ORIGINAL ARTICLE

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# Evaluation of ultrasound accuracy in estimating birth weight in a hospital in Peru

## Evaluación de la precisión ecográfica en la estimación del peso al nacer en un hospital de Perú

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**ABSTRACT**

Introduction: It is important to assess the accuracy of ultrasounds in developing countries like Peru, where many pregnant women face difficulties in accessing prenatal care and ultrasounds, especially in rural areas. Objectives: To evaluate the accuracy of fetal weight estimation by ultrasound at a Maternal and Child Hospital in Huánuco (Peru) and explore factors associated with the error in such estimation. Materials and methods: This is a retrospective descriptive study, with a population composed of pregnant women whose deliveries were attended at the hospital from August to December 2019. Statistical analysis was performed using STATA v16. Results: 69 participants meeting the selection criteria were included. 56,6% had secondary education. The average BMI was 30.7 kg/m2. The average gestational age of fetuses was 37,6 ± 1,4 weeks, with an estimated average weight of 3251,6 ± 405,9 grams. The percentage difference between the weight estimated by ultrasound and the birth weight in this study was 5,2%. No significant associations were found between the error in estimated weight by ultrasound > 5%, and factors such as education level, BMI, prenatal care, amniotic fluid index, interval between ultrasound and delivery, and type of delivery. Conclusion: The percentage error between the weight estimated by ultrasound and the actual birth weight was deemed acceptable. No significant association was found between this error and maternal or ultrasound-related factors.

Keywords: Prenatal ultrasound; Fetal weight; Birth weight; Prenatal care; Peru.

**RESUMEN**

Introducción: En países en desarrollo como Perú, evaluar la precisión de las ecografías obstétricas es fundamental, especialmente en contextos rurales donde el acceso a controles prenatales y estudios ecográficos es limitado. Objetivo: Evaluar la precisión de la estimación ecográfica del peso fetal en un hospital materno infantil de Huánuco (Perú) y explorar los factores asociados al error de dicha estimación. Materiales y métodos: Estudio descriptivo retrospectivo realizado en gestantes cuyos partos fueron atendidos en el hospital entre agosto y diciembre de 2019. El análisis estadístico se realizó con el programa STATA v16. Resultados: Se incluyeron 69 gestantes que cumplieron con los criterios de selección. El 56,6 % tenía educación secundaria y el índice de masa corporal (IMC) promedio fue de 30,7 kg/m². La edad gestacional promedio al momento del parto fue de 37,6 ± 1,4 semanas, con un peso fetal estimado por ecografía de 3251,6 ± 405,9 gramos. La diferencia porcentual entre el peso estimado y el peso real al nacimiento fue del 5,2 %. No se encontraron asociaciones estadísticamente significativas entre un error de estimación > 5 % y variables como nivel educativo, IMC, número de controles prenatales, índice de líquido amniótico, intervalo entre ecografía y parto, o tipo de parto. Conclusión: La precisión de la estimación ecográfica del peso fetal fue aceptable. No se identificaron factores maternos o ecográficos significativamente asociados a un mayor error en la estimación.

Palabras clave: Embarazo; Peso fetal; Peso al nacer; Ultrasonografía; Perú

## Introduction

Ultrasound examination currently constitutes an essential diagnostic modality in prenatal care due to its relatively low cost, wide availability in healthcare facilities, and superior accuracy in estimating fetal weight compared with clinical assessment methods[1]. This capability supports informed clinical decision-making during pregnancy, particularly in women who present to healthcare facilities near the time of delivery

without prior ultrasonographic evaluation, necessitating reliance on a single ultrasound examination performed at that stage.

Ultrasonographic estimation of fetal weight is generally regarded as accurate within 5% of actual birth weight, although a margin of error of up to 10% is considered clinically acceptable[2]. Multiple factors have been identified that may affect the accuracy of ultrasound-based fetal weight estimation, including operator-related variables such as limited experience, inadequate training, and insufficient quality control or audit processes[2]. Additionally, maternal characteristics—including age, body mass index (BMI), and parity—may influence image quality and measurement accuracy; however, evidence regarding the impact of these factors remains inconclusive[2–4].

It is crucial to evaluate the accuracy of prenatal ultrasounds in healthcare centers, especially in developing countries such as Peru, where many pregnant women, particularly those in the highlands or rural areas, do not receive regular prenatal checkups or may start them late[5].

