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ORIGINAL ARTICLE

Shaping the Transition: BMI's Link to Quality of Life and Clinical Profiles

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ABSTRACT

Background: Perimenopause represents a critical transitional phase in a woman's life, characterized by profound hormonal, metabolic, and physiological changes that significantly impact health and well-being. Body Mass Index (BMI) is an important anthropometric indicator that may modulate the severity of menopausal symptoms and influence quality of life during this vulnerable period. Understanding the relationship between BMI, quality of life, and clinico-biochemical parameters in perimenopausal women is essential for developing targeted, evidence-based interventions.

Objectives: To evaluate the association of BMI with quality of life using the MENQOL score and to describe the relationship of BMI with clinico-biochemical profile among perimenopausal women.

Methods: A cross-sectional analytical study was conducted among 134 perimenopausal women aged 45–55 years attending the Gynaecology OPD at Bharati Vidyapeeth (Deemed to be University) Medical College and Hospital, Pune, from February 2024 to July 2025. Quality of life was assessed using the validated Menopause-Specific Quality of Life (MENQOL) questionnaire. Anthropometric, haematological, biochemical, lipid profile, ultrasonographic, and cervical cytology data were collected and analyzed across BMI categories.

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Results: The mean age was 50.17 ± 3.40 years and mean BMI was 26.68 ± 7.10 kg/m². Of the participants, 58.2% were overweight or obese. The physical domain of MENQOL showed a statistically significant association with BMI ($p<0.001$), with scores rising progressively from underweight (2.25 ± 0.45) to obese women (3.15 ± 0.55). No significant differences were found in vasomotor ($p=0.286$), psychosocial ($p=0.694$), sexual ($p=0.655$), or total MENQOL scores ($p=0.439$) across BMI categories. Elevated lipid parameters, subclinical hypothyroidism, and hyperglycaemia were present across all BMI groups. Platelet count varied significantly across BMI categories ($p=0.043$). No significant BMI-related differences were found in endometrial thickness, uterine or ovarian pathology, Pap smear findings, or mammography classifications.

Conclusion: BMI significantly impacts the physical symptom domain of quality of life in perimenopausal women. Metabolic derangements, however, appear to be universal across all BMI categories, underscoring the importance of comprehensive metabolic screening for all perimenopausal women regardless of weight status.

KEYWORDS

• Perimenopause • Body Mass Index • Quality of Life • MENQOL • Clinico-biochemical profile • Lipid profile • Menopausal transition

INTRODUCTION

The menopausal transition is a significant period in a woman's life associated with substantial physical, metabolic, and psychological changes that are detrimental to both health and well-being. A woman is defined as postmenopausal after 12 consecutive months of amenorrhoea. Numerous lipid metabolic disorders arise during this transition, driven by alterations in hormones, including decreased oestrogen and increased circulating androgens, which contribute to the onset of metabolic syndrome, cardiovascular disease, and type II diabetes.[1] The perimenopause, considered a preceding stage typically occurring over several years before menopause, is increasingly recognized as a crucial window for medical interventions that may yield optimal long-term health outcomes. With approximately one-third of women's lives now lived after menopause, the global demographic shift toward an aging population has brought renewed attention to menopausal health.[2] BMI has been identified as an anthropometric indicator linked to health outcomes at all stages of life; the percentage of years lived in good perceived health between ages 50 and 75 decreases with higher BMI, with 81% of normal-weight individuals maintaining good perceived health compared to only 53% among those with class II obesity.[3]

The menopausal transition is associated with considerable changes in the clinico-biochemical profile, including lipid metabolism, glucose homeostasis, and inflammatory markers. Women undergoing this transition demonstrate increased total cholesterol, triglycerides, LDL, and ApoB, and decreased HDL and ApoA.[4] Studies indicate an average yearly increase of 7.4 ± 8.0 mg/dL in total cholesterol and 6.9 ± 6.5 mg/dL in LDL cholesterol during perimenopause.[5] Beyond lipid metabolism, hormonal fluctuations profoundly affect glucose homeostasis and insulin sensitivity.[6] Declining oestrogen and progesterone levels cause blood sugar fluctuations, and women experience significantly increased vulnerability to insulin resistance during this period, substantially elevating the risk of developing type II diabetes mellitus and cardiovascular disease.[7,8] These metabolic dysfunctions collectively create a complex pathophysiologic environment affecting both physical and mental health, manifesting as fatigue, mood disturbance, and abdominal weight gain.

