

# Ultrasonographic Renal Length and Parenchymal Thickness in Normal Sudanese Population

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**Abstract:** This study was intended to measure the ultrasound normative values of renal length and parenchymal thickness in adult Sudanese population in order to establish their reference value for Sudanese population while no recorded reference value in literature for them. Ultrasonographic kidney measurements were performed on 77 adult patients without known kidney lesions. Measurements included length and parenchymal thickness. The effect of age, gender, site (left and right side) and height was statistically analyzed. All normal patient was included in this study while any renal disease were excluded. This study was include (35) males and (42) females. The mean renal lengths were (10.15± 0.78) and (10.33± 0.80) cm for the right and left kidney respectively. The mean parenchymal thicknesses were (1.4714± 0.33cm) for the right kidney and (1.7169± 0.36cm) for the left kidney. These result were correlated with age, gender, site, and height which showed that there is no significant difference between right and left renal length, but there was significant difference between right and left parenchymal thicknesses. The significant effect of age was found only in left renal length. The significant effect of gender was noted only in the right parenchymal thicknesses. No significant difference among height groups for renal length, but there was significant difference in right parenchymal thickness. The study concluded that normal value of left renal length was affected with age and normal parenchymal thickness was affected with site (left or right). The right parenchymal thickness was affected with gender and height. Establishment of normal renal values of renal length and parenchymal thickness in Sudanese population will help us in evaluation of patients with chronic renal disease.

**Keywords:** Sonography, renal length, Parenchymal Thickness, Adults.

## 1. Introduction

Renal length and parenchymal thickness are valuable diagnostic parameters in urological and nephrology practice. In the adult, each kidney measures approximately 11 cm long, 2.5 cm thick, and 5 cm wide (M. Rumack, et al, 2011). The normal parenchymal thickness range from (14- 18mm). Further review of the literature shows that renal length varies with age, gender, body mass index and pregnancy (Shcherbak et.al 1989 and Guzman RP, et.al 1994). Renal infections/inflammations, nephrologic disorders, diabetes mellitus and hypertension are the most important co-morbid conditions affecting renal length (Yamaguchi S and Yamada-H. et.al 1992). Since the renal length and parenchymal thickness are affected by various factors, it is necessary to first establish the normal values. The information available in the West may not be extrapolated to Sudanese's population since the renal length and parenchymal thickness may differ between ethnic groups and according to body size (Emamian Sa, 1993 and Wang F, 1989). The current study determined the Ultrasonographic renal length and parenchymal thickness in a group of individuals without known renal disease and assessed the effect of age, gender, side and height.

## 2. Material and Methods

This prospective observational study was conducted in the department of diagnostic radiology, Fedail Specialized Hospital in Khartoum city- Sudan. Renal length and parenchymal thickness were assessed by ultrasound in Seventy seven healthy participants, having normal renal function tests, between January 2014 and July 2015. Participant's age ranged from (22- 79) years. Pregnant females, subjects with known diabetes and hypertension and the participant who were unable to change posture for

accurate assessment of kidneys during US examination were excluded from the study. Height was taken in meters (m). Participants required stopping having food for 6 hours before exam in order to reduce bowel gas. Ultrasound procedure performed according to the protocol of renal U/S scanning as mentioned by Sandra (Sandra L. H (2001). All the US examinations and measurements were performed using two-dimensional Real Time US machine with curvilinear transducer of (3.5–6 MHz). Once the kidney was located, the transducer was rotated slightly to determine the longest renal axis and renal length was measured as the maximum bipolar dimension in longitudinal plane. Then the renal parenchymal thickness was measured as the distance between outer renal margin and renal sinus. Correlation of renal length and parenchymal thickness with age, gender and height of the subjects were determined.

Data was analyzed on SPSS-16. Descriptive statistics were applied on the available data. Mean ±SD was presented for age, height, right renal length (RR L), left renal length (LR L), right parenchymal thickness and left parenchymal thickness. Frequencies and percentages were computed for gender and age groups.

## 3. Result

**Table (1):** Distribution of renal length and parenchymal thickness means according to participant's side (right and left) through the whole cases.

Variable	Renal	Mean	Std. D	P-Value
Renal Length	Right	10.1506	0.78348	0.16
	Left	10.3312	0.80447	
parenchymal	Right	1.4714	0.33001	<b>0.00</b>

thickness	Left	1.7169	0.36252	
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**Table 2:** Renal length and parenchymal thickness according to participant's age:

Age group	RR L	LR L	Rt p. thickness	Lt p. thickness
20-30	10.07	9.92	<b>1.58</b>	1.90
31-40	10.05	10.69	1.51	1.76
41-50	10.23	10.50	1.36	1.62
51-60	<b>9.95</b>	<b>9.67</b>	1.56	1.61
61-70	10.28	10.60	<b>1.32</b>	<b>1.58</b>
71-80	<b>11.07</b>	<b>10.77</b>	1.53	<b>2.00</b>

**Table 3:** Relationship of renal length and parenchymal thickness with gender:

Renal parameter	Gender	Mean	Std. D	P-Value
RR L	Male	10.075	0.749	0.43
	Female	10.215	0.814	
L R L	Male	10.394	0.655	0.52
	Female	10.279	0.915	
Rt parenchymal thickness	Male	1.566	0.304	0.02
	Female	1.39	0.334	
Lt parenchymal thickness	Male	1.76	0.378	0.31
	Female	1.68	0.349	

