332±513g. Among the tested formulas, the Hadlock formula exhibited the highest interclass correlation coefficient (0.874), signifying a strong correlation between the estimated and actual birth weights. Conversely, the Nzeh formula displayed the lowest correlation coefficient (0.656), indicating less accuracy. The study also revealed that ultrasound tends to overestimate the weight of growth-restricted and macrosomic babies. However, the weight of growth-restricted babies was estimated with greater precision than that of macrosomic babies, with a statistically significant difference ($p<0.05$). [4]

In a research study led by Bajracharya J et al (2012), the precision of birth weight prediction using fetal ultrasound was examined in a cohort of 150 patients aged between 18-40 years, with a gestational age of 37-42 weeks. The average age of the participants was 25.51 years. The study revealed that fetal ultrasound tended to overestimate the birth weight by roughly 370g. Approximately 40% of the estimates exceeded 10% of the actual birth weight. On the other hand, the study also discovered that the ultrasound underestimated the birth weight by about 220g. Based on these observations, the study concluded that clinical examination should be employed alongside ultrasound for a more accurate estimation of fetal weight. [5]

In 2013, Mohammed Adam and his colleagues conducted a study to evaluate the accuracy of ultrasound in estimating fetal weight in the Sudanese population. The study was conducted over a period of 36 months and involved 533 pregnant women. The average birth weight, estimated using Hadlock's formula, was 3.139kg with a standard deviation of 472g. The study concluded that there was a significant correlation between the weight estimated using Hadlock's formula and the actual birth weight. [6]

In a study led by Cletus Uche in 2015, a prospective analysis was performed on a sample of 282 Nigerian women to compare the sonographic estimation of fetal weight with the actual birth weight. The average estimated weight was 3378±49g, while the actual average birth weight was 3393±60g. The ultrasound identified 11% of the fetuses as growth-restricted, but after birth, 14.5% were found to be growth-restricted. Furthermore, 12.1% were estimated to be macrosomic by ultrasound, and 15.2% were confirmed as macrosomic after birth. The study concluded that the sonographic estimation using Hadlock's formula showed a good correlation with the actual birth weight in the Nigerian population. [7]

CONCLUSION:

Our study reveals a strong correlation between estimated ultrasound fetal weight in relation with actual birth weight. This correlation was observed across a broad spectrum of fetal weights, and it is important to note that our cases were not at an increased risk for macrosomia or growth retardation. In summary, our results, along with previous research, indicate that ultrasound estimate can be a valuable single parameter for estimating fetal weight. We also recommend comparing this parameter with other fetal weight estimation parameters, such as femur length (FL), abdominal circumference (AC), and biparietal diameter (BPD) in future studies, to explore its potential use beyond macrosomia.

The clinical method is a cost-effective, straightforward alternative that can be employed by various medical professionals, including nursing staff and midwives, after proper training. In the context of radiology, these findings can help guide the development of more accurate and accessible methods for fetal weight estimation.

REFERENCES:

1. Vorherr H. Factors influencing fetal growth. Am J Obstet Gynecol [Internet]. 1982 [cited 2023 Nov 21];142(5):577–88. Available from: https://pubmed.ncbi.nlm.nih.gov/7036747/
2. Salomon LJ, Alfirevic Z, Da Silva Costa F, Deter RL, Figueras F, Ghi T, et al. ISUOG Practice Guidelines: ultrasound assessment of fetal biometry and growth. Ultrasound Obstet Gynecol [Internet]. 2019;53(6):715–23. Available from: http://dx.doi.org/10.1002/uog.20272
3. Milner J, Arezina J. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. Ultrasound [Internet]. 2018 [cited 2023 Nov 21];26(1):32–41. Available from: http://dx.doi.org/10.1177/1742271x17732807
4. Eze CU, Egwuanumku KI, Agwuna KK, Odidi L, Ochie K, Nwadike IU. Validity of common ultrasound methods of fetal weight estimation in late pregnancy among women in Kwale, Niger Delta region, Nigeria. Afr Health Sci [Internet]. 2015 [cited 2023 Nov 21];15(1):206. Available from: http://dx.doi.org/10.4314/ahs.v15i1.27

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5. Bajracharya J, Shrestha NS, Karki C. Accuracy of prediction of birth weight by fetal ultrasound. Kathmandu Univ Med J (KUMJ) [Internet]. 2012 [cited 2023 Nov 21];10(38). Available from: https://pubmed.ncbi.nlm.nih.gov/23132481/
6. Adam M, Jumaa, Yousef M, Omer Sulieman A. The accuracy of Ultrasound in Estimation of fetal weight. Journal of American Science. 2013;
7. Sinha M, Shah S, Maheshwari S. To compare the accuracy of clinical and sonographic estimation of fetal weight among different BMI antenatal groups. International Journal of Health Sciences and Research [Internet]. 2015 [cited 2023 Nov 21]; Available from: https://www.semanticscholar.org/paper/95397fb217470570f3492577884462b0dd12d2f8