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Ultrasound-derived reference values for neonatal liver and spleen dimensions: a retrospective cohort study

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ABSTRACT

Aims: To determine liver and spleen sizes in preterm and term neonates using ultrasonography during the first week of life, and to examine their associations with gestational age, birth weight, length, gender, and postmenstrual week.

Methods: In this retrospective study, 112 neonates (66 preterm, 46 term) admitted to a tertiary NICU between June and December 2020 were included. Only infants with normal liver function and without conditions affecting organ size were analyzed. Liver and spleen dimensions were measured by ultrasonography within the first seven postnatal days. Correlations were assessed using Pearson, Bayesian Kendall's, and Bayesian Pearson tests. Regression analyses and comparisons with published data were also performed.

Results: In preterm infants, liver size correlated strongly with gestational age (r=0.825) and spleen size with birth weight (r=0.777). In term infants, liver size correlated with birth length (r=0.491) and spleen size with birth weight (r=0.495). Each 1-week increase in gestational age was associated with a 1.8 mm increase in liver size in preterm infants, while each 100 g increase in birth weight increased spleen size by 0.8 mm in both groups.

Conclusion: Liver and spleen sizes are closely linked to gestational age, birth weight, and length in neonates. Population-specific percentile references are recommended to improve clinical assessment accuracy.

Keywords: Neonate, ultrasound, visceral organs, birth weight, organ size

INTRODUCTION

Traditionally, neonatal liver and spleen sizes are assessed by palpation and percussion. However, these methods may fail to detect subtle changes reliably.[1,2] Ultrasonography is now the preferred method because it is non-invasive, safe, accurate, and practical for routine clinical use.[3]

Liver and spleen sizes vary according to gestational age, birth weight, length, and gender.[4-6] In addition, infections, congenital conditions, and malignancies can affect these dimensions, highlighting the need for precise measurement for diagnosis and clinical management.[1,2]

Although some reference ranges exist, there is no universally accepted standard. There is also uncertainty regarding which anthropometric parameters best correlate with liver and spleen sizes in neonates. This study aimed to identify the most reliable correlates of liver and spleen dimensions during the early neonatal period and to provide population-specific percentile values for clinical use.

METHODS

Ethics

The study was approved by the Marmara University Faculty of Medicine Clinical Researches Ethics Committee (Date: 07.01.2022, Decision No: 09.2022.23), and was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from the parents of all participants.

This retrospective study included neonates who underwent abdominal ultrasonography in the NICU of a tertiary hospital between June and December 2020. Ultrasonography was initially performed to evaluate urological conditions such as posterior urethral valve, vesicoureteral reflux, and hydronephrosis.

Inclusion and Exclusion Criteria

Neonates were eligible for the study if they met all of the following criteria: gestational age between 24 and 42 weeks, hemodynamically stable without the need for inotropic support, normal liver function tests, and no clinical or laboratory evidence of hepatic or splenic pathology. Written informed consent was obtained from parents or legal guardians.

Exclusion criteria were as follows: congenital anomalies or chromosomal abnormalities affecting liver or spleen size; clinical or laboratory evidence of infection, hemolytic

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disease, coagulopathy, or any systemic illness potentially affecting organ dimensions; intrauterine growth restriction beyond ±2 standard deviations according to Fenton growth charts; infants born to consanguineous parents; neonates receiving medications known to affect liver or spleen size (e.g., hepatotoxic drugs); and any condition that could interfere with accurate measurement of liver or spleen dimensions, including severe ascites, abdominal wall defects, or technical difficulties during ultrasonography.

All measurements were performed within the first seven days of life by a single radiologist using a General Electric VIVID 3 Expert device. Liver and spleen dimensions were measured in the craniocaudal plane. Gestational age, postmenstrual week (PMW) at the time of ultrasonography, gender, birth weight, and birth length were recorded for each infant.

We estimated that a minimum of 45 patients would be required for a linear regression model with three potential confounders to detect an effect size of f^2=0.35, with an alpha error rate of 0.05 and a power (1-β) of 0.90.

Statistical Analysis

We presented data as mean±standard deviation or median (interquartile range, IQR), depending on the distribution pattern. Non-normally distributed data were transformed to approximate a normal distribution prior to performing Pearson tests. Generalized linear regression models were created using statistically significant variables, and confounders were assessed using the backward elimination method by including correlated factors as dummy variables. Multicollinearity was also assessed using the variance inflation factor. For regression analysis models, a p-value <0.01 was considered statistically significant. Estimated marginal means tables and graphs were subsequently constructed.

