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Pattern of Presentation of Liver Function Tests Parameters in a Tertiary Institution in Delta State, Nigeria

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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

Aims: Liver function tests or "LFTs" are performed to measure liver function and identify the source of liver damage while examining the health state of the liver. The current study looked into the pattern of presentation of liver function tests values in a tertiary institution in Delta State, Nigeria.
Study Design: This was a cross-sectional study.
Place and Duration of Study: The study was carried out at the Delta state University Teaching Hospital (DELSUTH),Oghara, Delta State, Nigeria over a 24-month period.
Methodology: The study included 1436 recruited subjects who reported to the Chemical Pathology Laboratory for LFTs at the Delta State University Teaching Hospital (DELSUTH) in Oghara, Delta State, Nigeria. The participants' ages varied from infants to people in their 70s.
Results: There were no significant variations in total protein (TP) across the age groups. TP levels in neonates and infants varied from 4.73 g/dl (p>0.05). TP levels in adults varied from 6.43 to 7.75 g/dl. Total bilirubin (T.BIL) levels in adults were lower in general than in babies and neonates (p0.05). There were no gender differences in the LFTs parameters among the adult individuals. TP levels in the females (6.50 g/dl) were greater (p<0.05) than in the boys (8.84 g/dl) among the day-olds. However, after 2 weeks, the girls' TP levels (4.67 g/dl) were considerably lower (p0.05). All participants' TP levels were within reference intervals. More than 80% of subjects had substantially

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increased ALP levels. Infants have higher levels of bilirubin than adults.
Conclusion: At least 5% of the adult subjects developed hyperbilirubinemia. Gamma glutamyltransferase (GGT), Glutamate oxaloacetate transferase (GOT), and Glutamate pyruvate transferase (GPT) levels were significantly elevated in at least 50% of all subjects, regardless of age or gender. The immediate underlying reason is unknown.

Keywords: Liver function tests; alanine and aspartate transaminases; alkaline phosphatase; gamma-glutamyltransferase; serum bilirubin; albumin.

1. INTRODUCTION

The liver is responsible for a variety of functions, including primary detoxification of various metabolites, proteins synthesis, and the creation of digestive enzymes. It is located in the right upper quadrant of the body, just below the diaphragm. Metabolism, red blood cells (RBCs) regulation, glucose synthesis and storage, are all crucial functions of the liver. Although the name "liver function tests" or “LFTs” is deceptive because many of the tests do not assess liver function, they can help identify the source of liver damage [1,2,3]. Typically, LFTs include Alanine and aspartate transaminases (ALT and AST), alkaline phosphatase (ALP), gamma-glutamyltransferase (GGT), serum bilirubin (BIL) and albumin (ALB) to mention a few. These tests can assist identify the location of hepatic damage, and the pattern of elevation can aid in the organization of a differential diagnosis [4].

Changes in protein or enzyme levels can alert doctors to problems including liver cancer, fatty liver disease, or hepatitis. This is crucial, especially given the liver's importance in human metabolism. Abnormalities in liver enzymes are linked to a number of diseases. LFT levels can be used to spot differences and react rapidly to any problems that occur. The AST to ALT ratio of patients with alcohol use disorder differed from those with liver issues caused by pharmaceutical misuse, abuse, overdose, or response [5]. The sensitivity of liver function tests in diagnosing liver impairment varies substantially. The exact sensitivity of liver function tests is unknown and may differ between species.

Clinicians frequently experience difficulties in interpreting abnormalities in liver function testings. With the emergence of automated routine laboratory testings, this has grown more widespread. People who show one or more abnormalities in these tests do not necessarily have liver disease. Given the considerable differences in metabolisms among these groups, it is possible for LFT readings to differ between individuals of different age groups or between female and male gender. This is the foundation of the current research. The goal of the study is to see if there are any significant differences in LFTs between the sexes or owing to age.

