Assessment of Normal Hepatosplenic Span Using Ultrasound in Egyptian Population

Osama F. Ahmed

Department of anatomy, Faculty of Medicine, Benha University, Egypt
osamafouad20@yahoo.com

Abstract: Background: he human liver and spleen are organs demanding constant attention from the anatomical, immunological and clinical point of view. Enlargement of liver and spleen is associated with different hepatic and systemic diseases. Racial differences in hepatic and splenic lengths could result in incorrect interpretation of their sizes. So, population specific spleen and liver normograms would provide more accurate standards. **Purpose:** This study was designed to set baseline data for sonographic values of liver and spleen spans for Egyptians in Qualiobia and to identify their relationship with anthropometric variables. **Materials and methods:** The study included randomly selected 337 patients attended Al-Fouad radiology scan and laboratory center who were referred for different radiologic examinations not related to the liver or the spleen, the subjects involved were assayed with complete blood count (CBC), hepatic and renal functions tests, The age, body weight, height and the body mass index were calculated for each subject as well as sonographic evaluation of hepatosplenic spans were done. Subjects were divided into three groups according to their age. **Results:** Our results showed significant difference of BMI and liver size between males and females and there was statistically significant positive correlation of BMI with liver span while no statistically significant correlation with spleen span. Also there was statistically significant negative correlation between the hepatosplenic spans and age of the oldest group. **Conclusion:** The present study was an attempt to determine the normal range of the hepatosplenic spans which correlated variably with different anthropometric parameters.

[Osama F. Ahmed . **Assessment of Normal Hepatosplenic Span Using Ultrasound in Egyptian Population.** *Nat Sci* 2017;15(8):215-219]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 33. doi:10.7537/marsnsj150817.33.

Key words: Liver, spleen, normal size, Egyptians, anthropometric measures.

1. Introduction

The human liver and spleen are abdominal organs demanding anatomical, immunological and clinical constant attention. Liver is a pyramidal shaped organ that is located in the right hypochondrium under the right hemidiaphragm and epigastric areas, extending into the left hypochondrium, it has three smooth surfaces; superior, inferior and posterior surface with the gallbladder projecting below its inferior surface. Liver is divided into four main lobes, the right lobe which contains most of the liver's mass, a left lobe, and two small caudate and quadrate lobes (Osama et al., 2016).

Spleen could be considered as a large encapsulated mass of vascular and lymphoid tissue that situated in the upper left posterior region of the abdominal cavity between the fundus of the stomach and the diaphragm (Chakraborti et al., 2016).

Sonographically, the echogenicity of liver and spleen is homogenous with the spleen is slightly more echogenic than healthy liver tissue and markedly hyperechoic compared to kidney tissue (Benter et al., 2011).

Enlargement of liver and spleen is associated with different hepatic and systemic diseases which include inflammatory conditions, metabolic diseases, autoimmune diseases, primary and secondary neoplasms and anemias. On the other hand, the liver size is reduced in liver cirrhosis (Osama et al., 2016). Gross Changes in liver and spleen sizes need to be evaluated accurately and rapidly. This can be detected both clinically and sonographically. But the clinical examination is far from accurate to detect a small change in size (Al-Imam et al., 2000).

Ultrasound is considered the best imaging modality for liver and spleen assessment; it is the most reliable and most applicable examination, highly accepted among patients, practical, accurate, safe and cheap. Measurements of liver and spleen spans are vital steps in the sonographic assessment of abdomen (Sirisena et al., 2015). False-positive labeling of a patient as having splenomegaly or hepatomegaly can lead tomedical tests that invariably will benegative, causing unnecessary anxiety to the patient as well as health care expenditure (Chow et al., 2016).

Racial differences in hepatic and spleniclengthes could result in incorrect interpretation of the spleen size. So, population specific spleen and liver normograms would provide more accurate standards (Chakraborti et al., 2016). Many studies have been done all over the world for establishing precise sonographic values of liver and spleen spans and identify their relations to anthropometric variables. This study was designed to set baseline data for

sonographic value of liver and spleen spans for Egyptians in Qualiobia and to identify its relationship with anthropometric variables.