In Latin America, there is a limited body of research assessing the accuracy of ultrasound in estimating fetal weight, with most studies dating back approximately a decade[6–8]. Some of these studies have focused primarily on determining whether a positive correlation exists between ultrasound-estimated weight and actual birth weight[7,9], while others have assessed accuracy through the calculation of absolute percentage error[6,8,10]. However, none of these studies has examined the potential factors that may contribute to errors in fetal weight estimation.

Given the above, we conducted this study with the aim of evaluating ultrasound accuracy in normal-weight newborns in one of the largest hospitals in the Huánuco region of Peru and exploring the factors associated with error in such estimation.

## Materials and methods

### Study design and participants:

A retrospective, descriptive study was conducted in the Obstetrics and Gynecology Department of the Carlos Showing Ferrari Maternal and Child Hospital (HMICSF), one of the largest referral hospitals in the department of Huánuco, Peru.

The study included all pregnant women treated at the HMICSF and their full-term newborns (37 to 41 weeks of gestation) with a normal weight between 2,500 and 4,000 grams between August and December 2019

Pregnant women with complete maternal medical records were included in the study. Available data comprised information on comorbidities, maternal weight and height—allowing for the calculation of body mass index (BMI)—as well as the number of prenatal visits and gestational age, which was documented according to the method used for its determination (date of last menstrual period or first-, second-, or third-trimester ultrasound). Additionally, eligibility was restricted to women who had undergone an ultrasound examination at the study institution within seven days prior to delivery. Pregnancies complicated by congenital malformations were excluded, and only cases with cephalic fetal presentation at the time of ultrasound assessment were included.

On the other hand, newborns less than 36 weeks, incomplete medical records without a description of the estimated fetal weight, multiple pregnancies, fetal deaths, pregnancies with uterine or adnexal abnormalities, as well as those with abnormal amniotic fluid volume or placental vascular pathology, since it has been reported that, regardless of whether the newborn is small for gestational age, this condition has a negative correlation with birth weight[11].

Cases with low fetal weight for gestational age or macrosomia were also excluded in order to reduce the heterogeneity introduced by newborns with extreme weights, who in previous studies have consistently shown greater deviations in ultrasound estimates[4,12]. In particular, Chen et al. (2023) reported that the Hadlock IV formula is most accurate in the range of 2500 to 4000 g, while it tends to overestimate weight in small fetuses and underestimate it in macrosomic fetuses[13].

Likewise, pregnant women with comorbidities such as pregestational diabetes mellitus, described in multicenter studies as a factor that decreases the accuracy of ultrasound estima-

tion of fetal weight, were excluded[12]. Similarly, pregnant women with severe preeclampsia, in whom altered fetal growth patterns could affect the accuracy of ultrasound estimation, were excluded[14,15].

### Procedures and variables

General data on the pregnant woman (age, level of education, number of pregnancies, prenatal checkups during pregnancy, body mass index [BMI]), data from the last ultrasound scan performed during the 7 days prior to delivery (age calculated by ultrasound, estimated weight, amniotic fluid index [AFI], and the difference in days between the date of the ultrasound scan and delivery), weight of the newborn, and mode of delivery.

The ultrasounds were performed with two devices available at the hospital during the study period. Of the total ultrasounds analyzed, 74.4% were performed with the MEDISON SONOACE ultrasound machine and 25.6% with the MINDRAY ultrasound machine, model DC-N3. The method used to calculate fetal weight was the Hadlock 4 formula, used by both devices.

For the variable "percentage difference between the weight estimated by ultrasound and the birth weight," a formula used in previous studies[3,4,16] was used, which is expressed below:

Percentage difference (percentage error) = [(Estimated weight by ultrasound – birth weight) / birth weight] × 100.

Based on these criteria, the data were stratified into three categories: ultrasound-estimated fetal weights representing an underestimation of birth weight (<95%), estimates within ±5% of actual birth weight (95–105%), and estimates reflecting an overestimation of birth weight (>105%).

Ultrasonographic examinations were conducted by approximately seven obstetrician–gynecologists affiliated with the hospital, all of whom had more than five years of professional experience. However, in contrast to other studies, the institution does not include resident physicians in training, precluding analysis of accuracy according to level of training. Additionally, because operator identification was not consistently documented in ultrasound reports, this variable could not be incorporated into the accuracy analysis.