2. METHODOLOGY

2.1 Study Area

The research was carried out at the Delta State University Teaching Hospital (DELSUTH) in Oghara, Delta State, Nigeria. DELSUTH is a university teaching hospital affiliated with Delta State University (DELSU), Abraka. The institution is located in Delta State's Oghara, Ethiope West Local Government Area. The hospital, a 180-bed ultramodern specialist hospital, was built to provide quaternary services to Delta State residents and their neighbors. When the hospital first opened its doors in June 2009, an inaugural management board was sworn in to oversee its operations.

Regardless of age, all participants in the study were those who presented to the Chemical Pathology Laboratory for liver function tests (LFT). A total of 1436 people were recruited, ranging from day-old neonates to adults over the age of 70. Data was collected over a two-year period.

2.2 Specimen

Plasma was the specimen of choice. Blood was collected in Lithium Heparin anticoagulant tubes. All specimens were handled with standard precautions and sent to the laboratory immediately for processing. Specimens were centrifuged and supernatants collected into plain tubes using Pasteur pipettes. Specimens that could not be analyzed immediately were refrigerated and analyzed as soon as possible. LFTs were conducted following the methods of Hughes and Jefferson [6] and Johnston [7] using the Architect Abbott Chemistry c4000 and Immunoassay i1000sr Analyzers.

2.3 Data Analysis

Before entering the results into result sheets, each patient's laboratory result was coded with Arabic numerals. A data analyst entered and analyzed the data using Graphpad Prism version 5, and was validated by the researchers that ensured that there were no incorrect entries. The obtained means of LFT values were presented and separated according to case occurrences.

3. RESULTS AND DISCUSSION

As a person ages, they gradually lose their ability to maintain homeostasis due to structural changes or dysfunction. Most chronic diseases' outcomes are exacerbated by aging, which is critical. Because the liver has a remarkable ability to regenerate, it is critical to determine whether there were significant differences in liver function capacities as shown by LFT results across age groups, from infancy to adulthood. In this study, a number of 1436 individuals were recruited. Table 1 shows the distribution of the study participants according to age. A total of 1436 participants ranging from day-olds to 70 years were selected for the study. Table 2 presents the distribution of liver function test parameters in participants of the study according to gender. No significant differences in total protein was reported within the age groups. For the neonates (<1 month old) and infants (1 – 8 months), total protein ranged from 4.73 g/dl-($p>0.05$). Within the adult group, TP ranged from 6.43 – 7.75 g/dl[$p>0.05$). Just as with TP, total albumin concentration in all the participants irrespective of age ranged from 2.75 – 3.88 g/dl ($p>0.05$). Significant differences in ALP was reported among the age categories. ALP for day olds was 122.8 IU/L and it minimally ($p>0.05$) increased to 146.4 IU/L in the 3 week-old neonates. However, values were higher after one month of birth and during the first 8 months of infant life (146 – 287.5 IU/L, $p<0.05$). This value significantly dropped to 111.5 – 139.3 IU/L in the adult participants.

Total Bilirubin levels were higher in the neonates (9.43 - 15.74 mg/dl) compared to those within the 1 – 8 months category (5.18 – 8.52 mg/dl). T.BIL levels in the adults were generally lower than those in the infants and neonates ($p<0.05$). Similarly, concentrations of D.BIL, GGT, GOT and GPT were respectively higher in the neonates and infants than in the adult participants.

There are several physiological changes between neonates, babies, children, and adults that might alter absorption, distribution, metabolism, and excretion activities [8]. A variety of variables, including a poorly formed liver, may explain why most liver enzymes in neonates appear to be higher than those in adults, even if both newborns and adults' values were within reference limits. The liver develops from progenitor cells into a well-differentiated organ capable of bile production by 12 weeks of gestation. Full maturation can take up to two years after birth and entails the appropriate expression of signaling pathways such as those responsible for the JAG1 genes (abnormalities occur in Alagille's syndrome), amino acids transport, and insulin growth factors [9].

