PREVALENCE AND SONOGRAPHIC PATTERNS OF UTERINE FIBROID AMONG GHANAIAN WOMEN (Uterine Fibroid- The Ghanaian situation)

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ABSTRACT

Uterine fibroid represent a major public health problem and is regarded as the most common benign gynecologic tumors affecting premenopausal women. It is associated with considerable hospitalization and morbidity. The study aimed to establish the prevalence and characteristics of uterine fibroid among Ghanaian women. A retrospective cross-sectional study was carried out to analyze 584 trans-abdomino pelvic ultrasound images and reports of women (aged, 35.03 ± 6.64 years and range 20-74 years). The images and their corresponding reports were analyzed by a team of three sonographers concurrently. The number of fibroid nodules, location in the uterus, sonographic pattern and classification were assessed descriptively and inferentially using the statistical package for Social Scientists version 17. The average number of fibroid nodules, diameter and volume of the largest nodule were estimated as, 3.38 ± 1.30, 4.31cm ± 3.40 and 154.74 cm^3 ±473.80 respectively. The study indicated that 24.50% (143/584) of the images evaluated had fibroid. The highest prevalence (53.80%) of the fibroid case was found among women aged 30-39 years and the lowest were recorded among women aged > 49 years. Forty-four (44) percent of the fibroids were intramural with only 5.60 % been submucosal. Most (59.40%) of the fibroids were located within the corpus of the uterus and the most popular (85.3%) pattern of presentation of the nodules was hypoechoic. The prevalence and sonographic pattern of uterine fibroid among Ghanaian women have been assessed which could aid in appropriate surgical interventions and treatment in the country.
Keywords: *Uterine Fibroid, Sonographic patterns, Classification*

INTRODUCTION

Ultrasound is regarded as a first choice imaging modality in the field of gynecology[1]. During ultrasound scanning, both dynamic and static images can be produced and displayed as a spectrum. Ultrasound, which is non-ionizing radiation has no known adverse bio-effects and has excellent soft tissue and pelvic organ resolution and hence its preference in gynecological investigations. One common diagnostic investigation employing the use of ultrasound is uterine leiomyomas also referred to as myoma, fibromyoma, or fibroid. Uterine leiomyomas represent a major public health problem and the most common benign gynecologictumors affecting premenopausal women[2,3]and are often associated with considerable hospitalization and morbidity [4,5.]Fibroid is considered as the most common masses of the female pelvis which is estimated to occur in 20-40% of women during their reproductive years[6-7] and is believed that these tumors develop in the majority of American women and become symptomatic in one-third of these women[2, 8]. Fibroids are the most frequent indication for hysterectomy (abdominal and vaginal) and a

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leading cause of hospitalizations for gynecologic disorders[9,10], accounting for approximately one third of all procedures performed annually in the United States and is suggested that black women have a greater fibroid burden than whites [11-12]. Although the etiology of fibroids remains unknown, the ovarian hormones estrogen and progesterone are hypothesized to enhance fibroid[13-14]. The exact data on prevalence of fibroid condition are lacking, primarily because of limited population-based research, varying symptomatologies[15]and differences in case definitions across studies.A population-based study[16] in the United States found a cumulative incidence of uterine fibroids of greater than 66% by ultrasound examination of women approaching age 50 years. Statistics [16] from the Chinese Society of Health Management for nearly 500,000 adult Chinese women who had health examinations during the year 2008 showed a prevalence of ultrasound diagnosed uterine fibroids of 14.7%. It has been suggested that the natural history of fibroids is poorly understood, which makes it difficult to advise asymptomatic women with fibroids on the risk of developing clinical symptoms in the future[5]. Previous studies[17] on fibroids have been focused on symptomatic white women, with limited study of African-American women or women with asymptomatic disease. Literature search both electronic and manual indicated a gap in terms of documentation on the prevalence of fibroid cases among Ghanaian women as well as effort to promote and create awareness on fibroid among the populace. It is against this backdrop that this study was undertaken to establish the prevalence and characteristics of uterine fibroid among Ghanaian women. The intention was to identify the sonographic patterns which could aid in appropriate surgical interventions that will solve the problem of spontaneous miscarriages among the Ghanaian women.

