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The Cross-Sectional Ultrasound Study of Liver Size in Pregnancy with Demographic Correlations in Nigerian Women

Wekhe Chidinma [a] and Ugboma Enighe W [b*]

[a] *Department of Radiology, Rivers State University Teaching Hospital, Nigeria.*
[b] *Department of Radiology, University of Port Harcourt/University of Port Harcourt Teaching Hospital, Rivers State, Nigeria.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Ultrasonography is a valuable tool for assessing abdominal organs, including the liver, during pregnancy. Liver imaging is essential to diagnose and monitor liver emergencies and other liver diseases in pregnancy. Pregnancy is associated with physiological changes that can lead to gestational liver enlargement.
Aim: To investigate the ultrasonographic measurements of liver length in pregnant women, specifically examining how these measurements correlate with various demographic and clinical parameters.
Study Design and Setting: A prospective cross-sectional study conducted from a specialist hospital in Port Harcourt, Nigeria.

**Corresponding author: Email: enighe.ugboma@uniport.edu.ng;*

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Methodology: 559 healthy pregnant women underwent liver ultrasound, and their anthropometric and demographic data were collected. Liver length was measured, and the data were analysed using SPSS version 21.0 with statistical significance set at $p<0.05$.
Results: The mean liver length was 14.85±3.01 cm (12.0-29.0 cm). Liver length significantly correlated with parity (r=0.503, p=0.0001) but not with age, weight, height, or BMI.
Conclusion: The study found that liver size positively correlates with parity but is unaffected by the patients' anthropometric parameters.

Keywords: Ultrasonographic; liver length; findings; pregnant women.

1. INTRODUCTION

Pregnancy induces significant physiological changes in a woman's body, including alterations in the liver's structure and function. As the largest internal organ, the liver is crucial in metabolic processes, detoxification, and hormone production (Abdel- Misih et al. 2010). During pregnancy, the increased metabolic demands can lead to physiological hepatomegaly, characterised by an expansion in liver size due to enhanced blood flow and altered hormone levels (Cramer et al. 1992, Gatta et al. 2021).

Ultrasonography is the primary imaging modality for evaluating liver size in pregnant women, offering a safe, accessible, and non-invasive assessment (RSNA and ACR 2021). Previous studies have documented changes in liver length associated with gestational age and parity, indicating that multiparity may influence liver dimensions (Ugboma and Ugboma 2011). Notably, conditions such as hemolysis, elevated liver enzymes and low platelets (HELLP) syndrome and acute fatty liver during pregnancy require accurate imaging for timely diagnosis and management (Porrello et al. 2024).

This study aims to investigate the ultrasonographic findings of liver length in pregnant women, focusing on how these measurements relate to various demographic and clinical parameters. Understanding the normal physiological changes in liver size during pregnancy can help differentiate between benign adaptations and potential liver pathologies.

2. METHODOLOGY

2.1 Study Design and Setting

This research was conducted as a prospective cross-sectional study at a specialist hospital in Port Harcourt, Rivers State, Nigeria, over a six-month period. The research ethical committee approved the study, and informed consent was obtained from all participants.

2.2 Participants

Healthy pregnant women presenting for an obstetric scan, or another ultrasound examination were recruited into the study. A total of 559 patients participated, aged 19 to 59, with a mean age of 29.95 years (SD = 6.34). Women with a history of liver disease, those taking medications affecting liver function, or who had undergone hepatic surgery were excluded from the study.

2.3 Ultrasound Measurement

Real-time grey-scale ultrasound examinations were performed using a Zeron 200 Canon ultrasound machine equipped with a 3.5-5 MHz curvilinear transducer. Measurements were taken in the supine position during deep inspiration. The liver length was measured in the longitudinal plane at the midclavicular line, from the hepatic dome to the lower hepatic margin (A-B) (Fig. 1), with all measurements recorded in centimetres.

2.4 Data Collection

Demographic and anthropometric data were collected, including age, weight, height, and body mass index (BMI), calculated as weight in kilograms divided by height in meters squared (kg/m^2).