It was important to learn if there were any differences in the LFT parameters among the adult participants according to gender. Table 3 showed that there were no significant distinctions in TP, ALB or other parameters measures between both sexes. Similarly, distribution of total protein in Neonates and infants in the study according to gender showed no distinction between the boys and girls. However, among the day-olds, TP in the girls (6.50 g/dl) were significantly ($p<0.05$) higher than those of the boys (8.84 g/dl). After 2 weeks, however TP levels in the girls (4.67 g/dl) were significantly lower ($p<0.05$) (Table 4).

There were no statistical differences in the concentrations of ALB(Table 5) among male and female neonates as well as infants as well as in the ALP (Table 6).The enzyme alkaline phosphatase (ALP) is present in the bones, bile ducts, and liver. High levels of ALP may suggest liver inflammation, bile duct obstruction, or bone disease. Because their bones are developing, children and adolescents may have higher ALP levels. Pregnancy can also cause an increase in ALP levels(partly with contribution from placental source ALP production). Aspartate aminotransferase (AST) is an enzyme present throughout the body, including the heart, liver, and muscles. Because AST levels aren't as specific for liver damage as for that of alanine aminotransferasr(ALT), they're frequently evaluated in conjunction with ALT to screen for liver issues. AST can be released into the circulation when the liver is injured. A high AST level might suggest an issue with the liver or muscles. In adults, the usual range for AST is up to 40 IU/L, and it may be greater in newborns and young children.

Table 1. Distribution of study participants by age

Age category	(n)	(%)
1 day	39	2.21
3 days	56	3.25
1 week	38	2.28
2 weeks	34	2.08
3 weeks	29	1.82
1 month	16	1.02
2 months	20	1.29
3 months	27	1.76
4 months	24	1.59
6 months	33	2.23
8 months	12	0.83
<20 yrs	33	2.30
21 - 30 yrs	124	4.37
31 - 40 yrs	252	9.28
41 - 50 yrs	174	7.06
51 - 60 yrs	171	7.47
61 - 70 yrs	186	8.78
>70 yrs	168	8.70
	1436	100

Table 2. Distribution of liver function test parameters in the participants of the study according to gender