MATERIALS AND METHODS
A. Characteristics of the ultrasound machine used in the study
The ultrasound scanning machineused in the study has the following characteristics;
- Mobile Ultrasound machine
- Model: MINDRAY diagnostic ultrasound system.
- Probe type: Curvilinear array transducer of frequency 3.5 MHz

B. Method:
A retrospective cross sectional study was carried out to analyze 584 trans-abdominal pelvic ultrasound scan images of women aged >20years which were produced at Wellness Laboratories Ltd in Ghana. The images were produced between June and December, 2011 andwere stored in the memory drive of the ultrasound machine in the centre and the images and their associated reports were retrieved and analyzed. The number of fibroid nodules was recorded and to ensure consistency of measurement, only the largest fibroid nodule for each image was taken. The mean diameter (d_m) of the largest nodule was calculated as: $d_m = \frac{d1+d2+d3}{3}$, where d_1, d_2 and $d_3$are the diameters of the largest nodule measured in three perpendicular planes. The volume (V) of the largest fibroid nodule was calculated using the formula for the volume of a sphere (V $= \frac{\pi d3}{6}$). The locations of individual fibroid in the uterus, sonographic pattern as well as its classification were assessed.

C. Statistical Analysis

Both descriptive and inferential analyses were carried out using the statistical package for social scientist version 17.One way Analysis of Variance (ANOVA) was carried out to identify whether there was significant difference between the mean uteri volumes of patients with fibroid among the various age groupings and post-hoc tests (Bonferroni post-hoc tests) were carried out to demonstrate where the differences lay.Additionally, Pearson's correlation was used to determine significant relationships between age of patients and fibroid characteristics (diameter of largest nodule, uteri volumes, and number of nodules) and Chi-square analysis was used to show significant association between age group and diameter of largest nodules.

D. Fibroids Classification and Location

Fibroid nodules are mostly determined in different locations inside the uterus[18, 19], within the walls of the uterus or out of the uterus and are named as indicate in Figure 1.

Figure 1: A transverse section of the uterus with the various classifications of fibroids (Courtesy center for uterine fibroid [20])
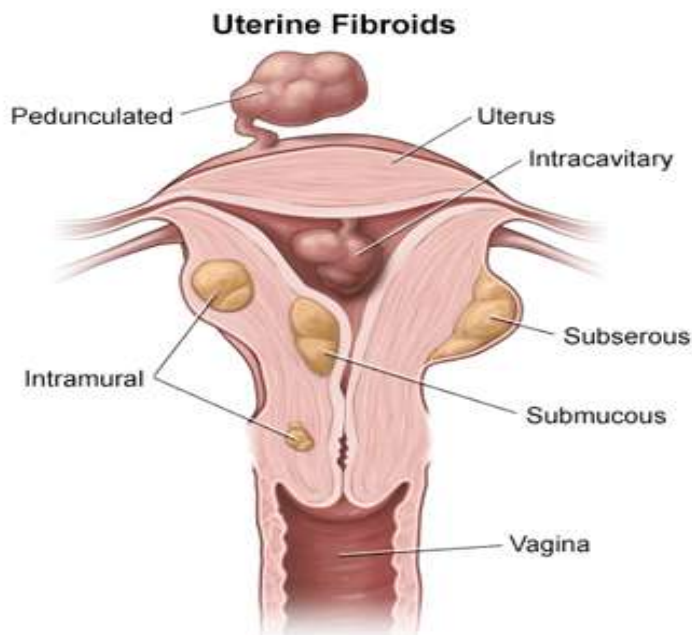

RESULTS
A. Descriptive Statistics of Conditions of the Uterus and Patient Data

The age range for all patients (N= 584) whose images were analyzed was 20.00–74.00 years, with mean and standard deviation values as 30.30years and 6.30, respectively. Descriptive statistics on the conditions of the uteri as indicated on the scanned images are shown in Table 1 and Figure 2.

