Case Study

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ROLE OF YOGA IN ALLEVIATE MUSCULOSKELETAL PAIN AND BALANCING HORMONES IN WOMEN WITH EARLY MENOPAUSE: A CASE STUDY

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Abstract

Early menopause, defined as the cessation of menstruation before the age of 45 years, affects up to 16.2% of Indian women and is linked to hormonal imbalance, musculoskeletal pain, psychological distress, and increased risk of osteoporosis and cardiovascular disease. Yoga has emerged as a potential non-pharmacological approach for managing menopausal symptoms. This case study evaluated the effectiveness of a structured yoga therapy protocol in managing hormonal imbalance and musculoskeletal pain in a 42-year-old woman experiencing early menopause. The patient underwent a six-month yoga therapy program consisting of 50-minute sessions, five days a week, with practices adapted from the "Yoga Protocol for Women of Reproductive Age" and modified during active menstruation. After six months, oestradiol levels increased by 25.41% while follicle-stimulating hormone levels decreased by 39.28%. Pain reduction was observed in multiple joints, including the lower back (75%), hip (44.4%), knee (37.5%), heel (44.4%), and shoulder (28.6%), though no improvement was noted in elbow pain and body mass index showed only minimal change (1.49%). These findings suggest yoga therapy may serve as a safe, effective, and cost-efficient intervention for early menopause management, particularly for improving hormonal balance and alleviating musculoskeletal discomfort. However, as this is a single case report without a control group, further research with larger, controlled trials is necessary to confirm these results.

Keywords: Early menopause; Yoga; Estradiol; Follicle stimulating hormone; Musculoskeletal Pain.

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Introduction

Early menopause exerts influence on 12.2% of women globally [1]. The figure of post-menopausal women is increasing in India; approximately 16.2% of Indian women are affected by early menopause [2]. Naturally, menopause occurs between the ages of 45 to 55 years. In early menopause, menstrual periods stop before age 45. Early menopause can be categorized into two types: [i] spontaneous (when menopause occurs naturally) and [ii] induced (when menopause is triggered by any medical procedure such as surgery or cancer treatment).

Spontaneous early menopause occurs in about 5% of women. Premature ovarian failure (POF), also referred to as premature ovarian insufficiency (POI), can cause spontaneous menopause. POF is a condition seen in women under 40 that involves absent menstrual periods, decreased levels of sex hormones, and increased levels of gonadotropins, which most often occurs without a known cause, but it can also result from autoimmune diseases, genetic factors, infections or inflammation, enzyme defects, or metabolic disorders. Women diagnosed with POF often experience lower overall and sexual well-being and report less satisfaction with their sex lives. Compared to women with normal ovarian function, those with POF are more likely to experience anxiety, depression, somatization, increased sensitivity, hostility, and greater psychological distress. When assessing long-term health outcomes, POF and other causes of spontaneous menopause are usually considered as a single group. Women affected by spontaneous menopause are more

likely to have lower bone density and are at greater risk for developing osteoporosis and experiencing fractures at an earlier age. They may also have poorer blood vessel function and a higher chance of developing coronary heart disease sooner than average, as these women face increased risks of cardiovascular disease and overall mortality.

Induced menopause can occur when both ovaries are surgically removed before natural menopause, or as a result of cancer treatments such as chemotherapy and radiation [3].

Menopausal changes are significantly related to musculoskeletal pain [4]. Early menopause is commonly characterized by a decrease in estrogen levels, resulting in symptoms like hot flashes, night sweats, psychological disturbances, disrupted sleep patterns, vaginal dryness, and skin changes. A decrease in estrogen levels leads to rising in follicle-stimulating hormone (FSH). In this, women experience either short or long menstrual cycles. However, sometimes they may have a natural menstrual cycle.

Early menopause may lead to complications such as heart disease, neurological disorders, sexual dysfunction, infertility, osteoporosis, and depression [5].