Age	T.P (g/dl)		ALB (g/dl)		ALP (IU/L)		T.BIL (mg/dl)		D.BIL (mg/dl)		GGT (IU/L)		GOTAST (IU/L)		GPTALT (IU/L)	
	Mean	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**	**Mean**	**SEM**
1 day	5.58	0.41	3.69	0.11	122.8	32.86	9.45	1.78	1.56	0.21	90.78	10.63	36.2	3.79	11.72	1.08
3 days	6.11	0.53	3.06	0.19	133.2	13.86	9.43	0.65	2.3	0.32	130.2	14.4	100.9	56.06	25.56	8.86
1 week	5.24	0.28	3.07	0.14	135.5	24.79	10.38	1.95	3.65	1.03	97	14.91	120.9	48.35	43.72	14.83
2 weeks	4.73	0.5	3.38	0.43	145.8	25.11	15.22	3.21	8.24	2.3	127	37.55	51	14.1	25.14	11.02
3 weeks	4.82	0.78	2.76	0.41	146.4	38.42	15.74	3.41	8.79	3.32	222.4	51.57	60.6	12.77	21.6	10.62
1 month	5.19	0.36	3.88	2.05	175.8	44.7	8.52	3.53	6.09	2.65	135.9	39.33	119.9	49.25	76.63	32.32
2 months	6.28	0.44	3.28	0.2	249.1	52.85	7.27	2.16	4.29	1.55	123.5	32.83	125.7	42.85	55.97	15.99
3 months	6.76	0.34	3.01	0.16	281.6	37.92	5.25	1.2	1.94	0.71	238.4	70.79	85.38	25.54	62.1	26.66
4 months	5.75	0.65	2.75	0.19	287.5	88.9	5.84	1.51	4.43	1.2	876	655.3	194	82.61	92.5	36.45
6 months	4.57	0.33	2.89	0.2	253.4	56.59	7.35	11.35	12.2	8.2	38		118	102	63	43
8 months	5.82	0.66	3.08	0.32	146.6	26.7	5.18	2.55	3.36	1.63	184.9	58.54	57.18	15.36	37.73	10.22
<20 yrs	6.43	0.29	2.75	0.22	139.2	33.11	6.4	1.71	3.87	1.07	173.8	63.19	127	41.84	170.9	57.58
21 - 30 yrs	6.52	0.14	3.27	0.09	119.1	10.66	3.14	0.62	1.78	0.44	106.6	19.37	141.1	30.96	115.1	32.74
31 - 40 yrs	6.76	0.11	3.37	0.08	117.6	6.84	3.42	0.53	2.18	0.35	140	23.9	81.52	11.36	62.71	9.76
41 - 50 yrs	6.93	0.13	3.44	0.07	109.6	8.99	2.63	0.41	1.74	0.31	158.3	19.81	83.07	12.32	52.85	7
51 - 60 yrs	7.75	0.79	3.46	0.07	111.5	10.49	2.22	0.37	1.48	0.27	178.3	25.8	57.53	7.14	50.68	8.11
61 - 70 yrs	6.79	0.12	3.33	0.08	136.3	14.37	2.14	0.3	1.42	0.24	199.2	31.18	60.31	9.57	42.19	10.93
>70 yrs	6.76	0.10	3.28	0.07	117.1	12.19	3.22	0.76	1.64	0.31	148.8	20.69	50.77	5.95	38.2	4.88
F-statistic	1.532		2.073		4.114		11.258		5.48		1.983		1.98		2.082	
p-value	0.076		0.052		<0.001		<0.001		<0.001		0.01		0.01		0.006	

TP	*6.0 - 8.0 g/dl*	*Direct (conjugated) bilirubin*	*0.0 - 0.3 mg/dl*
ALB	*3.2 - 5.2 g/dl*	*gamaglutamiltransferace*	*male 10 - 71, female 6 - 42 IU/L*
ALP	*male 40 - 130; female 35 - 105 IU/L*	*Glutamate oxaloacetate transferace*	*male <40; female <32 IU/L*
T.BIL	*0.1 - 1.0 mg/dl*	*Glutamate pyruvate transferace*	*male <41; male <33 IU/L*

Table 3. Distribution of liver function test parameters in adults participants of the study according to gender

Parameters	Adult Group Statistics				
	Gender	Mean	SEM	t	p-value
Total protein	F	6.46	0.44	0.099	0.922
	M	6.41	0.40		
Albumin	F	2.42	0.34	-1.369	0.181
	M	3.01	0.27		
Alkaline phosphatase	F	177.75	49.31	0.245	0.809
	M	161.27	46.07		
Total bilirubin	F	7.40	2.25	0.542	0.592
	M	5.53	2.57		
Direct (conjugated) bilirubin	F	4.49	1.44	0.537	0.596
	M	3.33	1.58		
Gama glutamyltransferase	F	251.62	109.06	1.363	0.187
	M	81.91	40.09		
Glutamate oxaloacetate transferase	F	153.83	64.81	0.597	0.555
	M	103.31	55.26		
Glutamate pyruvate transferase	F	227.17	97.96	0.960	0.345
	M	116.97	62.77		

Table 4. Distribution of total protein in Neonates in the study according to gender

