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Serum Prolactin as a Correlate of Menopausal Symptom Severity: A Prospective Observational Study Using the Menopause Rating Scale in Postmenopausal Women at a Tertiary Care Centre in South India.

Dr. Deepak Ramesh[1], Dr. Asha P.[2]*, Dr. Harshavardhan L.[3], Dr. Akhil Murali Nair[4], Dr. Sanjay N.[5].

[1]Junior Resident, Department of General Medicine, Mysore Medical College and Research Institute, Mysore, Karnataka, India.
[2]Assistant Professor, Department of Obstetrics & Gynaecology, Farookh Academy of Medical Education, Mysore, Karnataka, India.
[3]Professor, Department of General Medicine, Mysore Medical College and Research Institute, Mysore, Karnataka, India.
[4]Junior Resident, Department of General Medicine, Mysore Medical College and Research Institute, Mysore, Karnataka, India.
[5]Junior Resident, Department of General Medicine, Mysore Medical College and Research Institute, Mysore, Karnataka, India.

Correspondence:
Dr. Asha P.
Assistant Professor, Department of Obstetrics & Gynaecology, Farookh Academy of Medical Education, Mysore, Karnataka, India.

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Abstract

Background: Menopause is a universal physiological transition characterised by a complex interplay of hormonal changes that manifest as diverse somatic, psychological, and urogenital symptoms. While estrogen decline is the primary driver of postmenopausal symptomatology, the contributory role of other anterior pituitary hormones, particularly prolactin, remains inadequately characterised. Prolactin exerts neuromodulatory actions across thermoregulatory and limbic circuits, yet its relationship with the multidomain burden of menopausal symptoms has not been systematically evaluated in Indian postmenopausal women. ***Objectives:*** To evaluate the correlation between serum prolactin levels and menopausal symptom severity as assessed by the Menopause Rating Scale (MRS) in postmenopausal women, and to determine domain-wise associations across somatic, psychological, and urogenital symptom clusters. ***Methods:*** A prospective observational study was conducted at a tertiary care teaching hospital in South India from April 2024 to December 2025. Ninety postmenopausal women aged 45–65 years meeting pre-defined inclusion criteria were enrolled consecutively. Symptom burden was quantified using the validated Menopause Rating Scale (MRS). Serum prolactin, follicle-stimulating hormone (FSH), estradiol, haematological indices, and thyroid function were measured. Spearman's correlation coefficient was used to determine associations between serum prolactin levels and MRS total and domain scores. ***Results:*** The mean age of participants was 56.01 ± 6.08 years with a mean duration since menopause of 6.12 ± 3.58 years. Mean serum prolactin level was 9.59 ± 5.46 ng/mL. The mean MRS total score was 23.77 ± 5.09, with most participants exhibiting moderate symptom severity (52.2%). A statistically significant positive correlation was identified between serum prolactin and MRS total score ($r = 0.307$, $p = 0.003$). Domain-wise, significant correlations were observed with psychological symptoms ($r = 0.309$, $p = 0.003$) and vasomotor symptoms ($r = 0.252$, $p = 0.016$). No significant correlation was found with somatic symptoms ($r = 0.015$, $p = 0.889$). ***Conclusion:*** Serum prolactin demonstrates a significant positive correlation with overall menopausal symptom severity, with particularly robust associations in the psychological and vasomotor domains. These findings suggest that prolactin may participate in the neuroendocrine modulation of postmenopausal symptom expression. Routine prolactin assessment in the clinical evaluation of postmenopausal women may offer additional prognostic and therapeutic insights.

Keywords: Prolactin; Menopause Rating Scale, Postmenopause, Vasomotor symptoms, Psychological symptoms, Neuroendocrinology, India.