### Statistical analysis

The responses obtained were stored in Microsoft Excel 2016 spreadsheets, and statistical analysis was subsequently performed using STATA v16.0 statistical software. Relative and absolute frequencies were used to describe categorical variables. For numerical variables, means with standard deviations or medians with interquartile ranges were used, as appropriate. Visual inspection of the histogram was used to assess normality, and when there were doubts, this was supplemented with Shapiro-Wilk tests.

To evaluate the associated factors, fetal weight estimates were divided into three groups (underestimated, 5% estimate, and overestimated). To explore the association between this variable and various factors, ANOVA, Kruskal-Wallis, chi-square, and Fisher's exact tests were used, as appropriate. Spearman's correlation between estimated fetal weight and actual birth weight was also determined. Since no factor was statistically significant, no adjusted regressions were performed. Results with a $p < 0.05$ were considered significant.

### Ethical aspects and funding

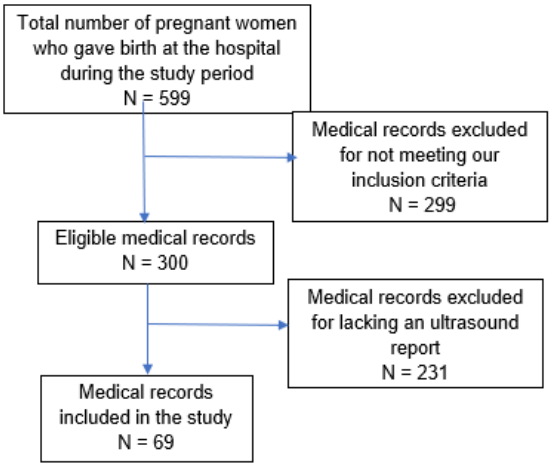
Data collection was authorized by the Training Unit of the Carlos Showing Ferrari Maternal and Child Hospital. Likewise, this study was evaluated and approved by the Institutional Research Ethics Committee of the Lambayeque Healthcare Network, through Certificate No. 053-CEI-RPLAMB.2023 issued in August 2023. This study was self-funded.

## Results

From August to December 2019, 599 pregnant women attended for delivery care, of which 68 medical records (11.5%) met the selection criteria (Figure 1).

The average age of the pregnant women was 26.4 years. In addition, it was more common to find among them those who had completed secondary school (56.6%). The average BMI of those evaluated was 30.7 ± 4.5 kg/m2. The average gestational age of the fetuses, established by ul-

Figura 1. Flujo de inclusión de participantes




trasound prior to delivery, was 37.6 weeks, with an average estimated weight (calculated using the Hadlock 4 method) of 3251.6 ± 405.9 grams. The mean amniotic fluid index AFI, calculated using the Phelan method, had an average of 12. The average interval between the ultrasound scan and the day of delivery was 1 day. The newborns had an average gestational age of 274 days (equivalent to 39.1 weeks) with an average weight of 3316.0 ± 402.2 grams. Most deliveries were eutocic (41.1%) (Table 1).

Figure 2 shows the scatter plot demonstrating a positive correlation between estimated fetal weight by ultrasound and actual birth weight, with a Pearson coefficient of 0.84 (p<0.001). The percentage difference between estimated weight by ultrasound and birth weight was 5.2% on average (Table 1).

Fetal weight estimates were divided into three groups: less than 95% (underestimated percentage) with 24 participants; between 95% and 105% (expected percentage) with 33 participants; and greater than 105% (overestimated percentage) with 11 participants.

Figura 2: Correlación entre el peso estimado por ecografía y el peso al nacer.