Age of neonate	Gender	Mean	SEM	t	p-value
1 day	F	6.50	0.70	2.666	***0.032****
	M	4.84	0.07		
3 days	F	6.01	0.64	-0.307	0.763
	M	6.40	1.10		
1 week	F	5.75	1.53	-1.143	0.201
	M	4.93	1.73		
2 weeks	F	4.67	0.17	-2.236	***0.040****
	M	5.81	0.48		
3 weeks	F	5.16	0.80	0.848	0.413
	M	4.30	0.62		
1 month	F	4.85	0.35	2.867	0.064
	M	2.13	0.71		
2 months	F	5.34	0.69	0.269	0.792
	M	5.13	0.43		
3 months	F	6.86	0.67	0.246	0.808
	M	6.69	0.32		
4 months	F	4.70		-0.896	0.465
	M	6.10	0.78		
6 months	F	5.60	0.70	-0.040	0.970
	M	5.65	0.79		
8 months	F	6.20		0.264	0.800
	M	5.44	0.96		

Table 5. Distribution of total albumin in Neonates in the study according to gender

Age of neonate	Gender	Mean	SEM	T	P
1 day	F	3.70	0.23	0.087	0.933
	M	3.68	0.09		
3 days	F	2.96	0.26	-0.743	0.470
	M	3.28	0.23		
1 week	F	2.31	0.14	-1.332	0.135
	M	2.14	0.14		
2 weeks	F	2.84	0.14	-1.688	0.111
	M	3.30	0.23		
3 weeks	F	2.86	0.51	-1.042	0.318
	M	3.81	0.77		
1 month	F	3.10	0.50	1.422	0.250
	M	2.03	0.50		
2 months	F	3.50	0.29	-0.462	0.651
	M	5.57	3.10		
3 months	F	3.09	0.26	-0.937	0.361
	M	3.46	0.30		
4 months	F	2.88	0.25	-0.698	0.493
	M	3.11	0.21		
6 months	F	2.50	0.32	-0.693	0.560
	M	2.83	0.24		
8 months	F	2.75	0.35	-0.207	0.849
	M	2.93	0.66		

Table 6. Alkaline phosphatase of neonates in the study presented comparatively according to gender

Age of neonate	Gender	Mean	SEM	T	P
1 day	F	121.00	29.21	-0.052	0.960
	M	124.60	63.27		
3 days	F	160.80	11.84	0.759	0.461
	M	138.12	36.09		
1 week	F	173.80	36.14	1.844	0.084
	M	87.69	25.90		
2 weeks	F	148.00	29.05	-0.199	0.846
	M	158.83	48.11		
3 weeks	F	175.50	95.50	0.791	0.487
	M	110.33	32.13		
1 month	F	249.40	98.32	1.119	0.282
	M	142.36	47.37		
2 months	F	283.44	76.22	0.639	0.532
	M	214.73	75.94		
3 months	F	127.34	31.48	-1.129	0.273
	M	214.92	57.21		
4 months	F	346.00	74.55	-0.299	0.793
	M	668.00	138.00		
6 months	F	225.00	169.12	0.502	0.650
	M	113.00	62.00		
8 months	F	126.00	41.2	-1.884	0.109
	M	184.86	29.81		

Table 7. Total bilirubin of neonates in the study presented comparatively according to gender

Age of neonate	Gender	Mean	SEM	T	P
1 day	F	8.94	2.72	0.236	0.818
	M	8.05	2.58		
3 days	F	9.83	0.98	0.671	0.504
	M	8.94	0.82		
1 week	F	8.71	2.20	-0.775	0.448
	M	11.78	3.10		
2 weeks	F	14.80	4.85	-0.261	0.800
	M	16.68	5.31		
3 weeks	F	16.34	10.43	1.566	0.140
	M	4.96	1.82		
1 month	F	8.85	3.64	0.725	0.478
	M	5.69	2.41		
2 months	F	3.53	2.41	-0.415	0.682
	M	4.61	1.38		
3 months	F	8.05	0.15	1.290	0.288
	M	4.37	2.21		
4 months	F	8.45	2.44	1.178	0.304
	M	6.53	1.25		
6 months	F	5.96	2.11	-0.642	0.545
	M	8.14	4.10		
8 months	F	6.73	3.21	-0.642	0.545
	M	8.14	4.10		

