

Prevalence of Fibromyalgia and Its Associated Factors in Saudi Arabia: An Updated Systematic Review

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Abstract Objectives: Fibromyalgia Syndrome (FMS) is a chronic pain disorder characterized by widespread musculoskeletal pain, fatigue, sleep disturbance, cognitive dysfunction and psychological distress. Epidemiological evidence from Saudi Arabia remains limited and heterogeneous. **Objective:** To synthesize evidence on the prevalence of fibromyalgia in Saudi Arabia and identify associated demographic, psychological, lifestyle and clinical factors. **Methods:** A systematic review was conducted according to PRISMA guidelines. PubMed, Web of Science, Embase and Google Scholar were searched for articles published before 30th June 2026, with no restriction on the earliest publication date. Eligible studies evaluated fibromyalgia prevalence or associated factors among participants in Saudi Arabia using established diagnostic or screening criteria. Prevalence estimates and associated demographic, psychological, lifestyle and clinical factors were synthesized. **Results:** The included studies represented diverse community, university, occupational and patient populations with selected clinical conditions. The pooled prevalence was 11.2% (95% CI, 9.09%-13.73%), with substantial between-study heterogeneity ($I^2 = 87.16\%$). Female sex, anxiety, psychiatric illness, sleep disturbances, chronic comorbidities and lifestyle and occupational factors were associated with fibromyalgia. Variations in diagnostic criteria, sampling strategies and population characteristics may have contributed to heterogeneity. **Conclusion:** Fibromyalgia was prevalent across the populations studied; however, the diversity of the included populations limits interpretation of the pooled estimate as a nationally representative prevalence for Saudi Arabia. However, its occurrence is associated with demographic, psychosocial, clinical and lifestyle factors. Standardized diagnostic criteria and longitudinal studies are needed to improve the comparability of evidence and clarify associated factors.

Key Words Fibromyalgia, Fibromyalgia Syndrome, Prevalence, Saudi Arabia, Associated Factors, Chronic Pain, Sleep Disturbances, Systematic Review

INTRODUCTION

Fibromyalgia Syndrome (FMS) is a chronic pain condition characterized primarily by widespread musculoskeletal pain and commonly accompanied by fatigue, sleep disturbances, cognitive impairment, mood disturbances and a range of somatic symptoms [1]. Over the past two decades, the conceptualization of fibromyalgia has evolved from that of a poorly understood chronic pain condition to that of a complex disorder involving central sensitization, altered nociceptive processing, neuroimmune interactions, autonomic dysregulation and psychosocial factors [2].

Although fibromyalgia is generally not considered a life-threatening disorder and is not characterized by the structural joint destruction or internal organ damage observed in many connective tissue or collagen vascular diseases, it is associated with a substantial physical, psychological, social and

economic burden [3,4]. Patients with fibromyalgia frequently experience reduced quality of life, functional impairment, fatigue, sleep disturbances, anxiety, depression and decreased work productivity, collectively imposing a substantial burden on patients, their families and healthcare systems. Furthermore, fibromyalgia is associated with increased healthcare utilization, frequent medical consultations, medication use and substantial socioeconomic costs despite the absence of demonstrable irreversible tissue damage [5,6].

Rapid modernization and socioeconomic transformation across Middle Eastern countries influence the prevalence, detection and clinical recognition of fibromyalgia by contributing to changes in sedentary behaviour, psychological stress, sleep disturbances, obesity and the burden of chronic diseases, factors that have been associated with fibromyalgia [7,8].

A range of biological, psychological and environmental factors have been associated with the onset, persistence and clinical progression of fibromyalgia [8]. Female sex is consistently identified as an important demographic factor associated with fibromyalgia, with women disproportionately affected compared with men across many epidemiological studies [10]. In addition, chronic medical conditions and autoimmune disorders, particularly rheumatoid arthritis and systemic lupus erythematosus, have been associated with an increased likelihood of fibromyalgia symptoms and features of central sensitization [11,12]. Psychological and psychosocial factors, including anxiety, depression, childhood trauma, adverse life experiences and chronic emotional stress have also been consistently associated with fibromyalgia and may influence pain perception and symptom severity [13,14]. Furthermore, certain personality characteristics, including perfectionism, heightened sensitivity, excessive responsibility and achievement-oriented behavior, have been proposed as potential factors associated with increased vulnerability to stress-related chronic pain conditions, including fibromyalgia [15,16].

A recent systematic review and meta-analysis of studies conducted in Saudi Arabia estimated a pooled prevalence of fibromyalgia Syndrome (FMS) of 13.4%, indicating that fibromyalgia constitutes a considerable health burden rather than an uncommon clinical condition [17]. This prevalence is relatively high compared with the estimated global prevalence 2-8% [18].

Therefore, an updated systematic review of fibromyalgia prevalence in Saudi Arabia is warranted to incorporate new evidence, reassess estimates across population groups, identify associated risk factors and clarify the applicability to the general population [19].

METHODS

Protocol Registration

The present systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (appendix 1) [20]. The review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD520261404505.

Database Sources and Search Strategy

Because a previous systematic review of fibromyalgia in Saudi Arabia was published in 2023, an updated, focused literature search was conducted. A new comprehensive literature search was conducted to identify all relevant studies examining fibromyalgia prevalence in Saudi Arabia published from 2018 until 25th June 2026. The search was performed in PubMed, Embase, web of science and google scholar to identify recently published evidence from Saudi Arabia.

The following search terms were used to identify studies on fibromyalgia in Saudi Arabia and to capture relevant demographic, clinical, psychological, lifestyle and epidemiological factors:

PubMed, MeSH headings, including “Fibromyalgia,” “Saudi Arabia,” and “Risk Factors,” were combined with corresponding free-text terms searched in titles and abstracts. In Embase, Emtree headings corresponding to these concepts were combined with free-text terms searched in titles, abstracts and author keywords. Web of Science Core Collection was searched using free-text terms in the Topic field, encompassing titles, abstracts, author keywords and Keywords Plus, while Google Scholar was searched using shorter free-text queries without controlled vocabulary headings. Across the databases, the fibromyalgia block included “fibromyalgia,” “fibromyalgia syndrome,” “chronic widespread pain,” and “fibromyositis”; the geographic block included “Saudi Arabia” and “Saudi population”; and the third block included “setting,” “outpatient setting,” “community setting,” “general population,” “incidence,” “epidemiology,” “risk factors,” “determinants,” “anxiety,” “depression,” “sleep,” “insomnia,” “trauma,” “obesity,” “chronic diseases,” and “medical conditions.” For PubMed, Embase and Web of Science, alternative terms and applicable controlled vocabulary headings within each block were combined using OR and the three blocks were combined using AND: (fibromyalgia) AND (Saudi Arabia) AND (associated factors or epidemiological characteristics). For Google Scholar, these concepts were translated into multiple shorter queries pairing disease and geographic terms with individual associated-factor or epidemiological terms. Search syntax and field restrictions were adapted to each platform.

Eligibility Criteria

Inclusion Criteria: Studies were eligible for inclusion if they were conducted among populations in Saudi Arabia, enrolled adults aged ≥ 18 years, reported the prevalence of fibromyalgia and/or factors associated with the condition, used recognized diagnostic criteria or validated screening instruments for fibromyalgia and were published in English. Eligible study designs comprised observational studies (cross-sectional, cohort and case-control studies, including prospective or retrospective approaches, as applicable) and randomized controlled trials, provided that they reported relevant epidemiological data. Systematic reviews and other review articles were excluded because this review focused on primary research, thereby avoiding duplication of evidence from underlying studies.

Exclusion Criteria

Studies were excluded if they were systematic or narrative reviews, editorials, letters, conference abstracts, case reports, or animal studies; did not report fibromyalgia prevalence or relevant associated factors; included nonhuman participants; were conducted outside Saudi Arabia; or focused exclusively on treatment outcomes without providing relevant epidemiological data.

Study Selection, Screening and Data Extraction

All records identified through the searches were imported into reference management software and duplicate bibliographic records were removed before screening.