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Table 1: Frequency and percentage of findings of the conditions of the uterus

Uterus condition	Frequency	Percentage
Pregnancy only	223	38.20
Normal Empty	217	37.20
Fibroid only	122	20.90
Pregnancy with Fibroid	22	3.80
Total	584	100.00

Figure 2: Ratio of patients confirmed with fibroid to those without fibroid
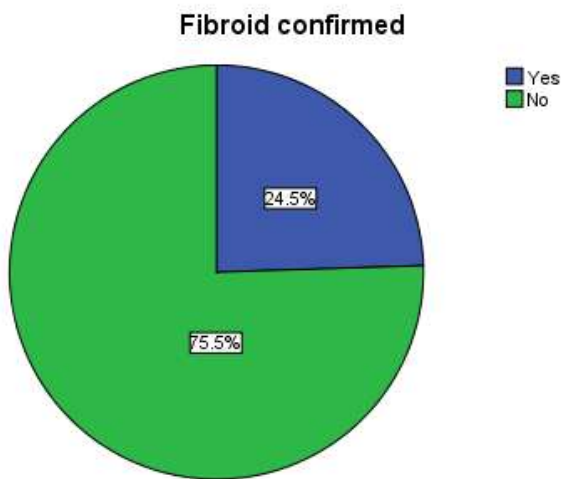
The study showed that 75.50% of the scanned uteri were without fibroid (either normal empty or contain pregnancy only) whiles 24.50% was confirmed having fibroid. The study indicated that the highest prevalence (53.80%) of the fibroid case was found among women aged 30-39yrs and the lowest (1.40%) recorded among women aged >49years. Women aged between 20-29 yrs also recorded significant percentage of 25.20% of fibroid. The age grouping of the patients and those confirmed of fibroid is shown in Table 2.

Table 2: Age Grouping of patients * Fibroid confirmed cross tabulation

Age Groupings	Fibroid confirmed
	N (%)
20-29 years	36 (25.20)
30-39 years	77 (53.80)
40-49 years	28 (19.60)
>49 years	2(1.40)
Total	143 (100.00)

B.   Fibroid Characteristics

The range, mean and standard deviation of the age of patients (n = 143) whose images were confirmed with fibroid were 21.00 to 54.00 years, 35.03yrs and 6.64, respectively. The average number of fibroid nodules, diameter and volume of the largest nodule were also estimated as, 3.38, 4.31cm and 154.74 cm^3 respectively. Table 3 shows the descriptive analysis of the confirmed fibroid cases.

Table 3: Descriptive analysis of the fibroid characteristics

Fibroid characteristics	N	Minimum	Maximum	Mean	Std. Deviation
Ages of patients confirmed with fibroid in years	143	21.00	54.00	35.03	6.64
Number of nodules	143	2.00	5.00	3.38	1.301
Diameter of the largest nodule (cm)	143	0.40	21.10	4.31	3.41
Volume of the largest nodules (cm^3)	143	0.03	4919.29	154.74	473.80

The study also indicated that 44% of the fibroids were intramural; 5.6 0 % submucosal and 59.40 % were located within the corpus of the uterus with only 4.90% located at the lower segment of the uterus. The most popular (85.30 %) pattern of presentation of the nodules was hypoechoic. Table 4illustrates the fibroid classification and location as well as the sonographic pattern whiles Figures 3 and 4 shows samples of pelvic ultrasound images analyzed.