BMI has a direct relationship with quality of life during perimenopause. A BMI greater than 25 is associated with increased severity of vasomotor symptoms such as hot flashes and night sweats, as well as comorbid conditions that further amplify negative impacts on well-being.[9] This study employs a cross-sectional design, which enables simultaneous examination of multiple variables representing different aspects of

health during the menopausal transition.[10] To date, limited information exists regarding the health implications of the wide range of weight values seen during perimenopause. This investigation therefore aims to fill an important gap in the literature by assessing the association between BMI, quality of life using the MENQOL questionnaire, and clinico-biochemical parameters in perimenopausal women — providing evidence that may assist healthcare professionals in developing more effective, individualized support programs for women undergoing this transition.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted at the Department of Obstetrics and Gynaecology, Bharati Vidyapeeth (Deemed to be University) Medical College and Hospital, Pune, Maharashtra, India, over an 18-month period from February 2024 to July 2025. Ethical approval was obtained from the Institutional Ethics Committee (REF: BVDUMC/IEC/76, dated 23/03/2024). A consecutive sampling technique was employed, enrolling 134 perimenopausal women aged 45–55 years attending the Gynaecology OPD who provided written informed consent. Women with surgical menopause (bilateral oophorectomy or hysterectomy), those receiving hormone replacement therapy, and those diagnosed with premature ovarian failure were excluded.

Standardized anthropometric measurements were recorded, and BMI was calculated as weight (kg)/height (m^2), with participants categorized as underweight (<18.5), normal (18.5–24.9), overweight (25–29.9), or obese (≥30 kg/m^2). Quality of life was assessed using the validated Menopause-Specific Quality of Life (MENQOL) questionnaire, comprising 29 items across four domains: vasomotor (3 items), psychosocial (7 items), physical (16 items), and sexual (3 items), each rated on a 7-point Likert scale. The questionnaire was translated into Marathi and validated prior to use. Comprehensive investigations included a complete haemogram, fasting blood sugar, TSH, full lipid profile (total cholesterol, LDL, HDL, triglycerides), and urine examination. Additional assessments included abdominal and pelvic ultrasonography for uterine and ovarian morphology and endometrial thickness, Pap smear for cervical cytology, mammography with BIRADS classification, and ECG. Statistical analysis was performed using ANOVA for normally distributed continuous variables, and chi-square tests for categorical variables, with significance set at $p<0.05$.

RESULTS

The study enrolled 134 perimenopausal women with a mean age of 50.17 ± 3.40 years and a near-equal distribution between the 45–50 and 51–55 year age groups (Table 1). The mean BMI was 26.68 ± 7.10 kg/m^2, placing the average participant in the overweight category, with 32.1% classified as obese — the largest single BMI group. The majority (59.7%) had 12 or more months of amenorrhoea, confirming a predominantly late perimenopausal to early postmenopausal sample.

Table 1: Baseline Demographic and Anthropometric Characteristics (n=134)

Parameter	Value
Mean Age ± SD (years)	50.17 ± 3.40
Age group 45–50 years, n (%)	68 (50.7%)
Age group 51–55 years, n (%)	66 (49.3%)
Mean Parity ± SD	3.15 ± 1.98
Mean Age at Menarche ± SD (years)	13.00 ± 2.11
Mean BMI ± SD (kg/m^2)	26.68 ± 7.10
Underweight (<18.5), n (%)	20 (14.9%)
Normal (18.5–24.9), n (%)	36 (26.9%)
Overweight (25–29.9), n (%)	35 (26.1%)
Obese (≥30), n (%)	43 (32.1%)
Currently menstruating, n (%)	1 (0.7%)
Amenorrhoea <12 months, n (%)	53 (39.6%)
Amenorrhoea ≥12 months, n (%)	80 (59.7%)

Clinico-biochemical analysis (Table 2) revealed that the overall population demonstrated a mean haemoglobin of 11.35 ± 2.21 g/dL, indicative of mild anaemia, while mean TSH of 5.31 ± 2.77 mIU/L suggested subclinical hypothyroidism and mean random blood glucose of 137.04 ± 34.99 mg/dL indicated hyperglycaemia — all present uniformly across BMI groups without statistically significant inter-group differences. The lipid profile demonstrated dyslipidaemia universally: mean total cholesterol was 223.44 ± 43.84 mg/dL and mean triglycerides were 220.10 ±

104.90 mg/dL, with no significant variation across BMI categories (all p>0.05). The only significant haematological finding was platelet count variation across BMI groups (p=0.043), with underweight women demonstrating the highest counts (322,103 ± 87,720 cells/μL) and overweight women the lowest (266,802 ± 85,610 cells/μL).