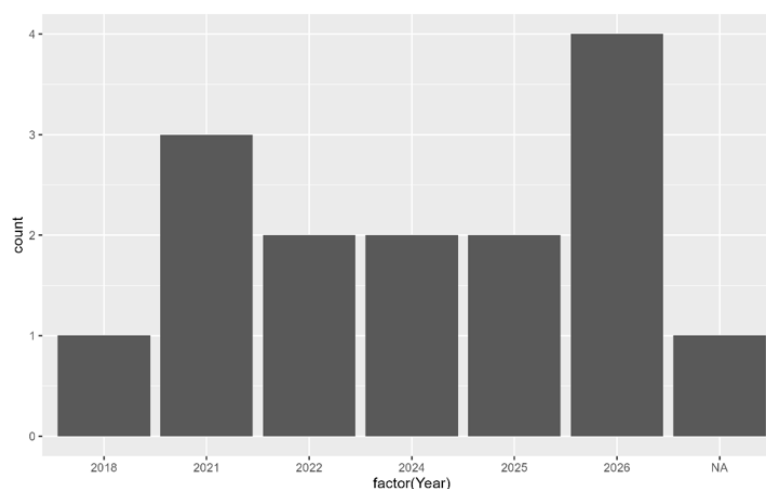


Figure 1: Distribution of the Included Studies by Publication Year

Two reviewers independently screened titles and abstracts and subsequently assessed potentially eligible full-text articles against the prespecified eligibility criteria. Eligible studies reported original data on the prevalence Of Fibromyalgia Syndrome (FMS), assessed using clearly defined diagnostic or screening criteria and/or factors associated with FMS among adults aged ≥ 18 years in Saudi Arabia, including predefined population subgroups. Eligible designs comprised cross-sectional, cohort and case-control studies, whether conducted prospectively or retrospectively and randomized controlled trials reporting relevant data. Systematic and narrative reviews were excluded because they did not provide original participant-level study populations; conference abstracts, editorials, letters, case reports, animal studies and studies conducted outside Saudi Arabia were also excluded. Disagreements were resolved through discussion and consensus, with a third reviewer consulted when necessary. Reasons for full-text exclusion were recorded and the selection process was summarized in the PRISMA flow diagram (Figure 1).

Potential duplicate publications and overlapping study populations were assessed by comparing authorship, institutions, recruitment settings and periods, eligibility criteria, sample sizes and participant characteristics across eligible reports. Shared institutions or recruitment periods prompted further assessment but were not considered sufficient evidence of overlap. No duplicate publications or overlapping populations were identified and the available recruitment and sampling information supported treating the included study populations as independent. Therefore, no reports required merging or exclusion because of population overlap. Data extracted from each included study comprised author and publication year, study design, setting, target population, sample size, diagnostic or screening criteria, prevalence estimates and reported factors associated with FMS. Associated factors were grouped into five domains: demographic, psychological, lifestyle, occupational and clinical or medical.

Quality Assessment of Included Studies

The methodological quality of the included studies was independently assessed by two reviewers using the methodological quality of the included studies was independently assessed by two reviewers using the nine-item Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data (2017 version). Although the eligibility criteria permitted multiple study designs, no cohort or case-control studies met the eligibility criteria for this review. The prevalence checklist was selected to assess the methodological quality of the included prevalence data.

The checklist assessed the appropriateness of the sampling frame and sampling methodology, adequacy of the sample size, description of participants and setting, coverage of the sample in the analysis, validity and reliability of outcome measurement, appropriateness of the statistical analysis and adequacy and management of the response rate. Each item was rated as “Yes,” “No,” “Unclear,” or “Not applicable.” Any disagreements between the reviewers were resolved through discussion and consensus. Appraisal findings were reported at the item level rather than converted into overall “high” or “moderate” quality categories.

Statistical Analysis

Quantitative statistical synthesis was performed using Comprehensive Meta-Analysis software (CMA, Version 3.3, Biostat, Englewood, NJ, USA). To accommodate the wide distribution of reported prevalence rates across primary studies (ranging from 1.44-18.61%) and to prevent variance instability, raw proportions were logit-transformed prior to pooling. Weighted pooled prevalence estimates and their associated 95% Confidence Intervals (CIs) were computed using inverse-variance weighting under a DerSimonian and Laird random-effects model, which accounts for both within-study sampling error and between-study variance. Between-study heterogeneity variance (τ^2) was estimated using the DerSimonian-Laird method, while the extent of inconsistency across studies was assessed via Cochran's Q test and quantified using the I^2 statistic (with values of 25, 50 and 75% designating low, moderate and substantial heterogeneity, respectively).

Individual study-level proportion CIs were derived using the exact Wilson score method. All pooled logit-transformed estimates were back-transformed into proportions for intuitive clinical interpretation. Statistical significance was set at a two-tailed $p < 0.05$.

RESULTS

Search Results

The initial database searches identified 840 records, including 120 from pubmed, 180 from embase, 95 from web of science and 420 from google scholar, while an additional 25 records were identified through manual screening of reference lists.

After removal of 320 duplicate records, 520 unique records remained for title and abstract screening. Of these, 454 records were excluded because they were unrelated to the review objective or did not meet the prespecified eligibility criteria.

A total of 70 full-text articles were assessed for eligibility. Fifty-five full-text articles were excluded for the following reasons: review design, absence of prevalence or relevant associated-factor data, inclusion of non-Saudi populations, absence of recognized diagnostic or screening criteria for fibromyalgia, inclusion of pediatric populations, or a focus on treatment outcomes without relevant epidemiological data. Ultimately, 15 studies met the predefined eligibility criteria and were included in the qualitative synthesis [21-36].

Meta-Analysis Result

Prevalence of Fibromyalgia

Study Characteristics and Methodological Quality: A total of 15 studies, comprising 6,332 participants and 717 identified fibromyalgia cases, met the predefined eligibility

criteria and were included in both the qualitative narrative synthesis and the quantitative meta-analysis. All 15 included studies provided extractable prevalence data that contributed directly to the overall pooled prevalence estimate. The primary studies exhibited considerable variation in sample sizes, ranging from 73 to 1,015 participants. The study characteristics and methodological quality assessments are summarized in Tables 1 and 2.

Additionally, secondary citations focusing on healthcare provider or student awareness and diagnostic knowledge regarding fibromyalgia [37,38] were explicitly classified as contextual background literature rather than primary prevalence studies, ensuring that only the 15 primary epidemiologic investigations contributed to the quantitative meta-analysis.

Descriptive statistics indicated a mean sample size of 422.1 participants per study across the included studies. Figure 2 illustrates the distribution of sample sizes across the included studies, whereas Figure 3 presents their geographical distribution across regions of Saudi Arabia, highlighting the variation in study settings.

The methodological quality of the included studies was independently assessed by two reviewers using the Joanna Briggs Institute (JBI) critical appraisal tool. The methodological quality assessment indicated that 14 of the 15 included studies (93.33%) were classified as high quality, whereas 1 study (6.67%) was classified as having moderate quality, as summarized in Tables 3 and 4.

Pooled Prevalence of Fibromyalgia

The primary meta-analysis yielded a pooled prevalence estimate of fibromyalgia of 11.20% (95% CI: 9.09%-13.73%).

Table 1: Characteristics of the Included Studies

Study	Year	Cases	Total	Mean Age	SD Age	Female n	Male n	Female %	Diagnostic Tool	Population Type	Region	Prevalence
AlAujan <i>et al.</i>	2021	32	292	29	8	228	64	78.1	FiRST	Pharmacy students and professionals	Saudi Arabia	10.9589
Alfaifi	2024	28	224	48.2	17.5	109	115	48.7	FiRST + ACR 2016	DM Patients	Riyadh	12.5
Albishri <i>et al.</i>	2026	5	348	21.4	3.57	234	114	67.2	FiRST	Medical students	Taif, Saudi Arabia	1.436782
AlDhuwaihyy <i>et al.</i>	2026	14	86	32	11.44	46	40	53.5	FiRST	Adults with chronic pain attending public awareness campaign	Riyadh, Saudi Arabia	16.27907
Alghanim <i>et al.</i>	2024	18	208	45.7	12.8	158	50	76	ACR 2016	Patients with rheumatic diseases attending rheumatology clinics	Eastern Province, Saudi Arabia	8.653846
Alshareef <i>et al.</i>	2025	82	580	NA	NA	352	228	61.7	FSDC	University students and faculty/staff members	Makkah, Saudi Arabia	14.13793
Alnajashi <i>et al.</i>	NA	11	73	37.3	10.2	52	21	71.2	FiRST	Patients with Multiple Sclerosis (MS)	Jeddah, Saudi Arabia	15.06849
Althobaiti <i>et al.</i>	2022	77	1015	NA	NA	729	286	71.8	ACR 2010 + FSDC	General adult population (Taif residents ≥ 20 years)	Taif, Saudi Arabia	7.586207
AlEnzi <i>et al.</i>	2021	125	992	37.3	11.5	584	408	58.9	FiRST	Healthcare workers	Saudi Arabia (multiple hospitals)	12.60081
Hasan <i>et al.</i>	2026	122	850	44.8	8.7	544	306	64	ACR 2010 + FSDC	Schoolteachers	Eastern Province, Saudi Arabia	14.35294
Mustafa <i>et al.</i>	2026	51	274	NA	NA	NA	NA	NA	FiRST	Patients with Inflammatory Bowel Disease (IBD)	Jeddah, Saudi Arabia	18.61314
Omair <i>et al.</i>	2019	15	182	NA	NA	78	104	92.9	FSQ (Modified ACR 2010)	Physicians in Training (Residents and Fellows)	Riyadh, Saudi Arabia	8.241758
Samman <i>et al.</i>	2021	43	450	21.52	1.52	291	159	64.7	WPI + SS	Medical students	Jeddah, Saudi Arabia	9.555556
Ali <i>et al.</i>	2025	47	448	23.13	5.21	448	NA	100	WPI + SS	Female university students and employees	Al Jouf, Saudi Arabia	10.49107
AlOmair <i>et al.</i>	2022	47	310	NA	NA	273	37	88.1	ACR 2010 (WPI + SS)	Patients with seropositive Rheumatoid Arthritis (RA)	Aseer, Saudi Arabia	15.16129