Bayesian Kendall's and Bayesian Pearson tests were used to evaluate the probability of the H1 (association hypothesis) and H0 (independence/no association hypothesis), with a stretched beta prior width set to 1. BF10 between 1-3 represents anecdotal evidence for correlation hypothesis, 3-10 moderate evidence, 10-30 strong evidence, >30 very strong evidence; where between 0.33-1 represents anecdotal evidence for no association, 0.1-0.33 moderate evidence, 0.03-0.1 strong evidence, and <0.03 very strong evidence. We also calculated intraclass correlation coefficients, which resulted in 0.651 for preterm liver and spleen sizes, and 0.674 for term neonates.

To compare our data with findings reported in other publications, we applied the estimated independent mean difference function or the one-sample Wilcoxon test. For these comparisons, a p-value <0.05 was considered statistically significant. All statistical analyses were performed using the JAMOVI 2.3.18 statistical software, including the esci and jsq extensions.

RESULTS

A total of 119 neonates (70 preterm and 49 term) underwent ultrasonographic measurements. Seven infants (four term and three preterm) were excluded based on the predefined criteria (normal liver function, absence of conditions affecting organ size, gestational age and birth weight within ±2 SD of post-conceptual age, and hemodynamic stability), leaving 112 neonates (66 preterm, 46 term) for final analysis. The demographic and anthropometric characteristics of these neonates are summarized in Table 1.

We assessed correlations between liver and spleen sizes and birth week, birth weight, birth length, gender, PMW, and postnatal day across all infant groups (Table 2). In preterm infants, liver and spleen sizes were significantly correlated with birth week, birth weight, birth length, and PMW. Specifically, liver size showed a strong correlation with birth length (Kendall's tau b=0.491, p<0.01, BF_{10}=22.62), while spleen size correlated strongly with birth weight (Kendall's tau b=0.495, p<0.01, BF_{10}=68.04).

In term infants, moderate evidence indicated a correlation between gender and spleen size (BF_{10}=8.08). Other observations included no gender effect on spleen size in preterm infants, no influence of birth week on spleen size in term infants, and no effect of postnatal day on liver or spleen sizes in either group, consistent with the independence hypothesis.

Liver and Spleen Dimensions in Preterm Infants

In preterm infants, liver and spleen dimensions were significantly correlated with birth week, birth weight, birth length, and postmenstrual week (PMW). These factors were included in a multivariate analysis using a generalized linear

Table 1. Comparison of demographic and anthropometric measurements in preterm and term newborns

	Preterm (n=66)	Term (n=46)	All newborns (n=112)
Gender % (n)	51.5% (n=34) male 48.5% (n=32) female	65.2% (n=30) male 34.8% (n=16) female	57.1% (n=64) male 42.9% (n=48) female
PN day (days)	1 (1-2) days	2 (1-4) days	2 (1-3) days
Birth week (weeks)	33.7 (31.0-35.0)	38.4 (38.1-39.9)	34.9 +/- 4.1
PMW (weeks)	33.9 (31.0-35.1)	39.0±1.1	35.2 +/- 4.2
Birth weight (gram)	1866±643	3241±429	2431 +/- 882
Birth length (cm)	43 (41-47)	49.9±2.8	45.2 +/-5.9
Liver dimension (mm)	47.3±7.4	59.2±7.8	52.2 +/- 9.5
Spleen dimension (mm)	34.0±6.6	44.6±6.4	38.4 +/- 8.3

PN day: Postnatal day at the assessment time, PMW: Postmenstrual week at the assessment time. A total of 119 neonates were initially assessed, and 7 infants (4 term, 3 preterm) were excluded based on predefined criteria, leaving 112 neonates for analysis. Data are presented as mean±standard deviation and median (interquartile range).