INTRODUCTION

Menopause, defined as the permanent cessation of menstruation following the irreversible loss of ovarian follicular activity, is an inevitable biological milestone in every woman's life. The World Health Organization and prevailing clinical consensus define natural menopause retrospectively after 12 consecutive months of amenorrhoea without a pathological or iatrogenic cause. The global burden of menopause is substantial: approximately 1.1 billion women worldwide are currently postmenopausal, with estimates projecting a continued rise as the global female population ages.[1] In India, the magnitude of this transition is particularly significant, given the large population base and a mean age of menopause of approximately 46–47 years - earlier than the global average of 51 years - resulting in a proportionally longer postmenopausal lifespan for Indian women.[2]

Postmenopause is characterised by a precipitous decline in ovarian oestrogen and progesterone production, accompanied by a compensatory elevation in gonadotropins - predominantly follicle-stimulating hormone (FSH) and luteinizing hormone (LH). These hormonal alterations underpin a diverse spectrum of clinical manifestations collectively termed the climacteric syndrome. The Menopause Rating Scale (MRS), a validated, self-administered instrument developed and widely adopted internationally, stratifies these complaints across three principal domains: somatic-vasomotor (hot flushes, sweating, cardiac discomfort, sleep disorders, musculoskeletal complaints), psychological (depressive mood, irritability, anxiety, cognitive impairment), and urogenital (sexual dysfunction, bladder symptoms, vaginal dryness).[3,4] Large-scale cross-sectional studies have demonstrated that the majority of menopausal women worldwide experience a clinically meaningful symptom burden, with psychological and vasomotor complaints predominating.[5,6] Among Indian postmenopausal women specifically, studies have documented significant somatic and psychological symptoms, often compounded by socioeconomic constraints and limited healthcare access.[7]

While declining oestradiol levels are rightly regarded as the central hormonal driver of menopausal symptomatology,[7] the postmenopausal endocrine milieu is characterised by coordinated changes across the entire hypothalamic-pituitary-gonadal (HPG) axis. Among the lesser-studied anterior pituitary hormones, prolactin - a polypeptide primarily produced by the lactotroph cells - has attracted growing scientific interest for its wide-ranging neuromodulatory properties beyond its classical roles in lactation and reproduction. Prolactin receptors have been identified in hypothalamic regions governing thermoregulation, in limbic structures mediating mood and anxiety, and in dopaminergic pathways involved in reward and motivation.[8] The secretion of prolactin is tonically inhibited by hypothalamic dopamine and is stimulated by serotonergic, endorphinergic, and thyrotrophin-releasing hormone (TRH) pathways - neurotransmitter systems that also undergo significant remodelling during the postmenopausal neuroendocrine transition.[9]

A critical observation in the context of menopause is that oestrogen exerts a dual regulatory influence on prolactin - at low concentrations, it stimulates prolactin secretion at the pituitary level, while at higher concentrations, it can suppress it via enhanced dopaminergic tone. With the dramatic decline in oestradiol following natural menopause, prolactin dynamics are potentially altered, though current data on the net directionality of prolactin changes in postmenopausal women remain inconsistent. A recent cross-sectional study on sex- and age-specific hormone reference intervals in a healthy Asian population documented that circulating prolactin levels remain relatively consistent across the postmenopausal transition compared to premenopausal women, despite marked elevations in gonadotropins.[8] This relative prolactin stability in the context of oestrogen withdrawal raises important mechanistic questions regarding its potential contribution to symptom severity in this population.

Prolactin's role in vasomotor regulation is particularly intriguing. The thermoregulatory centre in the hypothalamus, specifically the median preoptic area and the arcuate nucleus, contains populations of neurons co-expressing kisspeptin, neurokinin B, and dynorphin - the KNDy system - whose dysregulation in the context of oestrogen withdrawal is the current leading mechanistic explanation for hot flushes.[9] Prolactin interacts with this circuit and has been shown to modulate central thermosensitivity. Similarly, in the psychological domain, prolactin exerts complex effects on mood, anxiety, and stress reactivity through its interactions with the dopaminergic and serotonergic systems. States of prolactin excess have been linked to depressive symptoms, anxiety, and emotional lability, while experimental evidence in animal models demonstrates that prolactin modulates hippocampal neurogenesis and cognitive function.[10]

Despite these plausible mechanistic linkages, remarkably few studies have specifically evaluated the relationship between circulating prolactin levels and the multidimensional burden of menopausal symptoms using validated instruments. Most published data explore prolactin either in the context of hyperprolactinaemia syndromes or in relation to pharmacological interventions, with limited attention paid to the physiological range of prolactin variability in the postmenopausal setting. This knowledge gap is particularly prominent in the South Asian context, where the hormonal milieu and symptom phenotype of menopausal women may differ from Western populations due to genetic, dietary, and lifestyle factors.