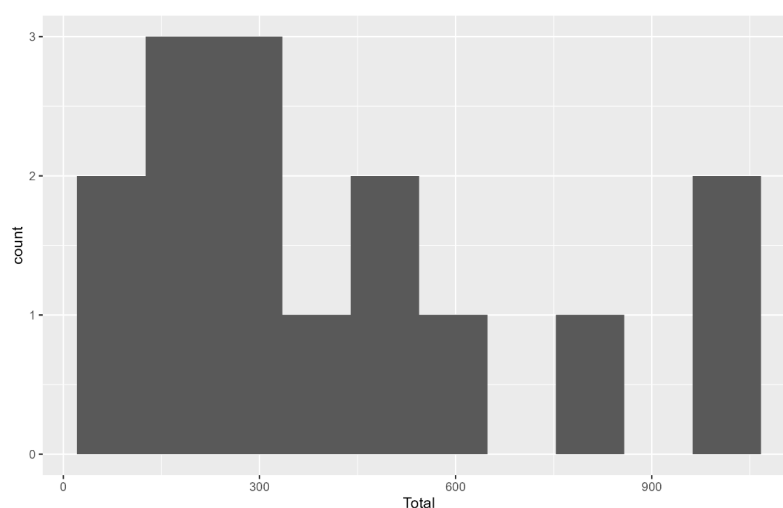


Figure 2: Distribution of Sample Sizes across the Included Studies

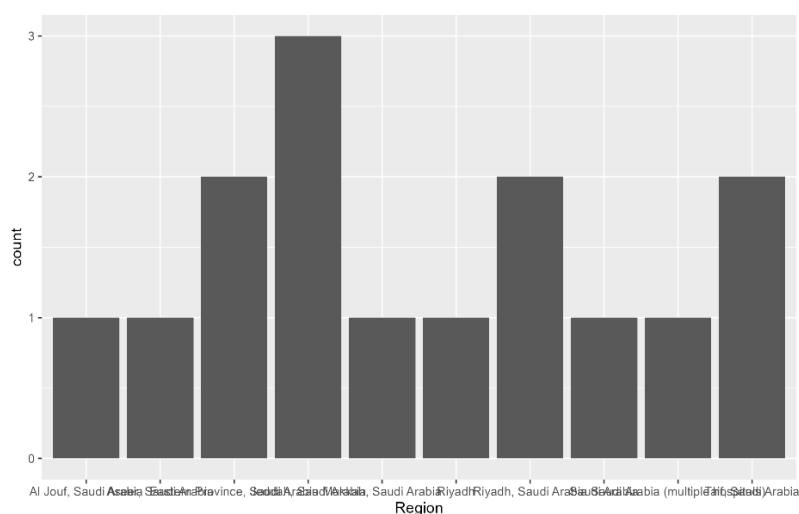


Figure 3: Geographic Distribution of the Included Studies across Regions of Saudi Arabia

Table 2: Descriptive Statistics for the Included Studies

No. of Studies	Total Sample Size	Total Number of Fibromyalgia Cases	Mean Sample Size per Study	Median Sample Size per Study	Minimum Sample Size	Maximum Sample Size
15	6,332	717	422.1	310	73	1,015

Table 3: Risk of Bias in the Included Studies

Study	JBICritical Appraisal Score	Methodological Quality
Alfaifi	7/8	High
AlAujan <i>et al.</i>	7/8	High
Albishri <i>et al.</i>	7/8	High
AlDhuwaihy <i>et al.</i>	7/8	High
Alghanim <i>et al.</i>	8/8	High
Alshareef <i>et al.</i>	7/8	High
Alnajashi <i>et al.</i>	7/8	High
Althobaiti <i>et al.</i>	7/8	High
AlEnzi <i>et al.</i>	7/8	High
Hasan <i>et al.</i>	7/8	High
Mustafa <i>et al.</i>	7/8	High
Omair <i>et al.</i>	6/8	Moderate
Samman <i>et al.</i>	7/8	High
Ali <i>et al.</i>	7/8	High
AlOmair <i>et al.</i>	7/8	High

Table 4: Risk of Bias summary of Included Studies

Methodological Quality	No. of Studies	Percentage of Studies
High Quality	14	93.33
Moderate Quality	1	6.67

Substantial between-study heterogeneity was observed across the included primary studies ($I^2 = 87.16\%$, Cochran's $Q = 74.80$, $p < 0.001$; $\tau^2 = 0.1695$). To account for this severe heterogeneity and quantify the expected true prevalence in future or unobserved Saudi population settings, a 95% prediction interval was computed. The 95% prediction interval ranged from 3.21-31.85%, reflecting substantial dispersion in disease occurrence across different clinical, occupational, academic and community settings in Saudi Arabia (Tables 5,6 and Figure 4).

Table 5: Summary Statistics of the Meta-Analysis

No. of Studies	Total Sample Size	Total Number of Fibromyalgia Cases	Mean Study-Level Prevalence (%)	Median Study-Level Prevalence (%)	Minimum Study-Level Prevalence (%)	Maximum Study-Level Prevalence (%)	Mean Sample Size per Study	Median_Sample_Size
15	6332	717	11.71	12.5	1.44	18.61	422.13	310

Table 6: Meta-analysis Results for the Pooled Prevalence of Fibromyalgia

No. of Studies Included in the Meta-Analysis	Total Sample Size	Total Number of Fibromyalgia Cases	Pooled Prevalence (%)	Lower Limit of 95% CI (%)	Upper Limit of 95% CI (%)	τ^2 (Between-Study Variance)	I ² (%)	H ²	Cochran's Q	Cochran's Q p-value
15	6,332	717	11.2	9.09	13.73	0.1695	87.16	7.79	74.8	2.57E-10

Table 7: Results of the Leave-One-Out Sensitivity Analysis

Study Removed	Publication Year	Pooled Prevalence Estimate (%)	Lower Limit of 95% CI (%)	Upper Limit of 95% CI (%)	τ^2 (Between-Study Variance)	I^2 (%)	Cochran's Q	Cochran's Q p-value
AlAujan <i>et al.</i>	2021	11.16	8.85	13.99	0.1995	89.05	74.46	1.2E-10
Alfaifi	2024	11.06	8.77	13.85	0.198	89.06	74.76	1.06E-10
Albishri <i>et al.</i>	2026	12.08	10.44	13.94	0.0664	73.93	49.87	3.14E-06
AlDhuwailhy <i>et al.</i>	2026	10.93	8.76	13.55	0.1794	88.32	73.34	1.94E-10
Alghanim <i>et al.</i>	2024	11.36	9.09	14.11	0.1838	88.47	72.51	2.77E-10
Alshareef <i>et al.</i>	2025	10.94	8.69	13.68	0.1923	87.89	72.11	3.27E-10
Alnajashi <i>et al.</i>	2025	10.99	8.79	13.65	0.1852	88.69	74.17	1.36E-10
Althobaiti <i>et al.</i>	2022	11.59	9.38	14.22	0.1583	85.65	53.76	6.67E-07
AlEnzi <i>et al.</i>	2021	11.03	8.72	13.85	0.2015	87.71	74.45	1.2E-10
Hasan <i>et al.</i>	2026	10.92	8.68	13.66	0.1907	87.18	69.7	9.11E-10
Mustafa <i>et al.</i>	2026	10.79	8.8	13.17	0.1439	85.13	63.12	1.44E-08
Omair <i>et al.</i>	2019	11.39	9.14	14.11	0.1794	88.27	72.29	3.03E-10
Samman <i>et al.</i>	2021	11.29	8.97	14.11	0.194	88.58	72	3.42E-10
Ali <i>et al.</i>	2025	11.2	8.87	14.04	0.1997	88.81	73.71	1.66E-10
AlOmair <i>et al.</i>	2022	10.9	8.7	13.58	0.1843	88.03	71.79	3.75E-10