Table 2. Correlation coefficients for liver and spleen dimensions in preterm and term infants

	Liver dimension				Spleen dimension			
	Preterm		Term		Preterm		Term	
	Correlation co-efficient	BF10	Correlation co-efficient	BF10	Correlation co-efficient	BF10	Correlation co-efficient	BF10
Gender	0.124	0.462^{AI}	0.137	0.463^{AI}	0.056	0.2^{MI}	0.283^{*}	8.08^{M}
Birth week	0.825^{***}	$>1000^{VS}$	0.254	0.747^{AI}	0.743^{***}	$>1000^{VS}$	0.148	0.293^{MI}
PMW	0.803^{***}	$>1000^{VS}$	0.285	1.094^{A}	0.757^{***}	$>1000^{VS}$	0.219	0.517^{AI}
Birth weight	0.791^{***}	$>1000^{VS}$	0.349^{*}	2.828^{A}	0.777^{***}	$>1000^{VS}$	0.495^{***}	68.039^{S}
Birth length	0.736^{***}	$>1000^{VS}$	0.491^{**}	22.62^{S}	0.704^{***}	$>1000^{VS}$	0.188	0.374^{AI}
Postnatal day	0.138	0.155^{MI}	0.042	0.195^{MI}	0.182	2.4^{A}	0.148	0.293^{MI}

PMW: Postmenstrual week. Kendall's Tau-b is used for gender and Pearson's rho test for others. Non-normal data were transformed into normal distribution before being subjected to analysis. *p<0.05, **p<0.01, ***p<0.001. A: Anecdotal evidence for H1 (correlation) hypothesis, M: Moderate evidence for H1 (correlation) hypothesis, S: Strong evidence for H1 (correlation) hypothesis, AI: Anecdotal evidence for H0 (independence) hypothesis, MI: Moderate evidence for H0 (independence) hypothesis, BF: Bayes factor

model, with non-normally distributed data transformed into normal distributions and analyzed as dummy variables. Confounding factors were addressed using the backward elimination method.

The analysis revealed that each 1-week increase in gestational age (GW) was associated with a 1.8 mm increase in liver dimension (95% CI: 1.3-2.2; AIC: 403.1; BIC: 407.5; R^2: 0.691; Chi-squared/DF: 0.371; eta squared from the general linear model: 0.657). Similarly, each 100-gram increase in birth weight corresponded to a 0.8 mm increase in spleen dimension (95% CI: 0.6-1.1; AIC: 404.8; BIC: 409.2; R^2: 0.669; Chi-squared/DF: 0.398; eta squared from the general linear model: 0.603). The estimated marginal means are presented in Table 3, and the corresponding graph is shown in Figure 1 and 2.

Table 3. Estimated marginal means for liver and spleen sizes stratified by birth week and weight

Birth week (weeks)	Mean liver size (mm)	Birth weight (gram)	Mean spleen size (mm)
28	40 (38-42)	1000	27 (24-29)
29	42 (40-44)	1200	34 (33-36)
30	43 (42-45)	1400	34 (33-36)
31	45 (43-47)	1600	32 (30-33)
32	47 (45-48)	1800	33 (32-35)
33	49 (47-50)	2000	35 (34-36)
34	50 (48-52)	2200	37 (35-38)
35	52 (50-54)	2400	38 (36-40)
36	54 (51-56)	2600	40 (38-42)
R^2:0.669 (GLM)		R^2: 0.625 (GLM)	

GLM: Generalized linear model. Results are presented as rounded values for clarity. The 95% confidence intervals are provided in parentheses.

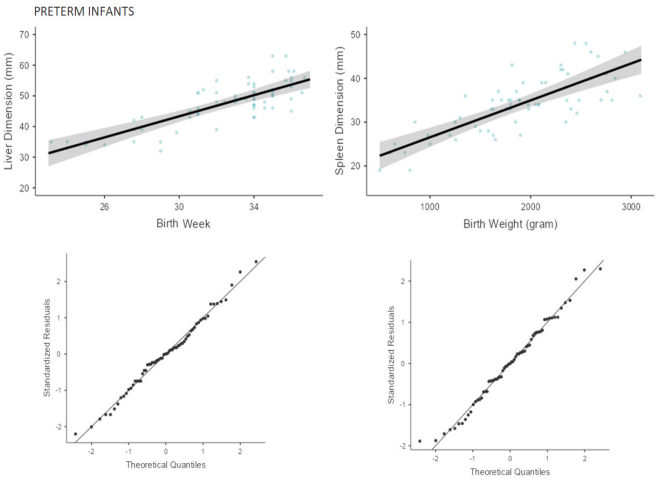

Figure 1. Liver and spleen dimensions in preterm infants and their associations with birth week and birth weight. The x-axis represents liver and spleen sizes, and the y-axis represents gestational age (weeks) or birth weight. The gray shaded area indicates the 95% confidence interval of the mean liver and spleen sizes. Standardized residual plots are also presented

