

## Real Time Sonographic Assessment of Common Uterine Sizes, Shapes and Positions in Nigerians

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### ABSTRACT

The uterine dimensions, shapes and positions of 700 subjects made up of premenarche, nulliparous, multiparous and postmenopausal subjects aged between 9 and 88 years were determined by real time transabdominal sonography. Results obtained show that the uterine dimensions in the premenarche are  $3.94 \pm 0.74\text{cm}$ ,  $1.76 \pm 0.47\text{cm}$ , and  $2.33 \pm 0.84\text{cm}$  for the length, thickness and width respectively. In the nulliparous group uterine dimensions are  $5.70 \pm 0.60\text{cm}$ ,  $3.30 \pm 0.50\text{cm}$ , and  $4.10 \pm 0.50\text{cm}$  for the length, thickness and width respectively. In the multiparous group the uterine dimensions are  $6.90 \pm 0.80\text{cm}$ ,  $4.10 \pm 0.70\text{cm}$ , and  $4.90 \pm 0.80\text{cm}$  for the length, thickness and width respectively. For the postmenopausal group the uterine dimensions are  $5.20 \pm 0.60\text{cm}$ ,  $2.80 \pm 0.90\text{cm}$ , and  $3.30 \pm 0.70\text{cm}$  for the length, thickness and width respectively. The uterine dimensions were found to vary according to the age, height and weight of the subjects. The incidences of pear-shaped uterus are 23% for premenarche, 99.2% for nulliparous, 95.2% for multiparous and 77% for postmenopausal groups. Tubular uteri were found in 77% and 21% of premenarchal and postmenopausal subjects respectively. Globular uterus occurred only in 0.8%, 4.8% and 2% of nulliparous, multiparous and postmenopausal subjects. The predominant uterine shape is pear except for the premenarche where tubular uterus predominates. Uterine anteversion was seen in 91.6%, 94.8% and 78% of nulliparous, multiparous and postmenopausal subjects. Uterine retroversion occurred in 8.4%, 5.2% and 22% of nulliparous, multiparous and postmenopausal subjects. The incidences of dextro rotated uterus are 98.8%, 99.6% and 100% for nulliparous, multiparous and postmenopausal subjects. Levo rotated uteri were found in only 1.2% and 0.4% of nulliparous and multiparous subjects. There is relatively strong positive correlation between the determined uterine dimension and age, height and weight of the subjects.

This study has established normal values of uterine dimension in premenarchal, nulliparous, multiparous and postmenopausal women in Nigeria that can be useful in assessing the normality of the uterus in our locality.

**Keywords:** Uterus, Size, Shape, Position, Sonography.

The uterus is the thick-walled muscular pouch of the female reproductive system. It is divided into four parts namely: the fundus, the corpus uteri or body, the isthmus and the cervix. The fundus is the dome-shaped portion, which rises above the entrances of the fallopian tubes. The body lies immediately below the fundus while the isthmus is a slight constriction of the body where it meets the cervix. The cervix is the short muscular and tubular part that opens into the vagina.

The uterine wall comprises the outermost serous layer, the perimetrium, the thick muscular middle layer, the myometrium and the innermost mucous lining adherent to the myometrium called the endometrium that is periodically shed during menses and this periodic "bleeding" is a sign of health in women of reproductive age. Redwine (2002) describes the myometrium as the relatively thick muscle

wall, which gives the uterus its pear shape. He did not consider the external dimensions of the uterus.

Imaging the uterus is achieved by computed tomography, ultrasound and less commonly, magnetic resonance imaging. Ultrasound is currently the examination of choice because it is cheap and easy to carry out and most importantly, does not involve the use of ionizing radiation. Conventional radiology plays almost no part except for hysterosalpingography, which is used to assess the uterine cavity and patency of the fallopian tubes. The less frequently employed magnetic resonance imaging is aimed at overcoming the limitations of ultrasound especially those resulting from the patient's body habitus. Computed tomography is known to involve the use of ionizing radiation and the administration of intravenous contrast medium. Fisher (1990) reports that the normal uterus on TI-weighted

image is seen as a homogenous medium-signal-intensity zonal anatomy. On T2-weighted image, the anatomic uterine divisions into corpus, isthmus and cervix is readily delineated.