Table 4: Classification, Location and Sonographic pattern of the fibroid

Fibroid characteristics	20-29	30-39	40-49	>49	TOTAL
Fibroid Classification	N (%)	N (%)	N (%)	N (%)	N (%)
Intramural	18(28.60)	34(54.00)	10(15.90)	1(1.60)	63(44.00)
Subserosa	11(29.70)	22(59.40)	4(10.80)	0(0.00)	37(25.90)
Pendunculated	2(18.20)	5(45.50)	3(27.30)	1((9.10)	11(7.70)
Mixed	3(12.50)	11(45.80)	10(41.70)	0(0.00)	24(16.80)
Submucosa	2(25.00)	5(62.50)	1(12.50)	0(0.00)	8(5.60)
Location of Fibroid					
Fundus	6(22.20)	14(51.90)	6(22.20)	1(3.7)	27(18.90)
Corpus	19(22.40)	52(61.20)	13(15.30)	1(1.2)	85(59.40)
Lower Segment	5(71.40)	2(28.60)	0(0.00)	0(0.00)	7(4.90)
Mixed	6(25.00)	9(37.50)	9(37.50)	0(0.00)	24(16.80)
Sonographic Pattern					
Hypoechoic	35(28.70)	65(53.30)	20(16.40)	2(1.60)	122(85.30)
Hyperechoic	0(0.00)	9(90.00)	1(10.00)	0(0.00)	10(7.00)
Isoechoic	1(25.00)	2(50.00)	1(25.00)	0(0.00)	4(2.80)
Cystic	0(0.00)	0(0.00)	1(100.00)	0(0.00)	1(0.70)
Mixed	0(0.00)	1(100.00)	5(83.30)	0(0.00)	6(4.20)

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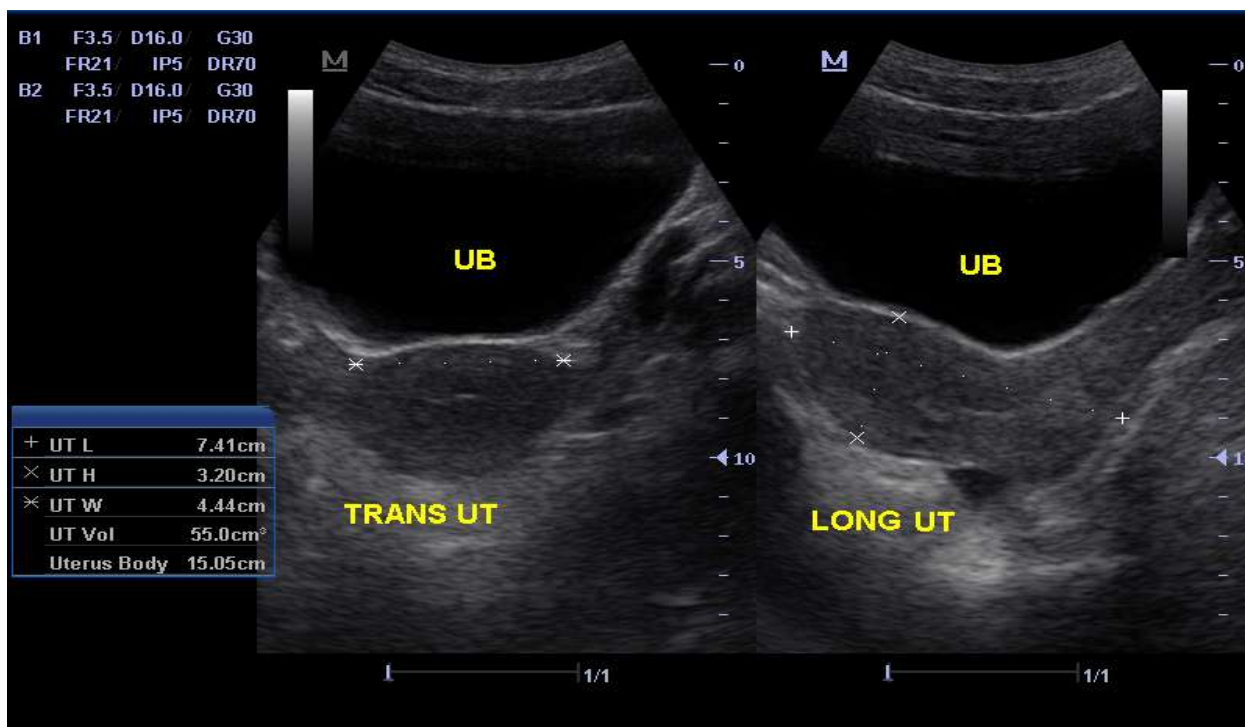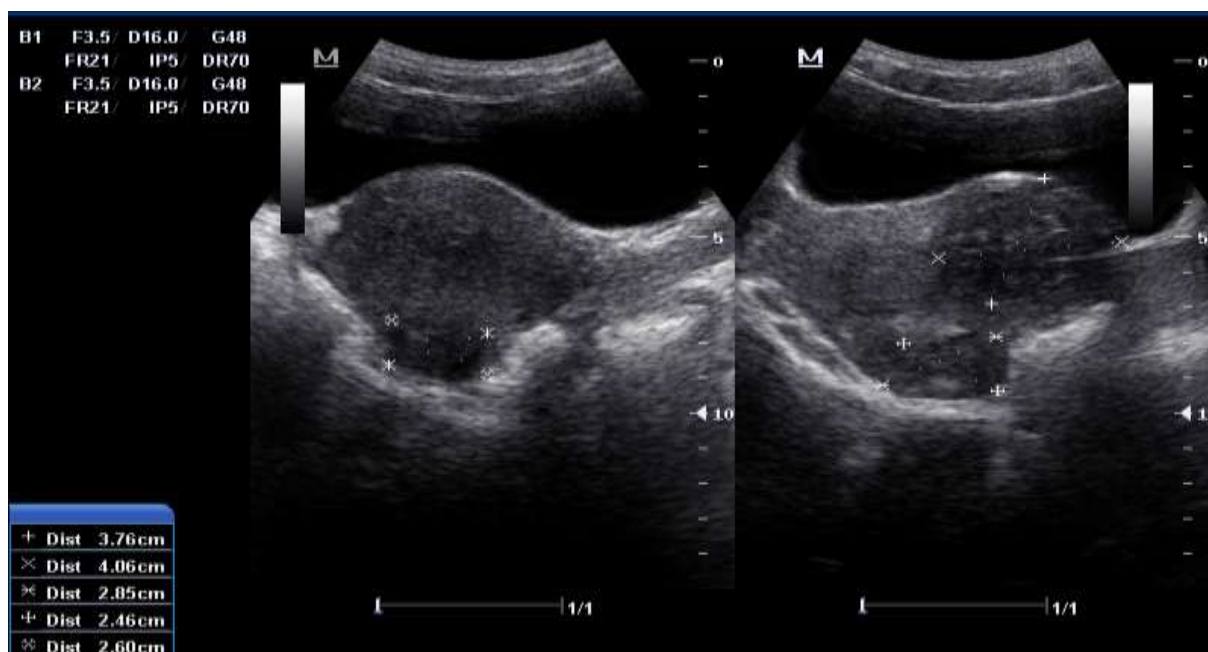Figure 3: A pelvic scan image without fibroid