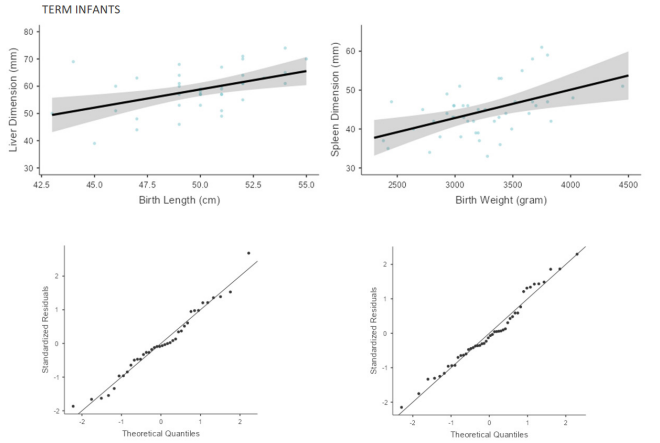

Figure 2. Liver and spleen dimensions in preterm and term infants and their associations with birth weight and birth length. The x-axis represents liver and spleen sizes, and the y-axis represents birth weight or birth length. The gray shaded area indicates the 95% confidence interval of the mean liver and spleen sizes. Standardized residual plots are also presented

Liver and Spleen Dimensions in Term Infants

In our study group, each 1 cm increase in birth length was associated with a 1.3 mm increase in liver dimension (95% CI: 0.5-2.2; AIC: 259.5; BIC: 262.8; R^2: 0.230; Chi-squared/DF: 0.869; eta squared from the general linear model: 0.241), and each 100 g increase in birth weight was associated with a 0.8 mm increase in spleen dimension (95% CI: 0.3-1.2; AIC: 293.2; BIC: 296.8; R^2: 0.246; Chi-squared/DF: 0.690; eta squared from the general linear model: 0.245). The estimated marginal means are provided in Table 4, and the corresponding graphs are shown in Figure 1 and 2.

Table 4. Estimated marginal means for liver and spleen sizes by birth length and weight

Birth length (cm)	Mean liver size (mm)	Birth weight (gram)	Mean spleen size (mm)
46	54 (49-58)	2400	39 (34-43)
47	55 (51-58)	2600	44 (42-46)
48	56 (53-59)	2800	41 (39-44)
49	58 (55-60)	3000	43 (41-45)
50	59 (56-61)	3200	44 (42-46)
51	60 (58-63)	3400	46 (44-48)
52	62 (58-65)	3600	47 (45-50)
53	63 (59-67)	3800	49 (45-52)
	R^2:0.230 (GLM)		R^2:0.246 (GLM)

GLM: Generalized linear model. Results are presented as rounded values for clarity. The 95% confidence intervals are provided in parentheses.

The percentiles and means of liver and spleen dimensions in preterm and term infants are presented in Table 5.

DISCUSSION

The dimensions of visceral organs in newborns vary according to anthropometric measurements[6]. Therefore, when analyzing ultrasonographic results, especially in preterm newborns, it is crucial to consider factors such as gestational age, weight, and length. Previous studies have reported varying correlation coefficients between anthropometric measurements and liver and spleen sizes in different age groups,[3,5,6,8-11] highlighting the need for percentile tables based on the parameters showing the strongest correlation.

In our study, the correlation between liver size and birth week and between spleen size and birth weight was strong in preterm infants, whereas in term infants, liver size correlated more with birth length and spleen size with birth weight, though the associations were less robust. Gender did not significantly affect liver or spleen dimensions in preterm infants, but a moderate correlation between gender and spleen size was observed in term infants.[3,5,6,12] These findings partially align with previous studies; some reported gender effects on spleen size,[3,12] while others did not.[5,6,10,11,13] The impact of gender on organ dimensions in term infants remains inconclusive and may benefit from multicenter studies with larger sample sizes.