The uterus may be involved in a number of pathological processes that may lead to changes in its size (Didia et. Al; (2001). These pathologies may also lead to distortion of its shape. Uterine masses such as leiomyoma, leiomyosarcoma and endometrial cancer can increase the uterine size and distort its shape. In very young girls, uterine size may become increased by collection in its cavity as reported by bello (2001). This is caused by imperforate hymen. The postpubertal uterus may at times be smaller than its normal size. In this hypoplastic state, the uterus may be incapable of any function. Therefore, establishing the uterine size and shape in health becomes very important especially with regards to those factors that may influence it (size and shape) such as age, parity, height and weight.

Normal uterine dimensions are well established for the caucasians as reported by moor and dalley (1999), McMinn (1994), Ellis (1983) and Robbins and Cotran (1979) and these values are used in most radio diagnostic centres in Nigeria. The scanty information available to sonographers and referring clinicians on normal uterine dimensions, shapes and positions in Nigerian women necessitated this work. The study by Didia et. Al; (2001). Targeted nulliparous Nigeria women who have had no previous uterine instrumentation. This study consequently includes the premenarhe, multiparous and postmenopausal groups who were not included in the study by Didia et. Al; (2001). This extension will provide a complete nomogram of uterine dimensions, shapes and positions in Nigeria.

### **MATERIALS AND METHODS**

A cross sectional descriptive design was adopted for this study. The subjects consisted of referrals to the ultrasound sections of the Radiology departments of Federal Medical Centre, Makurdi and Hospital of Immaculate Conception, Makurdi between April, 2005 and January, 2007. An informed consent was obtained from every one of them before enlistment into the study. Clearance was got from

Human Research and Ethics Committee of Federal Medical Centre, Makurdi and Medical Director of Hospital of Immaculate Conception, Makurdi to carry out this study.

The subjects that were eventually included in the study were only Nigeria women and girls from 9 years and above who were not pregnant nor had recently delivered babies in the past 12 weeks. Those who have hysterectomy or myomectomy or have uterine or adnexal masses as visualized on scan were excluded. 700 subjects eventually met the inclusion criteria and consist of 250 subjects each for the premenarhe and postmenopausal groups.

### **Data Collection**

On arriving at the department an informed consent was sought and obtained from each subject before enlistment into the study thereafter, the height and weight of the subjects were measured using a meter rule and a hana simple bathroom weighing scale model BR 9011. The age, parity, premenarhe and postmenopausal status were obtained prior to the scan.

Sonography was carried out on each subject using EHOSKAN-10 ultrasound machine manufactured by IZomed Medical Ultrasound Equipment Company with 3.5MHz and mechanical sector probes and Toshiba SSA 250 Ultrasound Machine with 3.75MHz curvilinear electronic probe in the presence of a chaperon. A full urinary bladder without distension was achieved prior to each scan by each subject ingesting water. The length and thickness of the uterus were obtained on the same longitudinal scan. A transverse image of the uterus was used to obtain the width. Measurements of the uterine dimensions were taken in three planes described by Chudleigh and pearce (1986) and as shown in figures 1 and

### **Data Analysis**

The data were categorized according to parity, premenarhe and postmenopausal and analysed using Microsoft Excel software package. Correlation analysis was done according to person's method as described by Owen and Jones (1977). The means, ranges and standard deviations of anthropometric variables and determined uterine dimensions were calculated.

## RESULTS

The mean uterine dimensions in the premenarche group were  $3.94 \pm 0.74$ cm (range 2.90cm-5.30cm) for length,  $1.76 \pm 0.47$ cm (range 1.10cm-3.10cm) for thickness, and  $2.33 \pm 0.84$ cm (range 1.20cm-4.40cm) for width. The mean uterine dimensions in the nulliparous group were  $5.70 \pm 0.60$  (range 4.30cm-6.80) for length,  $3.30 \pm 0.50$  (range 2-30.00cm-6.00cm) for the thickness and  $4.10 \pm 0.50$ cm (range 3.00cm-6.30cm) for width. In the multiparous group the uterus measured  $6.90 \pm 0.80$ cm (range 4.80cm-10.70cm) in length,  $4.10 \pm 0.70$ cm (range 2.70cm-6.30cm) in thickness and  $4.90 \pm 0.80$ cm (range 3.60cm-9.20cm) in width. In the postmenopausal group the mean uterine dimensions were  $5.20 \pm 0.60$ cm (range 3.50cm-6.10cm) for length,  $2.80 \pm 0.90$ cm (range 1.30-4.50cm) for thickness and  $3.30 \pm 0.70$ cm (range 1.90cm-5.00cm) for width. Table 1 shows the variation of uterine size according to age in the premenarche group. The age and uterine size distribution of the whole subjects irrespective of their reproductive status as presented in table 2 shows that there was an increase in uterine size with increasing age until between 50 and 59 years when there was a progressive decrease in uterine size with age. Table 3 shows that there is variation in uterine size according to subjects reproductive status.