Early menopause has been strongly linked to several factors, including low levels of education, poor socio-economic status, being underweight, the number of pregnancies, and the age at which a woman becomes pregnant. Research indicates that the age when a woman first menstruates, whether she breastfed previous children, and the timing of her first pregnancy all significantly influence when menopause begins. Other factors, such as not having children, using oral contraceptive pills, and whether a woman has had a live birth can also affect the timing of natural menopause. Additionally, the age at menopause is related to lifestyle and health factors like smoking, educational attainment, employment status, history of abortion, body mass index, and dietary habits. Smoking, in particular, has been shown to negatively impact reproductive health, with heavy smokers tending to experience menopause at an earlier age [6]. Lifestyle and dietary changes can be helpful in such a condition. Medical treatment primarily involves Menopausal Hormone Therapy (MHT) and combined oral contraceptives, which are not suitable for every woman and contraindicated in case of comorbidities [7]. Previous studies suggested that these medical treatments increase the risk of cardiovascular diseases, all cancers, and other health problems such as psychological conditions [8]. Yoga offers a safe, non-invasive, and cost-effective therapy. It works on both the psychological and physiological symptoms caused due to early menopause [9]. An illustration of the early menopause cause is shown in Figure 01.

The focus of this case study is to present the role of yoga in managing and treating early menopause symptoms and the problems associated with it. Therefore, we hypothesized that practicing yoga in a daily routine can be helpful to manage and treat the symptoms of early menopause by bringing back the homeostasis in the body.

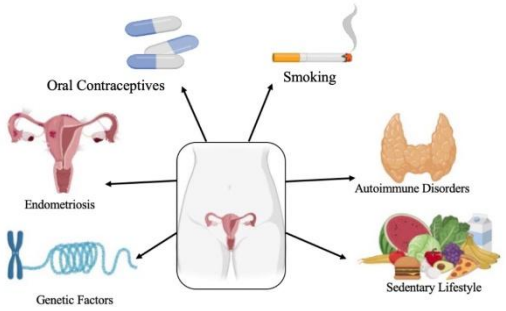

Figure 01: Common causes of Early Menopause

Footnote: Some genes are associated with premature ovarian failure and early menopause [10]. Endometriosis increases the risk of Premature Ovarian Insufficiency by 1.4 times [11]. Oral Contraceptive pills manipulate hormone levels, prevent ovulation, and may modify the rate of follicular atresia [12]. Cigarette smoke constituents inhibited granulosa cell aromatase and other key enzymes in estrogen synthesis, with the result in reduced estradiol production in vitro [13]. Autoimmunity, when it attacks the thyroid or adrenal glands, causes Premature Ovarian Insufficiency [14]. Sedentary Lifestyle contributes to endocrine dysfunction, which is characterized by hormonal imbalance, causing early menopause [15]. The mentioned conditions cause early menopause involving different mechanisms, but the most common is Premature Ovarian Insufficiency.

Case Report

A 42-year-old married female with a clinical history of irregular menstruation came for yoga therapy on 3rd January, 2024. It started at the age of 40 years. She got married at the age of 25 years. She had a miscarriage when conceived for the first time, and did abortion in the next pregnancy as foetus had no heart beat till second month thenshe had undergone two caesarean deliveries. She has a daughter and a son. In 2022, she noticed the irregularity in her menstrual bleeding with the feeling of loneliness, irritation and aggression; she started experiencing pain in her right shoulder, elbow and hip joint and pain in both knees and heels. Her lab reports showed imbalance in hormone levels indicating *early menopause* as described by the doctor. She did not used any medicine, however the condition worsened by the next year when she started taking medicine (contraceptive) for menstrual bleeding. She had taken that for 7 months regularly and after this she consumed it as per need whenever the menstrual bleeding was much delayed. She also complained of her lower back pain due to herniated disc between L4 and L5.