Liver Dimensions

Regarding liver sizes, birth length had the strongest correlation in term newborns, whereas birth week was the main determinant in preterm infants. Studies on children aged 0-16 years reported stronger correlations of liver size with length (r=0.81-0.92) than with weight (r=0.74-0.86).[5,8-10] However, studies focusing on newborns, including our own, demonstrated that birth weight had the strongest correlation with liver size in preterm infants[12] and all newborns.[13] Conversely, one study indicated length as the strongest correlate in term infants,[6] which differs from our findings. This discrepancy may reflect better intrauterine growth in term infants, allowing length and visceral organs to continue developing even if weight gain is less optimal.

Our analysis revealed that each 1-week increase in gestational age among preterm infants was associated with a 1.8 mm increase in liver dimension (95% CI: 1.3-2.2), and each 100-gram increase in birth weight corresponded to a 0.8 mm increase in spleen dimension (95% CI: 0.6-1.1). In term infants, each 1 cm increase in birth length was associated with a 1.3 mm increase in liver dimension (95% CI: 0.5-2.2), and each 100 g increase in birth weight with a 0.8 mm increase in spleen dimension (95% CI: 0.3-1.2). These findings suggest that liver and spleen sizes are closely related to birth week, weight, and length in neonates, supporting the use of population-specific percentile references.

Comparisons with published literature revealed both similarities and differences in liver dimensions across populations.[3,5,6,8-15] Liver sizes in term neonates from our study were 4.8 mm smaller than a 3-month postnatal group 5, 6 mm larger than a 2-month group8, and showed minor differences compared with other studies in the 0-3 month age range.[9,14] Upper limits and mean±SD values from studies conducted in Turkiye[12,13] were comparable to our preterm infant results, but notable variability exists, likely influenced by ethnicity, geographic location, patient risk groups, and operator experience (Table 6, 7).[3,6,12,13]

Spleen Dimensions

In both preterm and term neonates, spleen size showed the strongest correlation with birth weight rather than birth length, consistent with previous studies.[6,11,13] In preterm

Table 5. Liver and spleen dimensions in preterm and term infants

	Liver dimensions				Spleen dimensions			
Patient group	Mean	SD	5th p	95th p	Mean	SD	5th p	95th p
450-1500 g (n=17)	38.3	5.6	32.8	46.8	26.6	4.4	19.0	32.3
1501-2000 g (n=22)	48.2	4.0	43.0	54.8	33.5	4.0	27.0	38.9
2001-2501 g (n=16)	51.6	5.5	45.8	63.0	37.4	4.9	31.5	44.3
>2501 g (n=11)	53.5	4.1	48.0	58.0	40.8	4.8	35.0	47.0
24-31 weeks (n=22)	40.2	6.2	33.0	51.0	27.9	4.9	19.0	36.0
32-35 weeks (n=26)	48.8	3.8	43.0	54.8	34.9	4.3	28.0	42.5
35-37 weeks (n=18)	53.8	5.1	45.8	63.0	39.8	5.2	33.9	48.0
All preterm infants (n=66)	47.3	7.4	34.3	58.0	34.0	6.6	23.4	45.8
Term infants (n=46)	59.2	7.8	46.5	71.0	44.6	6.4	35.3	57.3

SD: Standard deviation, g: Grams, p: Percentiles. All measurements are given in milimeters.

Table 6. Comparison of liver dimensions with literature results in term infants

Age group	Liver size	Border percentiles$^{Lowest/highest}$	p^	Ref
Our results (term)	59.2±7.8	46.5/71.0$^{(5th/95th)}$		
1-3 months	64±10.4	48.0/82.0$^{(5th/95th)}$	0.012	Konuş et al.[5]
0-2 months	53.2±5.2	44.0/64.3$^{(3rd/97th)}$	<0.001	Amatya et al.[7]
0-3 months boys	65±12.3	48.0/89.0$^{(3rd/97th)}$	0.062	Dhingra et al.[9]
0-3 months girls	62±6.6	49.0/72.0$^{(3rd/97th)}$	0.277	Dhingra et al.[9]
Term infants	57.2±8.8	32.8/80.2$^{(min/max)}$	0.137	Ayede et al.[14]
Term infants	54.5±8.7	24.0/78.0$^{(min/max)}$	0.001	Soyupak et al.[13]
Term infants	45.8±5.6	32.0/62.0$^{(min/max)}$	<0.001	Chen et al.[15]
Term infants	60.9±4.9	53.0/69.7$^{(5th/95th)}$	0.04	Kahramaner et al.[6]