Table 8. Direct (conjugated) bilirubin of neonates in the study presented comparatively according to gender

Age of neonate	Gender	Mean	SEM	T	P
1 day	F	1.86	0.36	1.356	0.208
	M	1.32	0.21		
3 days	F	2.86	0.53	1.985	***0.050****
	M	1.60	0.24		
1 week	F	4.63	1.66	0.821	0.422
	M	2.92	1.32		
2 weeks	F	2.44	1.11	-3.758	0.002
	M	14.87	3.32		
3 weeks	F	5.62	4.60	-0.951	0.369
	M	11.96	4.82		
1 month	F	12.24	7.69	1.655	0.120
	M	3.29	1.43		
2 months	F	4.92	2.58	0.398	0.695
	M	3.66	1.83		
3 months	F	0.87	0.25	-1.076	0.292
	M	2.47	1.04		
4 months	F	5.35	0.25	0.571	0.608
	M	3.82	2.07		
6 months	F	8.17	6.22	1.205	0.295
	M	0.67	0.30		
8 months	F	0.30	1.29	-0.701	0.510
	M	5.41	2.58		

Table 9. Gama glutamyltransferase of neonates in the study presented comparatively according to gender

Age of neonate	Gender	Mean	SEM	T	P
1 day	F	61.75	12.80	-4.537	***0.003****
	M	97.21	7.22		
3 days	F	139.22	19.72	0.931	0.372
	F	103.22	24.19		
1 week	M	89.00	15.74	0.493	0.630
	F	96.23	18.40		
2 weeks	M	126.67	33.42	0.008	0.994
	F	103.20	23.12		
3 weeks	M	186.67	56.88	0.721	0.564
	F	206.40	21.24		
1 month	M	103.82	30.36	0.914	0.406
	F	101.44	22.87		
2 months	M	148.25	18.23	-0.667	0.522
	F	127.42	25.32		
3 months	M	162.32	25.30	0.388	0.715
	F	197.00	12.45		
4 months	M	67.25	16.40	0.755	0.588
	F	75.35	21.92		
6 months	M	82.31	21.30	-1.083	0.320
	F	64.39	18.03		
8 months	M	57.56	19.23	-1.113	0.130
	F	48.29	10.34		

Table 10. Concentration of Aspartate aminotransferase of infants and neonates in the study presented comparatively according to gender

Age of neonate	Gender	Mean	SEM	T	P
1 day	F	31.60	6.04	-1.253	0.246
	M	40.80	4.18		
3 days	F	128.90	83.84	0.692	0.501
	M	44.98	13.79		
1 week	F	155.50	82.67	0.707	0.489
	M	86.20	52.63		
2 weeks	F	56.14	20.19	0.352	0.731
	M	45.86	21.11		
3 weeks	F	71.50	29.50	0.644	0.565
	M	53.33	13.69		
1 month	F	81.00	36.29	-0.520	0.611
	M	137.64	70.38		
2 months	F	177.33	77.29	1.222	0.239
	M	74.08	34.11		
3 months	F	71.25	26.43	-0.425	0.676
	M	94.08	38.59		
4 months	F	197.00		-0.521	0.655
	M	1102.33	869.62		
6 months	F	278.00		0.509	0.661
	M	166.00	109.91		
8 months	F	83.33	68.34	0.560	0.615
	M	33.50	15.50		

Table 11. Levels of Alanine aminotransferase of neonates in the study presented comparatively according to gender

