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Original Article

A Community Based Study on Association of Menopausal Stage with Metabolic Health, Anemia, and MENQOL Scores in Postmenopausal Women

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ABSTRACT

Background: Menopause, an early transition in Indian women, impacts well-being and quality of life, with experiences influenced by socioeconomic disparities and phases of reproductive aging. **Objectives:** There is limited comparative data on the health status and QOL, this research was done in a bid to evaluate and compare metabolic health, anemia status, comorbidities, and QOL in urban rural and senile climacteric postmenopausal women. **Materials and Methods:** A cross-sectional community-based study involving 500 postmenopausal women (250 from rural areas and 250 from urban areas) employed structured interviews and the MENQOL questionnaire was used to evaluate sociodemographic, clinical, comorbidity, and hemoglobin parameters, with data analyzed through descriptive statistics, t-tests, and chi-square tests. **Results:** Prevalence of diabetes, hypertension, dyslipidemia, and anemia were 19.8%, 31.4%, 39.8% and 68.8% respectively. Also, there levels were greatly higher among senile women than in climacteric women ($p<0.001$). But difference between rural and urban was not significant ($p>0.05$). MENQOL result indicated that married, menopausal stage, education and marital status were related significantly with QOL ($p<0.05$). Place of residence, occupation, parity and family type didn't have a significant relationship with MENQOL. Rural and urban women had same domain scores in vasomotor, psychosocial, physical, and sexual domain. **Conclusion:** The findings suggest that menopausal stage, rather than place of residence, is the principal determinant of menopause-specific quality of life. Senile women exhibited poorer metabolic health, greater morbidity, and lower MENQOL scores than climacteric women. The study is strengthened by its comparative design and use of the validated MENQOL instrument, although its cross-sectional nature and potential recall bias limit causal inference. Multicentric longitudinal studies incorporating biochemical and genetic markers are warranted to validate these findings.

Keywords: Anemia, Comorbidities, MENQOL, Metabolic Disorders, Quality of Life.

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INTRODUCTION

Menopause is a natural biological transition signifying the permanent cessation of menstruation due to the depletion of ovarian follicles, marking the termination of reproductive capability. After 12 months of amenorrhea, this stage is clinically defined and is characterized by complex hormonal changes that lead to a wide range of vasomotor, psychological, urogenital, and musculoskeletal symptoms, which have a significant impact on women's overall health and Quality of Life (QOL) (Dalal and Agarwal, 2015b; Davis *et al.*, 2015). Recent evidence indicates that menopausal symptoms are not solely physiological; they are greatly linked to psychosocial and lifestyle factors, frequently resulting in multidimensional impairment of quality of life (Theis *et al.*, 2023; Keye *et al.*, 2023). Utilization of validated instruments, such as the Menopause-Specific Quality of Life (MENQOL) questionnaire, allows for a thorough assessment of symptom burden across physical, psychosocial, and sexual domains, thereby enhancing the comprehension of postmenopausal health outcomes.

In Indian women, early onset of menopause and inequality in terms of access to healthcare facilities and nutritional services are major determinants responsible for complicating their experience with menopause. It is well-established that education, co-morbidity, and lifestyle factors are highly influential when it comes to the quality of life among menopausal women, specifically

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those living in rural settings with an increased disease burden (Gupta *et al.*, 2023; Kang *et al.*, 2021). Studies in recent times have emphasized the effect of sleep disorder, mental health problems, and other health conditions associated with declining quality of life among menopausal women (Liu *et al.*, 2025). Nevertheless, there remains a significant gap in the literature on rural versus urban comparisons based on health and MENQOL.

MATERIALS AND METHODS

Study Design and Setting

It was a cross-sectional community-based study, having 500 postmenopausal women from rural (n=250) and urban (n=250) region of Himachal Pradesh, India. The research time period was [January 2023-January 2025], and data was collected by house-to-house surveys.