**Table 4:** Relationship of renal length and parenchymal thickness according to participant's height:

participant's height	RR L	LR L	Rt p. thickness	Lt p. thickness
1.40-1.50	10.4250	10.2250	<b>1.2500</b>	1.8000
1.51-1.60	10.2833	10.1833	1.4056	<b>1.6167</b>
1.61-1.70	<b>9.9594</b>	10.3063	1.3875	1.6563
1.71-1.80	10.2455	<b>10.5182</b>	1.6773	1.8636
1.81-1.90	<b>10.7000</b>	<b>10.1000</b>	<b>1.7000</b>	<b>1.9000</b>

#### 4. Discussion

The mean of renal lengths were (10.15) and (10.33 cm) for the right and left kidney respectively. The mean of renal parenchymal thickness were (1.47) and (1.71 cm) for the right and left kidney respectively. Although there was no significant difference between the right and left renal length but the study showed that the left kidney was slightly larger than the right one same result noted by Zeb Saeed et al, (2012). The study also revealed that, the left parenchyma was thicker than the right one, with significant difference between the right and left parenchymal thickness at (P= 0.00) using one way Anova, and that agreed with some authors such as (Emamian, 1993), as in table (1).

The smallest mean of RR L was (9.94cm), noted in the age group (51- 60) and the largest mean was (11.06cm), noted in age group (71-80). The study revealed that there was no significant difference in right renal length through age groups at (P=0.33), this finding agreed with El-Reshaid et al 2014), they found that right renal length was  $10.68 \pm 1.4$  (p = 0.56) without a significant change with age.

The smallest mean of LR L was (9.67cm), noted in the age group (51- 60) and the largest mean was (10.76cm), noted in age group (71-80), with significant difference at (P=0.00).

This result consistent with Glodny et al, 2009), they found that renal length affected with age significantly. The thinnest right parenchymal thickness (1.32 cm) was noted in the age group (61-70) and the thickest one (1.58cm) was noted the age group (20-30). No significant difference at (P=0.26).

The thinnest left parenchymal thickness (1.58cm) was noted in the age group (61-70) and the thickest one (2.00cm) was noted the age group (71-80). The study revealed that, no significant difference at (P=0.09), that meant cortical thickness did not vary significantly with age as shown in (Wael El-Reshaid et al 2014). While we observed that both the thinnest right and left parenchymal thickness were found in the same group of age (61-70), that means parenchymal thickness decrease with age, increased reduction in parenchymal thickness due to age was noted in the study carried out by (Emamian et al,1993) as in table (2).

The mean of right renal lengths were (10.07) and (10.21 cm) for male and female respectively. The mean of left renal lengths were 10.39 and 10.27 for male and female respectively. The study revealed that no significant difference in renal length (right and left) between male and female at (P= 0.43), (P=0.52) for right and left respectively, this finding consistent with [Luyckx VA 2010]; Some studies, however, show that renal length is greater in males than in females [Buchholz NP ,2000, Wang F, 1989] and other study found that renal length was similar for both genders (9.82 cm) in males and (9.88 cm) in females (Saeed et al, (2012). Also no significant difference noted in left parenchymal thickness between male and female at (P= 0.31).The only significant difference was noted in the right parenchymal thickness at (P = 0.02) using one way Anova, but bilaterally, the parenchyma in males was thicker than females. As in table (3).

#### • Renal length according to participant's height

The smallest mean of RR L was (9.95cm), noted in the height group (1.61-1.70) and the largest mean was (10.7cm) noted in height group (1.81-1.90). The smallest mean of LR L was (10.1cm), noted in the height group (1.81-1.90) and the largest mean was (10.51cm) noted in height group (1.71-1.80). The study revealed that, there was no significant difference among height groups at (P= 0.45) for right renal length and at (P= 0.74) for left renal length. The study showed that renal length did not correlate with height, this result agreed with El-Reshaid et.al 2014, table (4).

#### • Parenchymal thickness according to participant's height

The thinnest right parenchymal thickness (1.25 cm) was noted in the height group (1.40-1.50) and the thickest one (1.70 cm) noted in the height group (1.81-1.90). Right renal parenchymal thickness in the current study exhibited strong positive correlations with height at (P=0.00). This result is consistent with previous findings in (Emamian, 1993, Weisenbach J 2001 and Charles 2014). The thinnest left parenchymal thickness (1.61 cm) was noted in the height group (1.51-1.60) and the thickest one (1.90 cm) was noted the height group (1.81-1.90). The study showed that no significant difference among height groups for left

parenchymal thickness at (P=0.17). We observed that, the left parenchyma was thicker than the right. Table (4).

## 5. Conclusion and Recommendations

The study concluded that normal value of left renal length was affected with age and normal parenchymal thickness was affected with side. The right parenchymal thickness was affected with gender and height. The right parenchymal thickness was the most affected renal parameters, so the study recommended using in evaluation of patients with chronic renal disease in addition to left renal length. Establishment of normal renal values of renal length and parenchymal thickness in Sudanese population will help us detecting renal changes early.

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