2.5 Statistical Analysis

Data were analysed using SPSS version 21.0. Descriptive statistics were used to summarise patient demographics and liver length measurements. Pearson’s correlation coefficient assessed the relationships between liver length and various factors, including age, parity, weight, height, and BMI. Statistical significance was set at $p < 0.05$.

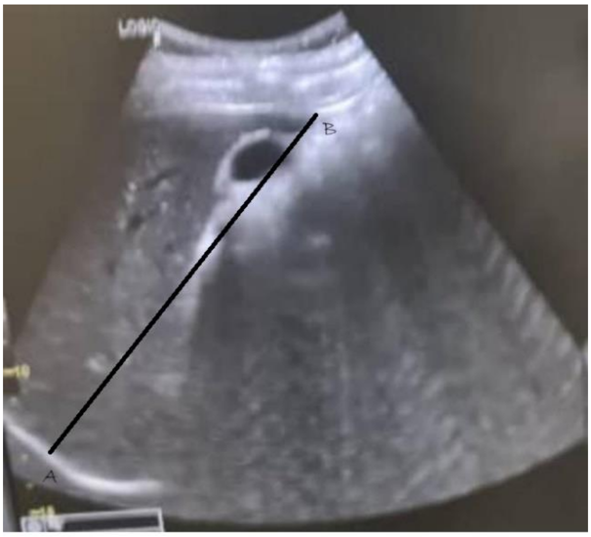

Fig. 1. Sonographic measurement of the liver length (A-B)

3. RESULTS

3.1 Demographic Characteristics

The study included 559 participants, predominantly aged between 20 and 39. Most participants (76.92%) had secondary education, and the majority fell within a healthy BMI range, though obesity was noted in 37.21% of the population.

Table 2 shows that the maternal mean weight is 69.74kg (SD=16.40), ranging from 32 to 121kg. The mean height is 157.94cm (SD=9.57), with a range of 116 to 190. 28.29 (SD7.94), with a range of 11.89 to 74.32. The BMI categorisation shows a significant prevalence of obese women, >30 being about 208 in number, which is 37.21% of the population.

Table 3 shows the parity and gestational age of participants. More patients had 1-3 previous births (64.22%), while nulliparous women constituted 33.27%. Women with a history of greater than 4 previous births were the fewest in number 14 (2.50%). The mean gestational age was 14.09 weeks (SD4.80), ranging from 6 to 37 weeks. About 99.64% were in early to near 37 weeks, while 0.36% were > 37 weeks GA.

Table 4 presents valuable information about liver size among the study population. The mean liver length during pregnancy is 14.85 cm, with considerable variation (SD = 3.01 cm) and a broad range (12.0-29.0 cm).

Table 1. Socio-Demographic characteristics (n=559)

Variables	Frequency	Percent (%)
Age		
10-19	25	4.47
20-29	228	40.79
30-39	271	48.48
40-49	32	5.72
50-59	3	0.54
Mean ± SD	29.95±6.34∞	
Range	[14-54]	
Educational Level		
None	7	1.25
Primary	60	10.73
Secondary	430	76.92
University	62	11.09

∞=*Mean ± Standard Deviation*

Table 2. Anthropometric parameters (n=559)

Variables	Frequency	Percent (%)
Weight (kg)		
Mean ± SD	69.74±16.40^∞	
Range	[32-121]	
Height (cm)		
Mean ± SD	157.93±9.57^∞	
Range	[116-190]	
BMI		
Mean ± SD	28.29±7.94^∞	
Range	[11.89-74.32]	
BMI Category		
Underweight (<18.5)	30	5.37
18.5 and 24.9	198	35.42
Overweight 25 and 29.9	123	22.00
Obesity ≥ 30	208	37.21

∞=Mean ± Standard Deviation

Table 3. Maternal characteristics (n=559)

