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Systematic Review of Frequency of Uterine Fibroids and Risk Factors Associated With It in Females of Reproductive Age Detected Through Ultrasound

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ABSTRACT

BACKGROUND: Uterine fibroids are the most common non-cancerous tumors in the reproductive system of females, mainly affecting women of reproductive age. These fibroids are also called leiomyoma's, Even though they are widely spread, the fibroid occurrence and its related risk factors are different significantly across multiple groups. Ultrasound is widely available, non- invasive, easy, non-corrosive and accessible imaging method for identifying and assessing uterine fibroids.
OBJECTIVE: This systematic review aims to estimate the frequency of uterine fibroids and identify the risk factors associated with it, in women of reproductive age, through ultrasound imaging.
METHODS: A thorough search was carried out in electronic databases, including google scholar and PubMed for studies published up to year 2022. The inclusion criteria consisted of observational studies that reported the prevalence of uterine fibroids and related risk factors in women aged 15 to 49, using ultrasound as the diagnostic method.
RESULTS: Initial findings show a wide range in fibroid prevalence, from 10% to over 60%, significantly influenced by age, ethnicity, and study location. Risk factors frequently linked to higher fibroid prevalence include increasing age, family history, null parity, obesity, and high exposure to estrogen. The variation in prevalence highlights the need for standardized ultrasound criteria and tailored risk profiles for different populations.
CONCLUSION: Uterine fibroids are very common among women of reproductive age, with several modifiable and non-modifiable risk factors. Ultrasound continues to be an important tool for early detection. Raising awareness and improving screening processes are critical, especially for high-risk groups, to reduce potential reproductive and health issues.
Keywords: Uterine Fibroids, Leiomyoma, Prevalence, Ultrasound, Risk Factors, Reproductive Age.

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INTRODUCTION

Uterine fibroids are benign smooth muscle tumors of the uterus. They are also called as leiomyomas and in women of reproductive age they represent the most common pelvic tumors (1). Globally, they affect an estimated 20% to 70% of women, with prevalence varying depending on different factors like population studied and diagnostic methods used (2)(3). Although many fibroids are asymptomatic, their presence can lead to a wide range of symptoms including abnormal uterine bleeding, pelvic pain, infertility, and recurrent pregnancy loss (4) (5) .

Ultrasound, particularly transabdominal and transvaginal sonography, is the most widely used imaging modality for the detection and evaluation of uterine fibroids due to its accessibility, safety, and cost-effectiveness (6). It allows accurate assessment of fibroid size, number, location, and vascularity, making it a key tool in both clinical diagnosis and epidemiological research (7).

The frequency of fibroids is influenced by various risk factors including age, race, genetic predisposition, hormonal influences, obesity, and reproductive history (8). Studies have shown that African and African-American women are worst affected, often developing fibroids at younger ages and with greater severity compared to women of other ethnicities (9). Additionally, nulliparity, early menarche, high body mass index (BMI), and a family history of fibroids have been consistently associated with increased risk (10).

Despite their high prevalence and clinical impact, uterine fibroids remain underdiagnosed in many regions, particularly where imaging resources are limited. Furthermore, variability in risk factor analysis, study design, population characteristics, and ultrasound criteria contributes to inconsistent prevalence data. Most available studies are cross-sectional, so There is a need for longitudinal, ultrasound-based cohort studies to track fibroid development and progression over time. Studies focusing on symptomatic patients may underestimate the true burden of fibroids. Asymptomatic cases, often detected only through routine imaging, are underrepresented, affecting overall prevalence and risk estimation. Hence, a systematic review is essential to synthesize the available evidence, quantify the frequency of uterine fibroids detected via ultrasound, and elucidate the associated risk factors in women of reproductive age. This review aims to provide a deep understanding of uterine fibroids and their determinants, with a focus on sonographic diagnosis, to provide more effective screening and management strategies.

P (Population) Females of reproductive age (15–49 years)

I (Intervention)sonographic assessment of uterine fibroids and associated risk factors
C (Comparison) Women without uterine fibroids or with differing risk factor profiles
O (Outcome) Frequency of uterine fibroids and its associated risk factors

METHODS

STUDY DESIGN: The review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA).

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SEARCH STRATEGY: Databases such as PubMed and Google Scholar, were used to conduct a complete search of these databases over a period of 2008 to 2022. Search words Uterine fibroids, leiomyoma, prevalence, ultrasound, risk factors or reproductive age were used with their Boolean equivalents in order to access the relevant articles. Only English-based, peer-reviewed investigations of humans were turned to search results, and the results were excluded manually.