GW: Gestational week at birth, ^: Estimated independent mean difference

Table 7. Comparison of liver dimensions with literature results in preterm infants

Age group	Liver size	Border percentiles$^{Lowest/highest}$	p^	Ref
Our results (preterm)	47.3±7.4	34.3/58$^{(5th/95th)}$		
34-42 GW	42.4±6.3	33.0/58.0$^{(min/max)}$	<0.001	Chen et al.[15]
Our results 34-42 GW	55.9+/-7.9	44.9/70.1$^{(5th/95th)}$		
24-31 GW	37±6.8	28.0/57.6$^{(min/max)}$	0.139	Soyupak et al.[13]
Our results 24-31	39.8±6.5	32.1/51.0$^{(5th/95th)}$		
32-35 GW	46±7.3	32.0/62.0$^{(min/max)}$	0.105	Soyupak et al.[13]
Our results 32-35	48.6±4.1	41.6/54.7$^{(5th/95th)}$		
36-37 GW	53.6±6.4	35.0/63.0$^{(min/max)}$	0.575	Soyupak et al.[13]
Our results 36-37	52.6±6.2	44.6/63.0$^{(5th/95th)}$		
<1500g (girls&boys)	-	31.7&26.1/58.1&53.1$^{(5th/95th)}$		Kahramaner et al.[12]
Our results <1500g	-	31.8/46.8$^{(5th/95th)}$		
1501-2000g (girls&boys)	-	40.8&42.0/62.2&56.9$^{(5th/95th)}$		Kahramaner et al.[12]
Our results 1501-2000g	-	41.2/54.7$^{(5th/95th)}$		
2001-2500g (girls&boys)	-	45.9&46.0/62.4&71.1$^{(5th/95th)}$		Kahramaner et al.[12]
Our results 2001-2500g	-	45.8/63.0$^{(5th/95th)}$		
>2500g (girls&boys)	-	52.0&47.2/66.1&65.0$^{(5th/95th)}$		Kahramaner et al.[12]
Our results >2500g	-	48.0/58.0$^{(5th/95th)}$		

GW: Gestational week at birth, ^: Estimated independent mean difference

infants, each 100-gram increase in birth weight was associated with a 0.8 mm increase in spleen dimension (95% CI: 0.6-1.1), and in term infants, the corresponding increase was 0.8 mm (95% CI: 0.3-1.2). These findings reinforce the importance of birth weight as a primary determinant of spleen size in the early neonatal period.

Comparisons with published literature revealed notable variability. Two studies involving infants up to three months of age reported larger spleen sizes than our cohort,[5,8] whereas three other studies found no significant differences.[3,9,11] Conversely, two studies reported significantly smaller spleen dimensions, by 10.7 mm[13] and 6.4 mm,[6] respectively, compared with our results. Such discrepancies likely reflect differences in ethnicity, geographic location, study populations, measurement techniques, and age at assessment. **Table 8 and 9** summarizes these comparisons and highlights both the similarities and differences between populations.

Clinically, this variation emphasizes the importance of using locally derived percentile curves for spleen size assessment. Universal cut-off values for splenomegaly may not be appropriate for all populations, as reliance solely on international reference data could lead to over- or under-diagnosis. The locally generated percentile tables in our study provide population-specific reference ranges, which can support accurate early detection of splenomegaly, guide timely investigations, and improve neonatal care outcomes.

Taken together with liver dimension findings, these results highlight that anthropometric parameters-particularly birth weight and length-are essential for interpreting visceral organ sizes in neonates. The percentile tables provided in this study offer clinicians practical tools for assessing liver and spleen enlargement in both preterm and term infants, reinforcing the need for population-specific references rather than generalized international cut-offs.[3,5,6,8-15]