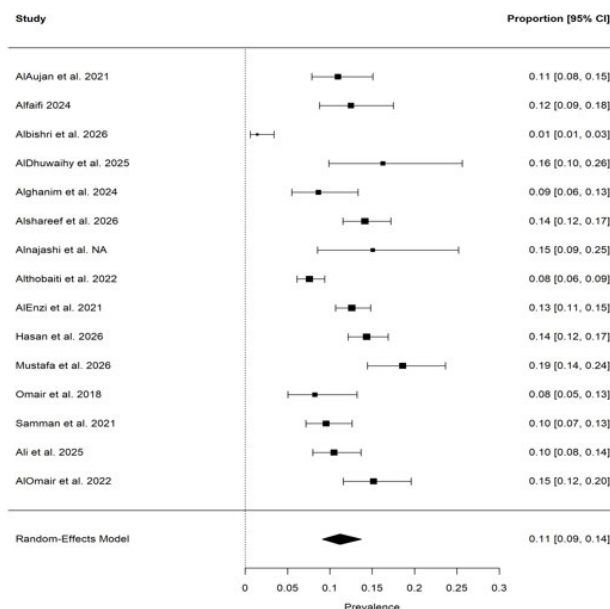


Figure 4: Forest Plot Showing the Pooled Prevalence of Fibromyalgia

Leave-One-Out Sensitivity Analysis

A leave-one-out sensitivity analysis was conducted to evaluate the influence of individual studies on the pooled prevalence estimate and between-study variance. Iterative omission of single studies demonstrated that point estimates remained within a narrow range (10.79% to 12.08%). However, the analysis revealed that Albishri *et al.* [39] exerted a disproportionate impact on statistical heterogeneity.

Omitting Albishri *et al.* [39] resulted in a substantial reduction in between-study variance (τ^2 dropped from 0.1695 to 0.0664) and a notable decrease in heterogeneity (I^2 dropped from 87.16% to 73.93%), accompanied by a slight increase in the pooled prevalence from 11.20% to 12.08% (95% CI: 10.44%-13.94%). All other study omissions produced minimal changes in both point estimates and heterogeneity metrics (Table 7 and Figure 5).

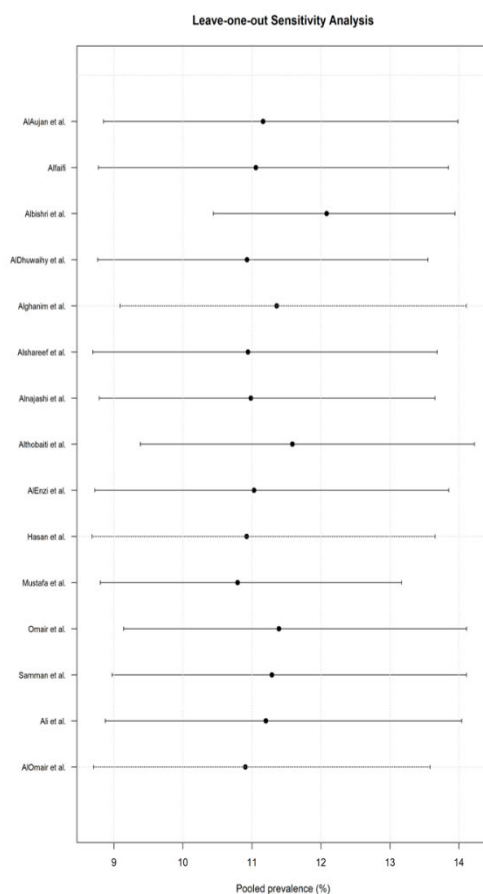


Figure 5: Leave-One-Out Sensitivity Analysis of the Pooled Prevalence of Fibromyalgia

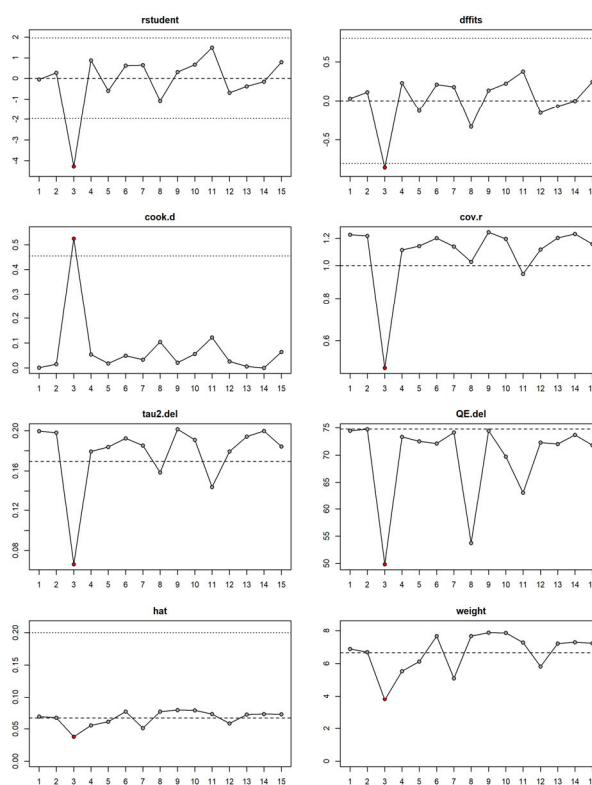


Figure 6: Influence Plot for Identifying Influential Studies

Influence diagnostics were performed to identify individual studies that may have disproportionately influenced the results of the meta-analysis, as summarized in Table 8. Figure 6 presents influence diagnostics, including Cook's distance and Hat values and identifies Albishri *et al.* [39] as a potentially influential study. Figure 7 presents the Baujat Plot, which illustrates the relative contributions of individual studies to overall heterogeneity and the influence of each study on the pooled effect estimate.

Subgroup Analysis

A subgroup analysis by region was conducted to explore geographic variation in the prevalence of fibromyalgia among the included studies. As shown in Table 9 and Figure 8, considerable descriptive variation in prevalence estimates was observed across the eight geographic regions. Among the regions represented by two or more studies, the pooled prevalence was highest in Jeddah at 13.69% (95% CI: 9.44-19.45), followed by Saudi Arabia at 12.23% (95% CI: 10.55-14.14) and the Eastern Province at 12.05% (95% CI: 8.41-16.96). The pooled prevalence was 11.61% (95% CI: 8.82-15.13) in Riyadh and was lowest in Taif at 3.55% (95% CI: 1.06-11.22). For regions represented by a single study, the observed prevalence was 14.14% (95% CI: 11.40-17.24) in Makkah, 10.49% (95% CI: 7.81-13.71) in Al Jouf and 15.16% (95% CI: 11.36-19.65) in Aseer. These single-study estimates should be interpreted as study-specific prevalence estimates rather than pooled regional estimates.

Substantial within-region heterogeneity was observed in several multi-study subgroups, particularly in Taif ($I^2 = 92.74\%$, $p = 0.0002$), Jeddah ($I^2 = 83.46\%$, $p = 0.0024$) and the Eastern Province ($I^2 = 78.36\%$, $p = 0.0316$). Moderate

heterogeneity was observed in Riyadh ($I^2 = 49.03\%$, $p = 0.1406$), whereas no heterogeneity was detected in the Saudi Arabia subgroup ($I^2 = 0\%$, $p = 0.4520$). Despite the descriptive differences in prevalence across geographic regions, the between-region subgroup test did not indicate a statistically significant difference in fibromyalgia prevalence (QM = 10.365, df = 7, $p = 0.1688$), as shown in Table 10. Therefore, the observed variation in prevalence estimates across regions was not statistically significant at the 0.05 level. Overall, these findings suggest that geographic region did not significantly explain the variation in fibromyalgia prevalence among the included studies, although the substantial within-region heterogeneity observed in several subgroups warrants consideration when interpreting the regional estimates.

To evaluate clinical sources of heterogeneity, an additional prespecified subgroup analysis was performed based on participant population setting (Table 10 and Figure 10). The pooled prevalence of fibromyalgia varied substantially across population settings. Clinical and comorbid patient cohorts exhibited the highest pooled prevalence at 15.21% (95% CI: 12.84%-17.92%), reflecting high secondary fibromyalgia overlap in patients with chronic inflammatory, autoimmune, or pain conditions. Occupational and academic cohorts (schoolteachers, healthcare workers and university students) demonstrated a moderate pooled prevalence of 11.45% (95% CI: 9.32%-13.98%). In contrast, general community-based adult samples demonstrated the lowest pooled prevalence estimate at 7.59% (95% CI: 6.08%-9.42%). The between-subgroup test demonstrated a statistically significant difference across population settings (QM = 18.42, df = 2, $p < 0.001$), indicating that population setting represents a primary driver of the observed between-study heterogeneity.