The distribution of the uterine size and subject height on one hand and weight on the other as presented in Table 4 shows that the uterine dimensions increased steadily with increasing height and weight. The correlation coefficient (r) between uterine length, thickness and width, and subject height were 0.63, 0.61 and 0.64 respectively. The correlation coefficient (r) between uterine length, thickness and width, and subject weight were 0.67, 0.68, and 0.68 respectively.

The predominant uterine shapes were tubular in the premenarche and pear in the nulliparous and postmenopausal subjects as shown in table 5. In the premenarche 23 subjects (23%) had pear-shaped uteri while 77 subjects (77%) had tubular uteri. In the nulliparous, 248 subjects (99.2%) had pear-shaped uterus while only 2(0.8%) subjects had globular uteri. The

multiparous group had 238 subject (95.2%) having pear-shaped uteri while 12 subject(4.8%) had globular uteri. In the postmenopausal group 77 subjects (77%) had pear-shaped uteri while 21 subjects (21%) had tubular uteri. Only 2 subjects (2%) had globular uteri.

The predominant uterine positions in the nulliparous, multiparous and postmenopausal groups were anteversion and dextro rotation as presented in table 5. Uterine positions were not determined in the premenarche. Uterine anteversion occurred in 229 (91.6%) nulliparous subjects, 237 (94.8%) multiparous subjects and 78 (78%) postmenopausal subjects. Uterine retroversion was found in 21 (8.41%) nulliparous subjects, 13 (5.2%) multiparous subjects and 22 (22%) postmenopausal subjects. Dextro rotated uteri were found in 247 (98.8%) nulliparous subjects, 249 (99.6%) multiparous subject and 100 (100%) postmenopausal subjects. Levo rotated uteri were found in 3 (1.2%) and 1 (0.4%) nulliparous and multiparous subjects respectively. No postmenopausal subject had levo rotated uterus.

## DISCUSSION

Assessing the normality of the uterus with regards to its size, shape position and echotexture is the primary aim of carrying out pelvic ultrasound investigation on female patients. It is by assessment along these set criteria that specific diagnosis can be made. Robbins and Cotran (1979) reported that the size of uterus varies depending on the age and parity of the individual. The size of the normality of the uterus.

From this study there was a steady increase in uterine size with increasing age as presented in the tables 1 and 2. The uterine size increased to the maximum between 40 and 49 years. At this age the uterine dimension were  $7.46 \pm 1.30$ cm for length,  $3.57 \pm 0.60$ cm for thickness and  $4.76 \pm 0.79$ cm for width. Table 2 shows that from 50 years there was a steady decrease in uterine size with increase age. This is the postmenopausal period and marks a period of atrophic changes in the uterus. This variation of uterine size with age is thought to a reflection of the subject's reproductive status, which changes with age.

Robbins and Cotran (1979) noted that the size of the uterus varies with age and parity

TABLE 1: VARIATION OF UTERINE SIZES WITH AGE

IN PREMENARCHE

Age (Years)	UTERINE SIZE (CM)		
	Length	Thickness	Width
9	3.20±0.21	1.40±0.17	1.70±0.21
10	3.50±0.43	1.30±0.25	1.60±0.28
11	3.60±0.18	1.60±0.86	1.90±0.34
12	4.10±0.53	1.90±0.39	2.40±0.47
13	4.90±0.17	2.30±0.35	3.50±0.56
14	5.10±0.10	2.40±1.25	3.90±0.07

TABLE 2: VARIATION OF UTERINE SIZE WITH AGE.

