

Possible Association Between Lipid Profile and Uterine Fibroid Size

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Abstract— Background: Uterine fibroids are the commonest benign tumors of the female reproductive tract and represent a major cause of gynecological morbidity in women of reproductive age. metabolic disorders, particularly dyslipidemia and obesity may play a role in fibroid development and growth but the relationship remains incompletely understood. **Aim of the study:** To evaluate the relationship between serum lipid profile and uterine fibroid size among women diagnosed with uterine fibroids. **Patients and methods:** cross-sectional study was conducted at Babil Teaching Hospital of Maternity and children, Iraq, from January 2025 to August 2025. A total of 80 women aged 18–50 years with ultrasonographically confirmed uterine fibroids were included. Demographic and clinical data, anthropometric measurements, and pelvic ultrasound findings were recorded. Fasting venous blood samples were collected to assess total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides. **Results:** The mean age of patients was 37.2 ± 4.8 years. Most participants were overweight or obese (85%), with a mean BMI of 29.1 ± 4.9 kg/m². Intramural fibroids were the most common type (55%), and the mean fibroid size was 4.8 ± 2.1 cm. Elevated total cholesterol was found in 57.5% of patients, high LDL in 50%, low HDL in 65%, and elevated triglycerides in 42.5%. Women with large fibroids (≥ 5 cm) had significantly higher total cholesterol and LDL levels and significantly lower HDL levels compared with those with smaller fibroids ($p < 0.05$). Fibroid size showed a significant positive correlation with total cholesterol ($r = 0.33$, $p = 0.004$) and LDL ($r = 0.36$, $p = 0.002$), and a significant negative correlation with HDL ($r = -0.28$, $p = 0.012$). **Conclusions:** Dyslipidemia was highly prevalent among women with uterine fibroids. Larger fibroid size is significantly associated with higher lipid levels and lower HDL.

Keywords— Lipid Profile, Uterine, fibroid, Gynecology and Obstetrics.

I. INTRODUCTION

A fibroid is a benign tumour of uterine smooth muscle termed a leiomyoma. The gross appearance is of a well-demarcated, firm, whorled tumour.

Such fibroids are highly prevalent, being found in approximately 40% of women overall, and are more common in those who are nulliparous, obese, have a family history or are of African descent (Yang *et al.*, 2022). They are usually multiple and can substantially increase the size of the uterus. Fibroids are classified according to their location in relation to the uterine wall (Al-Hendy *et al.*, 2023). A typical leiomyoma is well demarcated and surrounded by a pseudocapsule of connective tissue. The tumor's blood supply traverses this capsule and branches radially into the fibroid (Borahay *et al.*, 2022). While many individuals with uterine fibroids are asymptomatic, some may experience heavy menstrual bleeding or dysmenorrhea. Larger fibroids can press on the bladder, causing frequent urination, dyspareunia (painful intercourse), or lower back pain. In rare cases, fibroids may contribute to infertility (Kumar *et al.*, 2021).

Uterine fibroids may be a major cause of morbidity in females during childbearing years. Although the exact cause of uterine fibroid is still unclear, some of the risk factors associated with development of uterine fibroids are age, early menarche, reduced fertility, alcohol and caffeine consumption, family history [i.e., Hereditary], obesity, hypertension and diabetes mellitus (Giuliani *et al.*, 2020). It has been reported to occur in 20–40% of women during reproductive life and in as many as 70% of uteri removed at the time of hysterectomy (Li B *et al.*, 2023).

The development of UFs is associated with a change from a normal myometrial cell to a mutated cell with the potential for further division. Numerous factors, including genetic, hormonal, immunologic, environmental and lifestyle factors, might contribute to fibroids' growth and development (Navarro *et al.*, 2021). A greater understanding of diverse pathogenesis pathways is required to enable effective prevention and management measures to lessen the health, economic, social, and psychological impact of these tumors (Bulum *et al.*, 2025).