Table 2: Clinico-Biochemical Parameters Across BMI Categories

Parameter	Underweight (n=20)	Normal (n=36)	Overweight (n=35)	Obese (n=43)	p-value
Haemoglobin (g/dL)	11.36 ± 1.78	11.49 ± 2.35	10.87 ± 2.04	11.62 ± 2.40	0.487
WBC (cells/μL)	7262.50 ± 2261.59	8229.75 ± 1929.64	7505.40 ± 2200.46	7657.07 ± 2011.14	0.320
Platelet (cells/μL)	322103 ± 87720	290901 ± 73538	266802 ± 85610	313181 ± 84941	0.043*
BSL Random (mg/dL)	135.90 ± 40.12	137.64 ± 35.44	138.17 ± 31.07	136.14 ± 36.31	0.992
TSH (mIU/L)	5.01 ± 2.72	5.70 ± 2.93	5.55 ± 2.45	4.92 ± 2.93	0.561
Total Cholesterol (mg/dL)	227.10 ± 33.51	222.81 ± 47.63	230.80 ± 44.29	216.28 ± 44.67	0.521
HDL Cholesterol (mg/dL)	50.90 ± 16.01	53.78 ± 14.07	57.69 ± 15.51	53.67 ± 14.20	0.393
LDL Cholesterol (mg/dL)	136.20 ± 30.02	144.75 ± 32.13	138.09 ± 40.53	134.58 ± 36.85	0.637
Triglycerides (mg/dL)	226.20 ± 88.11	217.44 ± 112.11	223.20 ± 107.16	216.98 ± 107.33	0.984

***Statistically significant** at p<0.05

MENQOL quality of life analysis (Table 3) revealed a mean total score of 3.02 ± 0.50, reflecting moderate symptom burden. The physical domain was the only domain to show a statistically significant association with BMI (p<0.001), with a clear progressive increase in physical symptom scores from underweight (2.25 ± 0.45) through normal (2.85 ± 0.62), overweight (3.08 ± 0.47), to obese women (3.15 ± 0.55). No significant differences were observed in vasomotor (p=0.286), psychosocial (p=0.694), sexual (p=0.655), or total MENQOL scores (p=0.439) across BMI categories.

Table 3: MENQOL Quality of Life Scores by BMI Category

MENQOL Domain	Overall Mean ± SD	Underweight (n=20)	Normal (n=36)	Overweight (n=35)	Obese (n=43)	p-value
Vasomotor	3.11 ± 1.14	3.47 ± 0.98	2.87 ± 1.45	3.07 ± 1.00	3.19 ± 1.02	0.286
Psychosocial	2.95 ± 0.69	3.03 ± 0.71	2.88 ± 0.68	3.04 ± 0.69	2.90 ± 0.70	0.694
Physical	3.02 ± 0.49	2.25 ± 0.45	2.85 ± 0.62	3.08 ± 0.47	3.15 ± 0.55	<0.001*
Sexual	3.00 ± 1.16	2.97 ± 1.13	3.06 ± 1.41	3.17 ± 1.11	2.84 ± 0.97	0.655
Total MENQOL	3.02 ± 0.50	3.13 ± 0.47	2.99 ± 0.59	3.08 ± 0.48	2.95 ± 0.44	0.439

***Statistically significant** at p<0.05

Imaging and screening findings (Table 4) revealed a mean endometrial thickness of 8.31 ± 3.90 mm, within the acceptable range for perimenopausal women, with no significant variation by BMI (p=0.570). Uterine abnormalities were present in 34.3% and ovarian abnormalities in 23.1% of participants overall, with no significant inter-BMI differences (p=0.307 and p=0.106, respectively). Abnormal Pap smear findings (ASCUS, LSIL, or HSIL) were noted in 58.2% of participants overall, with the highest ASCUS proportion in underweight women (45.0%), though overall Pap distribution did not differ significantly by BMI (p=0.448). Mammography findings categorized as BIRADS 3 or 4 were found in 31.3% of participants, without significant BMI-related differences (p=0.235).

Table 4: Imaging and Screening Findings Across BMI Categories

Parameter	Overall	Underweight (n=20)	Normal (n=36)	Overweight (n=35)	Obese (n=43)	p-value
Endometrial Thickness mm, Mean ± SD	8.31 ± 3.90	8.75 ± 4.34	8.36 ± 3.80	8.80 ± 3.76	7.65 ± 3.93	0.570

table cont....

Abnormal USG Uterus, n (%)	46 (34.3%)	9 (45.0%)	10 (27.8%)	15 (42.9%)	12 (27.9%)	0.307
Abnormal USG Ovaries, n (%)	31 (23.1%)	5 (25.0%)	5 (13.9%)	13 (37.1%)	8 (18.6%)	0.106
Abnormal Pap Smear (ASCUS/LSIL/HSIL), n (%)	78 (58.2%)	15 (75.0%)	20 (55.6%)	19 (54.3%)	24 (55.8%)	0.448
BIRADS 3 or 4, n (%)	42 (31.3%)	4 (20.0%)	10 (27.8%)	14 (40.0%)	14 (32.6%)	0.235