2. Materials and Methods

This study was approved by the committee of ethics at Benha University. The study included 337 patients attended Al-Fouad radiology scan and laboratory center who were referred for different radiologic examinations not related to the liver or the spleen, the study population includes 131 females and 206males with age ranging from 20 to 70 years old. The individuals were classified into the following age groups: Group I: 20 to less than 40 years, Group II: 40 to less than 60 years and Group III: with ages more than 60 years. An informed consent, with complete explanation of the study and its purpose, was obtained from all subjects included in the study, those subjects fulfilled the following criteria: they should not be diabetic nor jaundiced, have no history of hepatitis or alcohol consumption, no history of chronic anemia, no history of abdominal trauma nor surgery, no history of any systemic disease. Pregnant women were not included in the study. Subject involved were assayed with complete blood count (CBC), hepatic and renal functions tests, any subject with abnormal results was excluded from the study. The age of each subject was recorded, the body weight in kilograms and height in meters were measured from the scales provided in the center. The body mass index was calculated using the following formula: BMI= weight (kgm)/height (m)2. Ultrasound scans for the liver and spleen were done for each subject. All the scans were performed by a single sonographer using a Mindray DC-6 scanner with a convex transducer of frequency 3.5MH. The examinations were performed with the subject in the supine position, the upper limbs are straight, close to the body and the lower limbs are also straight, without any support under the head, and without any preparation or sedation. The liver was measured with the transducer positioned below the costal cage, with longitudinal orientation, in orthogonal position relative to spine plane. The craniocaudal diameter of the liver on the midclavicular line, through an oblique line traced between the upper extremity and the lower hepatic border. For spleen size measurements, the span was estimated as the longest longitudinal length from the dome to the tip of the spleen with the probe oriented longitudinally in the coronal plane at the left mid -axillary line of the lower ribs with the hilum appearing in the image.

Statistical Analysis*:* The Chi Square test for nominal categorical data and Student's t-test for numerical variables. Pearson correlation tests were used to assess the relationship between the examined variables. Statistical analysis was performed using a level of significance of $p < 0.05$.

3. Results

In this study, we included 337 subjects that fulfilled the criteria of the study, 206 were males (61.1 %) and 131 were females (38.9%) (figure 1).

The subjects were divided into three groups according to age distribution (table 1).

The above table showed that in Group II, the number of cases was the highest (44.5%) followed by Group I (38.3 %). The least number of cases was found in group III (17.2%).

In this study the average age of males was 39.7 years and the average age of females was 30.8 years (table 2 & figure 2).

Table 2 and figure 2 of anthropometric measures showed that the average height of males in our study population is 178.5 cm while the average height of females is 156.3 cm. The average weight of males is 77.6 Kg while it is 72.3 Kg for female. BMI calculation showed that 55.5% of whole males have BMI below 25 kg/m ^{2} with average of 24.47 kg/m ^{2}, and 25% of females have BMI below 25kg/m ^{2} with average of 29.12 kg/m ^{2} denoting significant difference in BMI between males and females.

Liver span measurement showed that the average span of liver among Egyptian males is 15 cm while it is 16.9cm among females, average span of spleen is 11.2cm among males and 11.38 cm among females, showing significant difference of liver size between males and females and insignificant difference in spleen span.

The liver span was measured in the midclavicular line and the spleen span was measured in the midaxillary line (figure 3 & 4).

From the above table, it was observed that hepatosplenic span was significantly decreased in older age (Group III) in all subjects as well as males and females ($p<0.05$) while there was no significant difference among the other age groups ($p> 0.05$).

The relation between liver and spleen spans with anthropometric variables was analyzed statistically; there was significant statistical correlation between liver span and the sex of the subject, while no significant statistical correlation between liver span and age or height. However, after stratification of subjects into age groups, there was significant negative correlation between age and hepatic spans of the oldest group (group III) in both males and females ($p< 0.05$). There was statistically highly significant positive correlation of BMI with liver span (r: 0.7 & $p< 0.01$) (figure 3), regarding to the spleen, the length of the spleen is positively correlated with the height. However, the correlation did not reach the level of statistical significance ($p = 0.063$). Significant

negative correlation is also noted between spleen span and the age in group III, while no significant correlation noted with age in the other groups, BMI or sex of the subjects.

