

NORMAL SIZE AND VALUES IN ADULT POPULATION IN THE WESTERN REGION
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ABSTRACT

Background: The spleen is the main part of the human immune system, composed of lymphatic tissues, there is a wide range of disorders and disease may affect the size of the spleen. This study aims to assess the normal range of spleen size in the population of Jeddah, western area, Saudi Arabia. **Method:** This retrospective study targeted Saudi adults with normal spleen admitted to King Abdulaziz University Hospital from August to October 2016. The data were collected using a data collection sheet that includes a patient's profile number, age, gender, and spleen size in axial, sagittal and coronal views. **Result:** The mean age score was 38.5 ± 17.2 (range: 18-95), of which 199 (43.4%) were male and 260 (56.6%) female. The mean scores of spleen coronal, sagittal, axial views and the spleen volume were 94.8 ± 16.1 , 86.3 ± 17.7 , 97.2 ± 20.0 and 445.1 ± 238.6 respectively, **Conclusion:** Determination of pathologic changes in spleen size among adult patients requires knowing the normal range of dimensions for this organ in healthy adults.

KEYWORDS: Spleen size, computed tomography, spleen coronal, sagittal and axial views.

INTRODUCTION

The spleen is a main part of the human immune system, composed of lymphatic tissues.^[1] It is also the largest organ in the reticuloendothelial system. There is a wide range of disorders and diseases that may affect the size of the spleen. Both infections like malaria and tuberculosis and chronic illnesses like sickle cell anemia, liver diseases and portal hypertension, autoimmunity, injury and malignancy. Also, long exposure to formaldehyde can cause morphological changes in the spleen structure and zone.^[2,3,4]

The determination of abdominal organ size and volume has significant potential clinical value. There is a notable correlation between platelet value, spleen size, and splenic volume detects severe liver disease and correlates with splenic hyperfunction. Several studies assessed the influence of several health conditions to the size of the spleen, which might induce inhomogeneity in the spleen size. Malaria, typhoid fever, sickle cell anemia, malnutrition and environmental issues are among these conditions. Several studies demonstrated that sickle cell anemia (SCA) and malaria might cause splenomegaly.^[3,5]

Variation in the spleen size due to differences in race has been reported in few studies.^[6]

A couple of Asian cohort studies have shown that spleen size is actually smaller compared to published literature.^[7,8] Also, spleen size was found to be smaller in African-American athletes compared to white American athletes.^[9] Thus, the provision of accurate values should be specific to any given population.

The assessment of the size of an organ is an integral part in the evaluation of a disease whether it is localized or systemic. This involves the screening of an organ for diagnostic and prognostic purposes.^[3,10]

There are few publications reported the normal size of spleen for adults in Saudi Arabia (Alkharj) and Arab countries (Jordan, Iraq & Sudan).^[10,12]

This study aimed to obtain the normal range for spleen size in the population of Jeddah, western area, Saudi Arabia by using computed tomography as a simple and reliable method.

METHOD

This retrospective study targeted Saudi adults with normal spleen size who admitted to King Abdulaziz University Hospital for other health conditions from August to October, 2016. This study approved by King Abdulaziz University ethical committee.

A total of 2000 files of patients at KAUH was reviewed during that period. Only 459 patients matched the inclusion criteria and included in the study. The data were collected using a data collection sheet that includes a patient's profile number, age of the patient, gender, and spleen size in axial, sagittal and coronal views.

RESULT

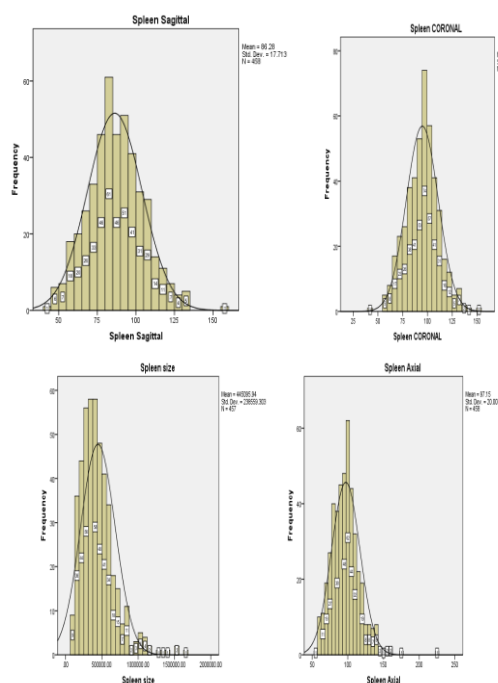
The mean age score for the 459 participants was 38.5 ± 17.2 (range: 18-95), of which 199 (43.4%) were male and 260 (56.6%) female. Spleen dimensions were

reported from three views axial, sagittal and coronal using computed tomography.