Participants and Sampling

A stratified random sample of 500 postmenopausal women (250 rural, 250 urban) was selected, including postmenopausal women with willingness to participate and excluding those with surgical menopause, severe illness, cognitive impairment, or unwillingness to participate. The sample size was calculated using 50% prevalence, 5% precision, and 95% confidence interval (minimum 384), and increased to 500 to allow subgroup analysis (climacteric vs. senile stages). Staging of menopausal was determined in number of years since the last menstrual period upto 7 years is categorised as climacteric and more than seven is senile.

Data Collection Tools

A pre-tested structured interview schedule was employed to gather sociodemographic information, menopause-related information, and presence of any co-morbid illnesses. The health status of the respondents was measured through fasting blood sugar levels, blood pressure, lipid profile, and hemoglobin values. Blood pressure was taken after 5 min of rest (average value of two measurements) with high blood pressure being defined as BP ≥140/90 mmHg. Fasting blood sugar ≥126 mg/dL was indicative of diabetes mellitus. The lipid profile was carried out using enzymatic technique; those with total cholesterol ≥200 mg/dL were considered to be dyslipidemic. Hemoglobin levels were determined by an automated machine. Anemia was diagnosed based on WHO guidelines. The quality of life was measured using the 29-item MENQOL questionnaire. High scores indicate more symptoms; the four domains of effect were none, mild, moderate, and severe.

Ethical Considerations

Ethical approval From Maharishi Markendeshwar University Mullana Ambala Institutional Ethics Committee] was received with Project No.- IEC No. 2327]. Written Informed consent was obtained by all the participants following explanation of study objectives in local dialect (Hindi/Pahari).

Statistical Analysis

The data analysis was done in SPSS version 22.0 (IBM Corp., Armonk, NY).

RESULTS

Among 500 women (250 urban, 250 rural), urban climacteric (n=147) had a mean age of 49.23±3.04 vs. senile (n=103) 46.67±4.39 (t=5.45, p<0.001), and rural climacteric (n=148) 47.80±3.32 vs. senile (n=102) 46.12±3.73 (t=3.73, p<0.001), indicating significantly higher menopausal age in climacteric groups and slightly later menopause in urban women shown in Figure 1.

Diabetes (19.8%), hypertension (31.4%), and dyslipidemia (39.8%) showed no significant rural-urban differences (p>0.05), though urban rates were slightly higher for diabetes (22.4% vs 17.2%), while all conditions were significantly more prevalent and severe in senile than climacteric women (p<0.001), as shown in Table 1.

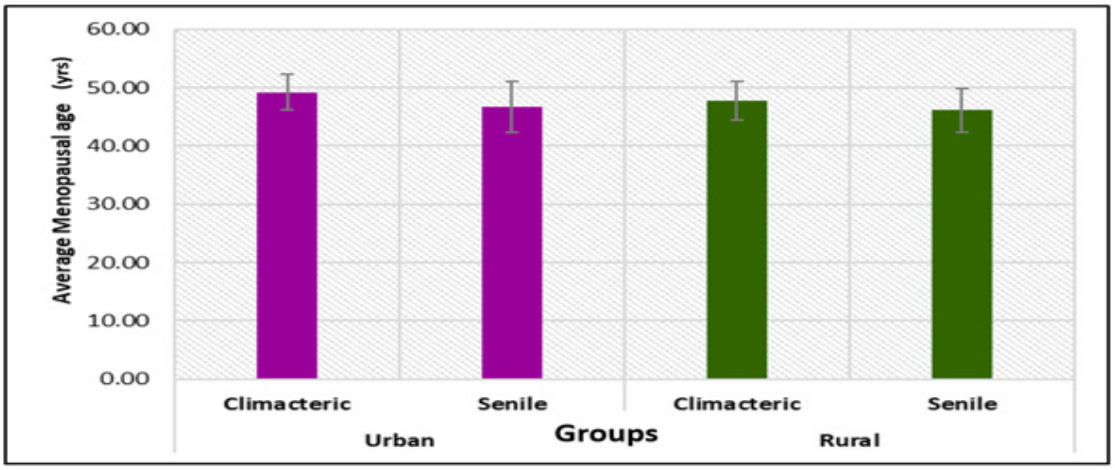


Figure 1: Average Menopausal age with standard deviation in total, Urban rural, Climacteric and Senile.