Age of neonate	Gender	Mean	SEM	T	P
1 day	F	12.40	1.50	0.607	0.561
	M	11.04	1.66		
3 days	F	30.22	13.15	0.731	0.478
	M	16.24	3.75		
1 week	F	64.10	27.14	1.410	0.176
	M	23.33	9.97		
2 weeks	F	34.14	21.73	0.806	0.436
	M	16.14	5.16		
3 weeks	F	35.00	28.00	1.041	0.374
	M	12.67	3.84		
1 month	F	68.20	38.13	-0.170	0.867
	M	80.45	44.84		
2 months	F	73.22	28.95	1.085	0.294
	M	38.71	13.19		
3 months	F	97.38	67.85	1.040	0.311
	M	40.38	12.58		
4 months	F	61.00		-0.425	0.712
	M	103.00	49.37		
6 months	F	47.00	29.54	0.723	0.522
	M	19.00	9.00		
8 months	F	20.00		-0.700	0.510
	M	48.86	14.58		

Table 12. Presentation of percentage of participants within the age categories that presented with abnormal levels of the test analytes

Age category	(n)	T.P	ALB	ALP	T.BIL	D.BIL	GGT	AST	ALT
		Percentage abnormality (%)							
1 day	39	18.2	18.20	81.80	0.00	0.00	90.90	45.50	9.10
3 days	56	84	84.00	100.00	2.00	1.00	100.00	92.00	88.00
1 week	38	18.2	18.20	86.40	0.00	4.50	95.50	45.50	31.80
2 weeks	34	12.5	6.30	100.00	6.30	6.30	75.00	43.80	25.00
3 weeks	29	50	50.00	100.00	0.00	0.00	100.00	90.00	60.00
1 month	16	0	6.30	87.50	6.30	0.00	68.80	50.00	43.80
2 months	20	13	13.00	100.00	13.00	13.00	73.90	65.20	56.50
3 months	27	18.2	27.30	87.90	18.20	18.20	93.90	66.70	57.60
4 months	24	20	20.00	100.00	0.00	0.00	100.00	80.00	80.00
6 months	33	25	50.00	100.00	50.00	50.00	75.00	75.00	75.00
8 months	12	7.7	7.70	92.30	7.70	7.70	76.90	53.80	38.50
<20 yrs	33	5.7	2.90	97.10	14.30	14.30	74.30	51.40	51.40
21 - 30 yrs	124	10.1	10.10	86.20	10.90	10.10	65.20	44.90	31.90
31 - 40 yrs	252	5.6	6.40	89.10	7.90	6.70	73.80	38.20	29.20
41 - 50 yrs	174	5.4	7.60	80.40	8.20	9.80	73.40	46.70	38.60
51 - 60 yrs	171	6.6	8.80	85.20	4.90	4.90	77.50	39.60	31.30
61 - 70 yrs	186	7.5	7.50	89.60	10.00	10.40	70.60	46.80	31.80
>70 yrs	168	5.6	6.20	82.60	7.30	6.20	70.80	34.30	28.70

Reference values

TP	*6.0 - 8.0 g/dl*	*Direct (conjugated) bilirubin*	*0.0 - 0.3 mg/dl*
ALB	*3.2 - 5.2 g/dl*	*Gamma glutamyltransferase*	*male 10 - 71, female 6 - 42 IU/L*
ALP	*male 40 - 130; female 35 - 105 IU/L*	*Aspartate aminotransferase*	*male <40; female <32 IU/L*
T.BIL	*0.1 - 1.0 mg/dl*	*Alanine aminotransferase*	*male <41; male <33 IU/L*

There were no significant disparities ($p>0.05$) in ALB concentrations (Table 5) between male and female neonates; infants or adults, as well as with T.BIL (Table 7) and D.BIL (Table 8) concentrations. However, D.BIL concentrations in three-day old newborns were greater in the females (2.86 mg/dl) than in the boys (1.60 mg/dl, p0.05) (Table 8). Bilirubin is produced as a byproduct of the destruction of red blood cells. It is normally metabolized by the liver. It is eliminated through faeces after passing through the liver. Bilirubin cannot be adequately processed by a diseased liver. This results in an excessively high bilirubin level in the blood. A high bilirubin level may suggest that the liver is not working correctly. Total bilirubin levels should be between 0.1 and 1.2 milligrams per deciliter (mg/dL). Certain hereditary illnesses cause elevated bilirubin levels, yet liver function is normal.