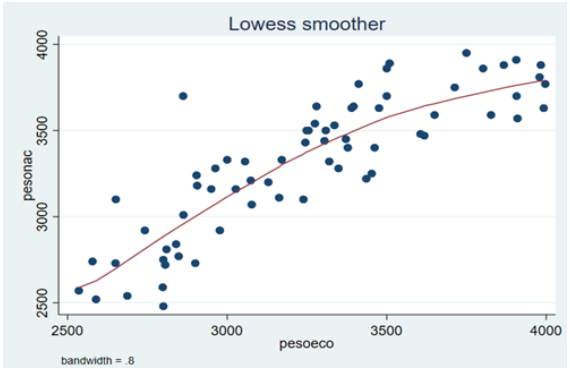



Table 1. Characteristics of the study participants (n = 68).

| Variables | n (%) |
|---|---|
| Age, years* | 26.4 ± 7.6 |
| Educational level | |
| Complete or incomplete primary | 14 (23.3) |
| Complete or incomplete secondary | 34 (56.6) |
| Complete or incomplete higher education | 12 (20.0) |
| Body mass index, kg/m²* | 30.7 ± 4.5 |
| Number of pregnancies† | 2 (1–3) |
| Six or more prenatal visits | 59 (93.6) |
| Fetal weight estimated by ultrasound, g* | 3251.6 ± 405.9 |
| Amniotic fluid index, cm† | 12 (9–14.9) |
| Mean gestational age at ultrasound prior to delivery, days | 37.6 ± 1.4 |
| Gestational age at delivery (based on last menstrual period or first, second, or third trimester ultrasound), weeks* | 39.1 (38–40.7) |
| Birth weight, g* | 3316.0 ± 402.2 |
| Interval between ultrasound and delivery, days† | 1 (0–5) |
| Percent difference between estimated fetal weight and actual birth weight† | 5.22 (2.2–7.0) |
| Error rate in estimated fetal weight | |
| < 95% | 24 (35.2) |
| 95–105% | 33 (48.5) |
| > 105% | 11 (16.2) |
| Women whose estimated fetal weight was within ±10% of actual birth weight | 64 (94.1) |
| Mode of delivery | |
| Vaginal (eutocic) | 28 (41.1) |
| Elective cesarean section | 15 (22.0) |
| Emergency cesarean section | 25 (36.7) |

*No data were obtained on the level of education of 8 individuals, the number of prenatal checkups for 6 individuals, the BMI of 2 individuals, and the AFI of 12 participants.*
** Mean ± standard deviation.*
*† Median (interquartile range).*
*Source: Authors.*

The relationship between errors in fetal weight estimates (< 95%, 95% to 105%, and > 105%) and factors such as level of education, BMI, prenatal checkups, AFI, the number of days between the ultrasound scan, the day of birth, and the mode of delivery was evaluated using bivariate analysis. The results showed no significant association between any of these variables (Table 2). Because no factor was statistically significant, no adjusted regressions were performed.

## Discussion

The present study found that ultrasound-based estimation of fetal weight performed within sev-

Table 2. The relation between study variables and an adequate birth weight calculation.

| Characteristics | Percentage error in the estimation of neonatal weight | | | | Statistical test |
|---|---|---|---|---|---|
| | < 95% n (%) | 95–105% n (%) | > 105% n (%) | *p*-value | |
| Age, years* | 24.8 ± 8.4 | 27.9 ± 6.8 | 25.3 ± 8.7 | 0.174 | Kruskal–Wallis |
| Educational level | | | | 0.477 | Fisher's exact test |
| Primary | 2 (14.2) | 9 (64.2) | 3 (21.4) | | |
| Secondary | 13 (38.2) | 15 (44.2) | 6 (17.6) | | |
| Higher education | 5 (41.6) | 6 (50.0) | 1 (8.3) | | |
| Number of pregnancies† | 2 (1–3) | 2 (1–3) | 2 (1–3) | 0.999 | Kruskal–Wallis |
| Body mass index, kg/m² | 30.1 ± 4.1 | 30.8 ± 4.5 | 31.7 ± 5.3 | 0.635 | ANOVA |
| Prenatal care | | | | 0.102 | Fisher's exact test |
| Uncontrolled | 0 (0) | 2 (50.0) | 2 (50.0) | | |
| Controlled | 22 (37.2) | 29 (49.1) | 8 (13.5) | | |
| Amniotic fluid index, cm | 13.1 ± 4.8 | 12.2 ± 3.9 | 12.7 ± 4.6 | 0.822 | Kruskal–Wallis |
| Interval between ultrasound and delivery, days† | 3 (1–6.5) | 1 (0–2) | 1 (0–6) | 0.112 | Kruskal–Wallis |
| Mode of delivery | | | | 0.516 | Fisher's exact test |
| Vaginal (eutocic) | 13 (54.1) | 11 (33.3) | 4 (36.3) | | |
| Elective cesarean | 3 (12.5) | 9 (27.2) | 3 (27.2) | | |
| Emergency cesarean | 8 (33.3) | 13 (39.3) | 4 (36.3) | | |
| Birth weight, g* | 3460.4 ± 304.5 | 3253.6 ± 407.0 | 3188.2 ± 509.6 | 0.080 | ANOVA |