The mean scores of spleen in coronal, sagittal, axial views and the spleen volume were respectively 94.8 ± 16.1 , 86.3 ± 17.7 , 97.2 ± 20.0 and 445.1 ± 238.6 respectively, the results and graphs showed approximately symmetric with slightly platykurtic for coronal and sagittal views, showed moderately positive skewed with leptokurtic of axial view, and showed high positive skewed and leptokurtic for spleen size. (Table 1 & Figures 1-4)

Table (1): Spleen dimensions

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Statistic	Statistic	Statistic	Statistic		Statistic	Statistic	Statistic
Spleen Coronal	459	42	150	94.77	16.100	ap.045	platy.239
Spleen Sagittal	458	40	157	86.28	17.713	ap.232	.227
Spleen Axial	458	55	225	97.15	20.007	m1.043	lept3.814
Spleen size	457	99715.20	1658111.00	445095.9378	238559.30262	h1.561	3.824
Spleen size (cm ³)	457	99.7		1658.1		445.1	238.6
Valid N (listwise)				457			



Figures (1-4): Spleen dimensions:

DISCUSSION

This study obtains standard values of spleen size measured by computed tomography for Saudis from age 15-89 years who attend KAUH, which could be used as a reference for future studies.

Regarding the human spleen anatomy, it is the largest encapsulated mass of vascular and lymphoid tissue; it has a crescent shaped structure, a smooth serosal surface, two ends, two borders and two surfaces. It is located in the left hypochondriac region of the abdomen cavity between the stomach and diaphragm. There are two fatty ligaments keep it in its place: the gastrosplenic ligament, and the splenorenal ligament.^[6,10,11]

The human spleen is a very important organ, it requires more attention from a clinical point of view.^[6] Several studies reported that imaging of the spleen is uncommon in daily clinical practice when we compare it with other upper abdominal organs.^[13] Even though there are numerous evidences linked changes in spleen size and shape to several congenital and acquired disorders. This means that there is more clinical information about the normal shape and size of the spleen that helps surgeons, clinicians and radiologists in diagnosis variance gastrointestinal and hematological diseases. Splenomegaly could be a critical sign and an indication of a sever latent disease such as lymphoma.^[12,14,15]

Physicians should assess the spleen size during every abdominal examination. However, physical examination is subjective and inaccurate, due to the fact spleen size is not palpable unless its size increases three times its normal size.^[4,10,12]

Several studies demonstrated the high efficiency of radiologic imaging techniques in determining spleen size

specially in the diagnosis and follow up of splenomegaly.^[4,10] Ultrasonography, conventional radiography, nuclear scan, CT scan and MRI imaging is integral tools in defining diseases that affect the spleen.^[12,13,16] The first and most common tool was ultrasonography and has no ionizing radiation risk.^[6,12,13]

On the other hand, computed tomography (CT) reported as a reliable modality with the highest level of sensitivity and specificity in determining changes in the spleen size.^[4,16] The CT provides a three-dimensional image of the spleen, which allows the advantage of calculating its volume as well as the surface area.^[10,11,17] This study used CT scan to define spleen size, where the mean score of spleen volume was $445.1 \pm 238.6 \text{ cm}^3$, which was higher than other studies.

Alkharj's study showed that the spleen size mean was $161.42 \pm 54.91 \text{ cm}^3$ as calculated by volumetric software.^[10] Another study was done in Jordan reported that the normal spleen size was 184.15 cm^3 and authors used ultrasonographic examinations.^[12]

The relation between age and spleen size showed no significant relation between age and spleen size in Alkharj, India and Nigeria studies.^[1, 10,16] There was a negative correlation between age and spleen size in studies that were done in Turkish, India and Jordan.^[4,6,12,14]

Similar results were found regarding the relation between gender and spleen size, in studies that were done in Alkharj, Jordan, India and Nigeria.^[1, 10,16]

There was no significant difference in the studies that were done in Turkish and India.^[4,6,12,14]

There are several factors could cause a difference in the spleen size and shape like: different total number of participants, different age, differences in the number of participants by gender, provinces and race.^[4]

Limitation:

The fact that all the participants were from one health center (KAUH) limited the ability of generalizing the results with the community.