Variables	Frequency	Percent (%)
Parity		
Median	1^α	
IQR	[0.5-2]	
Parity		
0	186	33.27
1-3	359	64.22
≥4	14	2.50
Gestational Age		
Mean ± SD	14.09±4.80^∞	
Range	[6-37]	
Gestational Age		
<37	557	99.64
≥37	2	0.36

∞=Mean ± Standard Deviation, α=Median, Inter-quartile Range

Table 4. Liver parameters

Variables (n=559)	Mean ± SD
Mean liver length	
Mean +SD	14.85+3.01
Range	(12.0-29.0)

Table 5 presents the correlation analysis of liver length in 559 pregnant participants, revealing notable findings. A strong positive correlation exists between parity and liver length (r = 0.503, p < 0.0001), indicating that liver size increases with the number of pregnancies. In contrast, no significant correlations were found with age (r = 0.081, p = 0.080), weight (r = 0.018, p = 0.124), height (r = -0.068, p = 0.107), or BMI (r = 0.038, p = 0.268). The mean liver length was measured at 14.85 cm (SD = 3.01), from 12.0 to 29.0 cm.

4. DISCUSSION

The findings of this study reveal a significant correlation between parity and liver length in pregnant women, indicating that liver size increases with a history of multiple pregnancies. This observation aligns with previous research demonstrating that physiological changes during pregnancy can alter liver morphology, mainly due to hormonal fluctuations and increased blood volume. For example, (Tkachenko O et al., 2024) emphasised that elevated levels of placental hormones, such as human placental lactogen and prolactin, trigger hepatocyte proliferation, contributing to increased liver size. Supporting this, (Sohail et al. 2018) reported a considerable increase in liver dimensions among multiparous women, reinforcing the argument that reproductive history significantly influences liver morphology during pregnancy.

While the established link between parity and liver length is compelling, the absence of significant correlations with age and body mass index (BMI) in this study contrasts with findings from earlier research, which suggested that both age and BMI could influence liver size. (Porrello et al., 2024) found that older age and higher body weight correlate with increased liver dimensions, reflecting the complexity of factors affecting hepatic morphology. However, variations reported in studies conducted by (Tota-Maharaj R et al. 2024) provide a more nuanced perspective, indicating that liver size deviations may be more influenced by localised biological and environmental factors rather than directly attributable to age or anthropometric metrics.

In contrast to the findings in pregnant women, the average liver length in non-pregnant women typically ranges from 12.5 cm to 13.5 cm. (Gatta et al. 2022). This difference of 1.5 cm to 2.5 cm in liver length between pregnant and non-pregnant women underscores how the physiological adaptations of pregnancy affect hepatic morphology. The known physiological processes, such as increased metabolic demands and reproductive hormones acting on the liver during pregnancy, produce substantial changes, making understanding normative liver lengths critical for clinical evaluations.

Moreover, variations in liver length among non-pregnant women can also be attributed to factors such as genetic predisposition, ethnic backgrounds, hormone levels, and environmental influences. For instance, research has shown that liver dimensions can differ significantly between populations, with different ethnic groups demonstrating varying average liver sizes (Tota-Maharaj R et al. 2024). Failure to account for these factors when evaluating liver health in reproductive women could lead to misdiagnosis or inappropriate management strategies, particularly in settings with limited reference ranges for liver size.

The implications of using ultrasonography as the primary imaging modality for assessing liver dimensions during pregnancy cannot be overstated. This imaging technique is accessible, cost-effective, and poses no risk of ionising radiation, making it especially suitable for pregnant populations (RSNA and ACR 2021). However, despite its numerous advantages, ultrasonography does have limitations regarding its diagnostic reliability. For instance, it may struggle to differentiate between normal physiological hepatomegaly and pathological conditions such as acute fatty liver of pregnancy (AFLP) or HELLP syndrome, which can also present with enlarged livers (Porrello et al. 2024, Kratzer et al. 2003). Such challenges underscore clinicians' need to integrate clinical evaluations alongside imaging findings to ensure accurate diagnoses, as relying solely on ultrasonography may lead to misinterpretation of results that could compromise patient care.