Recently, growing scientific interest has centered on the role of metabolic disorders—particularly dyslipidemia and obesity—in the development and progression of leiomyomas. Adipose tissue accumulation promotes heightened peripheral aromatization, increasing bioavailable estrogen levels that stimulate fibroid cell division and excessive extracellular matrix deposition. Furthermore, dyslipidemia is closely linked to insulin resistance, chronic low-grade systemic inflammation, and elevated reactive oxygen species (ROS), which collectively cultivate a permissive, pro-tumorigenic microenvironment for smooth muscle proliferation. Cholesterol also acts as a crucial biosynthetic precursor for the steroid hormones driving tumor advancement (Yang *et al.*, 2021, Yang *et al.*, 2020, Yang *et al.*, 2024).

Despite these plausible pathways, the direct correlation between specific serum lipid components and the physical enlargement of these tumors requires further investigation. Clinical evaluations often yield inconsistent results regarding how low-density and high-density lipoproteins influence tumor dimensions. Consequently, this cross-sectional study primarily aims to evaluate the relationship between serum lipid profile parameters—specifically total cholesterol, low-

density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides—and uterine fibroid size among diagnosed women. Ultimately, this research seeks to clarify whether an atherogenic lipid pattern serves as a driving factor for fibroid expansion.

II. METHODS

Study Design

Cross-sectional study designed to assess the possible association between serum lipid profile parameters including total cholesterol (TC), low-density lipoprotein (LDL), high-density lipoprotein (HDL) and triglycerides (TG) and the presence of uterine fibroids and their relation with fibroids size.

Study Setting

The study was conducted at Babil Teaching Hospital of Maternity and Children, Iraq, over a period of 8 months, from January 2025 to August 2025. Data collection was conducted after obtaining approval from the Iraqi Board of Medical Specializations / Scientific Council of Gynecology and Obstetrics. The study included a total of 80 women attending the gynecology outpatient clinic at the hospital during the study period who were presented with Abnormal menstrual bleeding and were diagnosed with uterine fibroids, confirmed by ultrasound which is done by expert sonographer using SAMSUNG USS-HS6NL40/WR(Korea,2021).

Ethical approval

1. The study protocol was approved by the Iraqi Board of Medical Specializations / Scientific Council of Gynecology and Obstetrics. (the number of the approval is 675A on 5-12-2024).
2. Verbal consent was obtained from all the patients.
3. Administrative approvals were taken from committee at Babil Teaching Hospital of Maternity and children.

Inclusion Criteria

1. Women aged 18–50 years
2. Women diagnosed with uterine fibroids by ultrasound
3. Chronic medical disease (diabetes mellitus, hypertension, thyroid disorders, PCO, or familial dyslipidemia).
4. Women on hormonal treatment
5. Pregnant women.
6. Women with body mass index more than 40.

Sample Collection

Venous blood samples (5 ml) were collected under aseptic conditions by laboratory personnel after 9–12 hours of overnight fasting. Participants were instructed to avoid high-fat meals the day prior to the test.

Venipuncture was performed using a sterile needle and syringe. The collected samples were immediately sent to the hospital laboratory for analysis. Lipid parameters (total cholesterol, HDL, LDL, triglycerides) were measured using an automated biochemical analyser available at the hospital.

Data Collection

A structured questionnaire (Appendix) was prepared for each patient and was filled after verbal consent is taken from

each patient prior to taking the blood sample for lipid profile, containing:

- Demographic data included including age, marital status, history of infertility, parity, menstrual history and family history.
- physical examination and assessment: 1-General examination. 2-Anthropometric data:
 - Height: the standing height of a woman is measured from the crown of her head to her heels.
 - Weight: using a portable digital scale, the weight was determined in kilograms. o The BMI was determined using the following equation: o BMI = body weight in kilograms / height in meters (m²)
 - 3-Vital signs (blood pressure, pulse rate, respiratory rate, and body temperature)
- Ultrasound Assessment: Uterine fibroids were confirmed and measured via transabdominal or transvaginal ultrasound. The largest diameter (in cm) of the dominant fibroid was recorded.
- Laboratory variables of lipid profile: the laboratory reference values were used as the following:
 - Total cholesterol: < 200 mg/dL
 - Low-density lipoprotein (LDL): < 130 mg/dL
 - High-density lipoprotein (HDL): > 50 mg/dL
 - Triglycerides: < 150 mg/dL

After completing the data collection in the paper questionnaires all the patients' data was transformed into a Microsoft excel work sheet and sent for further statistical analysis.