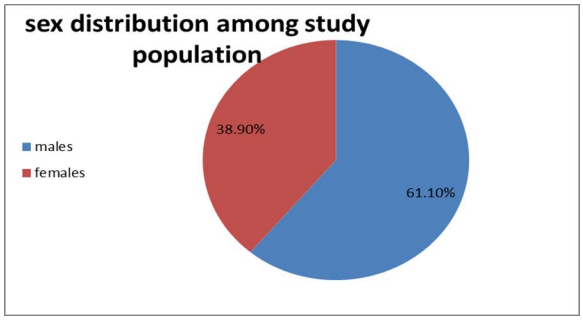

Figure 1: sex distribution among study population

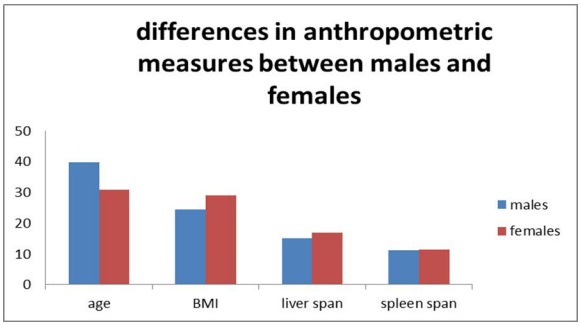

Figure 2: graphic representation of the differences in anthropometric variables between both genders.

Table 1: Showing group with gender distribution of individuals.

Parameters	Subjects		Groups (from I to III)		
			Group I	Group II	Group III
Males	206		74	99	33
Females	131		55	51	25
Total	337		129	150	58
Percentage (%)	males	females	38.3	44.5	17.2
	61.1	38.9			

Table 2: Average values of anthropometric variables and age among males and females

	Males	Females	P- value
Age (Years)	39.7	30.8	< 0.05
Height (cm)	178.6	156.3	< 0.05
BMI (kg/m 2)	24.47	29.12	< 0.05
Liver span	15	16.9	<0.05
Spleen span	11.2	11.38	>0.05

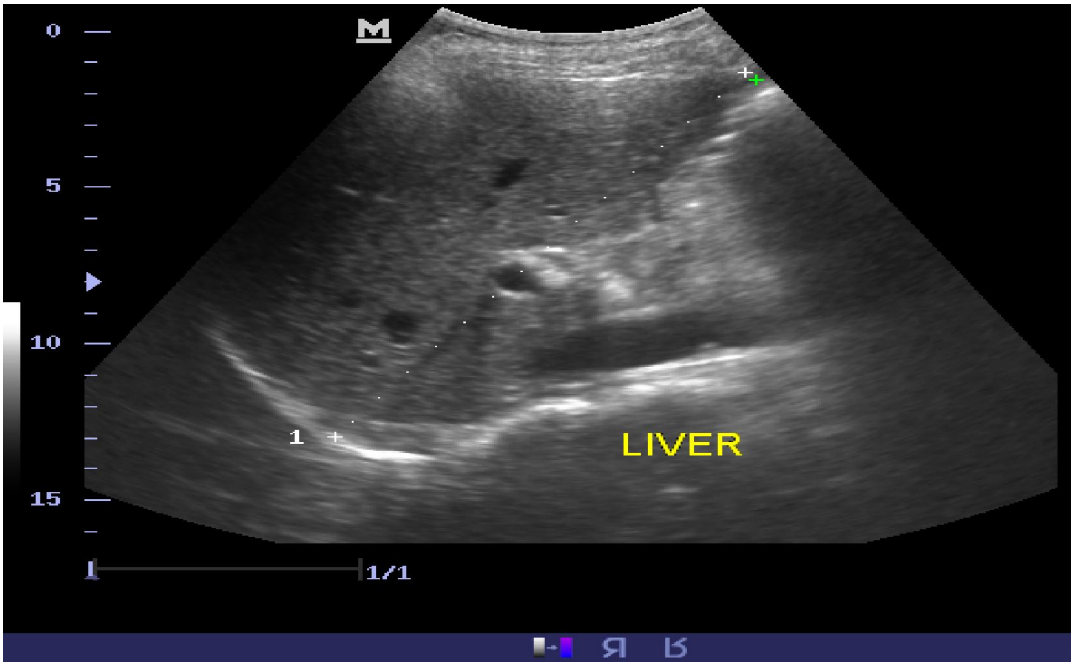

Figure 3: sonographic measurement of liver span in MCL.