Figure 4: Pelvic scan image with uterine fibroid

C: Analysis of mean differences and correlation

Analysis of Variance (ANOVA) was carried out to identify whether there was significant difference between the mean uteri volumesof patients with fibroid among the various age groupings. There was significant difference in the mean uteri volumes of patients withfibroid among the four age groups (f= 4.042; p= 0.009). However the mean number of nodules did not show significant difference among the age groups as shown in Table 5.

Table 5: Analysis of variance (ANOVA) of the prevalence of the fibroid characteristics (number of nodules and uteri volumes) among the age groupings

Fibroid Characteristics	Age Group	N	Mean	Std. dev	F-value	P-value
Number of nodules	20-29 years	36	3.11	1.28	1.272	0.286
	30-39 years	77	3.38	1.32		
	40-49 years	28	3.75	1.24		
	>49 years	2	3.50	2.12		
	Total	143	3.38	1.31		
Volume of the uterus					4.042	0.009
	20-29 years	36	99.80	85.47		

Additionally, post-hoc tests were carried out to demonstrate where the differences lay (Bonferroni post-hoc tests). The findings show that there was significance difference between the mean uteri volumes of patients with fibroid in the age groups 30-39 yrs and 40-49 yrs (p= 0.009). However, all the other age groups were not significant as shown in Table 6.