INCLUSION CRITERIA:

Studies including females of reproductive age (15–49 years)
Studies from any geographical region or ethnic group
Studies that use ultrasound (transabdominal or transvaginal) as the primary imaging modality for detecting uterine fibroids
Cross-sectional studies reporting prevalence or associated risk factors
Systematic reviews and meta-analyses relevant to fibroid prevalence or risk factors using ultrasound data
Studies analyzing one or more risk factors associated with fibroid development (e.g., age, BMI, race, parity).
Studies published within the last 20 years (e.g., 2005–2025), unless a landmark study older than that is highly relevant.

EXCLUSION CRITERIA:

Studies focusing exclusively on postmenopausal women or pediatric/adolescent populations outside reproductive age
Studies using only clinical diagnosis, MRI, or histopathology without ultrasound confirmation
Case reports, editorials, conference abstracts, letters to the editor, and expert opinions.
Studies with insufficient data on prevalence or without analysis of risk factors
Studies not reporting uterine fibroid frequency or lacking investigation into risk factors
Studies focusing solely on fibroid treatment without any epidemiological context

DATA EXTRACTION:

The following data was noted using the structured data extraction form: author (s), date of publication, country, study design, sample size, age, and type of ultrasound (transabdominal, transvaginal), major ultrasound parameters such as size, number and location of fibroids, and the associated risk factors.

RESULTS

This systematic review analyzed data from ten studies encompassing diverse geographical populations, methodologies, and diagnostic tools. Prevalence rates of uterine fibroids varied significantly across studies due to differences in diagnostic approaches, population characteristics, and reporting standards.

Prevalence Estimates:

The prevalence ranged from 21.1% in Slovenia Bizjak & Bečić, 2016 (10) using transvaginal ultrasound, to up to 80% among African-American women, Catherino et

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al., 2013 (9). Studies using ultrasound or imaging consistently reported higher detection rates for example Doherty et al., 2014 reported 70% via imaging vs. 40% clinically.

A large international survey Zimmermann et al., 2012 (4) showed a prevalence up to 40–50%, though this was based on self-reported data and likely underrepresents true rates due to lack of imaging confirmation.

Epidemiological reviews Wise & Laughlin-Tommaso, 2016 (8) and Khan et al., 2014 (1)shows prevalence of >50% by age 50 especially when sensitive diagnostic tools are used.

Variation was observed across ethnic groups, with higher rates among Black women compared to White women in the study Marshall et al., 1997 (2) showed ~60% in Black women, ~30% in White women by age 35, while Stewart & Nowak, 2022 study (2,5) estimates up to 70% by menopause.

Sample sizes varied widely, from 406 (Rovio, 2008) to over 21,000 women (Zimmermann et al., 2012), strengthening generalizability in some cases while emphasizing detailed clinical evaluation in others.

Associated Risk Factors:

Age

All reviewed studies confirmed age as the most consistent and strongest risk factor. Fibroid prevalence increases notably after age 30 and peaks in the late 40s presented by studies Bizjak & Bečić, 2016 (10) and Wise & Laughlin-Tommaso, 2016 (8).

Stewart & Nowak (2022) (5) describe age-related hormonal changes for example increased estrogen exposure as key contributors to fibroid growth.

Race/Ethnicity

Catherino et al. (2013) (9) and Marshall et al. (1997) highlighted that Black women are 2–3 times more likely to develop fibroids and at earlier ages.

Differences in fibroid size, number, and symptom severity were also more pronounced among African American women, indicating potential genetic and epigenetic influences.Body Mass Index (BMI)

High BMI was consistently associated with increased fibroid risk showed in studies Bizjak & Bečić, 2016 (10), Khan et al., 2014 (1) ,Wise & Laughlin-Tommaso, 2016 (8).

Catherino et al. (2013) (9) linked obesity to estrogen excess and inflammatory processes that may promote fibroid growth.

Parity and Reproductive History

Nulliparity (having no children) was linked with higher fibroid risk. Women with higher parity had significantly reduced odds of developing fibroids showed in Khan et al., 2014 (1); Wise & Laughlin-Tommaso, 2016 (8) studies.

Hormonal Contraceptives

Bizjak & Beč(10) found a reduced prevalence among users of combined oral contraceptives. Khan et (1)also suggested a protective hormonal modulation effect of

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contraceptives.

Hypertension

Though not the central focus of most studies, hypertension was occasionally cited as a potential risk factor in studies Doherty et al., 2014 (7); and Wise & Laughlin-Tommaso, 2016 (8).

Genetics

Genetic predisposition was discussed by Stewart & Nowak (2022) (5), citing polymorphisms affecting growth factors and hormonal receptors.

Catherino et al. (2013) (9)pointed to race-specific genetic variations contributing to fibroid pathophysiology.