Age (years)	No. of Subject	UTERINE SIZE (CM)		
		Length	Thickness	Width
9- 19	158	4.69±1.04	2.40±0.87	3.05±1.06
20 - 20	293	6.09±0.73	3.58±0.53	4.34±0.61
30 - 39	36	6.85±0.86	4.13±0.81	4.96±0.94
40 - 49	53	7.46±1.05	4.50±0.91	5.24±0.91
50 - 59	43	5.52±0.39	3.27±1.00	3.58±0.58
60 - 69	42	5.12±0.53	2.50±0.53	3.20±0.61
70 and over	25	4.59±0.74	2.32±0.76	2.83±0.82
Total	700			

TABLE 3: MEAN VALUES OF UTERINE DIMENSIONS AND CORRESPONDING ANTHROPOMETRIC VARIABLES.

Variables	Premenarcho	Nulliparous	Multiparous	Postmenopausal
Age (years)	11.1±1.4	22.5±4.5	30.6±8.3	59.9±7.8
Height (cm)	144.30±8.40	159.50±8.10	160.50±8.50	155.90±6.60
Weight (kg)	39.8±7.5	63.1±28.6	68.0±12.1	55.7±8.1
Parity	-	-	3.9±4.2	-
Uterine length (cm)	3.94±0.74	5.70±0.60	6.90±0.80	5.20±0.60
Uterine thickness (cm)	1.76±0.47	3.30±0.10	4.10±0.70	2.80±0.90
Uterine width (cm)	2.33±0.84	4.10±0.50	4.90±0.80	3.30±0.70

TABLE 4: VARIATION OF UTERINE SIZE WITH HEIGHT AND WEIGHT OF SUBJECTS.

Height (cm)	Length (cm)	Thickness (cm)	Width (cm)
120 - 135	3.41±0.50	1.28±1.13	1.61±0.24
136 - 151	5.31±1.31	1.82±1.02	3.54±1.25
152 - 167	6.05±0.96	1.53±0.86	4.29±0.88
168 - 183	0.06±1.02	3.97±0.79	4.56±0.80
Correlation Coefficient (r)	0.63	0.61	0.64
Weight (kg)			
25 - 46	3.91±0.78	1.74±0.49	2.22±0.75
47 - 68	5.91 ± 0.88	3.38±0.79	4.11±0.81
69 - 90	6.71±1.03	1.04±0.80	4.82±0.90
91 - 106	7.08±1.30	1.70±0.55	5.35±0.91
Correlation Coefficient (r)	0.67	0.68	0.68

TABLE 5: DISTRIBUTION OF COMMON UTERINE SHAPES ACCORDING TO PARITY.

Group	Pear-Shaped	Tubular	Globular
Premenarcho (n=100)	23 (23%)	77 (77%)	0 (0%)
Nulliparous (n=250)	248 (99.2%)	0 (0%)	2 (0.8%)
Multiparous (n=250)	238 (95.2%)	0 (0%)	12 (4.8%)
Postmenopausal (n=100)	77 (77%)	21 (21%)	2 (2%)

Table 6: INCIDENCES OF UTERINE POSITIONS

Group	Anteversio	Retroversio	Dextro rotation	Levo rotatio
Premenarcho	Not determined	Not determined	Not determined	Not determined
Nulliparous (n=250)	229 (91.6%)	21 (8.4%)	249 (98.8%)	3 (1.2%)
Multiparous (n=250)	237 (94.8%)	13 (5.2%)	249 (99.6%)	1 (0.4%)
Postmenopausal (n=100)	78 (78%)	22 (22%)	100 (100%)	0 (0%)

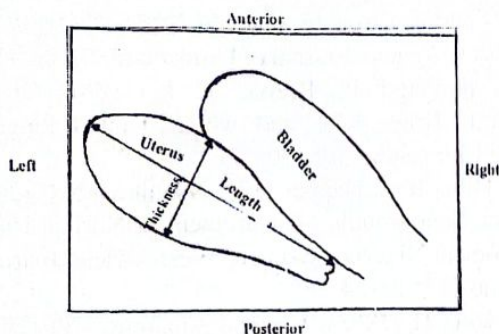


Fig. 1: Longitudinal measurement of the uterus

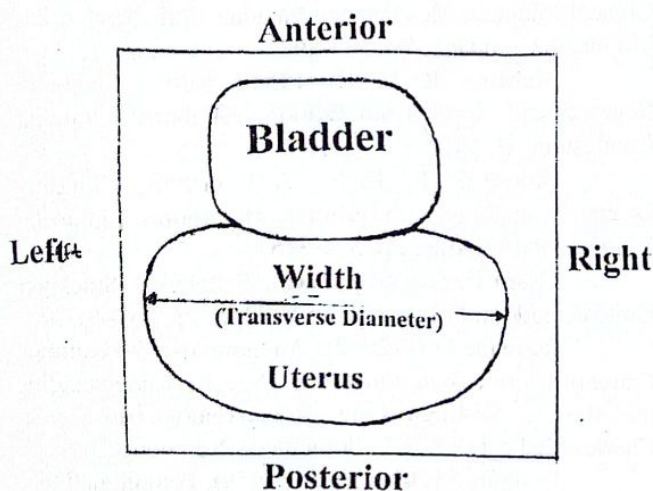


Fig. 2: Transverse measurement of the uterus.