The height and weight values were not available for the patients.

CONCLUSION

This study provides reference data for the spleen size, as clinically spleen is a common factor and an important organ in numerous diseases, where the change occurs in enlarging or reducing its size.

There is a need to determine cut off point for defining splenomegaly. Furthermore, multicenter base studies with large sample size need to be conducted in order to provide inclusive and critical information about the

situation and to determine all the factors influence the spleen size among the Saudi community.

REFERENCES

1. Ehimwenma O, Tagbo MT. Determination of normal dimension of the spleen by ultrasound in an endemic tropical environment. *Niger Med J.* 2011; 52(3): 198-203.
2. Zhang B, Lewis SM. A study of the reliability of clinical palpation of the spleen. *Mem Inst Oswaldo Cruz.* 1998; 93 Suppl 1: 245-8.
3. Jastaniah W. Epidemiology of sickle cell disease in Saudi Arabia. *Ann Saudi Med.* 2011 May-Jun; 31(3): 289-93.
4. Caglar V, Alkoc OA, Uygur R, Serdaroglu O, Ozen OA. Determination of normal splenic volume in relation to age, gender and body habitus: a stereological study on computed tomography. *Folia Morphol (Warsz).* 2014; 73(3): 331-8.
5. Chopra R, Al-Mulhim AR, Al-Baharani AT. Fibrocongestive splenomegaly in sickle cell disease: a distinct clinicopathological entity in the Eastern province of Saudi Arabia. *Am J Hematol.* 2005 Jul; 79(3): 180-186.
6. Chakraborti S, Saha N, Debbarma B, Das S, Diana Leishram D. Normal Spleen Length by Ultrasonography in Adults of Tripura. *Journal of Dental and Medical Sciences.* 2016; 15(1): 55-60.
7. Loftus WK1, Metreweli C. Normal splenic size in a Chinese population. *J Ultrasound Med.* 1997 May; 16(5): 345-7.
8. Kaneko J, Sugawara Y, Matsui Y, Ohkubo T, Makuuchi M. Normal splenic volume in adults by computed tomography. *Hepatogastroenterology.* 2002 Nov-Dec; 49(48): 1726-7.
9. Hosey RG1, Kriss V, Uhl TL, DiFiori J, Hecht S, Wen DY. Ultrasonographic evaluation of splenic enlargement in athletes with acute infectious mononucleosis. *Br J Sports Med.* 2008; 42(12): 974-7.
10. Siddiqui MA, Ali AH and Serhan O. Estimation of standard splenic volume in Saudi Arabian adult population: using 3D reconstruction of abdominal CT scan images. *J. Morphol. Sci.,* 2015; 32(4): 227-230.
11. Yildiz AE, Ariyurek MO, Karcaaltincaba M. Splenic anomalies of shape, size, and location: pictorial essay. *ScientificWorld Journal.* 2013; 21.
12. Badran DH, Kalbouneh HM, Al-Hadidi MT, Shatarat AT, Tarawneh ES, Hadidy AM, Mahafza WS. Ultrasonographic assessment of splenic volume and its correlation with body parameters in a Jordanian population. *Saudi Med J.* 2015; 36(8): 967-72.
13. Vancauwenberghe T, Snoeckx A, Vanbeckevoort D, Dymarkowski S, Vanhoenacker FM. Imaging of the spleen: what the clinician needs to know. *Singapore Med J.* 2015; 56(3): 133-44.
14. Serter S, Ceylan C, Tunçyürek Ö, Örgüç Ş, Pabuçcu Y. Sonographic evaluation of spleen size and

- prevalence of accessory spleen in a healthy male Turkish population. *Turk J Haematol.* 2010; 27(1): 25-8.
15. Çeliktas M; Sema Özandaç S; Göker P & Bozkır MG. Sonographic Determination of Normal Spleen Size in Turkish Adults. *Int. J. Morphol.* 2015; 33(4): 1401-1405.
 16. Asghar A, Agrawal D, Yunus SM, Sharma PK, Zaidi SH, Sinha A. Standard Splenic Volume Estimation in North Indian Adult Population: Using 3D Reconstruction of Abdominal CT Scan Images. *Anat Res Int.* 2011; 1-5.
 17. Laman M, Aipit S, Bona C, Siba PM, Robinson LJ, Manning L and Timothy M. E. Davis TME. Ultrasonographic assessment of splenic volume at presentation and after anti-malarial therapy in children with malarial anemia. *Malaria Journal.* 2015; 14: 219.