In this context, the present study was designed to evaluate the correlation between fasting serum prolactin levels and the multidomain severity of menopausal symptoms, as quantified by the Menopause Rating Scale, in a prospectively recruited cohort of postmenopausal women attending a tertiary care institution in South India. We hypothesised that serum prolactin levels, even within the normal postmenopausal range, would demonstrate a positive correlation with menopausal symptom severity - particularly in the psychological and vasomotor domains - consistent with its known neuromodulatory role.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Department of General Medicine at a tertiary care teaching hospital in South India from April 2024 to December 2025. The objective was to evaluate the relationship between serum

prolactin levels and menopausal symptom severity in postmenopausal women presenting to outpatient and inpatient services.

Study Population and Eligibility Criteria

Women aged 45–65 years who had attained natural menopause, defined as at least 12 consecutive months of spontaneous amenorrhoea, were included. Women with known endocrine disorders (pituitary, thyroid, or adrenal diseases), those receiving hormone replacement therapy or medications known to affect prolactin levels (e.g., antipsychotics), patients with chronic systemic illnesses including significant hepatic, renal, or cardiac disease, and those with premature or surgically induced menopause were excluded to minimise confounding.

Sample Size and Sampling

The sample size was calculated using a correlation-based formula, incorporating assumptions for effect size, standard deviation, and a significance level of 0.05 with 80% power. A minimum sample of 90 participants was determined to be sufficient. A purposive consecutive sampling approach was employed until the required sample was achieved.

Data Collection and Clinical Assessment

Written informed consent was obtained from all participants. Detailed demographic information, medical history, and menopausal history were recorded using a structured proforma. Menopausal symptom severity was assessed using the Menopause Rating Scale (MRS), a validated instrument evaluating three domains - somatic-vasomotor, psychological, and urogenital - with a composite total score representing overall symptom burden.

Laboratory Investigations

Fasting serum samples were collected under standardised conditions. Serum prolactin, FSH, oestradiol, thyroid stimulating hormone (TSH), haemoglobin, and routine biochemistry were measured using validated laboratory platforms. Serum prolactin was measured by chemiluminescence immunoassay.

Outcome Measures

The primary outcome was the correlation between serum prolactin levels and total MRS score. Secondary outcomes included domain-wise correlations between prolactin levels and the somatic-vasomotor, psychological, and urogenital MRS subscales.

Statistical Analysis

Data were analysed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation; categorical variables as frequencies and percentages. The Shapiro-Wilk test was applied to assess normality. Spearman's rank correlation coefficient was used to evaluate associations between prolactin and MRS scores. A p-value of < 0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee, and the study was conducted in accordance with the Declaration of Helsinki.

RESULTS

Baseline Demographic Characteristics

The study enrolled 90 postmenopausal women. The majority were aged 55–65 years (55.6%), with a mean age of 56.01 ± 6.08 years. Participants were predominantly retired (33.3%) or housewives (24.4%), reflecting a non-working or semi-active population. The mean duration since menopause was 6.12 ± 3.58 years, indicating a mid-to-late postmenopausal cohort (Table 1).

Table 1. Baseline demographic characteristics of study participants

Parameter	Frequency (n=90)	Percentage (%)
Age Group (years)		
45–55	40	44.4
55–65	50	55.6
Occupation		
Business	21	23.3
Employed	17	18.9
Housewife	22	24.4
Retired	30	33.3
Sex		
Female	90	100.0
Values expressed as frequency and percentage		

Anthropometric and Laboratory Parameters

The mean BMI was 26.05 ± 4.28 kg/m², indicating an overall overweight profile consistent with postmenopausal metabolic changes. Mean haemoglobin was 12.39 ± 1.29 g/dL. Mean TSH was 2.66 ± 1.12 mIU/L (within normal limits). The mean serum prolactin was 9.59 ± 5.46 ng/mL with a wide inter-individual range (0–24.4 ng/mL) (Table 2).