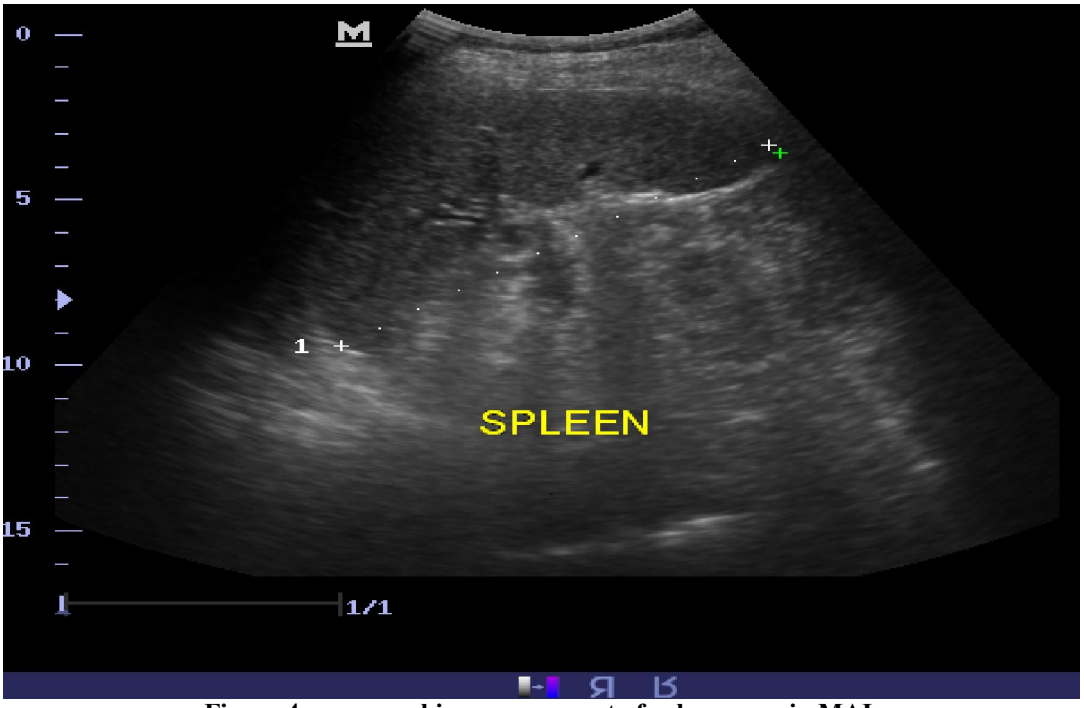

Figure 4: sonographic measurement of spleen span in MAL

Table 3: Showing means of hepatosplenic length in all the age groups:

	All subjects			Males			Females		
	Age	Liver span Cm	Spleen span Cm	age	liver span Cm	Spleen span	age	Liver span Cm	Spleen span Cm
Group I	29	16.3	11.2	29.1	15.7	11.6	25.9	16.8	11.5
Group II	48.7	15.7	10.9	41.8	15.4	11.8	37.4	17.1	11.2
Group III	66.4	14.2	10.1	65.9	14.5	10.5	66.2	15.3	10.4

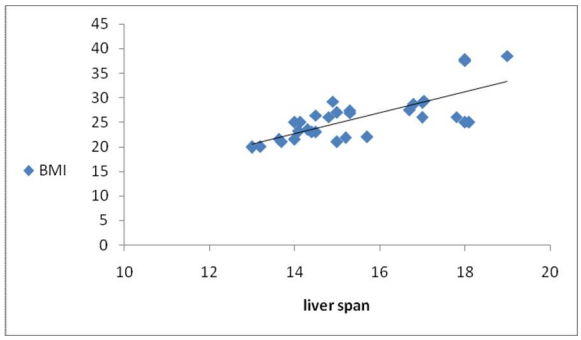

Figure 3: highly significant positive correlation between BMI and liver span. r = 0.7, p < 0.01.

4. Discussion

It is mandatory to identify the normal average values of liver and spleen dimensions measured sonographically as reference values, because this can help in early diagnosis of pathological changes (Emad et al., 2009). Longitudinal hepatic diameter at MCL and splenic diameter at MAL are the most commonly applied and predominant clinical method of estimating liver and spleen sizes in routine diagnostic situations (Christoph et al., 2012).

This study is a trial to set baseline data of normal liver and spleen spans measured by ultrasound among Egyptian adults in the area of Qualiobia, and to correlate them to anthropometric variables.

Our results showed that obesity is predominant in Egyptian population with about 54% of study population had BMI > 25, there was significant difference between males and females in BMI with females had significantly higher BMI values (average is 29.12Kgm/ m^2) as compared to males (average is 24.47Kgm/ m2). This is in concordance with many previous studies in both developed and developing countries (Kanter and Caballero, 2012) and ensure that the prevalence of obesity in Egyptian adults is very high, particularly among women as descried also in the previous Egyptian study (Galal, 2002) that may be due to greater Egyptian cultural acceptance of excess weight gain among women than men which is attributed due to fertility considerations.