Table 1: Metabolic Comorbidities and Mean Biomarker Levels Among Postmenopausal Women (*n*=500).

Condition	Total n (%) Mean±SD	Rural total n (%) Mean±SD	Rural climacteric n (%) Mean±SD	Rural senile n (%) Mean±SD	Urban total n (%) Mean±SD	Urban climacteric n (%) Mean±SD	Urban senile n (%) Mean±SD	*p (Urban vs Rural)	†p(Climacteric vs Senile)
Diabetes Status									
No diabetes	401 (80.2%) 94.8±7.2 mg/dL	183 (73.2%) 94.3±7.6	132 (89.2%) 93.5±7.0	51 (50.0%) 96.2±8.1	218 (87.2%) 95.2±6.9	128 (87.1%) 94.1±6.5	90 (87.4%) 96.7±7.3	0.178	<0.001
Diabetes	99 (19.8%) 157.4±22.6 mg/dL	43 (17.2%) 155.1±21.5	16 (10.8%) 149.6±18.7	27 (26.5%) 159.8±22.9	56 (22.4%) 159.1±23.4	19 (12.9%) 152.7±19.2	27 (26.2%) 163.8±24.1	0.178	<0.001
Hypertension status									
No hypertension	343 (68.6%) 128±10.5 mmHg	167 (66.8%) 127±10.4	120 (81.1%) 126±10.0	47 (46.1%) 130±10.9	176 (70.4%) 129±10.7	122 (82.9%) 128±10.2	54 (52.4%) 131±11.1	0.441	<0.001
Hypertension	157 (31.4%) 152±12.3 mmHg	83 (33.2%) 151±12.0	28 (18.9%) 149±11.6	55 (53.9%) 154±12.7	74 (29.6%) 153±12.4	25 (17.0%) 150±11.8	49 (47.6%) 155±12.9	0.441	<0.001
Dyslipidemia status									
No dyslipidemia	301 (60.2%) 178±24.5 mg/dL								
Dyslipidemia	199 (39.8%) 228±32.7 mg/dL	99 (39.6%) 227±32.4	31 (21.0%) 225±31.5	68 (66.7%) 230±33.4	100 (40.0%) 229±33.0	32 (21.8%) 226±31.8	68 (66.0%) 231±33.6	1.000	<0.001

Table 2: Prevalence and Mean Hemoglobin Levels by Anemia Severity, Location, and Menopausal Stage (*n*=500).

Anemia severity (Hb g/dL)	Total n (%) Mean±SD	Rural total n (%) Mean±SD	Rural climacteric n (%) Mean±SD	Rural senile n (%) Mean±SD	Urban total n (%) Mean±SD	Urban climacteric n (%) Mean±SD	Urban senile n (%) Mean±SD	*p (Urban vs Rural)	†p (Climacteric vs Senile)
Normal (≥12.0)	157 (31.4%) 12.8±0.5	77 (30.8%) 12.7±0.5	46 (31.1%) 12.7±0.5	31 (30.4%) 12.8±0.5	80 (32.0%) 12.9±0.4	47 (58.8%) 12.8±0.5	33 (41.2%) 13.0±0.4	0.212	0.318
Mild (11.0-11.9)	105 (21.0%) 11.5±0.3	56 (22.4%) 11.4±0.3	26 (17.6%) 11.4±0.3	29 (28.4%) 11.3±0.3	49 (19.6%) 11.6±0.3	30 (20.4%) 11.5±0.3	19 (18.4%) 11.6±0.3	0.041	0.089
Moderate (8.0-10.9)	226 (45.2%) 9.6±0.8	107 (42.4%) 9.5±0.9	73 (48.6%) 9.4±0.9	34 (33.3%) 9.6±0.8	119 (47.6%) 9.7±0.8	71 (47.6%) 9.6±0.8	48 (46.6%) 9.8±0.7	0.154	0.267
Severe (<8.0)	12 (2.4%) 7.2±0.5	6 (2.4%) 7.3±0.5	4 (2.7%) 7.3±0.5	2 (2.0%) 7.2±0.4	6 (2.4%) 7.1±0.4	1 (0.7%) 7.4±0.3	5 (4.9%) 7.0±0.4	0.462	0.381

