

THE ESTIMATION OF KIDNEY SIZES IN TURKISH POPULATION

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SUMMARY : Estimation of the renal size is often required especially for differential diagnosis of renal diseases. In this study to estimate the normal range of kidney length of the healthy Turkish Population, 673 subjects among 9 to 59 years of age were studied by ultrasonography which is accepted to be the most suitable noninvasive technique for the estimation of kidney length.

In this present study, it has been noticed that there is a positive and significant correlation between kidney length and body mass index in age 9-19 years. Our data also showed that kidneys reach to their mature sizes at the 3rd decade of life and remain without significant changes until 60 years of age. No significant changes in the length of left and right kidney and no difference relation to sex were observed.

Our results also indicated that the estimation of renal size using our approach obtained in this study are more accurate than the values which are procured by the equations given in the literature.

Key Words : Ultrasonography, kidney length.

INTRODUCTION

The presence of close relationship between kidney sizes and functions (1,2) has stimulated the research related to kidney sizes which are known to be helpful in the diagnosis of kidney diseases (2,7). It has been shown by many authors that bipolar kidney length is an accurate indicator of kidney weight and volume as well as its functional state. That is why the longitudinal axis of kidney is used as a reliable parameter during clinical examinations (1,3-8,10-14).

The measurement of kidney length by ultrasonography is a noninvasive and easy technique. Ninan *et. al.* (2) reported that beside its easiness and noninvasiveness, ultrasonography is also the most accurate

technique among the other methods. It has been also indicated by the same authors that radiographic techniques cause 15% of false results due to photographic errors and contrast medium induced osmotic increase in kidney volume.

Many investigators agree that besides its benefit as an indicator of functional deteriorations of kidney, the kidney length is also a valuable growth parameter for children in growing age (10,12,13,15). Tajima using the longitudinal length of kidney in his study showed that Weitzel growth charts are not suitable for following the growth rate of Japanese Children (12,13). Similar researches were repeated by the investigators of other countries (1,3-11,15,16) and the similar results were found.

Generally the linear growth and height are influenced directly both by nutrition and genetic (17,18) and close relation between nutrition and kidney length as

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well as its functions suggest that kidney size of Turkish population must be dissimilar from the kidney sizes of other population who have different nutritional habit and genetic background. Consequently the same equations defined in the literature (12,13,20) should not be used for the estimation of kidney lengths of Turkish population. However there is neither data showing physiological range of kidney size nor suitable equations to estimate it in healthy Turkish population.

When taking into consideration the importance of imaging equipments in clinical diagnosis, this lack of information related kidney sizes reduces the clinical benefit of diagnostic equipments imported and calibrated by the norms of manufacturing countries by leading misdiagnosis. Considering the importance of misdiagnosis and insufficient usage of imported medical equipments in health as well as economy, to establish a suitable equations for our population becomes a necessity.

In this survey, to minimize the effect of this lack of information, healthy population aged 9 to 59 who lives in Antalya for ten years were measured and used to estimate the new equations unique to our population.

MATERIALS AND METHODS

Each person selected for this study was invited to participate in an examination given at the nearby mobile examination center. Following clinical and laboratory examination, 673 healthy subjects (384 females and 289 males) aged between 9 to 59 who live in Antalya for ten years were included into this survey. Ultrasonography was performed by the same radiologist and longitudinal axis of both kidney were measured using

Table 1: Kidney length measured by ultrasonography (mean±SD).

AGE (years)	RIGHT KIDNEY (mm)		LEFT KIDNEY (mm)	
	Female	Male	Female	Male
9-19	n=104 97.27±9.85	n=79 98.71±11.92	n=106 97.86±9.46	n=80 95.5±10.8
20-29	n=74 104.01±9.28	n=31 105.81±8.67	n=74 103.58±9.46	n=32 106.78±9.14
30-39	n=71 102.0±9.65	n=61 104.08±10.10	n=71 101.82±9.83	n=63 105.16±9.97
40-49	n=60 101.13±9.32	n=53 104.36±10.90	n=59 101.20±9.62	n=53 103.51±10.76
50-59	n=75 102.63±10.18	n=65 105.4±12.0	n=74 100.93±12.60	n=66 105.53±11.15

Thosiba SAL 32B Model Linear Scanning Ultrasound without pretreatment.

In a preliminary study, the kidney sizes were measured in 25 subjects using Thosiba 38B Model Linear Scanning and compared with the results of Thosiba SAL 32B model was used for the measurement of kidney lengths throughout study.

Biomedical Statistical Software Packed program (BMDP) was used for the statistical analysis of the results. The relation between age, sex, body mass index as well as height and kidney length were formulated by way of this program.

RESULTS

Despite the normal findings of physical examination and laboratory tests, 30 women and 28 men were excluded from the study due to kidney pathology diagnosed by ultrasonography.

Figure 1: Height/Kidney length relation in adult females.

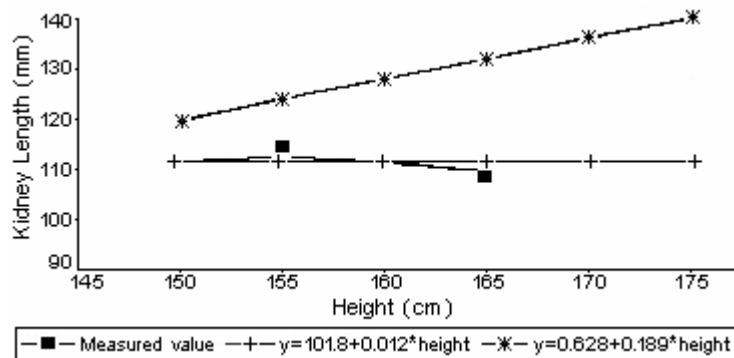


Table 2: Equations used for the estimation of kidney length.