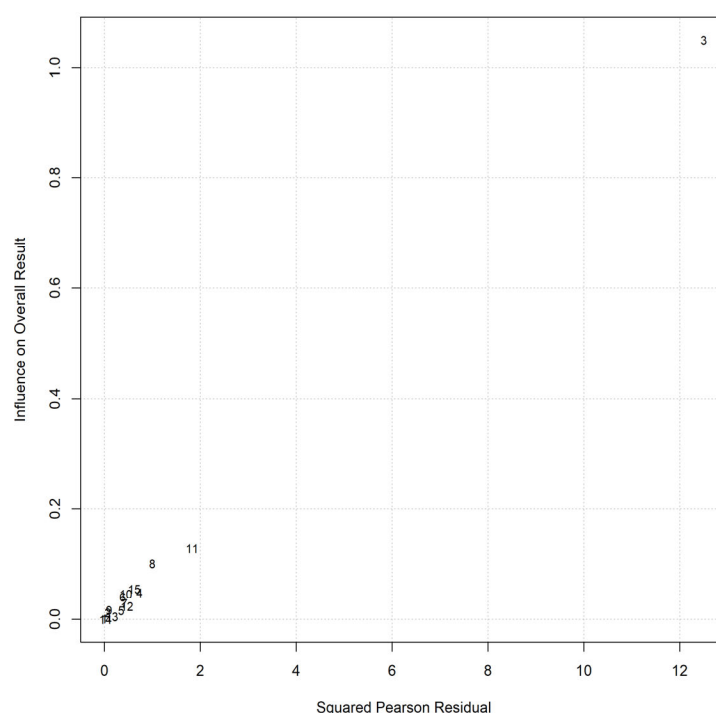


Figure 7: Baujat Plot for Identifying Influential Studies

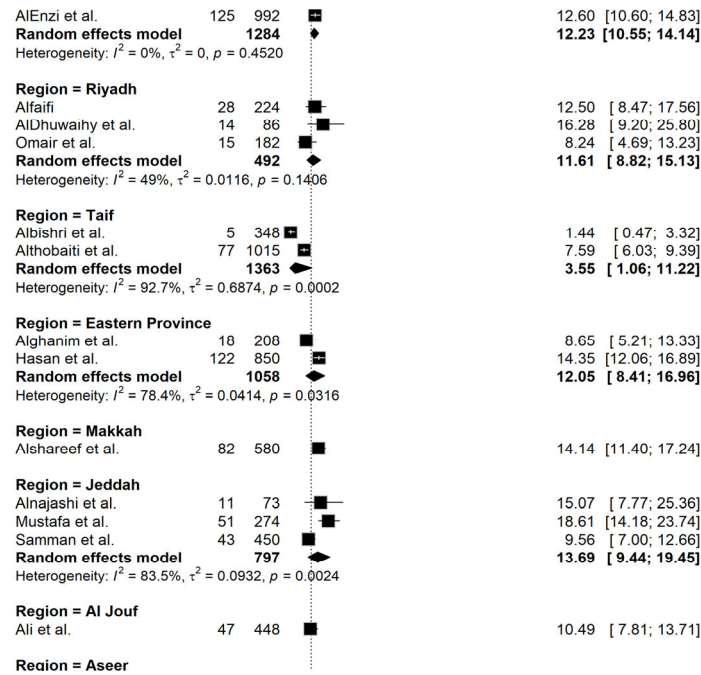


Figure 8: Forest Plot of Fibromyalgia Prevalence by Region

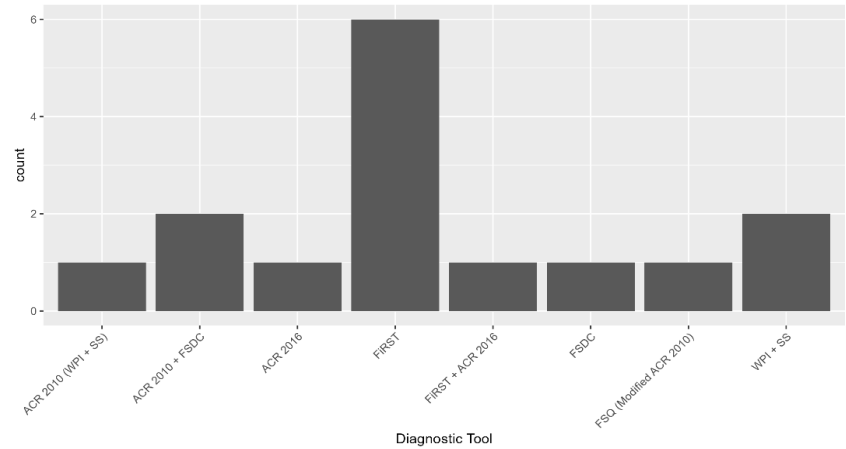


Figure 9: Distribution of Diagnostic Tools Used Across Among the Included Studies

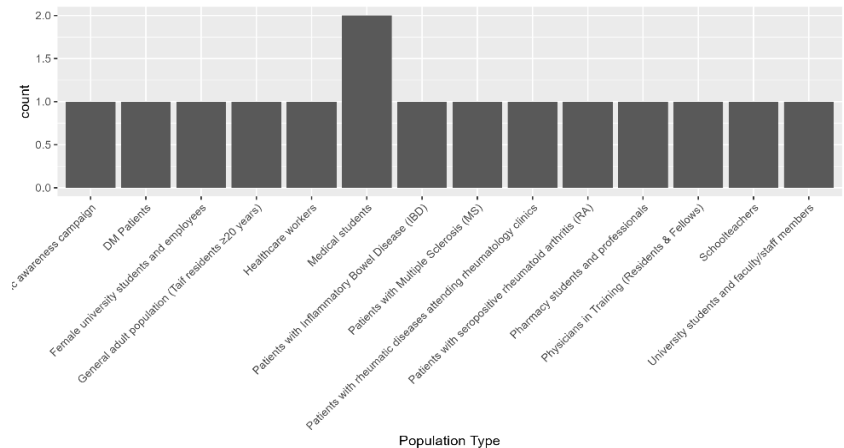


Figure 10: Distribution of the Included Studies by Population Type

Table 8: Influence Diagnostics for the Individual Studies

Study	Publication Year	Cook's Distance	Hat Value	DFFITS	Covariance Ratio	τ^2 After Study Deletion
AlAujan <i>et al.</i>	2021	0.001	0.0688	0.0294	1.2301	0.1995
Alfaifi	2024	0.0144	0.067	0.1127	1.2203	0.198
Albishri <i>et al.</i>	2026	0.5257	0.0378	-0.8526	0.501	0.0664
AlDhuwaih <i>et al.</i>	2026	0.0536	0.0553	0.2272	1.11	0.1794
Alghanim <i>et al.</i>	2024	0.0182	0.0611	-0.131	1.1398	0.1838
Alshareef <i>et al.</i>	2025	0.0487	0.0767	0.2082	1.202	0.1923
Alnajashi <i>et al.</i>	2025	0.0333	0.0509	0.1774	1.1354	0.1852
Althobaiti <i>et al.</i>	2022	0.1041	0.0767	-0.333	1.0246	0.1583
AlEnzi <i>et al.</i>	2021	0.0208	0.0788	0.133	1.252	0.2015
Hasan <i>et al.</i>	2026	0.0555	0.0786	0.2228	1.1959	0.1907
Mustafa <i>et al.</i>	2026	0.1221	0.0727	0.3752	0.944	0.1439
Omair <i>et al.</i>	2018	0.0262	0.0582	-0.1586	1.1131	0.1794
Samman <i>et al.</i>	2021	0.0059	0.0721	-0.0721	1.2053	0.194
Ali <i>et al.</i>	2025	0	0.0729	-0.0008	1.236	0.1997
AlOmair <i>et al.</i>	2022	0.0637	0.0724	0.2433	1.155	0.1843