Table 2. Anthropometric and laboratory parameters (normally distributed variables)

Parameter	Mean	SD	Minimum	Maximum
Height (cm)	156.82	5.50	139.9	171.0
Weight (kg)	63.90	9.90	45.3	89.3
BMI (kg/m²)	26.05	4.28	18.4	37.5
Haemoglobin (g/dL)	12.39	1.29	10.0	15.0
TSH (mIU/L)	2.66	1.12	0.50	5.42
Serum Prolactin (ng/mL)	9.59	5.46	0.00	24.40
BMI = Body Mass Index; TSH = Thyroid Stimulating Hormone; SD = Standard Deviation				

Hormonal and Clinical Parameters

Hormonal evaluation confirmed postmenopausal status: mean FSH was 59.61 ± 17.97 IU/L and mean oestradiol was 14.93 ± 6.37 pg/mL. The mean total MRS score was 23.77 ± 5.09. Among domains, psychological symptoms had the highest mean score (8.97 ± 2.75), followed by vasomotor (7.51 ± 3.01) and somatic symptoms (7.29 ± 2.78), indicating a predominance of psychological distress in this cohort (Table 3).

Table 3. Hormonal and clinical parameters (non-normally distributed variables)

Parameter	Mean	Median	SD	Min	Max
Age (years)	56.01	56.00	6.08	45	65
Years since menopause	6.12	6.00	3.58	1	12
FSH (IU/L)	59.61	58.00	17.97	30.6	115.5
Oestradiol (pg/mL)	14.93	15.20	6.37	1.2	24.6
MRS Total Score	23.77	24.00	5.09	13	36
MRS Vasomotor Score	7.51	8.00	3.01	0	12
MRS Psychological Score	8.97	9.00	2.75	1	16
MRS Somatic Score	7.29	7.00	2.78	1	15
FSH = Follicle Stimulating Hormone; MRS = Menopause Rating Scale; SD = Standard Deviation					

Distribution of Menopausal Symptom Severity

The majority of participants exhibited moderate menopausal symptoms (52.2%), followed by mild (36.7%), while a smaller proportion had severe symptoms (11.1%), indicating a clinically relevant symptom burden across the cohort (Table 4).

Table 4. Distribution of menopausal symptom severity (MRS total score)

Severity	Frequency	Percentage (%)
Mild	33	36.7
Moderate	47	52.2
Severe	10	11.1
Severity classification based on Menopause Rating Scale scoring criteria		

Domain-wise Distribution of MRS Scores

Domain-wise analysis demonstrated that moderate severity predominated across all symptom domains. Notably, the psychological domain had the highest proportion of severe cases (30.0%), followed by vasomotor (21.1%) and somatic symptoms (13.3%), underscoring the predominant psychological disturbance in this South Indian postmenopausal cohort (Table 5).

Table 5. Domain-wise distribution of MRS scores

Domain	Severity	Frequency	Percentage (%)
Vasomotor	Mild	22	24.4
	Moderate	49	54.4
	Severe	19	21.1
Psychological	Mild	6	6.7
	Moderate	57	63.3
	Severe	27	30.0
Somatic	Mild	23	25.6
	Moderate	55	61.1
	Severe	12	13.3

Correlation Between Serum Prolactin and MRS Scores

A statistically significant positive correlation was observed between serum prolactin levels and total MRS score ($r = 0.307$, $p = 0.003$). Domain-wise analysis revealed significant correlations with psychological symptoms ($r = 0.309$, $p = 0.003$) and vasomotor symptoms ($r = 0.252$, $p = 0.016$), while no significant correlation was observed with somatic symptoms ($r = 0.015$, $p = 0.889$) (Table 6).

Table 6. Correlation between serum prolactin and menopausal symptom scores

Variable	Correlation Coefficient (r)	p-value
MRS Total Score	0.307	0.003*
MRS Vasomotor Score	0.252	0.016*
MRS Psychological Score	0.309	0.003*
MRS Somatic Score	0.015	0.889
Correlation assessed using Spearman's rho. *p < 0.05 considered statistically significant		

Inter-domain Correlation of MRS Scores

Strong positive correlations were observed between total MRS score and all domain subscores: vasomotor ($r = 0.675$, $p < 0.001$), psychological ($r = 0.573$, $p < 0.001$), and somatic ($r = 0.550$, $p < 0.001$). Inter-domain correlations between individual symptom clusters were weak and non-significant, suggesting relative independence of symptom expression across domains (Table 7).