*The level of education was not recorded for 8 individuals, the number of prenatal checkups for 6 individuals, the body mass index for 2 individuals, and the amniotic fluid index for 12 participants.*
**Mean ± standard deviation; † Median (interquartile range).*
*Source: Authors.*

en days prior to delivery yielded a mean percentage error of 5.22%, a value considered clinically acceptable according to international standards. Furthermore, 94.1% of the estimates demonstrated an error of less than 10%. No statistically significant associations were identified between estimation error and maternal characteristics (including age, body mass index, educational level, and number of prenatal visits), ultrasonographic variables (such as amniotic fluid index and the interval between ultrasound examination and delivery), or mode of delivery. These findings indicate that, within this population of normal-weight neonates, ultrasonographic fetal weight estimation was accurate and was not significantly influenced by the variables evaluated.

These results are consistent with findings from international studies, which generally report margins of error for ultrasound-based fetal weight estimation ranging between 5% and 10%[2,4,16]. For instance, a cohort study conducted in 2017 reported a mean error of 8.2 ± 6.5% [3], while a study from Nigeria documented an average absolute percentage deviation of 7.5%[17]. In contrast, studies conducted in New Zealand and Mumbai reported error rates exceeding 10%[16,18]. Notably, these latter studies included macrosomic neonates in their study populations, a factor that may have contributed to higher estimation errors compared with the present study, which exclusively included newborns with normal birth weight.

With regard to maternal characteristics, BMI has been described as a common risk factor for underestimating fetal weight[16], and it has also been mentioned that in patients with a BMI > 30 kg/m2 there is greater deviation in accuracy[19]. However, contradictorily, in our study we did not find a significant association($p$=0.63) between maternal BMI and underestimation or overestimation of fetal weight, despite the fact that the average BMI in our population was greater than 30 (30.7 ± 4.5). This association was also not evident in two cohort studies[3,4].

Another maternal characteristic described in the literature was maternal age, where it is mentioned that older age would overestimate the calculation of fetal weight, especially in patients over 33 years of age[19]. In contrast, in our study, we did not find significant differences in maternal age between the groups that underestimated (24.8 ± 8.4 years) or overestimated (25.3 ± 8.7 years) fetal weight, but it is important to note that, compared to the study mentioned above, our population was much younger, with an aver-

age age of 26 years. The number of pregnancies, primiparity, was described in one cohort as a factor associated with inaccurate weight estimation[3]. This characteristic was not evident in our study, since in the group where fetal weight was overestimated or underestimated, most of the participants were multiparous.

Regarding ultrasound characteristics, it was mentioned that amniotic fluid volume would be an important data point to record, as it determines the quality of the ultrasound image[16]. In our study, we evaluated this variable, the AFI, but we did not find a statistically significant difference ($p$=0.82) between the groups, which coincided with a study that evaluated the association with low amniotic fluid volume[3].

Similar results were described in a recent Chinese cohort, where, when applying the Hadlock IV formula, the same one used in this study, no significant associations were found between the accuracy of the ultrasound estimate and maternal variables (BMI, height, weight, or gestational age) or ultrasound variables (fetal presentation, biparietal diameter, head circumference, abdominal circumference, femur length, or amniotic fluid volume)[13]. These findings reinforce the idea that the variability observed in fetal weight estimation may be due more to factors inherent in the method than to the maternal or fetal characteristics evaluated.

A systematic review published in 2018 mentions that among the factors identified as contributing to inaccuracy were the equipment operator; lack of experience, insufficient training and auditing, and poor optimization of the ultrasound image[2].

These characteristics, especially operator experience, were evaluated in a cohort study conducted that same year, which found that although accuracy was almost the same between resident physicians and specialists, the latter obtained more accurate results in macrosomic newborns[4]. Although in the present study all ultrasounds were performed by obstetrician-gynecologists (specialists), no information was available on their individual level of experience, so this variable could not be analyzed, representing a limitation of the study.