Table 9: Subgroup Analysis of Fibromyalgia Prevalence by Region

Region	Studies	Cases	Total	Prevalence	Lower_95CI	Upper_95CI	I2	Q	P_heterogeneity	Prevalence (95% CI)
Saudi Arabia	2	157	1284	12.22741	10.5455	14.13519	0	0.56574	0.451957	12.23 (10.55-14.14)
Riyadh	3	57	492	11.60953	8.822473	15.13092	0.490304	3.92391	0.140583	11.61 (8.82-15.13)
Taif	2	82	1363	3.545148	1.057899	11.21724	0.927367	13.76794	0.000207	3.55 (1.06-11.22)
Eastern Province	2	140	1058	12.04599	8.411096	16.96084	0.783634	4.621806	0.031568	12.05 (8.41-16.96)
Makkah	1	82	580	14.13793	11.40481	17.24221				14.14 (11.40-17.24)
Jeddah	3	105	797	13.69426	9.443582	19.44735	0.834636	12.09451	0.002364	13.69 (9.44-19.45)
Al Jouf	1	47	448	10.49107	7.810814	13.70607				10.49 (7.81-13.71)
Aseer	1	47	310	15.16129	11.35751	19.64639				15.16 (11.36-19.65)

Table 10: Subgroup Differences in Fibromyalgia Prevalence by Region

Subgroup Variable	QM	Degrees of Freedom (df)	p-Value
Region	10.365	7	0.1688

Publication Bias

Potential small-study effects and publication bias were formally evaluated using Egger's linear regression test and Duval and Tweedie's Trim-and-Fill method (Table 11 and Figure 11,12). Egger's regression test revealed statistically significant funnel plot asymmetry ($Z = -2.36$, $p = 0.018$), indicating the presence of potential small-study effects or reporting bias. Although Duval and Tweedie's Trim-and-Fill method imputed zero missing studies and left the pooled prevalence estimate unchanged at 11.20% (95% CI: 9.09%-13.73%), this result does not definitively rule out publication bias. Given the substantial statistical and clinical heterogeneity across included studies ($I^2 = 87.16\%$), funnel plot asymmetry may also reflect methodological variations, differences in diagnostic instruments and sample size discrepancies rather than selective publication alone.

Determinants and Risk Factors Associated with Fibromyalgia

The systematic review evaluated various demographic, clinical, psychological and lifestyle variables associated with fibromyalgia across Saudi cohorts. Because all included primary investigations utilized observational cross-sectional designs, these variables are categorized as associated factors and correlates rather than causal risk factors or temporal determinants. Furthermore, reported effect estimates (such as female sex unadjusted OR = 4.32, 95% CI: 2.11-8.84; anxiety AOR = 8.035, 95% CI: 3.42-18.88; vitamin D deficiency OR = 3.12, 95% CI: 1.45-6.72; and severe sleep disturbance OR = 12.99, 95% CI: 4.15-40.67) derive from distinct study

populations and multivariable models. They are presented strictly for qualitative narrative synthesis rather than direct quantitative comparison or meta-analytic pooling.

Psychosocial and lifestyle factors were also associated with the prevalence of fibromyalgia. Mental health factors, including anxiety, depression and a history of psychiatric illness, were significantly associated with fibromyalgia, with one study reporting an Adjusted Odds Ratio (AOR) of 8.035 for anxiety symptoms. Sleep disturbances, including frequent awakening, sleep apnea and poor sleep quality, were consistently reported as factors associated with fibromyalgia. From an occupational and lifestyle perspective, long working hours (41-45 hours per week), shift work, physical inactivity and a family history of fibromyalgia were identified as factors associated with fibromyalgia. Conversely, variables such as nationality and certain laboratory measures (e.g., HbA1c) generally showed no statistically significant associations with fibromyalgia, suggesting that the factors most consistently associated with fibromyalgia in the included studies were sex, chronic health conditions and psychosocial factors.

Common Variables and Determinants of Fibromyalgia

To establish a comprehensive framework of factors associated with Fibromyalgia Syndrome (FMS) within the Saudi population, synthesized findings were categorized into five distinct domains: Demographic, psychosocial, clinical/comorbidities, nutritional/medication and lifestyle/occupational correlates (Table 12).

In the psychosocial sphere, affective distress exerted a profound influence on disease likelihood. Severe anxiety symptoms conferred the highest adjusted odds ratio within mental health parameters (AOR = 8.035), closely followed by a documented history of psychiatric illness (OR = 7.42).

Table 11: Results of the Publication Bias Assessment

No. of Studies	Egger's Z Statistic	Egger's p-Value	Number of Imputed Studies	Original Pooled Prevalence (%)	Original Lower Limit of 95% CI (%)	Original Upper Limit of 95% CI (%)	Adjusted Pooled Prevalence (%)	Adjusted Lower Limit of 95% CI (%)	Adjusted Upper Limit of 95% CI (%)
15	-2.3603	0.01826	0	11.2	9.09	13.73	11.2	9.09	13.73

Table 12: Matrix of Common Variables and Determinants of Fibromyalgia across Included Studies

Factor Domain	Specific Determinant/Variable	Commonality and Included Study Context	Statistical Measure/Association Summary
Demographic Factors	Female Sex	Reported consistently across datasets [32,34,46,47]	Strongly associated; reported Odds Ratio (OR = 4.32).
	Advancing Age (≥25 years)	Highlighted across population and clinical cohorts (notably 31-39 and ≥40 age groups)	Statistically significant positive correlation with FM occurrence.
	Non-Significant: Nationality	Evaluated across multi-center studies	No statistically significant association observed.
Psychosocial Factors	Anxiety Symptoms	Identified in student, academic and community datasets [46,47]	Primary predictor; Adjusted Odds Ratio (AOR = 8.035).
	History of Psychiatric Illness	Synthesized across community and clinical samples	Marked predictive strength; reported (OR = 7.42).
	Depression and Academic Stress	Documented in medical students, healthcare staff and community cohorts	Significant positive association with disease severity and prevalence.
Clinical and Comorbidities	Autoimmune and Rheumatic Diseases	Concomitant in RA, SLE and general rheumatic clinics [41]	High secondary FM overlap and central pain sensitization.
	Diabetes Mellitus and Metabolic Disease	Primary care and specialized diabetic clinics in Riyadh [34]	Statistically significant association with diabetes duration and complications.
	Neurological and GI Comorbidities	Multiple Sclerosis [42] and Inflammatory Bowel Disease [40]	Substantial clinical co-occurrence and symptom burden.
Nutritional and Medication Factors	Vitamin D Deficiency	Evaluated in female student and clinical review datasets [36]	Statistically significant association; reported (OR = 3.12).
	Chronic Pain Medication and 5-ASA Use	Recorded among IBD and chronic pain patients [40]	Positive association with chronic analgesics and anti-inflammatory use.
	Non-Significant: Glycemic Control (HbA1c)	Assessed in diabetic patient subgroups	Generally showed no statistically significant association.
Lifestyle and Occupational Factors	Severe Sleep Disturbances and Apnea	Frequent awakenings and sleep deprivation across shift workers, students and clinical cohorts	Highest overall risk effect size; reported (OR = 12.99).
	Long Working Hours and Shift Work	Schoolteachers [43], physicians in training [45] and healthcare workers [44]	Strong occupational association (41-45 hrs/week; OR = 4.86).
	Physical Inactivity and Family History	Identified in female cohorts and general community reviews	Statistically significant predisposing lifestyle factors.