Statistical Analysis

Data analysis was done using IBM® Statistical Package for Social Sciences (SPSS) version 27 for Microsoft® Windows 11, results were presented in simple measures of frequency, percentage, mean, range and standard deviation and illustrated as tables and figures.

Associations were tested using the independent samples t-test for continues variables and chi-square test or Fisher's exact test for associations between categorical variables.

Pearson's correlation coefficient was used to assess the relationship between fibroid size and lipid profile parameters (total cholesterol, LDL, HDL, triglycerides). A p-value < 0.05 was considered statistically significant.

III. RESULTS

A total of 80 women aged 18 to 50 years diagnosed with uterine fibroids were included in the study. As shown in Table 3.1. The mean age of patients was 37.2 ± 4.8 years, with the largest proportion in the 31–40-year age group (45%). The majority were multiparous (92.5%), and had no history of infertility (82.5%).

A positive family history of fibroids was reported by 25% of women. Regarding body mass index (BMI), 42.5% were overweight and another 42.5% were obese, with a mean BMI of 29.1 ± 4.9 kg/m². Show in Table 3.1.

Table 3.2. showed the characteristics of the uterine fibroids.

TABLE 3.1: Demographic and clinical characteristics of the sample (n = 80)

Variable	Value n (%)
Age (years)	
18–30	14 (17.5%)
31–40	36 (45%)
41–50	30 (37.5%)
mean $\pm$ SD	37.2 $\pm$ 4.8
Parity	
Nulliparous (P0)	6 (7.5%)
Multiparous (P1–P5)	74 (92.5%)
History of infertility	
Yes	14 (17.5%)
No	66 (82.5%)
Family history of fibroid	
Yes	20 (25%)
No	60 (75%)
BMI (kg/m²)	
Normal (<25)	12 (15%)
Overweight (25–29.9)	34 (42.5%)
Obese (30–40)	34 (42.5%)
(mean $\pm$ SD)	29.1 $\pm$ 4.9

TABLE 3.2: Characteristics of uterine fibroids among the patients

Variable	Value n (%)
Number of fibroids	
Single	54 (67.5%)
Multiple	26 (32.5%)
Size of dominant fibroid	
<3 cm	13 (16.3%)
<5 cm	44 (55%)
>5 cm	23 (28.7%)
mean $\pm$ SD	4.8 $\pm$ 2.1 cm
Location	
Submucosal (FIGO 0,1,2)	16 (20%)
Intramural (FIGO 3,4)	44 (55%)
Subserosal (FIGO 5,6,7)	20 (25%)

TABLE 3.3: Distribution of lipid profile values of the patients with fibroid

Lipid Parameter	Mean $\pm$ SD (mg/dL)	Abnormal n (%)	Reference Range
Total Cholesterol	198.6	46 (57.5%)	< 200 mg/dL
LDL	144.3	40 (50%)	< 130 mg/dL
HDL	42.1	52 (65%)	> 50 mg/dL
Triglycerides (TG)	166.9	34 (42.5%)	< 150 mg/dL

TABLE 3.4: Comparison of lipid profile between small (<5 cm) and large ($\geq$ 5 cm) fibroids

Lipid Parameter	1–5 cm (n = 57)	5–12 cm (n = 23)	p-value
Total Cholesterol	192.4 $\pm$ 18.6	211.5 $\pm$ 23.4	0.008*
LDL	137.8 $\pm$ 20.9	159.6 $\pm$ 26.8	0.011*
HDL	43.5 $\pm$ 7.9	38.6 $\pm$ 9.1	0.037*
Triglycerides	162.2 $\pm$ 37.4	178.7 $\pm$ 42.5	0.089

*Statistically significant at p < 0.05

TABLE 3.5: Correlation between lipid profile and fibroid size (cm)

Lipid Parameter	Pearson's R	p-value
Total Cholesterol	0.33	0.004*
LDL	0.36	0.002*
HDL	-0.28	0.012*
Triglycerides	0.21	0.063

*Statistically significant at p < 0.05.