Table 7. Inter-domain correlation among MRS scores

Variables Compared	Correlation Coefficient (r)	p-value
Total vs Vasomotor	0.675	<0.001*
Total vs Psychological	0.573	<0.001*
Total vs Somatic	0.550	<0.001*
Vasomotor vs Psychological	0.130	0.220
Vasomotor vs Somatic	0.066	0.536
Psychological vs Somatic	0.021	0.841
Correlation assessed using Spearman's rho. *p < 0.05 considered statistically significant		

DISCUSSION

This prospective observational study systematically evaluated the relationship between serum prolactin levels and menopausal symptom severity in 90 postmenopausal women attending a tertiary care facility in South India, using the validated Menopause Rating Scale. Three principal findings emerged: first, serum prolactin demonstrated a statistically significant positive correlation with total MRS score, indicating a broader hormonal complexity to menopausal symptom expression beyond oestrogen deficiency alone; second, among symptom domains, prolactin correlated significantly and comparably with both psychological and vasomotor symptoms; and third, no significant association was identified between prolactin and the somatic symptom domain. These results are placed in the context of the existing neuroendocrinological literature and the growing understanding of the multidimensional nature of the menopause transition.

Overall Symptom Burden in the Study Cohort

Before addressing the primary and secondary correlates, it is important to contextualise the overall symptom profile of the enrolled population. The mean total MRS score of 23.77, with 52.2% of participants in the moderate severity category, reflects a substantial and clinically significant symptom burden consistent with published data from other South Asian postmenopausal cohorts.[7] Psychological symptoms were the most severe domain in our population (mean score 8.97),

exceeding both vasomotor (7.51) and somatic (7.29) domains. This finding differs from some Western studies where vasomotor symptoms are typically dominant, suggesting a possible differential symptom phenotype in Indian women - a pattern also observed by Malik et al. in their study of urban Indian postmenopausal women using the MRS, where psychological symptoms demonstrated the strongest correlation with declining oestradiol levels.[7] The overweight BMI profile (mean 26.05 kg/m²) of our cohort is noteworthy, as recent multinational studies have confirmed that elevated BMI is independently associated with more severe menopausal symptoms, particularly psychological and vasomotor complaints, and contributes to cognitive impairment risk in postmenopausal women.[11,12]

Correlation Between Serum Prolactin and Total MRS Score (Primary Objective)

The central finding of this study - a statistically significant positive correlation between serum prolactin and total MRS score ($r = 0.307$, $p = 0.003$) - extends the current understanding of postmenopausal neuroendocrinology. To date, the clinical literature on prolactin in the postmenopausal context has been largely focused on pharmacological perturbations (antipsychotic-induced hyperprolactinaemia) rather than physiological variability. A recent large cross-sectional study of hormonal reference intervals in healthy Asian individuals confirmed that prolactin levels remain broadly stable across the postmenopausal transition, implying that inter-individual variability in prolactin - rather than a systematic rise or fall - may be the clinically relevant parameter in this context.[8] Our data support this interpretation: with a mean prolactin of 9.59 ng/mL and a range of 0–24.4 ng/mL, the observed variability correlated meaningfully with symptom burden.

The mechanistic basis for this association is plausible at multiple levels. Prolactin is secreted in a pulsatile fashion under tonic dopaminergic inhibition from the tuberoinfundibular dopaminergic (TIDA) system, and is stimulated by serotonergic input. During the postmenopausal transition, the decline in oestrogen disrupts dopaminergic and serotonergic signalling - the same neurotransmitter systems that govern KNDy neuron activity, thermoregulation, and affective regulation.[10] Women with higher prolactin levels within the normal range may represent those with relatively greater serotonergic drive or less robust dopaminergic suppression, creating a neuroendocrine state more permissive to symptom amplification across multiple domains. Furthermore, prolactin receptors expressed in hypothalamic thermoregulatory centres and limbic circuits provide direct substrates for prolactin's contribution to both vasomotor instability and psychological disturbance.[8] The prospective design of our study, with standardised hormonal measurements and validated symptom assessment, strengthens the credibility of this association.

Prolactin and Psychological Symptoms

The significant correlation between serum prolactin and psychological MRS domain score ($r = 0.309$, $p = 0.003$) is one of the most important findings of this study, particularly given that psychological complaints - including depressive mood, irritability, anxiety, and mental exhaustion - constituted the most severe symptom domain in our cohort. This finding has robust mechanistic support in the existing literature.