Significant differences in Gamma glutamyl-transferase levels in the one-day old neonates were reported between the boys and girls. Whereas GGT was 97.21 IU/L in the boys, it was significantly lower in the one-day old girls (61.75 IU/L, $p<0.05$) (Table 9). Apart from the aforementioned, no differences in the GGT concentrations in the other age categories for both neonates and infants were reported (Table 9). No differences in concentrations of AST in the infants and neonates in the study were presented comparative with gender (Table 10). No differences in Levels of ALT(Table 11) between the boys and girls were also reported.

Table 12 presents the percentage of participants within the age categories that presented with abnormal levels of the test LFT analytes. At least 15% of neonates presented with abnormal TP levels as against less than 10% in the adults. For ALP, at least 80% of neonates sampled during the study presented with abnormal levels of ALP; this was similarly across all age ranges. Less than 5% of neonates presented with abnormal T.BIL and D.BIL levels, compared to at least 5% of the adults, which presented withsignificantly different levels of same analyte. Whereas between 43 – 90% of both infants and neonates presented with abnormal levels of GGT and AST, only less than 50% of adults presented same.

Hyperbilirubinemia, also known as jaundice or significantly elevated bilirubin levels, is a multifactorial disorder with numerous symptoms. The most frequent type is physiological jaundice, although, pathological jaundice is also widespread in some locations. The majority of the neonates had increased bilirubin levels, which might be attributed to a number of causes. Neonatal jaundice caused by breast milk feeding is also seen on occasion. Hemolytic jaundice is caused by blood type incompatibility with ABO and Rh factors, which happens when the fetus and mother blood groups are incompatible and the fetus blood breaches the umbilical cord barrier before birth, resulting in fetal blood hemolysis owing to a significant immunological reaction [10]. If jaundice appears during the first 24 hours after delivery, the total blood bilirubin level rises by more than 5 mg per dL (86 mol per L) each day or is more than 17 mg per dL (290 mol per L) in a day, or a newborn exhibits signs and symptoms suggestive of serious disease, is termed pathologic.

Age differences were observed to play a significant role in the outcome of the LFTs. While it is expected that neonatal livers will not function at full capacity when compared to adult livers, aged adult livers will also lose functionality as they age. According to Cieslak et al. [11], liver function declines with age. Aging is a condition in which a person gradually loses his or her ability to maintain homeostasis as a result of structural changes or dysfunction. Most chronic diseases are exacerbated by aging. Because the liver has a remarkable ability to regenerate, this review examined the effect of aging on clinical liver disease, with references to preclinical models when pathogenesis was relevant.

Changes in LFT results are frequently required as a result of aging and changes in hepatic structure. Aging is linked to changes in hepatic structure and function, as well as changes in liver cells like hepatic sinusoidal endothelial cells [12].The volume and blood flow of the liver decrease with age. According to ultrasound studies, the volume of the liver decreases by 20–40% as one ages [12-15]. Such changes are associated with a decrease in blood flow in the liver, as those aged 65 years or older had a 35% decrease in liver blood volume compared to those aged less than 40 years [15].

4. CONCLUSION

Total protein of all subjects were within reference limits. Over 80% of participants presented with significantly elevated ALP levels. More infants presented with elevated bilirubin than the adults. Among the adult participants however, at least 5% had hyperbilirubinemia. Significant elevation

in gamma glutamyltransferase, Aspartate aminotransferase, and Alanine aminotransferase levels were reported in at least 50% of all participants irrespective of age or gender. The immediate root cause is unknown.

ETHICAL APPROVAL

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

CONSENT

Participants in the LFT trial gave written informed permission. Before their specimen samples were used, the parents/guardians of neonates and minors under the age of 18yr gave their consent. An effective approach was designed to protect the IDs from illegal use and disclosure.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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