Table 6: Post hoc test (Bonferroni) of the prevalence of the fibroid characteristics (number of nodules and uteri volumes) among the age groupings

Dependent Variable	(I) Age Grouping of patients	(J) Age Grouping of patients	Mean Difference (I-J)	P-value	95% C.I.	
Volume of uterus	20-29 years	30-39 years	15.674	1.000	-49.194	80.543
		40-49 years	-71.329	0.125	-152.953	10.296
		>49 years	99.798	1.000	-133.123	332.719
	30-39 years	20-29 years	-15.674	1.000	-80.543	49.194
		40-49 years	-87.0032*	0.009	-158.834	-15.172
		>49 years	84.123	1.000	-145.549	313.796
	40-49 years	20-29 years	71.329	0.125	-10.296	152.953
		30-39 years	87.0032*	0.009	15.172	158.834
		>49 years	171.127	0.319	-63.829	406.082
	>49 years	20-29 years	-99.798	1.000	-332.719	133.123
		30-39 years	-84.123	1.000	-313.796	145.549
		40-49 years	-171.127	0.319	-406.082	63.829

Pearson's correlation was used to determine significant relationships between age of patients and fibroid characteristics (diameter of largest nodule, uteri volumes, and number of nodules). Significant correlations were found between age and diameter of largest nodules (r = 0.209; p = 0.012) and number of nodules (r = 0.208; p= 0.012).Chi-square analysis showed significant association between age group and diameter of largest nodules (p = 0.025), location of fibroid (p = 0.050) and sonographic pattern (p = 0.009).

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DISCUSSION

A. Demography and Fibroid

A total of 584 trans-abdominal pelvic ultrasound scanned images of women were analyzed out of which 143 representing 24.50% were confirmed to have fibroid. The finding is consistent with available data[20] which suggest that fibroids are the most common pelvic tumour in women, causing symptoms in approximately 25% of reproductive age women with the overall prevalence of fibroids increasing to over 70%.

The mean, standard deviation and range of the age of the sampled population (confirmed fibroid cases; n = 143) were 35.03 years, 6.64 and 21-54 years respectively. The study indicated that the highest prevalence (53.80%) of the fibroid cases was found among women aged 30-39 years and the lowest (1.40%) recorded among women aged greater than 49years. The current study showed that women aged between 20-29 years also recorded significant percentage of 25.20% of fibroid. The above results agree with similar findings conducted elsewhere[20, 21] which suggest that uterine fibroid by sonography is very common among women in their late 30's and 40's and usually shrink after menopause with a prevalence of two to five times more in black women than white women. This study however, is in contrast with that of Lurie *et a.l,* (2005)[22] which estimated the prevalence of uterine fibroid as 4% in women aged 20-30 years, 11 to 18% in women between 30-40 years and 33% in women between 40-60 years. Having fibroids much younger may be related to a strong family history and the increased risk of uterine leiomyoma in people of African descent. In the lower age group, this may result in infertility and problems with childbearing. The recorded situation in Ghana is worrying in view of health and other risk implications. Fibroid has social, economic and medical implications in the women populace. Premenopausal women (18-45yrs) in Ghana constitute about 40% of the Ghanaian population[23] and are strong component of the country's workforce and thus contribute immensely to the economy. Their role in the development of the economy therefore cannot be over emphasised. The Ghanaian woman is engaged in government and non-governmental businesses and has seen a tremendous growth which is an indication that women are gradually taking up more equally demanding responsibilities aside their traditional roles[24]. Therefore managing the health of the Ghanaian woman is essential for the socio-economic growth of the country.

Fibroids can cause a wide range of clinical symptoms such as heavy menstrual periods, pressure symptoms to surrounding organs and infertility problems[25] and are associated with spontaneous miscarriages [26]. Fibroid tumours are asymptomatic and could be associated with menorrhagia, pelvic pain, urinary obstructive symptoms, infertility, and pregnancy loss[27].The clinical convention symptoms and the need for treatment are directly linked to the type of fibroid, the position of the fibroid, and the size of the fibroid[27].