DISCUSSION

The present cross-sectional study examined the association between BMI, quality of life, and clinico-biochemical parameters in 134 perimenopausal women aged 45–55 years. Our primary finding was that BMI significantly influenced the physical symptom domain of the MENQOL questionnaire ($p<0.001$), with a linear increase in physical symptom burden from underweight to obese women. This finding is consistent with those of Refaei M *et al* (2021),[11] who in a comparable sample of 136 women found BMI to be a significant predictor of all MENQOL domains, with the strongest effect on the physical domain (coefficient 1.421, $p=0.001$). Similarly, Ghazanfarpour M *et al* (2013)[12] and Daley A *et al* (2007)[13] both reported that obesity was associated with greater physical symptom burden during the menopausal transition. Notably, however, we did not replicate the association between BMI and vasomotor symptoms reported by Daley A *et al* ($p<0.03$),[13] or the prediction of vasomotor symptoms by BMI found by Refaei M *et al* ($p=0.019$).[11] This discrepancy may reflect ethnic and geographic differences in thermoregulatory response to hormonal fluctuations; the Indian population studied here may experience vasomotor symptoms differently from Western cohorts. Similarly, no significant association was found between BMI and psychosocial ($p=0.694$), sexual ($p=0.655$), or total MENQOL ($p=0.439$) scores, contrasting with Refaei M *et al*,[11] who found significant predictions across all domains. This suggests that cultural, socioeconomic, and population-specific factors substantially modulate the relationship between body weight and quality of life dimensions beyond the physical.

Regarding the clinico-biochemical profile, a striking finding of this study was that metabolic derangements — specifically elevated total cholesterol, triglycerides, LDL, subclinical hypothyroidism, and hyperglycaemia — were uniformly present across all BMI categories, without statistically significant inter-group differences (all lipid $p>0.05$; TSH $p=0.561$; BSL $p=0.992$). This finding challenges the conventional expectation that metabolic dysfunction would be disproportionately concentrated among overweight or obese individuals, and instead supports the view that perimenopausal hormonal changes drive a generalized metabolic vulnerability independent of weight status — consistent with large cohort data from the SWAN study.[14] The only significant haematological finding was platelet count variation across BMI categories ($p=0.043$), with underweight women showing the highest counts and overweight women the lowest; this novel observation warrants further investigation, particularly given the potential implications for cardiovascular risk stratification in this population. In a parallel domain, Woods R *et al* (2020)[15] demonstrated that lean body mass rather than total BMI was protective against vasomotor symptoms in the SWAN cohort (overall association $p=0.023$), suggesting that future interventions should prioritize maintenance of muscle mass through resistance training over simple weight reduction. Our findings of universally elevated lipid parameters across all BMI categories further reinforce this argument — weight loss alone is unlikely to adequately address the metabolic risk landscape of perimenopause.

Comprehensive screening assessments revealed that structural and cytologic changes in the female reproductive tract were not significantly associated with BMI. Endometrial thickness, uterine and ovarian pathology, Pap smear findings, and mammography classifications showed no significant inter-BMI differences ($p=0.570$, 0.307, 0.106, 0.448, and 0.235, respectively), suggesting that reproductive organ changes during perimenopause are determined primarily by ovarian senescence rather than by metabolic or adiposity-related factors. Notably, 73.9% of Pap smears showed abnormal or inadequate results, and 31.3% of mammograms were BIRADS 3 or 4, with this burden distributed uniformly across BMI categories — an important finding underscoring that all perimenopausal women, regardless of weight, require regular gynaecologic and breast cancer

screening. Collectively, these results carry significant clinical implications: healthcare providers should implement comprehensive metabolic and cancer screening for all perimenopausal women irrespective of BMI, while simultaneously promoting resistance-based physical activity and individualized dietary strategies targeting the hormonal rather than purely weight-related drivers of menopausal health. Future longitudinal studies incorporating detailed body composition analysis, larger and more diverse populations, and objective metabolic markers such as HbA1c and fasting glucose will be essential to further elucidate the complex interrelationships between body composition, metabolic health, and quality of life during this critical life transition.

CONCLUSION

This cross-sectional study of 134 perimenopausal women demonstrated that while BMI significantly influences the physical symptom domain of quality of life ($p<0.001$), with a linear worsening of physical symptoms from underweight to obese women, it does not significantly affect vasomotor, psychosocial, sexual, or total MENQOL scores. The metabolic profile — including dyslipidaemia, subclinical hypothyroidism, and hyperglycaemia — was uniformly elevated across all BMI categories, establishing that perimenopause itself, rather than BMI, is the primary driver of metabolic vulnerability in this population. Platelet count was the only haematological parameter that varied significantly with BMI, warranting further research. Reproductive organ structural and cytologic changes were likewise independent of BMI, highlighting that ovarian senescence rather than adiposity governs these changes. These findings advocate for universal metabolic and cancer screening for all perimenopausal women regardless of weight, and for clinical strategies that emphasize lean muscle mass preservation and hormone-targeted interventions over weight-centric approaches alone.

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