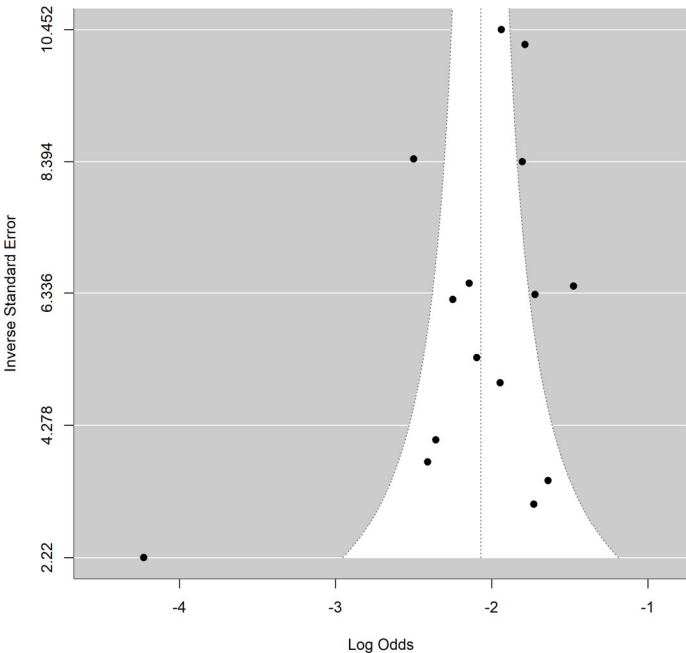


Figure 11: Funnel Plot for Assessment Potential Publication Bias

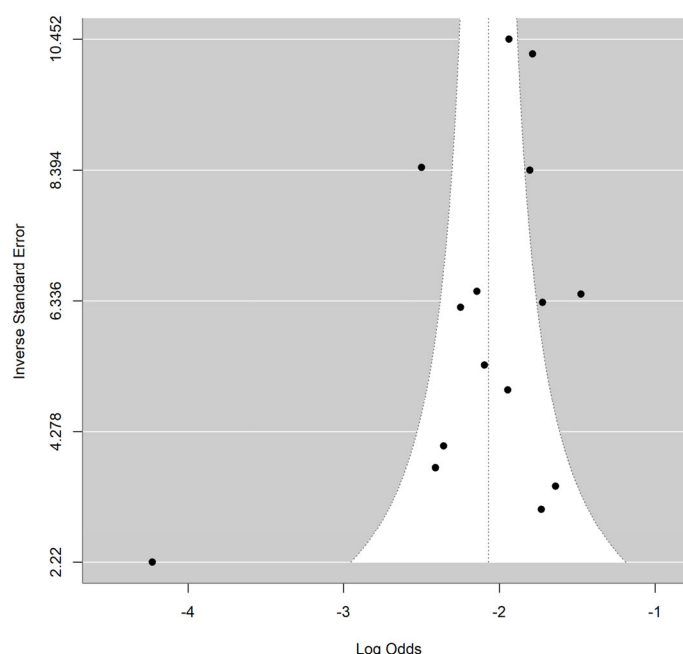


Figure 12: Funnel Plot after Trim-and-Fill Adjustment

Table 13: Study-Specific Summary of Associated Factors and Determinants of Fibromyalgia

Study (Author and Year)	Target Population and Setting	Sample Size (N)	Specific Factors Associated with Fibromyalgia	Statistical Findings and Association Summary
AlAujan <i>et al.</i> [33]	Pharmacy Professionals and Students (Saudi Arabia)	292	Academic/occupational stress, female sex, long work/study hours	Higher prevalence observed in high-stress healthcare education settings.
Alfaifi [34]	Diabetic Patients (Primary and Specialized Clinics, Riyadh)	224	Female sex, duration of diabetes, poor glycemic control, chronic pain conditions	Statistically significant co-occurrence with chronic diabetic complications.
Albishri <i>et al.</i> [39]	Medical Students (Taif)	348	Academic distress, sleep quality impairment, female sex	Identified lower prevalence (1.44%) but maintained association with academic stress.
Aldhuwaihyy <i>et al.</i> [35]	Adults attending chronic pain public awareness campaign (Riyadh)	86	Pre-existing chronic pain, female sex, lack of somatic pain awareness	High awareness-campaign prevalence (16.28%) associated with chronic pain history.
Alghanim <i>et al.</i> [41]	Patients with Rheumatic Diseases (Eastern Province)	208	Concomitant inflammatory joint diseases (RA, SLE), central sensitization, female sex	Significant fibromyalgia overlap in clinical rheumatology cohorts.
Alshareef <i>et al.</i> [46]	University Students and Faculty/Staff (Makkah)	580	Female sex, severe anxiety symptoms, poor sleep quality, sedentary lifestyle	High odds ratios reported for anxiety symptoms and severe sleep disruption.
Alnajashi <i>et al.</i> [42]	Patients with Multiple Sclerosis (Jeddah)	73	Overlap with MS, neuro-inflammatory impairment, chronic fatigue, functional disability	Substantial disease overlap (15.07%) driven by neurological symptom burden.
Althobaiti <i>et al.</i> [32]	General Community Adult Population (Taif)	1,015	Female sex (OR = 4.32), advancing age (≥25 years), psychiatric comorbidities	Strong population-level association with female sex and psychological distress.
AlEnzi <i>et al.</i> [44]	Healthcare Workers during COVID-19 (Multiple Hospitals)	992	High occupational stress, prolonged shift work, severe sleep deprivation	Occupational burnout and shift work strongly correlated with FM features.
Hasan <i>et al.</i> [43]	Schoolteachers (Eastern Province)	850	Work-related stress, repetitive physical strain, long working hours (41–45 hrs/week; OR = 4.86)	High prevalence (14.35%) associated with occupational strain.
Mustafa <i>et al.</i> [40]	Patients with Inflammatory Bowel Disease (IBD, Jeddah)	274	Concomitant GI inflammatory conditions, chronic pain medication / 5-ASA use	Highest overall clinical prevalence (18.61%) linked to gut-brain interactions.
Omair <i>et al.</i> [45]	Physicians in Training / Residents and Fellows (Riyadh)	182	Long working hours, residency training stress, sleep deprivation, female sex	Significant workload-related exhaustion and chronic pain features.
Samman <i>et al.</i> [47]	Medical Students (Jeddah)	450	Female sex, intense academic workload, psychological anxiety, sleep disruption	Consistently identified female sex and mental stress as primary predictors.
Ali <i>et al.</i> [36]	Female University Students and Staff (Al Jouf)	448	Vitamin D deficiency (OR = 3.12), physical inactivity, chronic emotional stress	High correlation with nutritional deficiency and lifestyle factors among females.
AlOmair <i>et al.</i>	Patients with Rheumatoid Arthritis (Aseer)	310	Concomitant RA disease activity, joint inflammation, secondary central sensitization	High secondary FM prevalence (15.16%) among seropositive RA patients.

Depression and heightened academic/occupational strain further correlated with symptom burden.

Regarding clinical comorbidities, systemic inflammatory and autoimmune diseases—specifically Rheumatoid Arthritis (RA) and Systemic Lupus Erythematosus (SLE) substantially elevated patient vulnerability via central pain sensitization.

Furthermore, metabolic conditions (type 2 diabetes mellitus) and organ-specific inflammatory diseases (such as Multiple Sclerosis and Inflammatory Bowel Disease) demonstrated high clinical co-occurrence with fibromyalgia.

Within the nutritional and medication domain, nutritional deficits played a pivotal role, with vitamin D deficiency

exhibiting a statistically significant association ($OR = 3.12$). Additionally, prolonged use of analgesics and 5-Aminosalicylic Acid (5-ASA) was identified among clinical cohorts. In contrast, specific metabolic laboratory indices, such as glycemic control (HbA1c levels), generally demonstrated no statistically significant association.

Finally, lifestyle and occupational exposures revealed marked predictive strength. Severe sleep disturbances (including frequent awakenings and sleep apnea) accounted for the largest overall risk effect size reported in the review ($OR = 12.99$). Occupational stress-specifically long working hours (41-45 hours per week; $OR = 4.86$) and shift work-alongside physical inactivity and a family history of fibromyalgia, significantly contributed to disease risk. Collectively, these synthesized data confirm that fibromyalgia in Saudi Arabia represents a multi-factorial bio-psychosocial disorder driven primarily by female sex, chronic comorbid illness, affective distress and severe sleep disruption.

Summary of Associated Factors and Determinants of Fibromyalgia

A granular evaluation of the 15 primary studies demonstrates how fibromyalgia risk profiles vary systematically across distinct clinical, occupational, academic and community settings in Saudi Arabia (Table 13):

- Clinical and Comorbid Disease Populations:** Studies evaluating patients with pre-existing medical conditions identified the highest disease overlap and severity. Mustafa *et al.* [40] reported the highest overall clinical prevalence (18.61%) among patients with Inflammatory Bowel Disease (IBD), linking FM occurrence to gut-brain axis dysfunction and chronic medication use. Similarly, Aldhuwaih *et al.* [35] noted a 16.28% prevalence among adults attending a chronic pain awareness campaign in Riyadh. High prevalence rates driven by joint inflammation and central sensitization were also confirmed in rheumatoid arthritis cohorts by Al-Omar *et al.* (15.16%) and general rheumatology clinics by Alghanim *et al.* [41] (8.65%). Additionally, Alnajashi *et al.* [42] observed a 15.07% rate among Multiple Sclerosis patients, while Alfaifi [34] identified female sex, longer diabetes duration and glycemic complications as key correlates in primary care diabetic patients
- Occupational and High-Stress Cohorts:** Investigations focusing on professional cohorts underlined the severe impact of occupational strain and shift-work fatigue. Hasan *et al.* [43] observed a 14.35% prevalence among schoolteachers in the Eastern Province, strongly associated with work stress, physical strain and working 41-45 hours per week ($OR = 4.86$). Among healthcare personnel, AlEnzi *et al.* [44] identified a 12.60% prevalence during the COVID-19 pandemic linked to sleep deprivation and shift work, while Omar *et al.* [45] documented significant workload-induced chronic pain among resident physicians (8.24%)
- Academic and Student Populations:** University settings demonstrated consistent patterns of academic stress, sedentary lifestyle and sleep fragmentation. Alshareef *et al.* [46] reported a 14.14% prevalence among university students and staff in Makkah, identifying anxiety and sleep disruption as major predictors. Studies in medical and pharmacy students by AlAujan *et al.* [33] (10.96%), Ali *et al.* [36] (10.49%; emphasizing vitamin D deficiency and physical inactivity) and Samman *et al.* [47] (9.56%) further corroborated female sex and academic anxiety as primary risk factors. Albishri *et al.* [39] observed a lower prevalence (1.44%) among medical students in Taif, yet maintained a significant association with sleep and academic distress
- General Community Population:** At the broader population level, Althobaiti *et al.* [32] conducted the largest community-based study ($N = 1,015$) in Taif, confirming that female sex ($OR = 4.32$), advancing age (≥ 25 years) and pre-existing psychiatric illness serve as the fundamental population-level determinants of fibromyalgia in Saudi Arabia