Our study showed that there was significant difference in average liver spans among males (15cm)

and females (16.9 cm) while no significant difference in spleen span between both genders (males 11.2 cm, females 11.38 cm).

In analyzing the statistical correlation between liver and spleen spans with age, sex, height and BMI, we found that liver span was statistically significant positively correlated with sex and BMI, it is apparent that the main influencing factor is BMI with liver span seen significantly greater among individuals with higher BMI and females, with higher BMI were mentioned to be significantly higher among females. Regarding to spleen span, it is found to be higher in individuals with higher height However, no statistically significant level was reached. When testing the correlation after stratifications of subject into age groups, there was significant negative correlation between age and hepatospenic spans of the oldest group (group III) in both males and females. Many previous studies analyzed the relation between anthropometric measures and hepatosplenic spans. A pilot study was conducted on a Rajisthani population to know the normograms of liver in correlation with age and gender. Both parameters were found to have a positive influence on the hepatosplenic span (Mittal and Chowdhary, 2010). However, BMI was not taken into consideration which could have guide to the clinician for better diagnosis of organomegaly. Similarly, to evaluate the effect of anthropometrical measurements on the span of liver in adult Jordanian population, Tarawneh ES et al suggested that the best predictor of female liver span is body surface area and in males it is the height measurement (Tarawneh et al., 2009). In another study conducted by Mustapha et al in height, weight and BMI only gender correlation came out to be positive and that mean splenic volume in African adults was lesser than that of published in western population (Mustapha, 2010).

Conclusion

Liver and spleen are frequently involved in various systemic and local diseases. The present study was to determine the normal range of the hepatosplenic lengthes and their correlation with different anthropometric measures in Egyptian adults of Qualiobia, thus may help avoid unnecessary medical evaluations of individuals who are currently classified as having hepatosplenomegaly. To get a comprehensive and conclusive data, we need to accommodate a larger sample size covering the Egyptian population.

References

1. Al-Imam O, Suleiman A, Khuleifat S. (2000): Ultrasound assessment of normal splenic length and spleen-to-kidney ratio in children. Eastern Mediterranean Health Journal;6(2/3):514-6.
2. Benter T, Klühs L, Teichgräber Ulf. (2011): Sonography of the spleen. J Ultrasound Med; 30:1281-93.
3. Chakraborti S, Saha N, Debbarma B, Das S, Leishram D. (2011): Normal Spleen Length by Ultrasonography in Adults of Tripura. IOSR-JDMS; 15 (1): 55-60.
4. Chow KU, Luxembourg B, Seifried E, Bonig H. (2016): spleen size is significantly influenced by Body height and sex: Establishment of Normal Values for Spleen Size at US with a Cohort of 1200Healthy Individuals. Radiology; 279(1): 306-313.
5. Christoph F, Carla S, Jedrzejczyk M. (2012): EFSUMB-European Course Book Ultrasound of the liver, University of Bologna. Department of Diagnostic Imaging, 2nd Medical Faculty of Warsaw Medical University.
6. Galal OM. (2002): The nutrition transition in Egypt: obesity, undernutrition and the food consumption context. Public Health Nutr; 5:141–8.
7. Kanter R and Caballero B. (2012): Global Gender Disparities in Obesity: A Review. Adv Nutr Adv Nutr; 3: 491-498.
8. Mittal R, Chowdhary DS. (2010): A Pilot Study of the Normal Measurements of the Liver and Spleen by Ultrasonography in the Rajasthani Population. JCDR; (4):2733-2736.
9. Mustapha Z, Tahir A, Tukur M, Bukar M, Lee WK. (2010): Sonographic determination of normal spleen size in an adult African population. Eur J Radiol;75(1): e133-135.
10. Osama A., Walid G, Alfatih H. (2016): Sonographic Average Value Of Normal Liver Span Among Saudi Adults Referred To Najran University Hospital. IOSR-JDMS;15 (5): 27-34.
11. Sirisena UA, Jwanbot DI, Pam SD, Chagok NM. (2015): Relationship between Adult Liver and Spleen Sizes from Sonographic Measurements with Body Mass Index (BMI) in a Nigerian Cross-Section Population in Jos. Journal of Health, Medicine and Nursing; 16(27): 27-33.
12. Tarawneh ES, Hadidy AM, Haroun AA, Mahafza WS, Samara OA, Arafeh FM, Alsharif AA. (2009): Ultrasound Measurement of Liver Span in Jordanian Adults: A Preliminary Experience. J Med J 2009; 43(3).

8/25/2017