SUMMARY TABLE

PRISMA Table: Summary of Prevalence, Sample Sizes, and Risk Factors of Uterine Fibroids

No.	Author name	Study Type	Population Details	Sample Size	Detection Method	Prevalence Reported	Key Risk Factors Identified
1	Bizjak & Bečić (2016)	Cross-sectional	Women aged 25–56	485 women	Transvaginal Ultrasound	21.1%	Age, BMI, parity, hormonal contraceptives
2	Zimmermann et al. (2012)	Survey-based	Self-reporting women online	21,746 women	Self-report (survey)	Up to 40–50% (varies)	Symptom variability, underreporting without ultrasound
3	Marshall et al. (1997)	Cohort study	Premenopausal women	1,364 women	Imaging + Clinical data	~60% Black, ~30% White	Race (notably higher in Black women), age

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4	Wise & Laughlin-Tommaso (2016)	Epidemiologic review	Women from menarche to menopause	Review of pooled studies	Pooled clinical + imaging data	Up to 70–80% lifetime	Age, race, BMI, parity, hormonal influence
5	Khan et al. (2014)	Review	General female population	Not specifie d	Literature-based data	>50% by age 50	Age, race, hormonal factors, genetics
6	Stewart & Nowak (2022)	Review	Women of reproductive age	Not specifie d	Review of imaging data	Up to 70% by menopau se	Estrogen exposure, race, age
7	Catherino et al. (2013)	Comparative review	Multi-ethnic populations	Not specifie d	Imaging + pathology	Up to 80% in African American s	Race, genetics, inflammation
8	Doherty et al. (2014)	Review	Women of reproductive age	Not specifie d	Clinical + imaging data	~20–40%	Age, estrogen, environmenta l exposures
9	Rovio (2008)	Thesis/Monogr aph	Finnish cohort	406 women	Ultrasound + surgical data	Not specified, but high	Diagnostic accuracy of ultrasound, surgical correlation

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10	Heinonen et al.	Academic report	Finnish population	Not specifie d	Imaging-based	Not explicitly stated	Ultrasound reliability, general epidemiologi cal factors

DISCUSSION

The studies collectively support that ultrasound is a reliable, non-invasive imaging modality capable of detecting both symptomatic and asymptomatic fibroids in women of reproductive age. Its diagnostic value makes it a gold standard for epidemiologic and clinical research on uterine fibroids.

Demographics and Disparities

The disparity in fibroid prevalence among racial groups particularly Black women is consistent and compelling. Genetic predisposition, coupled with environmental and social determinants, may explain these findings showed in studies Catherino et al., 2013 (9); Marshall et al., (2) .

Age remains the most consistent risk factor across studies Stewart & Nowak, 2022 (5); Wise & Laughlin-Tommaso, 2016 (8).

Hormonal and Reproductive Influences

The protective effects of parity and hormonal contraceptives suggest that hormonal cycling and uterine inactivity during pregnancy might limit fibroid development showed by Khan et al., 2014
(1); Bizjak & Bečić, 2016 (10).

This supports the hypothesis that cumulative estrogen exposure plays a key role in fibroid etiology Doherty et al., 2014 (7).

Metabolic Risk Factors

Obesity's association with fibroid risk suggests systemic inflammation and hormonal imbalance (e.g., elevated estrone from adipose tissue) may drive fibroid growth (Wise & Laughlin-Tommaso, 2016 (8) ; Stewart & Nowak, 2022 (5)).

Clinical Relevance

Despite the high prevalence, many fibroids remain asymptomatic and are found incidentally via ultrasound. Symptoms when present can significantly affect quality of life and may include menorrhagia, pain, infertility, and bulk symptoms (Doherty et al., 2014 (7); Zimmermann et al., 2012 (4)).

Limitations and Future Directions

Several studies (Zimmermann et al. (4), Rovio (11)) acknowledged limitations in population-based sampling and reliance on self-reporting.

Variation in ultrasound quality, operator skill, and fibroid measurement techniques may affect detection rates (Rovio, 2008 (11)).

Future research should explore genomic, hormonal, and inflammatory pathways while

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adopting standardized ultrasound diagnostic protocols to ensure global comparability.

CONCLUSION

The findings from this systematic review highlight that uterine fibroids are a prevalent gynecological condition among women of reproductive age worldwide, with prevalence rates ranging from approximately 21% to as high as 80%, depending on the population studied and diagnostic methods used. Studies utilizing ultrasound consistently reported higher prevalence, underscoring its importance as a sensitive diagnostic tool. Several key risk factors were identified across the reviewed literature, including increasing age, African ancestry, higher body mass index (BMI), nulliparity, hormonal exposure (such as estrogen), and genetic predisposition. Racial and ethnic differences, particularly the disproportionately higher prevalence among Black women, were consistently documented. Importantly, the variation in reported prevalence also reflects differences in study designs, diagnostic criteria, and population demographics. Despite methodological differences, the collective evidence supports the need for increased awareness, early screening (especially through ultrasound), and individualized management strategies to address this widespread condition. Future research should aim for standardized diagnostic protocols and longitudinal studies to better understand the progression and outcomes of fibroids, especially in underserved populations.

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