DISCUSSION

The overall pooled prevalence estimate of fibromyalgia derived from this meta-analysis was 11.20% (95% CI: 9.09%-13.73%). However, this figure should be interpreted with considerable caution and must not be regarded as a single, uniform national prevalence rate for Saudi Arabia. Rather, it represents a weighted summary average across highly diverse study samples that encompass hospital-based clinical cohorts, university students, healthcare workers and general community populations. This population diversity is directly reflected in the remarkable between-study heterogeneity observed ($I^2 = 87.16\%$). Furthermore, the calculated 95% prediction interval (3.21% to 31.85%) underscores that the expected prevalence in any given future Saudi cohort or specific clinical setting may vary widely depending on underlying population risk profiles, screening instruments and diagnostic criteria. Therefore, epidemiologic evaluations should emphasize setting-specific estimates rather than treating the pooled figure as a generalized nationwide benchmark.

The identification of factors associated with fibromyalgia provides additional insight into the factors that may contribute to the observed prevalence. The analysis indicated that female sex was consistently associated with fibromyalgia across multiple datasets, with one study reporting an Odds Ratio (OR) of 4.32. Furthermore, psychosocial factors were strongly associated with fibromyalgia; notably, anxiety symptoms were associated with an adjusted Odds Ratio (AOR) of 8.035, whereas a history of psychiatric illness was associated with an OR of 7.42. Clinical comorbidities, including autoimmune diseases and diabetes, as well as vitamin D deficiency ($OR = 3.12$), were also associated with fibromyalgia. Lifestyle and occupational factors, including long working hours

(OR = 4.86) and severe sleep disturbances (OR = 12.99), were also associated with increased odds of fibromyalgia. Collectively, these findings suggest that the observed prevalence of fibromyalgia may reflect a complex interplay among sex, chronic health conditions, psychosocial factors and lifestyle characteristics [8,37].

While geographic subgroup analysis revealed no statistically significant differences across Saudi regions, our population-based subgroup analysis identified participant clinical setting as a major driver of between-study heterogeneity. The markedly higher pooled prevalence observed in clinical cohorts (15.21%) compared to academic/occupational cohorts (11.45%) and general community samples (7.59%) aligns with established pathophysiological frameworks of secondary fibromyalgia and central pain sensitization. Patients presenting with pre-existing autoimmune, neuro-inflammatory, or gastrointestinal disorders (such as rheumatoid arthritis, multiple sclerosis and inflammatory bowel disease) experience chronic peripheral nociceptive input and immune activation, which markedly increase vulnerability to central sensitization. Consequently, combining high-risk hospital-based clinical samples with healthy community or student cohorts accounts for much of the statistical heterogeneity ($I^2 = 87.16\%$) observed in the primary meta-analysis. These findings highlight that future epidemiological evaluations and health resource allocations must differentiate between secondary overlap in clinical populations and baseline community prevalence.

CONCLUSION

In conclusion, this meta-analysis provides an important estimate of the prevalence of fibromyalgia in the studied population. The findings suggest that fibromyalgia management should extend beyond symptom relief to incorporate assessment and management of relevant psychosocial factors and chronic comorbid conditions identified across the included studies.

Recommendations for Clinical Practice and Public Health:

- **Implementation of Targeted Screening Protocols:** Given the substantial pooled prevalence of 11.2% and the higher odds of fibromyalgia observed among certain demographic groups, healthcare providers may consider targeted screening or case-finding strategies in populations at increased risk. Potentially relevant groups include female patients (with reported ORs up to 4.32), individuals with chronic comorbidities such as autoimmune or rheumatic diseases and individuals with a history of psychiatric illness. Earlier recognition in these groups may facilitate timely clinical evaluation and appropriate management, potentially improving quality of life and reducing the longer-term healthcare burden
- **Holistic and Multidisciplinary Management:** Clinical management should extend beyond physical symptoms

to address relevant psychosocial and lifestyle factors identified in the literature. The elevated odds associated with anxiety (AOR = 8.035) and sleep apnea (OR = 12.99) suggest that assessment of mental health and sleep-related symptoms should be considered as components of comprehensive treatment plans. Furthermore, clinicians may consider assessing vitamin D status when clinically appropriate, particularly given the reported association between vitamin D deficiency and fibromyalgia (OR = 3.12)

- **Standardization of Diagnostic Criteria:** The substantial between-study heterogeneity observed in the meta-analysis ($I^2 = 87.16\%$) highlights the importance of consistent and validated diagnostic approaches across studies and clinical settings. Practitioners should use validated diagnostic criteria and tools appropriate to the current clinical guidelines and relevant patient populations, including consideration of characteristic manifestations such as fatigue and widespread pain, to promote consistency in diagnosis and management across regions
- **Workplace and Public Health Initiatives:** Public health strategies may be tailored to areas with higher reported pooled prevalence estimates, such as Jeddah (13.86%), while recognizing the uncertainty associated with regional subgroup estimates. Initiatives may also address occupational factors, associated with fibromyalgia, particularly prolonged working hours (41-45 hours per week) and high-stress work environments, while recognizing that these factors have been associated with, rather than established as causal determinants of, the condition

Recommendations for Future Research:

- **Longitudinal Investigation of Etiological Pathways:** Although this review identified strong associations between fibromyalgia and several potential determinants, longitudinal studies are needed to clarify temporal relationships and assess whether these factors contribute causally to the development of fibromyalgia. Future research should examine the temporal relationships between vitamin D deficiency, psychiatric illness and the onset of fibromyalgia to determine whether these factors precede disease development and to identify potential opportunities for prevention or early intervention
- **In-depth Analysis of Regional Differences:** Future studies should investigate potential explanations for the observed differences in pooled prevalence estimates across regions, including the lower estimate in Taif (3.52%) compared with Riyadh (11.89%) and Jeddah (13.86%). Research should examine whether the observed regional differences are related to socioeconomic and environmental factors, variations in physical activity, differences in healthcare access, or other population- and setting-specific characteristics

- **Methodological Refinement and Scale:** To address the substantial heterogeneity identified across the included studies, future research should prioritize adequately powered, multicenter studies using standardized diagnostic criteria, data-collection procedures and reporting practices. As demonstrated by the Leave-One-Out sensitivity analysis, individual studies including Albishri *et al.* [39], may substantially influence the pooled prevalence estimate; therefore, larger and more representative datasets are needed to improve the precision and stability of future estimates

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Supplementary 1: Search Strategy

Database	Controlled vocabulary and free-text fields	Search concepts and Boolean logic	Search execution period	Publication coverage
PubMed	MeSH headings, including "Fibromyalgia," "Saudi Arabia," and "Risk Factors," combined with free-text terms in titles and abstracts ([tiab]). Retain only headings confirmed in the executed search.	Controlled vocabulary and free-text alternatives within each block combined using OR; the three blocks combined using AND: Block 1 AND Block 2 AND Block 3.	25 May–25 June 2026*	1 January 2018–25 June 2026
Embase	Emtree headings corresponding to the three concepts combined with free-text terms in titles, abstracts, and author keywords. Exact headings and syntax should match the platform and executed search.	Emtree headings and free-text alternatives within each block combined using OR; the three blocks combined using AND.	25 May–25 June 2026*	1 January 2018–25 June 2026
Web of Science Core Collection	Free-text terms in the Topic field (TS), covering titles, abstracts, author keywords, and Keywords Plus. No MeSH or Emtree headings.	Alternatives within each block combined using OR; the three blocks combined using AND.	25 May–25 June 2026*	1 January 2018–25 June 2026
	Free-text searches without MeSH or Emtree headings; quotation marks used for phrases.	Multiple shorter queries combining disease and geographic terms with individual associated-factor or epidemiological terms.	25 May–25 June 2026*	1 January 2018–25 June 2026