Prolactin is a known modulator of the stress response axis. Experimental evidence demonstrates that prolactin stimulates the hypothalamic-pituitary-adrenal (HPA) axis while modulating hippocampal neurogenesis and dopaminergic reward pathways - mechanisms centrally implicated in the pathogenesis of depression and anxiety.[10] A study by Zhou et al. in an animal model of perinatal stress demonstrated that lower prolactin levels during the postpartum period were associated with greater anxiety and depressive-like behaviours, reversible through interventions that restored prolactin to higher levels.[10] While direct extrapolation from animal models to human postmenopausal populations requires caution, this bidirectional relationship between prolactin and mood regulation is consistent with our observation that women with higher prolactin levels exhibited a greater psychological symptom burden, possibly reflecting a reactive or compensatory neuroendocrine response in the context of oestrogen withdrawal.

Moreover, in the postmenopausal state, the loss of oestrogen-mediated serotonergic facilitation disrupts serotonin receptor sensitivity in limbic regions, a mechanism proposed as the neurobiological basis for the heightened risk of depression and anxiety during this transition. Since serotonin is also a principal secretagogue of prolactin via the 5-HT2C receptor pathway, higher prolactin in a state of oestrogen deficiency may index a compensatory serotonergic activation that, paradoxically, amplifies the affective symptom burden by disrupting the balance of monoaminergic signalling. This hypothesis is consistent with the finding that pharmacologically elevated prolactin in the context of antipsychotic use is associated with depressive symptoms and emotional lability, though in our study the prolactin levels remain within the physiological range. The relative independence of symptom domains observed in our inter-domain correlation analysis (weak, non-significant correlations between psychological, vasomotor, and somatic domains) further supports the possibility that these effects are mediated through domain-specific, rather than global, neurobiological mechanisms.

Prolactin and Vasomotor Symptoms

The significant correlation between serum prolactin and vasomotor MRS domain score ($r = 0.252$, $p = 0.016$) is consistent with an emerging body of evidence implicating the anterior pituitary and its regulatory circuits in hot flush pathophysiology.

Hot flushes result from a narrowing of the thermoregulatory zone in the hypothalamic preoptic area, driven by dysregulation of KNDy neurons in the arcuate nucleus following oestrogen withdrawal.[9] This circuit is intimately connected with dopaminergic and serotonergic pathways that also regulate prolactin secretion. Specifically, reduced oestrogen decreases hypothalamic dopamine activity, thereby both increasing prolactin sensitivity and destabilising the thermoregulatory set point.

A key mechanistic link is provided by the pharmacokinetic study by Malavasi et al. (CLARA study, 2026), which demonstrated that effective oestrogen replacement therapy significantly reduced vasomotor and psychological MRS scores while prolactin levels showed minimal variation - suggesting that symptomatic improvement from oestrogen is not mediated primarily through prolactin suppression, but rather through direct central oestrogen receptor activation.[13] This implies that in untreated postmenopausal women, prolactin variability may add an independent layer of neuroendocrine influence on vasomotor regulation, as supported by our findings. In addition, the large multinational study by Blümel et al. (2026) demonstrated that hot flush severity was a robust and independent determinant of health-related quality of life across 3,523 women, with increasing hot flush severity associated with markedly impaired quality of life (OR 4.10 for very severe symptoms), underscoring the clinical significance of accurately characterising all neuroendocrine contributors to vasomotor burden.[6]

The magnitude of the prolactin-vasomotor correlation ($r = 0.252$) was slightly lower than the prolactin-psychological correlation ($r = 0.309$), suggesting a somewhat stronger prolactin-mood versus prolactin-thermostasis connection in this cohort. This hierarchy is biologically plausible given the more direct role of dopaminergic and serotonergic systems - prolactin's primary regulatory inputs - in mood regulation than in thermoregulatory physiology. Future mechanistic studies employing simultaneous measurement of dopaminergic and serotonergic biomarkers alongside prolactin and symptom severity assessments would help clarify the directionality and mediating pathways of these relationships.

Absence of Correlation with Somatic Symptoms

The lack of a significant correlation between serum prolactin and the somatic MRS domain score ($r = 0.015$, $p = 0.889$) is equally informative. The somatic domain in the MRS encompasses musculoskeletal complaints such as joint and muscle pain, cardiac discomfort (palpitations), and sleep disturbances. These symptoms are predominantly driven by peripheral oestrogen deficiency - particularly its effects on musculoskeletal tissues, autonomic cardiovascular function, and sleep architecture - rather than by central neuromodulatory mechanisms.[3] Prolactin receptors, while distributed across multiple peripheral tissues including bone, immune cells, and breast, have a less established role in musculoskeletal pain pathways and autonomic cardiovascular regulation compared to oestrogen receptors. Consequently, inter-individual variability in circulating prolactin would not be expected to significantly influence peripheral somatic symptoms, and our null finding in this domain is mechanistically coherent.