Most women (67.5%) had a single fibroid, while 32.5% had multiple fibroids. The mean size of the dominant fibroid was 4.8 $\pm$ 2.1 cm.

Intramural fibroids were the most common location (55%), followed by subserosal (25%) and submucosal (20%) types.

The lipid profile of the patients was showed in Table 3.3. The mean total cholesterol level was 198.6 mg/dL, with 57.5%

of women exceeding the normal reference limit of < 200 mg/dL.

LDL was elevated in 50% of cases, with a mean of 144.3 mg/dL. The mean HDL level was 42.1 mg/dL, and 65% had values lower than 50 mg/dL. Triglycerides were elevated in 42.5% of women, with a mean value of 166.9 mg/dL.

Patients with large fibroids ($\geq$ 5 cm) showed significantly higher levels of total cholesterol (211.5 $\pm$ 23.4 mg/dL vs. 192.4 $\pm$ 18.6 mg/dL, p = 0.008) and LDL (159.6 $\pm$ 26.8 mg/dL vs. 137.8 $\pm$ 20.9 mg/dL, p = 0.011), and lower HDL (38.6 $\pm$ 9.1 mg/dL vs. 43.5 $\pm$ 7.9 mg/dL, p = 0.037). Although triglyceride levels were higher in the large fibroid group, the difference did not reach statistical significance (p = 0.089). As showed in table 3.4.

Table 3.5. showed the correlations between lipid profile parameters and fibroid size. Statistically significant positive correlations were found between fibroid size and both total cholesterol (r = 0.33, p = 0.004) and LDL (r = 0.36, p = 0.002).

HDL was negatively correlated with fibroid size (r = -0.28, p = 0.012). Triglycerides showed a weak positive correlation (r = 0.21) but did not reach statistical significance (p = 0.063).

IV. DISCUSSION

The current study found that 85% of patients were either overweight or obese, with a mean BMI of 29.1 $\pm$ 4.9 kg/m². This high prevalence of excess body weight supports the hypothesis that obesity contributes to fibroid development through increased peripheral conversion of androgens to estrogen in adipose tissue. Elevated estrogen levels, along with insulin resistance and chronic inflammation associated with obesity that may enhance fibroid growth and progression. This is consistent with (Qin *et al.*, 2021). Study that found a significant positive association between obesity and the risk of uterine fibroids and that Women with the highest BMI had about a 19% higher risk compared with those of normal BMI (OR = 1.19). Also, substantial weight gain since age 18 was associated with an increased risk of UFs (OR = 1.26). they concluded that obesity is an important risk factor for uterine fibroids.

Most women in this study had a single fibroid (67.5%), while 32.5% had multiple fibroids. The mean size of the dominant fibroid was 4.8 $\pm$ 2.1 cm, with more than half of the cases having fibroids measuring 3–5 cm. Intramural fibroids were the most common type (55%), followed by subserosal (25%) and submucosal (20%) fibroids. This is consistent with (Ahmed *et al.*, 2025) study that found that intramural fibroids were the most common type, affecting 50% of patients, followed by subserosal fibroids in 25%. in their study most fibroids were found on the anterior uterine wall (59.38%), while posterior wall and lateral wall fibroids accounted for 23.44% and 17.19% of cases, respectively(14).

Analysis of the lipid profile showed a high prevalence of dyslipidemia among women with fibroids. More than half of the patients (57.5%) had elevated total cholesterol, half (50%) had high LDL, and 65% had reduced HDL levels. Additionally, 42.5% had elevated triglycerides. These findings suggest that lipid metabolism abnormalities are common in

women with uterine fibroids and may play a role in tumor growth through hormonal modulation, oxidative stress, and inflammatory pathways.