SEX AND AGE GROUPS		AGE (year)	HEIGHT (cm)	BODY MASS BMI (kg/m ²)
FEMALE	9-19 (years)	n=104 y=57.47+0.27x r=0.39 (p<0.001)	n=104 y=57.47+0.27x y=57.47+0.27x	n=95 y=85.41+0.64x r=0.25+x.64x
	20-59 (years)	n=280 y=104.2-0.043x	n=229 y=101.6+0.012x	n=552 y=100.98+0.06x
MALE	9-19 (years)	n=79 y=68.86+2.083x r=0.53 (p<0.001)	n=73 y=25.26+0.47x r=0.58 (p<0.001)	n=79 y=61.94+1.94x r=0.42 (p<0.01)
	20-59 (years)	n=210 y=105.1-0.007x	n=189 y=97.79+0.042x	n=197 y=101.8+0.13x

As seen in Table 1, in age 9-19 the kidney length showed significant increase with age. It was noted that kidney reaches its mature size at age 20-29 and remains unchanged until the 6th decade of life.

There was no significant difference between the left and right kidney length. In age 9 to 19 the mean kidney length of girls was longer than that of boys, however in other decades of life, the kidney length of male was found to be longer than those of female counterparts. As seen in Table 2 significant positive correlations were found between age, height, body mass index and kidney length of men and women in aged 9 to 19. Estimated kidney length using our equations which were calculated by the results of the pres-

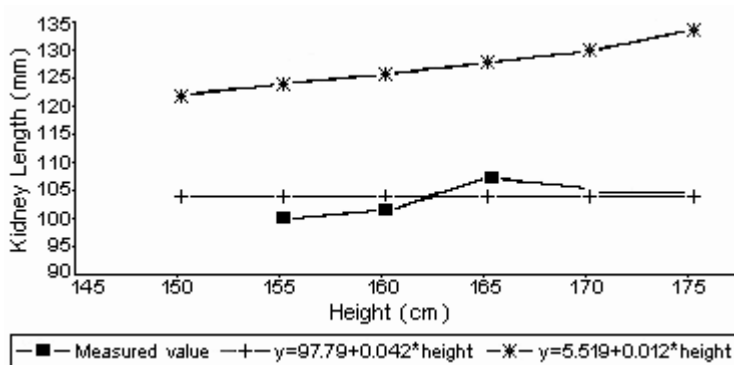
ent survey are found to be quite different from the values estimated from the equations given in the literature (20). Figures 1 and 2 clearly show that estimated kidney lengths based on our own formulas are well accord with the measured kidney lengths of the same person and Kidney lengths estimated by Hudson's equations are significantly longer than measured lengths.

DISCUSSION

Since Ultrasonography is a reliable, noninvasive and easy technique, it has been preferred in many clinical surveys (2,3,7-9,12,15). It has been reported that with this technique the mean kidney size varied between 83 and 113 mm in Indian Donors. Using Ultrasonography Nina *et. al.* (2) found that the mean kidney length was 95.2+6.2 mm in normal population. When taking into consideration the above mentioned results our findings related kidney length of men and women seem not to be significantly different.

On the other hand our measured kidney sizes are significantly shorter than the values reported from European countries (19,20) Figures 1 and 2 clearly show that estimated kidney length using the Hudson's equation defined in the literature do not reflect the kidney length of healthy Turkish population, and when considering the pathological conditions affecting on kidney sizes this shortness may give wrong impression to the clinician. Consequently they should not be used in our clinics.

Figure 2: Height/Kidney length relation in adult males.



The presence of a good accordance between estimated kidney length using our sex, age and body mass index dependent formulas and measured lengths of the same person agree within the results of the authors reporting the accuracy of age, sex, body mass index dependent equations in estimation of normal limit of kidney sizes. The difference between the kidney lengths reported in the literature and ours strongly suggests the necessity of our own norms for the calibration of imaging equipments used in our clinics.

Presence of significant correlation between kidney length and height in age 9-19 supports the previous studies indicating the close relationship between linear growth and kidney length (5-8,10-14) and also indicates that kidney lengths can be used as a growth parameter in growing age.

Despite the positive correlation between kidney length and height in growing age, due to the stability of its length, in aged 20-59 there is no such a relation between height and kidney length and this lack of correlation seen in adult age is also another evidence showing the importance of kidney length as a growth parameter. Since subjects over 60 were excluded, the regression in kidney length due to aging could not be observed in our study.

Our results also show that in addition to age and height and sex the equations based on body mass index are useful for the estimation of kidney length of people aged between 20-59. This finding agrees with the reports showing the significant relationship between body mass index and kidney length (1,4,14). Especially relations among age, height, and kidney lengths are found to be significant in aged 9 to 19.

When taking into consideration the authors who studied the effects of nutrients on kidney aging and growth (17,18) the dissimilarities between kidney lengths found in this study and those reported in the literature seem to be normal expectation and supports the importance of usage of equations unique to Turkish population during diagnosis of renal diseases. However more and detailed studies are needed to obtain

reliable nationwide equations to estimate kidney length.

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