Table 01: Demographic Details

Gender	**Female**
Age	42
Height (Cm)	163
Weight (Kg)	71

BMI	26.7
Marriage status	Married
Occupation	Rendering Artist
Onset of Menopausal Symptoms	Age of 40 years
Frequency of Menstrual Cycle	2 months (averagely)

Assessment Tool

To test the blood hormone levels, venous blood sample (10 mL) was collected from the subject and extracted in the laboratory as per the standard guidelines stipulated in the manual. The Numeric Pain Rating Scale was used to observe the intensity of musculoskeletal pain. This scale contains numbers from 0 to 10. Numbers indicate intensity of the pain as per the following: "0" indicates no pain, numbers "1 to 3" indicates mild pain, "4 to 6" indicates moderate pain and "7 to 10" means severe pain. Participant was asked to rate the level of pain she has been experiencing over the past 24 hours. Reliability has been tested 0.95.

Intervention

Three different modules of Yoga practices were taught over duration of 6 months. Yoga practices were given 5 days a week for 50 minutes as per the given module.

Selected Shatkriyas (Kapalbhati) bring preponderance of the Parasympathetic System that helps balance the psychological state. It also tones the abdominal region nerves that are also connected with the reproductive parts.

Asanas that tone and strengthen the abdominal viscera and stimulate endocrine glands, i.e., gonads, thyroid, and adrenal glands, are selected. Muscles get strengthened by isometric performance of asanas, passive stretching restores the normal level of muscle tone, and ensures proper removal of metabolic wastes from the articulation by increasing circulation there. These asanas help alleviate musculoskeletal pain. Shifting in the compression or force on abdominal viscera stimulates the Autonomic Nervous System, which regulates the hormonal secretions [16].

According to the Hatha yogic texts, Nadishodhana purifies the nadis (ensuring free flow of prana, which regulates different functions of the body) and cultivates health. Selected pranayama helps to manage some common symptoms of early menopause, such as hot flashes, night sweats, etc., and brings about relaxation in the body [17]. Yogic practices such as Meditation and Yoga Nidra induce deep relaxation, which helps to manage the symptoms related to early menopause. The details of yogic practices are given in Tables 02 and 03. 3Module for First Three Months: A set of practices is given to the participant in the first three months, detailed in Table 02.

Table 02: Module for First Three Months

Sr. No.	Yoga Practice	Rounds	Duration
1.	**PRAYER**		1 Minute
2.	**YOGIC SUKSHMA VYAYAMA**		10 Minute
	Neck Movements:		
	Forward and Backward bending	3 Rounds	
	Right and Left bending	3 Rounds	
	Right and Left Twisting	3 Rounds	
	Neck Rotation	3 Rounds	
	Shoulder Movements		
	Shoulder Stretch	3 Rounds	
	Shoulder Rotation (Forward and Backward)	3 Rounds	
	Trunk Movements		
	Trunk Twisting (Kati Shakti Vikasaka)	3 Rounds	
	Knee Movement	3 Rounds	
	Ankle Movement		
	Ankle Stretch	3 Rounds	
	Ankle Rotation	3 Rounds	
3.	**YOGASANAS**		20 Minute
	Standing Posture:		
	Tadasana		
	Vrikshasana		
	Konasana		
	Katichakrasana		
	Veerbhadrasana		
	SittingPosture:		
	Dandasana		
	Sukhasana		
	Badhakonasana		
	Shashankasana		
	Marjariasana (with breathing)		
	Malasana		
	ParivrataSukhasana		
	Supine Posture:		
	Viparitakarani with wall support		
	EkpadaPawanmuktasana		
	Prone Posture:		
	Saral Bhujangasana		
	Saral Shalabhasana		

4.	**PRANAYAMA**		10 Minute
	Nadishodhana		
	Bhramari Pranayama		
	Sheetali Pranayama		
5.	**YOGA NIDRA**		3 Minute
6.	**SHANTI PATHA**		1 Minute
	TOTAL TIME		45 Minute

Module for Last Three Months: A set of practices is given to the participant in the last three months, detailed in Table 03.