Most postmenopausal women were anemic, in which moderate anemia was most prevalent (45.2%), followed by normal hemoglobin (31.4%), mild (21.0%), and severe anemia (2.4%), showing no significant rural-urban differences or mean Hb variation ($p>0.05$), while senile women had significantly higher prevalence, particularly of moderate and mild anemia ($p<0.05$) Shown in Table 2.

Comorbidities were highly prevalent among postmenopausal women, with significant stage-wise variation but minimal rural-urban differences. Depression was most common (75.6%), higher in urban (78.4%) than rural (72.8%) women, and significantly greater in senile women ($p<0.001$). Anemia affected 68.8%, with greater severity in rural and elderly groups. Dyslipidemia (39.8%) and hypertension (31.4%) were higher in rural populations and significantly lower in climacteric than senile women ($p<0.001$), while diabetes (19.8%) was more common in senile women. Other conditions-hypothyroidism (8.4%), hypotension (3.4%), cardiovascular disease (1.6%), and cancer (0.8%)-showed no rural-urban variation. Surgical history was noted in 18%, mainly hysterectomy (6.4%), caesarean section (3.6%), appendectomy (3.0%), and cholecystectomy (2.4%). Overall, comorbidity burden increased with menopausal

stage, with negligible rural-urban differences shown in Table 3. Moderate anemia was most prevalent (45.2%), followed by normal Hb (31.4%), mild (21.0%), and severe (2.4%); most women had normal menopause (97.8%), with early menopause comprising 1% and contributing 1.2% severe cases, while mean Hb was slightly higher in late menopause (13.7±0.4 g/dL), and overall anemia patterns were largely driven by the predominance of normal menopausal women shown in Table 4.

No major differences in any MENQOL domains among rural and urban areas. The overall scores were similar (p=0.126), the psychosocial and physical effects were similar, whereas vasomotor symptoms were slightly reduced but not significant in rural women (p=0.061), and the sexual decline was moderate in both groups (p=0.115). According to menopausal stage, senile women demonstrated inferior metabolic health, increased anemia prevalence, and more significant MENQOL decline compared to climacteric women as shown in Table 5.

Table 3: Comorbidities and Surgical history prevalence in the Postmenopausal female population (n=500).