therefore, to assess the normality of the uterine size the reproductive status of the patient should be taken into consideration. The uterine size increased with parity as presented in table 3. However, the size decreased with the onset of menopause (climaterium). The premenarche uterine size was  $3.94 \pm 0.7\text{cm}$  for length,  $1.76 \pm 0.47\text{cm}$  for thickness and  $2.33 \pm 0.84\text{cm}$  for width and the nulliparous uterine size was  $5.70 \pm 0.60\text{cm}$  for length,  $3.30 \pm 0.50\text{cm}$  for thickness and  $4.10 \pm 0.50\text{cm}$  for width. The nulliparous values differs from the previously reported values by Didia et. Al., (2001), which are  $7.30 \pm 1.30\text{cm}$  for length,  $3.57 \pm 0.60\text{cm}$  for thickness and  $4.76 \pm 0.79\text{cm}$  for width. These values ((Moore and Dalley 1999), Ellis (1983) and Robbins and Cotran (1979)).

The uterus size increase with age and so do height and weight increase with age. Table 4 shows that uterine length and other dimensions increased with height and weight. The

correlation coefficient ( $r$ ) between subject the height and the length, thickness and width of uterus were 0.63, 0.61 and 0.64 respectively. The correlation coefficient ( $r$ ) between the subject weight and uterine length, thickness and weight were 0.67, 0.68 and 0.68 respectively. This relationship might not be strictly with height and weight, as these two variables are known to vary with age. Dida et. Al (2001) reported a positive correlation value of 0.95 between uterine dimensions and anthropometric variables.

The determination of normal uterine shape is a key factor in diagnosing uterine masses. Uterine masses such as fibroids are known to distort uterine outline. Also congenital malformations are only suspected at ultrasound when uterine size and shape are abnormal. The commonest uterine shapes identified in this study are pear-shape and tubular as shown in table 5. Pear-shaped uteri were predominant in the nulliparous, multiparous and postmenopausal groups with incidences of 99.2%, 95.2% and 77% respectively. The tubular uteri were found in 77% and 21% of the premenarche and postmenopausal subjects. Sanders and Wilson (1991) observed that at the premenarche stage the uterus is tubular but becomes pear-shaped at puberty. The uterus retains the shape it adopted at puberty during the postmenopausal period. The clinical significance of the findings of this study is obvious. If at the premenarche stage uterus is found to be pear-shaped rather than tubular, the age of the patient should be closely investigated. This is because the uteri are pear-shaped in premenarche subjects who are on the verge of attaining menarche. Thus the relationship between uterine shape and patient's reproductive status should always be taken into consideration when assessing the normality of the uterus. Uterine retroversion is a factor implicated in infertility. This causative factor for infertility is not yet well understood.

This study recorded high incidences of uterine anteversion as shown in table 6. The

incidences recorded were 91.6%, 94.8% and 78% for the nulliparous, multiparous and postmenopausal groups respectively. The incidences of uterine retroversion for the nulliparous, multiparous and postmenopausal groups were 8.4%, 5.2% and 22% respectively as shown in table 6. The incidence of uterine retroversion recorded in this study for the nulliparous group is slightly lower but comparable to the value reported by Didia et. Al, (2001) which was 10%. The incidence of retroversion is lower in the multiparous group compared to the nulliparous group. The significance of this is not clear yet but we think it might be a factor related to fecundity. The incidences of dextro rotation were high being 98.8% for nulliparous, 99.6% for multiparous and 100% for postmenopausal groups respectively as presented in table 6.

### CONCLUSION

This study has established a nonogram of uterine size, shapes and positions in the premenarche, nulliparous, multiparous and postmenopausal Nigerian girls and women. This will be of great gynaecological importance to both the referring clinician and sonographers.

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