Furthermore, although variables such as educational level and number of prenatal checkups were included in our analysis, no significant associations with estimation error were found. As far as we have reviewed, these variables have been poorly addressed in the literature on ultrasound accuracy. Our study considered these variables because of their possible role, especially in obstetric care settings in developing countries.

Regarding the interval between the ultrasound and delivery, some studies have indicated that accuracy improves when the ultrasound is performed within seven days prior to birth[20]. However, we did not find a statistically significant difference in accuracy ($p$=0.11), which could be influenced by the homogeneity in the timing of ultrasounds in our sample (median of 1 day).

Finally, although some studies have linked overestimation of fetal weight with an increased risk of cesarean section[4], in our study population, although 63.5% of those whose weight was overestimated ended up having a cesarean section, a similar percentage was obtained in the group whose weight was estimated correctly (66.5%). This could be because, as the hospital is a regional referral center, most patients arrive with a specific indication for cesarean section, such as a history of previous cesarean section or other obstetric conditions, which could have influenced the mode of delivery regardless of the estimated fetal weight.

## Limitations and Strengths

Several limitations and strengths of the present study warrant consideration. One notable limitation was the inclusion of only 13.8% of the total eligible population, primarily due to incomplete or missing ultrasonographic data in 231 medical records. The absence of ultrasound examinations performed within the seven days preceding delivery, or the lack of ultrasound documentation altogether, may be attributed to the hospital's role as a referral center, where patients often present for emergency care, thereby limiting the feasibility of conducting or recording prior imaging assessments.

Another important limitation was the inability to incorporate the operator-related variable into the analysis, as ultrasound reports did not consistently document the identity of the examiner or their level of professional experience. This

omission may have influenced the accuracy of fetal weight estimation and should be addressed in future studies.

On the other hand, when obtaining data for this study, only normal-weight newborns were considered, which could have underestimated errors in the accuracy of fetal weight estimation in the gynecology department. We therefore recommend that future studies consider low-weight and macrosomic newborn populations to obtain ultrasound accuracy data that includes all groups of patients attending the hospital.

Despite these limitations, we believe that this study makes a valuable contribution, as, to our knowledge, there are no previous studies in Peruvian hospitals that evaluate the accuracy of ultrasound estimation of fetal weight and its association with clinical and ultrasound variables.

## Conclusion

In conclusion, it was determined that the percentage error between the weight estimated by ultrasound and the actual birth weight of newborns in a hospital in Peru was 5.22%, which is considered an acceptable percentage. Also, 94.1% of those evaluated had an error of less than 10%.

In relation to the factors possibly related to the error in the estimate, we found no significant association with any of them, such as maternal or ultrasound factors.