Table 03: Module for Last Three Months

Sr. No.	Yoga Practice	Rounds	Duration
1.	**PRAYER**		1 Minute
2.	**YOGIC SUKSHMA VYAYAMA**		10 Minute
	Neck Movements:		
	Forward and Backward bending	3 Rounds	
	Right and Left bending	3 Rounds	
	Right and Left Twisting	3 Rounds	
	Neck Rotation	3 Rounds	
	Shoulder Movements		
	Shoulder Stretch	3 Rounds	
	Shoulder Rotation (Forward and Backward)	3 Rounds	
	Trunk Movements		
	Trunk Twisting (Kati Shakti Vikasaka)	3 Rounds	
	Knee Movement	3 Rounds	
	Ankle Movement		
	Ankle Stretch	3 Rounds	
	Ankle Rotation	3 Rounds	
3.	**SURYA NAMASKAR**		
4.	**YOGASANAS**		
	Standing Posture:		20 Minute
	Tadasana		
	Utkatasana		
	UrdhvaHastottanasana		
	Katichakrasana		
	Trikonasana		
	SittingPosture:		
	Parvatasana		
	Vakrasana/Ardha Matsyendrasana		
	Ushtrasana		
	Janu Shirshasna/ paschimottanasana		
	Gomukhasana		
	Marjariasana		
	Supine Posture:		
	Pawanmuktasana		
	Matsyasana		
	Sarvangasana/ Viparitakarani		
	Setubandhasana		
	Prone Posture:		
	Bhujangasana		
	Makarasana		
	Shalabhasana		
	Dhanurasana		
5.	**KAPALBHATI**	10-20 strokes	1 Minute
6.	**PRANAYAMA** (without Kumbhaka)		7 Minute
	Anuloma-Viloma/Nadishodhana (Alternate Nostril Breathing)		
	Bhramari Pranayama		
	Ujjayi Pranayama		
7.	**DHYANA/ DHARANA**		2 Minute
8.	**YOGA NIDRA**		3 Minute
9.	**SHANTI PATHA**		1 Minute
	TOTAL TIME		45 Minute

In addition to the above two modulesfrom "Yoga Protocol for Women of Reproductive Age" given by Morarji Desai National Institute of Yoga, 5 5-minute warm-up session was kept in each yoga therapy session.

Module used during Menstruation

During the menstrual bleeding period, after starting prayer, the patient was given abdominal breathing, shashankasana, baddhakonasana, suptabaddhakonasana, balasana, shavasana, nadishodhana, and yoga nidra or 'lam' chanting (Beej mantra of mooladhara chakra).

Data Extraction and Analysis

Data were extracted as per the stipulated instructions in the manuals. Data calculation was done using MS Office (2019).

Results

Measurements of the hormones such as Estrogen and Follicle Stimulating Hormone (FSH) were taken two times i.e., before starting the yoga therapy and after 6 months of therapy. The results showed improvement in the estradiol (25.41%) and FSH (39.28%) levels. Reduction in menstrual cycle frequency (50%) was noted. The participant observed a decrease in pain of shoulder pain (28.57%), lower back (75%), hip joint (44.44%), knee (37.5%) and heels (44.44%). However, no remarkable improvements were noted in elbow pain (0%) as well as in BMI (1.49%) [Table 04].

Table 04: The outcomes of pain and hormones are presented in percentage change.

Test	Pre	Post	Difference	% change
BMI	26.7	26.3	0.4	1.49
Estradiol	24 pg/mL	30.1 pg/ml	6.1	25.41
FSH	58.8 IU/mL	35.7 IU/ml	23.1	39.28
	7	5	2	28.57
Elbow Pain	6	6	0	0
Lower Back Pain	8	2	6	75
Hip Joint Pain	9	5	4	44.44
Knee Pain	8	5	3	37.5
Heel Pain	9	5	4	44.44
Menses Cycle Frequency	2 months	1 month	1	50

Discussion

The patient, a 42-year-old woman experiencing irregular menstruation, musculoskeletal pain, and psychological distress associated with early menopause, showed noticeable improvements after undergoing a six-month yoga therapy regimen. The outcomes of the present study showed an increase in estradiol and a decrease in FSH after six months of yoga practice. Estradiol is produced by ovarian granulosa cells in response to FSH, plays a central role in endometrial proliferation and menstrual cycle regulation. In early menopause, Estradiol levels drop due to follicular depletion. However, yoga may indirectly stimulate residual follicular activity via endocrine modulation. It is aligned with the previous study reported that decreased estradiol may lead to disrupt the hypothalamic-pituitary-ovarian (HPO) axis. As a result, a failure of endometrial development occurs, which may cause irregular menstrual cycles [18]. The HPO axis regulates female reproductive function. Disruption at any level due to stress, metabolic disturbance, or inflammation can impair gonadotropin-releasing hormone (GnRH) pulsatility, suppress estradiol production, and elevate FSH due to a lack of negative feedback from estrogen.