This domain-specific pattern of correlation - significant for psychological and vasomotor but not somatic symptoms - reinforces the specificity of the prolactin-symptom association and argues against a confounded, globally elevated symptom severity explanation. If prolactin were merely a non-specific marker of overall symptom burden, one would expect comparable correlations across all three domains. The selective domain-specific associations therefore strengthen the biological plausibility of the observed relationships and provide a mechanistic roadmap for future investigation.

Clinical and Research Implications

Our findings have several important clinical and research implications. First, the routine hormonal workup of postmenopausal women presenting with significant psychological or vasomotor symptoms may benefit from the inclusion of serum prolactin measurement, alongside the standard FSH and oestradiol assessment. While prolactin levels in our cohort remained within the normal range, their variability correlated significantly with symptom severity, suggesting that even physiological fluctuations in prolactin may be clinically meaningful. Second, from a therapeutic standpoint, interventions targeting dopaminergic or serotonergic pathways - which are the principal regulators of prolactin secretion - might offer additional benefit for women with high prolactin levels and significant psychological or vasomotor symptoms. Third, the finding that psychological symptoms were the most severe and most strongly correlated with prolactin levels underscores the need for routine psychological screening in postmenopausal women, a recommendation consistent with current international menopause care guidelines and supported by the large-scale epidemiological literature on menopausal health burden.[5,6]

The reproductive aging process, as comprehensively reviewed by Muhammad (2025), is a systemic neuroimmune transition involving coordinated remodelling of hypothalamic signalling networks, oxidative stress pathways, and mitochondrial function - far beyond a simple reduction in ovarian oestrogen production.[9] Understanding prolactin as one component of this integrated neuroendocrine remodelling offers a richer framework for symptom characterisation and personalised management in postmenopausal women. The assessment of gonadotropin dynamics and their neurological correlates -

including the recently described role of FSH and LH in brain structure and Alzheimer's disease risk - further contextualises prolactin's role within a broader hormonal-neural network that undergoes significant perturbation during the menopausal transition.[14]

Limitations

This study has several limitations that warrant consideration. The cross-sectional (single time-point) design of hormonal measurements limits the ability to establish temporal or causal relationships between prolactin and symptom severity. The study was conducted at a single tertiary care centre in South India, which may limit generalisability to community-based or non-Indian postmenopausal populations. The sample size, while adequate for correlation analysis as per the pre-specified power calculation, may not be sufficient for subgroup analyses or multivariate modelling. The study did not simultaneously measure neurotransmitter biomarkers (e.g., serotonin metabolites, dopamine) that would provide mechanistic corroboration for the observed prolactin-symptom associations. Additionally, lifestyle factors such as physical activity, dietary patterns, and psychosocial stress - known modulators of both prolactin and symptom severity[12] - were not systematically quantified. Finally, the relatively wide inter-individual variability in serum prolactin and the absence of serial measurements preclude conclusions about whether the observed correlations reflect tonic or phasic prolactin differences. Longitudinal studies with repeated hormonal assessments and validated psychosocial instruments, ideally conducted across multiple centres, are warranted to validate and extend these preliminary findings.

CONCLUSION

This prospective observational study demonstrates a statistically significant positive correlation between serum prolactin levels and menopausal symptom severity in postmenopausal women, as measured by the validated Menopause Rating Scale. The correlations were significant for overall symptom burden, psychological symptoms, and vasomotor symptoms, while no significant association was observed in the somatic domain. These findings suggest that prolactin participates in the neuroendocrine modulation of menopausal symptom expression, particularly in domains governed by central monoaminergic pathways. Incorporating serum prolactin assessment into the standard hormonal evaluation of postmenopausal women with significant psychological or vasomotor complaints may provide clinically actionable information. Larger, longitudinal, and multicentre studies are needed to confirm these findings and to elucidate the mechanistic pathways linking prolactin to domain-specific symptom burden in the postmenopausal state.

Conflict of Interest

The authors declare no conflict of interest.

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Ethical Approval

Obtained from the Institutional Ethics Committee.

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