Furthermore, international studies have documented varying liver dimensions in pregnant populations, underscoring the importance of developing locally relevant normative data. For instance, a study conducted in India reported average liver lengths of 13.9 cm in pregnant women, slightly lower than the 14.85 cm in our study (Sohail et al. 2018). In contrast, research

Table 5. To assess how Age, Parity, BMI, Weight and Height are associated with selected parameters using the *Pearson correlational coefficient analysis*

Variables	Age, Parity, Weight, Height and BMI			
	The Pearson correlation coefficient, r	**95.0% Confidence Interval for r**		***p-value***
		Lower Bound	**Upper Bound**	
Liver length	0 .081	-0.020	0.360	0.080
Liver length	0.503	0.154	0.207	**0.0001***
Liver length	0.018	-0.027	0.219	0.124
Liver length	-0.068	-0.478	0.047	0.107
Liver length	0.038	-0.078	0.279	0.268

**Statistically significant (p<0.05)*

from the United States indicated liver lengths averaging 15.2 cm, suggesting that regional differences—potentially influenced by genetic, dietary, or environmental factors—may significantly affect liver size parameters during pregnancy (Kratzer et al. 2003). Therefore, establishing a comprehensive understanding of normal liver size during pregnancy is vital since deviations could arise from physiological adaptations or pathological conditions, necessitating careful evaluation and monitoring.

In addition to the significant findings within the study context, a critical consideration is the variation in liver length between pregnant and non-pregnant states. This variation emphasizes the need for clinicians to establish separate normative ranges when assessing liver size in women based on their reproductive status. Providing context for these differences is essential in evaluating liver health, as it assists healthcare providers in better interpreting ultrasound findings and making informed clinical decisions.

Moreover, a significant limitation of this study is the lack of postpartum evaluation regarding liver size changes. Understanding the reversibility of liver changes post-delivery is crucial, especially considering that some women may experience prolonged liver enlargement, which could lead to potential health issues if not monitored (Abdel-Misih et al. 2010). Future research should work towards implementing longitudinal designs to assess liver changes over various stages of pregnancy and extend into the postpartum period. Such an approach would yield valuable insights into liver health and its physiological dynamics across the reproductive process and provide critical information for postpartum care.

In summary, this study highlights the significant influence of parity on liver size during pregnancy while questioning the roles of age and BMI in these physiological changes. Incorporating ultrasonography into routine prenatal care is essential for monitoring liver health, enabling clinicians to detect potentially serious conditions early. The observed differences in liver dimensions between pregnant and non-pregnant women emphasise the physiological adaptations during pregnancy, underscoring the necessity of appropriate normative data. Continued research on liver adaptations across diverse populations is vital to understanding their broader implications for maternal and fetal well-being. Future studies can enhance the knowledge necessary for optimising pregnancy management and improving outcomes for mothers and infants.

5. CONCLUSION

This study establishes a significant correlation between parity and liver length during pregnancy, demonstrating that liver size increases with the number of pregnancies. The mean liver length was measured at 14.85 cm (SD = 3.01), ranging from 12.0 to 29.0 cm. These findings highlight the necessity of incorporating ultrasonography into routine prenatal care for monitoring liver health, as changes in liver size can indicate various underlying physiological adaptations or potential complications. Understanding these dynamics, particularly the influence of parity enhances clinical decision-making and promotes better outcomes for both mothers and infants. Continued research into liver adaptations across diverse populations is crucial for optimizing pregnancy management and ensuring maternal and foetal well-being.

6. LIMITATIONS

While this study provides valuable insights into the ultrasonographic evaluation of liver dimensions during pregnancy, certain limitations must be acknowledged. First, the study's cross-sectional design limits the ability to establish causality. Longitudinal studies tracking liver size changes before, during, and after pregnancy would provide more comprehensive insights. Additionally, the study did not assess postpartum liver measurements, which could clarify the reversibility of any physiological changes and contribute to understanding recovery times after childbirth.