Yoga reduces HPO axis dysregulation by lowering stress-induced hypothalamic dysfunction [19]. Chronic stress is known to increase cortisol via the hypothalamic-pituitary-adrenal (HPA) axis, which inhibits GnRH secretion and disrupts luteinizing hormone (LH) and FSH pulsatility [20]. Multiple studies have shown that yoga reduces cortisol levels and sympathetic overdrive [21], thereby potentially restoring GnRH pulsatility. A previous study reported that improved blood flow and oxygenation to pelvic organs through *asanas* may enhance ovarian function and estrogen synthesis [22]. Breathing practices (*pranayama*) such as Nadi Shodhana have been linked to parasympathetic activation, lowering systemic inflammation [23], which is a contributor to ovarian aging. Reduction in inflammatory cytokines with yoga may delay follicular apoptosis and support residual estrogen production [24]. High FSH levels in early menopause indicate low estrogen-mediated negative feedback. The normalization of estradiol levels reactivates this feedback loop, reducing FSH secretion from the anterior pituitary.

Moreover, yoga modulates autonomic tone, influencing hypothalamic signaling to the pituitary. A study showed a decrease in plasma FSH and LH following regular yoga practice in women [25]. By restoring homeostasis in the neuroendocrine axis, yoga may reduce the pituitary's overproduction of FSH.

Six months of regular yoga practice was associated with a noticeable reduction in musculoskeletal pain across multiple joints, including the shoulder, elbow, lower back, hip, knee, and heel. This pain relief can be attributed to yoga's multifaceted physiological and biomechanical benefits. A previous study reported that through improved postural alignment, enhanced muscle strength, and increased joint mobility, yoga reduces abnormal mechanical stress on musculoskeletal structures [26]. Furthermore, yoga enhances core strength and spinal stability, reducing strain on load-bearing joints such as the lumbar spine and knees [27,28]. By facilitating stretching of tight muscle groups and strengthening of weak ones, yoga promotes balanced biomechanics and improved circulation, thereby reducing localized stiffness and pain [29,30].

In addition to its mechanical effects, yoga induces biochemical and neurophysiological changes that modulate pain perception. It downregulates the sympathetic nervous system and activates the parasympathetic system, reducing stress hormone (cortisol) levels and systemic inflammation. Studies have shown that yoga practice decreases pro-inflammatory cytokines such as IL-6 and TNF-α while increasing anti-inflammatory markers like IL-10, contributing to reduced nociceptive signaling in chronic pain conditions [31,32]. Moreover, yoga increases central levels of gamma-aminobutyric acid (GABA), a neurotransmitter that inhibits pain pathways, and promotes endorphin release, improving pain tolerance [33]. The mindfulness and breath awareness cultivated during yoga practice also enhance interoception and emotional regulation, which are crucial in reducing the affective component of chronic pain. Thus, yoga serves as both a physical and psychological intervention in managing multi-site musculoskeletal pain.

Conclusion

This case study suggests that Yoga may have a significant impact on managing the symptoms related to early menopause. Yoga therapy not only works to balance the hormones but also helps to manage musculoskeletal pain. It is more economical than the other medical management. Yoga therapy offers a non-invasive, low-cost alternative to conventional treatments. However, the findings in this study should be interpreted with caution, as it is based on a single case and lacks a control group. Further research involving larger sample sizes and controlled trials is needed to validate these findings and assess the broader efficacy of yoga therapy for early menopause.

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Declaration of Interest

The authors state that they have no known conflict of interest that can influence this case study report.

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