B. Fibroid Characteristics

The average number of fibroid nodules, diameter and volume of the largest nodule were estimated as, 3.38, 4.31cm and 154.74 cm^3 respectively. In women of child bearing age this may be associated with frequent miscarriages and may also be a cause of dysmenorrhea and menorrhagia. Significant correlations were found between age and diameter of largest nodules (r = 0.209; p = 0.012) and number of nodules (r = 0.208; p= 0.012). This lends credence to the fact that fibroids are responsive to the reproductive

hormones estrogen and progesterone [28]. In premenopausal women, larger fibroid sizes are expected. Growing evidence [6] suggest that fibroids grow from tiny uterine muscle cells and may be initially diagnosed by an imaging procedure as small nodules and can grow to larger sizes where they are palpated through the abdominal wall with size ranging from 2 to 7.5 cm. Moreover, fibroids can be present without showing any symptom in many women and on the average, six to seven fibroid nodules may be detected on the affected uterus [20].The average number (3.38) of nodules recorded in the sample population is lower than reported. Evidence from other studies also indicates that black women are more likely to have larger and more symptomatic tumors than white women [29]

The results presented herein show that there were significant association between age group and diameter of largest nodules (p = 0.025), location of fibroid (p = 0.050) and sonographic pattern (p = 0.009) and is confirmed by Evans and Brunsel (2007) [26] who observed that uterine fibroid increases with age and may occur in 30% of women between 40-60 years of age.

The results of the study also indicated that 63 out of 143 (44 %) of the fibroids were intramural with only 5.60% been submucosal. Fibroids are muscular in origin which therefore follows that they may be more intramural leiomyoma's compared to the rest. Most (59.40%) of the fibroids were located within the corpus of the uterus with only 4.9 % located at the lower segment of the uterus. The corpus is the commonest site for location of intrmural fibroids and corroborates the results of earlier studies. The most popular (85.3%) pattern of presentation (sonographic) of the nodules was hypoechoic. The hypo echogenic nodules reflect the younger age of onset and thus less calcification in the nodules. Fibroid nodules are mostly determined in different locations inside the uterus, within the walls of the uterus or out of the uterus[27, 30]. Intra-mural fibroids located entirely within the uterine wall are noted to be the most common classification. This was consistent with the current study. Sub-mucosal fibroids which recorded the least (5.6%) is located beneath the mucosa or the endometrial lining of the uterus which is indirectly adjacent to the uterine cavity and are clinically noted [27,30] as the greatest cause of irregular bleeding and reproductive out comes due to their closeness to the endometrium and also distort the endometrial lining based on their size. This often results in problems with implantation of the embryo and bleeding. Sub-serosal fibroids recorded the second highest (25.9%). It lies beneath the serosa as they are located at the outer layer of the uterus and distend to distort the outer contour of the uterus. The pedunculated which recorded 7.7% of all the fibroid cases are noted to be attached to the uterus by a stalk and usually grow bigger into the abdomen[27]. Hypo echoic pattern of fibroid nodules was the most common recorded fibroid (85.3%). This finding was consistent with previous studies [31]as themost common (79%) echo pattern noted in diagnosed fibroid nodules using sonography and followed by mixed (heterogeneous) echo texture (14.3%).   Child bearing plays a pivotal role in the Ghanaian family[32] system which makes infertility a key health and social concern because women in this category could face stigmatization. Fibroids create marital problems relating to intercourse due to frequent and excessive bleeding, blood changes associated with menstrual cramps and heavy bleeds and therefore a health condition that requires attention.

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The study has shown the prevalence rate of fibroid among Ghanaian women as 24.5% and the most popular (85.3%) pattern of presentation of the fibroid nodules among the Ghanaian women washypoechoicwith 44% of the fibroids been intramural. The presented hereincould aid in appropriate surgical interventions that will contribute to the provision of high-quality care in the country. The findings of this study demonstrate the importance of creating awareness on fibroid among the clinicians in Ghana in order to improve the quality of diagnosis and the need of implementing appropriate quality measures that will contribute to the provision of high-quality care in the country.

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Figure Legend
Figure 1: A transverse section of the uterus with the various classifications of fibroids (Courtesy center for uterine fibroid [20])
Figure 2: Ratio of patients confirmed with fibroid to those without fibroid
Figure 3: A Pelvic scan image without fibroid
Figure 4: A Pelvic scan image with uterine fibroid