Another limitation is the exclusion of women with pre-existing liver conditions or those on medications that could affect liver function. Future studies could benefit from a larger and more diverse sample size, including various socioeconomic backgrounds, to improve generalizability. While effective, the reliance on ultrasound imaging might overlook specific subtle hepatic pathologies that could be better identified through MRI or liver biopsy in high-risk populations.

FUTURE RESEARCH DIRECTIONS

Given the findings of this study, future research should focus on the following areas:

1. **Postpartum Evaluation**: Investigating liver dimensions and function in the postpartum period to assess whether liver enlargement is reversible and how long it takes for liver size to return to baseline after childbirth.
2. **Longitudinal Studies**: Conduct studies that follow women from pre-pregnancy through postpartum to capture how liver size and function change with each stage of the reproductive process.
3. **Impact of Lifestyle Factors**: Exploring how lifestyle choices, including diet and exercise, affect liver size and health during pregnancy and postpartum recovery.
4. **Comparative Studies**: Examining liver size changes across different populations and health care settings to identify potential environmental or genetic influences on liver health in pregnancy.
5. **Pathological Assessment**: Investigating the prevalence of pregnancy-related liver diseases in larger cohorts and establishing diagnostic criteria to differentiate between physiological and pathological changes.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

CONSENT

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Abdel-Misih, S. R., & Bloomston, M. (2010). Liver anatomy. *Surgical Clinics of North America*, 90(4), 643–653.

Cramer, S. D., Wong, L., Kasinger, R. S., Ogren, L., & Talamantes, F. (1992). Regulation of the hepatic growth hormone receptor and serum growth hormone-binding protein during pregnancy in the mouse: Effects of litter size. *Endocrinology*, 131(7), 2914–2920. https://doi.org/10.1210/endo.131.7.2914

Gatta, G., Di Grezia, G., Cuccurullo, V., Sardu, C., Iovino, F., Comune, R., Ruggiero, A., Chirico, M., La Forgia, D., Fanizzi, A., et al. (2022). MRI in pregnancy and precision medicine: A review from literature. *Journal of Personalized Medicine*, 12(1), 9. https://doi.org/10.3390/jpm12010009

Gatta, G., Di Grezia, G., Cuccurulo, V., et al. (2021). MRI in pregnancy and precision medicine: A review from literature. *Journal of Personalized Medicine*, 12(1), 9. https://doi.org/10.3390/jpm12010009

Khan, S. A., Y, S., et al. (2018). Sonographic evaluation of normal liver, spleen, and renal parameters in the adult population: A multicenter study. *Journal of the College of Physicians and Surgeons Pakistan*, 28(11), 834–839.

Kratzer, W., Fritz, V., Mason, R. A., Haenle, M. M., Kaechele, V.; Roemerstein Study Group. (2003). Factors affecting liver size: A sonographic survey of 2080 subjects. *Journal of Ultrasound in Medicine*, 22(11), 1155–1161. https://doi.org/10.7863/jum.2003.22.11.1155

Porrello, G., Cannella, R., Bernuau, J., et al. (2024). Liver imaging and pregnancy: What to expect when your patient is expecting. *Insights into Imaging*, 15, 66. https://doi.org/10.1186/s13244-024-01622-x

RSNA & ACR. (2021, February 25). Statement on safety of the developing pregnancy. *RadiologyInfo.org*. Retrieved August 23, 2024, from

Tkachenko, O., Shchekochikhin, D., & Schrier, R. W. (2024). Hormones and hemodynamics in pregnancy. *International Journal of*

Endocrinology and Metabolism, 12(2), e14098.

Tota-Maharaj, R., Blaha, M. J., Zeb, I., et al. (2014). Ethnic and sex differences in fatty liver on cardiac computed tomography: The Multi-Ethnic Study of Atherosclerosis. *Mayo Clinic Proceedings*, 89(4), 493–503.

Ugboma, H. A., & Ugboma, E. (2011). A pilot study of the normal sonographic measurements of the liver in normal pregnant women in the University of Port Harcourt Teaching Hospital, South-South Nigeria. *Nigerian Journal of Clinical Practice*, 14(3), 19–24.

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