Condition	Total n (%)	Rural total (n=250)	Rural climacteric (n=148)	Rural senile (n=102)	Urban total (n=250)	Urban climacteric (n=147)	Urban senile (n=103)	*p (Rural vs Urban)	†p (Climacteric vs Senile)
Comorbidities									
Diabetes	99 (19.8)	43 (17.2)	16 (10.8)	27 (26.5)	56 (22.4)	19 (12.9)	27 (26.2)	0.178	<0.001
Dyslipidemia	199 (39.8)	99 (39.6)	31 (21.0)	68 (66.7)	100 (40.0)	32 (21.8)	68 (66.0)	1.000	<0.001
Cardiovascular disease	8 (1.6)	3 (1.2)	1 (0.7)	2 (2.0)	5 (2.0)	1 (0.7)	4 (3.9)	0.724‡	0.069‡
Depression	378 (75.6)	182 (72.8)	77 (52.0)	102 (100.0)	196 (78.4)	109 (74.1)	87 (84.5)	0.176	<0.001
Hypothyroidism	42 (8.4)	22 (8.8)	13 (8.8)	9 (8.8)	20 (8.0)	6 (4.1)	14 (13.6)	0.872	0.083
Hypotension	17 (3.4)	3 (1.2)	2 (1.4)	1 (1.0)	14 (5.6)	8 (5.4)	6 (5.8)	0.014‡	1.000‡
Hypertension	157 (31.4)	83 (33.2)	28 (18.9)	55 (53.9)	74 (29.6)	25 (17.0)	49 (47.6)	0.441	<0.001
Cervical & arthritis	32 (6.4)	17 (6.8)	1 (0.7)	16 (15.7)	15 (6.0)	3 (2.0)	12 (11.7)	0.855	<0.001
Anemia	344 (68.8)	177 (70.8)	78 (52.7)	99 (97.1)	167 (66.8)	82 (55.8)	85 (82.5)	0.385	<0.001
Cancer	4 (0.8)	2 (0.8)	1 (0.7)	1 (1.0)	2 (0.8)	1 (0.7)	1 (1.0)	1.000‡	1.000‡
Surgical History									
Any surgery done	90 (18.0)	45 (18.0)	25 (16.9)	20 (19.6)	45 (18.0)	24 (16.3)	21 (20.4)	-	-
Hysterectomy	32 (6.4)	16 (6.4)	9 (6.1)	7 (6.9)	16 (6.4)	8 (5.4)	8 (7.8)	-	-
Caesarean section	18 (3.6)	9 (3.6)	5 (3.4)	4 (3.9)	9 (3.6)	4 (2.7)	5 (4.9)	-	-
Appendectomy	15 (3.0)	7 (2.8)	4 (2.7)	3 (2.9)	8 (3.2)	4 (2.7)	4 (3.9)	-	-
Cholecystectomy	12 (2.4)	6 (2.4)	3 (2.0)	3 (2.9)	6 (2.4)	3 (2.0)	3 (2.9)	-	-
Other gynecological surgery	8 (1.6)	4 (1.6)	2 (1.4)	2 (2.0)	4 (1.6)	2 (1.4)	2 (1.9)	-	-
Other abdominal/ orthopedic surgery	5 (1.0)	3 (1.2)	2 (1.4)	1 (1.0)	2 (0.8)	1 (0.7)	1 (1.0)	-	-

Table 4: Distribution of Anemia Severity Across Menopause Categories (*n*=500).

Anemia Severity (Hb g/dL)	Total n (%) Mean Hb±SD	Early menopause n (%) Mean Hb±SD	Normal menopause n (%) Mean Hb±SD	Late menopause n (%) Mean Hb±SD
Normal (≥12.0)	157 (31.4%) 12.8±0.5	3 (1.9%) 13.2±0.5	152 (30.4%) 12.8±0.5	2 (1.3%) 13.7±0.4
Mild (11.0-11.9)	105 (21.0%) 11.5±0.3	1 (0.6%) 11.4±0.0	103 (20.6%) 11.5±0.3	1 (0.6%) 11.4±0.0
Moderate (8.0-10.9)	226 (45.2%) 9.6±0.8	1 (0.6%) 9.0±0.0	222 (44.4%) 9.6±0.8	3 (1.9%) 9.9±0.5
Severe (<8.0)	12 (2.4%) 7.2±0.5	0 (0.0%) -	12 (2.4%) 7.2±0.5	0 (0.0%) -
Total	500 (100.0%) -	5 (1.0%) -	489 (97.8%) -	6 (1.2%) -

Table 5: Association of MENQOL with Place.

Domains of MENQOL		Place				Significance	
		Rural		Urban			
		No.	%	No.	%	chi sq	*p*-value
Vasomotor	No effect	170	68.0%	147	58.8%	5.59	0.061
	Mild decline	56	22.4%	79	31.6%		
	Moderate decline	24	9.6%	24	9.6%		
	Severe decline	0	0.0%	0	0.0%		
Psychosocial	No effect	200	80.0%	193	77.2%	1.73	0.421
	Mild decline	49	19.6%	57	22.8%		
	Moderate decline	1	.4%	0	0.0%		
	Severe decline	0	0.0%	0	0.0%		
Physical	No effect	91	36.4%	80	32.0%	1.66	0.437
	Mild decline	142	56.8%	156	62.4%		
	Moderate decline	17	6.8%	14	5.6%		
	Severe decline	0	0.0%	0	0.0%		
Sexual	No effect	14	5.6%	7	2.8%	5.94	0.115
	Mild decline	28	11.2%	27	10.8%		
	Moderate decline	139	55.6%	162	64.8%		
	Severe decline	69	27.6%	54	21.6%		
MENQOL	No effect	113	45.2%	111	44.4%	4.15	0.126
	Mild decline	133	53.2%	139	55.6%		
	Moderate decline	0	0.0%	0	0.0%		
	Severe decline	4	1.6%	0	0.0%		