## References


1. Preyer O, Husslein H, Concin N, Ridder A, Musielak M, Pfeifer C, et al. Fetal weight estimation at term – ultrasound versus clinical examination with Leopold's manoeuvres: a prospective blinded observational study. BMC Pregnancy Childbirth. 2019;19(1):122.doi: 10.1186/s12884-019-2251-5
2. Milner, Arezina. The accuracy of ultrasound estimation of fetal weight in comparison to birth weight: A systematic review. Ultrasound J. Br. Med. Ultrasound Soc. 26 (1) :32-41. doi:10.1177/1742271X17732807
3. Tas, Kir, Yilmaz, Yavuz. Accuracy of sonographic fetal weight estimation in full-term singleton pregnant women. Pak. J. Med. Sci. 35 (1) :34-38. doi:10.12669/pjms.35.1.373
4. Stubert, Peschel, Bolz, Glass, Gerber. Accuracy of immediate antepartum ultrasound estimated fetal weight and its impact on mode of delivery and outcome - a cohort analysis. BMC Pregnancy Childbirth 18 (1) :118. doi:10.1186/s12884-018-1772-7
5. Hernández-Vásquez, Vargas-Fernández, Bendezu-Quispe. Factores asociados a la calidad de la atención prenatal en Perú. Rev. Peru. Med. Exp. Salud Publica 36 (2) :178-187. doi:10.17843/rpmesp.2019.362.4482
6. Urdaneta Machado, Baabel Zambrano, Rojas Bracamonte, Taborda Monton, Maggiolo, Contreras Benítez. Estimación clínica y ultrasonográfica del peso fetal en embarazos a términos. Clínica E Investig. En Ginecol. Obstet. 40 (6) :259-268. doi:10.1016/j.gine.2012.12.002
7. Freire, Cecatti, Paiva. Correlação entre peso fetal estimado por ultrassonografia e peso neonatal. Rev. Bras. Ginecol. E Obstetrícia 32 :4-10. doi:10.1590/S0100-72032010000100002
8. Díaz Salazar, López Peña, García de Yegüez, Herrera, Meléndez, Salas. Cálculo de peso al nacer por ultrasonido en las embarazadas de alto riesgo. Salus 15 (3) :13-18.
9. Mamani. Correlación entre el peso estimado por ecografía y el peso del recien nacido en gestantes a termino del Centro de salud La Esperanza – Tacna 2016. Rev. Médica Basadrina 12 (1) :10-15. doi:10.33326/26176068.2018.1.627
10. Ayala, Andrade. Higher concordance in clinical assessment versus ultrasound to estimate fetal weight when compared with birth weight in full-term newborns: Original Research. Rev. Ecuat. Pediatría 22 (2) :12:1-10. doi:10.52011/0077
11. Hendrix, Bons, Alers, Severens-Rijvers, Spaanderman, Al-Nasiry. Maternal vascular malformation in the placenta is an indicator for fetal growth restriction irrespective of neonatal birthweight. Placenta 87 :8-15. doi:10.1016/j.placenta.2019.09.003
12. Dittkrist, Vetterlein, Henrich, Ramsauer, Schlembach, Abou-Dakn, et al. Percent error of ultrasound examination to estimate fetal weight at term in different categories of birth weight with focus on maternal diabetes and obesity. BMC Pregnancy Childbirth 22 :241. doi:10.1186/s12884-022-04519-z
13. Ma, Cheng, Zhang, Cai, Xu. Evaluating the accuracy of sonographic fetal weight estimations using the Hadlock IV formula in a Chinese population. Quant. Imaging Med. Surg. 13 (6) :3726-3734. doi:10.21037/qims-22-778
14. MATEUS, NEWMAN, ZHANG, PUGH, GREWAL, KIM, et al. Fetal Growth Patterns in Pregnancy-Associated Hypertensive Disorders: NICHD Fetal Growth Studies. Am. J. Obstet. Gynecol. 221 (6) :635.e1-635.e16. doi:10.1016/j.ajog.2019.06.028
15. Ben-Haroush, Yogev, Bar, Mashiach, Kaplan, Hod, et al. Accuracy of sonographically estimated fetal weight in 840 women with different pregnancy complications prior to induction of labor. Ultrasound Obstet. Gynecol. 23 (2) :172-176. doi:10.1002/uog.940
16. Benson-Cooper, Tarr, Kelly, Bergin. Accuracy of ultrasound in estimating fetal weight in New Zealand. Australas. J. Ultrasound Med. 24 (1) :13-19. doi:10.1002/ajum.12239
17. Okafor, Okafor, Mbachu, Obionwu, Aronu. Correlation of Ultrasonographic Estimation of Fetal Weight with Actual Birth Weight as Seen in a Private Specialist Hospital in South East Nigeria. Int. J. Reprod. Med. 2019 :3693797. doi:10.1155/2019/3693797
18. Ingale, Khade, Shirodkar. Clinical versus ultrasonographic fetal weight estimation and its correlation with actual birth weight. Int. J. Reprod. Contracept. Obstet. Gynecol. 8 (2) :503-512. doi:10.18203/2320-1770.ijrcog20190275

19. Siskovicova, Ferianec, Krizko, Alfoldi, Kunochova, Záhumensky, et al. Analysis of factors influencing ultrasound-based fetal weight estimation. Bratisl. Lek. Listy 124 (1) :25-28. doi:10.4149/BLL_2023_003

20. Faschingbauer, Dammer, Raabe, Schneider, Faschingbauer, Schmid, et al. Sonographic weight estimation in fetal macrosomia: influence of the time interval between estimation and delivery. Arch. Gynecol. Obstet. 292 (1) :59-67. doi:10.1007/s00404-014-3604-y