Table 8. Comparison of spleen dimensions with literature results in term infants

Age group	Spleen size	Lowest/highest persentile	p	Ref
Our results (term)	44.6±6.4	35.3/57.3$^{(5th-95th)}$		
1-3 months	53±7.8	40.0/65.0$^{(5th-95th)}$	<0.001^	Konus et al.[5]
0-2 months	53.2±5.2	44.0/64.3$^{(3rd-97th)}$	<0.001^	Amatya et al.[8]
0-3 months boys	49.0±14.4	37.0/87.0$^{(3rd-97th)}$	0.361^	Dhingra et al.[9]
0-3 months girls	44.5±5.3	32.0/52.0$^{(3rd-97th)}$	0.275^	Dhingra et al.[9]
0-3 months girls	44.0±5.7	32.0/55.0$^{(min/max)}$	0.282^	Megremis et al.[3]
0-3 months boys	46.0±8.4	28.0/68.0$^{(min/max)}$	0.956^	Megremis et al.[3]
0-3 month	45$^{(median)}$	33.0/58.0$^{(10th-90th)}$	0.384^{W}	Rosenberg et al.[11]
Term infants	33.9±5.4	18.0/49.0$^{(min/max)}$	<0.001^	Soyupak et al.[5]
Term infants	38.2±4.3	32.0/45.7$^{(5th/95th)}$	<0.001^	Kahramaner et al.[6]

GW: Gestational week at birth, ^: Estimated independent mean difference, W: One sample Wilcoxon rank test

Table 9. Comparison of spleen dimensions with literature results in preterm infants

Age group	Spleen size	Lowest/highest persentile	p	Ref
Our results (preterm)	34.0±6.6	23.4/45.8$^{(5th/95th)}$		
24-31 GW	23.9±3.9	16.0/32.0$^{(min/max)}$	0.006^	Soyupak et al.[13]
Our results 24-31 GW	27.9+/-4.9	19.0/36.0$^{(5th/95th)}$		
32-35 GW	28.2±5.3	17.0/40.0$^{(min/max)}$	<0.001^	Soyupak et al.[13]
Our results 32-35 GW	34.7+/-4.4	28.0/42.4$^{(5th/95th)}$		
36-37 GW	33.3±3.7	26.0/42.0$^{(min/max)}$	<0.001^	Soyupak et al.[13]
Our results 36-37 GW	39.8+/-5.0	33.9/48.0$^{(5th/95th)}$		
<1500g (girls&boys)	-	14.8&17.8/39.3&34.6$^{(5th/95th)}$		Kahramaner et al.[12]
Our results <1500g	-	19.0/36.2		
1501-2000g (girls&boys)	-	22.8&22.8/41.6&42.4$^{(5th/95th)}$		Kahramaner et al.[12]
Our results 1501-2000g	-	27.0/38.8		
2001-2500g (girls&boys)	-	28.8&26.4/45.6&44.4$^{(5th/95th)}$		Kahramaner et al.[12]
Our results 2001-2500g	-	31.5/44.3		
>2500g (girls&boys)	-	33.3&24.7/46.3&53.0$^{(5th/95th)}$		Kahramaner et al.[12]
Our results >2500g	-	35.0/47.0		

GW: Gestational week at birth, ^: Estimated independent mean difference, W: One sample Wilcoxon rank test

Clinical Implications

Our percentile tables for liver and spleen dimensions can assist clinicians in the early detection of hepatomegaly and splenomegaly during the neonatal period. By providing locally derived reference ranges, these tables allow for more accurate assessment of organ sizes in both preterm and term infants, reducing the risk of misdiagnosis. Early identification of abnormal organ enlargement can guide timely investigations and interventions, thereby improving neonatal care outcomes.

Limitations

This was a single-center, retrospective study, which may limit the generalizability of the findings. The relatively small sample size further restricts the strength of the conclusions. In addition, measurement variability due to operator dependency, the lack of external validation, and the absence of certain potential confounders (e.g., maternal diseases, perinatal factors) may have influenced the results. Despite these limitations, our findings provide useful local references and a basis for further multicenter studies with larger populations.

CONCLUSION

As a result, birth week, birth weight, and birth length are the primary determinants of liver and spleen sizes in both preterm and term neonates. While gender may influence spleen size in term infants, its impact on liver dimensions remains unclear. The locally derived percentile tables provided in this study offer practical tools for clinicians to accurately assess liver and spleen enlargement, facilitating early detection of hepatomegaly and splenomegaly. These population-specific references emphasize the need for tailored assessments in neonatal care, rather than relying solely on international standards, ultimately supporting timely interventions and better neonatal outcomes.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of the Marmara University Faculty of Medicine Clinical Researches Ethics Committee (Date: 07.01.2022, Decision No: 09.2022.23).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

Availability of Data and Material

The datasets will be shared upon reasonable request

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