DISCUSSION

Climacteric women exhibited a markedly higher menopausal age compared to senile women in both urban (49.23±3.04 vs. 46.67±4.39) and rural (47.80±3.32 vs. 46.12±3.73) groups, indicating a slight delay in menopause among urban populations. This supports the notion that socioeconomic factors affect menopausal timing, with menopausal stage serving as a more significant determinant than residence (An and Li, 2023b; Dwyer *et al*., 2024; Sievert *et al*., 2021).

The lack of substantial rural-urban differences in diabetes (19.8%), hypertension (31.4%), and dyslipidemia (39.8%), coupled with their markedly elevated prevalence in elderly women ($p<0.001$), corroborates recent findings that menopausal stage and hormonal decline are principal factors influencing metabolic risk. A lack of estrogen during menopause can make insulin resistance worse, change lipids in an adverse way, and elevate heart disease risks (Anagnostis and Stevenson, 2023). Furthermore, prolonged post-menopause correlates with an elevated prevalence of metabolic syndrome and its components, elucidating the increased burden noted in elderly women (Erdoğan and Sanlier, 2024).

The elevated incidence of anemia, especially moderate anemia (45.2%), corroborates recent findings indicating that anemia is prevalent among postmenopausal women due to age-related and hormonal alterations (Kim and Kim, 2022). The absence of rural-urban disparities ($p>0.05$) indicates a more pronounced effect of biological aging, whereas the notably elevated burden in senile women ($p<0.05$) corresponds with evidence that the risk of anemia escalates with the progression and duration of menopause (Fakhri *et al*., 2024).

The current study identified no significant rural-urban disparities in MENQOL domains, indicating that residence plays a minimal role in influencing menopausal quality of life. These findings align with recent research emphasizing the more substantial impact of comorbidities and perceived health status (Nissy *et al*., 2025). Similar psychosocial and physical effects among groups reinforce the notion that menopausal symptoms are predominantly influenced by hormonal fluctuations rather than environmental factors (Yerra *et al*., 2021). Menopausal stage was identified as the principal determinant, with senile women exhibiting inferior metabolic health, an increased comorbidity burden, and a more significant decline in quality of life relative to climacteric women, aligning with findings that associate advancing menopausal stage with deteriorating MENQOL outcomes (Mukherjee *et al*., 2025). In general, these results show that biological aging and the stage of menopause are the main factors that affect menopausal health outcomes.

CONCLUSION

The study shows that the place of residence is not a significant determinant of the quality of life in menopause-specific cases, since comparable MENQOL results have been seen across all domains, while menopausal stage is regarded as a major factor influencing the outcome. In the study, senile women had poor metabolic profile, increased morbidity and decreased quality of life compared to climacteric women. It is apparent that physiological aspects are more relevant compared to geographical factors. One major advantage associated with this study involves its comparative approach, which enables the assessment of both residential location and menopausal stage, in addition to multi-dimensional assessment using the MENQOL scale. Its limitations include its cross-sectional design, preventing causal analysis, as well as recall bias. Further research should aim at the development of multi-centric and longitudinal studies, incorporating biochemical, genetic.

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ABBREVIATIONS

MENQOL: Menopause-Specific Quality of Life; **QOL:** Quality of Life; **BP:** Blood Pressure; **Hb:** Haemoglobin; **WHO:** World Health Organization; **SPSS:** Statistical Package for the Social Sciences; **SD:** Standard Deviation; **n:** Number of Participants; **IEC:** Institutional Ethics Committee.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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