These results align with a previous study in Babil Teaching Hospital for Maternity and children by Turkey BN, Rubayae. that included 100 women diagnosed with uterine fibroids by ultrasound, divided into two equal groups based on fibroid size: large fibroids ($\geq 5 \text{ cm}^3$) and small fibroids ($< 5 \text{ cm}^3$) and found a significant difference in lipid profile parameters between the two groups and that women with large fibroids had significantly lower high-density lipoprotein levels and significantly higher low-density lipoprotein and total cholesterol levels compared with women with small fibroids ($p < 0.001$). but their study found no significant differences between the groups regarding very low-density lipoprotein or triglyceride levels.

Another study by (Afruz *et al.*, 2020) also found that Women with uterine fibroids had significantly higher serum total cholesterol and triglyceride levels, along with significantly lower HDL-C levels, compared with controls ($p < 0.05$) and that the mean atherogenic index was also significantly higher in the fibroid group than in the control group (4.30 ± 1.41 vs 2.86 ± 0.97 ; $p < 0.05$). they concluded that there is a clear association between dyslipidemia and uterine fibroids, with affected women demonstrating a more atherogenic lipid profile.

The current study showed that women with large fibroids ($\geq 5 \text{ cm}$) had significantly higher total cholesterol and LDL levels and significantly lower HDL levels compared to those with smaller fibroids. These results indicate a strong association between atherogenic lipid patterns and fibroid enlargement. Although triglyceride levels were higher in the large fibroid group, the difference was not statistically significant, suggesting that triglycerides may have a weaker or indirect influence on fibroid growth.

Possible biological mechanisms connecting dyslipidemia to fibroid growth are plausible. Cholesterol is the biosynthetic precursor for steroid hormones (including estrogens and progestogens) that drive leiomyoma growth; elevated LDL may promote oxidative stress and smooth-muscle cell proliferation, while low HDL reduces anti-inflammatory and antioxidant buffering. Moreover, metabolic syndrome, insulin resistance, and chronic low-grade inflammation often accompany dyslipidemia and obesity and can create a permissive microenvironment for tumor growth (sandeepa *et al.*, 2022).

The current study showed that fibroid size have a significant positive correlation with total cholesterol ($r = 0.33$) and LDL ($r = 0.36$), and a significant negative correlation with HDL ($r = -0.28$). These relationships indicate that higher cholesterol and LDL levels are associated with increased fibroid size, while protective HDL levels decrease as fibroid size increases. Triglycerides showed only a weak, non-significant correlation with fibroid size. dyslipidemia may contribute not only to the presence of fibroids but also to their progression and enlargement. those results are in line with Turkey BN, Rubayae (Lin *et al.*, 2023).

Another study by (Sharami *et al.*, 2019) also found that cholesterol levels were significantly higher in the uterine fibroid case group and that age and LDL-cholesterol were the only factors positively associated with the development of uterine fibroids and fibroid size.

While a study by Wu (et al., 2025) aimed to assess the causal effects of blood lipids and lipid-lowering drugs on uterine fibroids (UFs) found that higher HDL-cholesterol levels were protective against UFs (OR = 0.88), while higher triglyceride levels increased UF risk (OR = 1.14). And that inhibition of cholesteryl ester transfer protein (CETP) reduced UF risk (OR = 0.95). they suggest a causal role of HDL-C and TG in UF development and highlight CETP inhibition as a potential protective mechanism.

Not all prior studies are consistent a study by (Sadlonova et al., 2008) found that women with uterine fibroids showed significantly higher serum HDL-cholesterol levels compared with controls. and also women with fibroids also had significantly lower LDL-cholesterol levels than controls. they found a positive correlation between the volume of the largest fibroid and HDL-cholesterol levels in this age group (30-45 years) and no significant differences in insulin resistance parameters between women with and without fibroids.

V. CONCLUSIONS

Larger fibroid size was significantly associated with higher total cholesterol and LDL levels and lower HDL levels, suggesting a possible metabolic influence on fibroid growth. These findings support the hypothesis that dyslipidemia may contribute to the progression and enlargement of uterine fibroids. Therefore, lipid profile assessment may be valuable in the clinical evaluation of women with fibroids, and early identification of metabolic abnormalities could assist in improving patient management and reducing disease burden. Larger fibroid size was significantly associated with higher total cholesterol and LDL levels and lower HDL levels, suggesting a possible metabolic influence on fibroid growth.

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