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TRANSFORMING PERIMENOPAUSAL HEALTH: NUTRITIONAL AND MOVEMENT-BASED INTERVENTIONS

Aditi Vohra[1], Dr. Tarvinder Jeet Kaur[2]

[1*]Research Scholar, Department of Home Science, Kurukshetra University, Kurukshetra, Haryana, India
[2]Professor & Chairperson, Department of Home Science, Kurukshetra University, Kurukshetra, Haryana, India

ABSTRACT

Perimenopause, a transitional phase preceding menopause, signifies a decline in estrogen levels, often manifesting in one's 40s or even 30s, with associated symptoms such as irregular menstrual cycles, hot flashes, mood swings, and altered body composition. These symptoms not only affect quality of life but also pose long-term health risks, including cardiovascular disease, hypertension and osteoporosis. Given the complex hormonal changes during perimenopause, effective interventions are imperative. This study in Ambala, Haryana, aimed to assess the impact of dietary and physical activity interventions on perimenopausal women's health. Fifty women aged 35 to 50, self-reporting perimenopause, underwent a three-month intervention. The experimental group received tailored nutrition and movement guidance, while the control group maintained their usual lifestyle. Noteworthy enhancements were observed in dietary habits, anthropometric measurements, and biochemical parameter in the experimental group. These improvements included increased intake of nutrient-rich foods, reduction in weight, BMI, WC, HC, WHR and improvements in perimenopausal symptoms and related biochemical marker like hypertension. These findings underscore the efficacy of personalized interventions in mitigating perimenopausal symptoms and improving overall health, emphasizing the importance of lifestyle modifications during this transitional phase. This study investigates the effects of dietary and exercise interventions on physical health markers, dietary habits, physical activity levels, BMI and biochemical assessment of perimenopausal women. By exploring the impact of lifestyle modifications, the research aims to alleviate symptoms, enhance quality of life and reduce the risk of lifestyle diseases during this transitional phase.

Keywords: Perimenopausal, Nutrient, Cardiovascular Disease, Fiber, Lifestyle Modification

Corresponding Author
Aditi Vohra,
aditikap09@gmail.com

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1. INTRODUCTION

The perimenopausal phase marks a significant transition in a woman's life, signalling the initial decline in ovarian function until one year after her final menstrual cycle (Fu Z et al. 2018). This period, bridging reproductive maturity and older age, is often accompanied by a multitude of clinical symptoms (Ji & Yu, 2015). Moreover, the decreased estrogen levels during menopause disrupt the normal cycle of bone renewal, increasing the risk of osteoporosis and fractures. Additionally, estrogen plays a pivotal role in managing fat distribution and the differentiation of fat cells, which can lead to increased abdominal fat, consequently elevating the risk of heart disease and hypertension (Jang et al. 2019). These include changes in menstrual patterns, memory decline, irritability, excessive sweating, difficulty sleeping and joint discomfort (Ji & Yu, 2015).

Managing the physical health of women during the perimenopausal stage is paramount for alleviating symptoms and preventing the onset of chronic illnesses. Zhu et al. (2013) found that a combination of dietary and physical exercise interventions significantly improved various health markers in obese perimenopausal women, including enhanced good cholesterol, reduced insulin resistance, lower plasma insulin levels, and protection against hypertension. Similarly, Ruan et al. (2020) highlighted the positive impacts of exercise rehabilitation on perimenopausal syndrome.

A well-balanced diet tailored to the needs of perimenopausal women is crucial. This diet should maintain energy balance and include adequate amounts of calcium, vitamin D, dietary fiber and iron (Guthrie et al. 1994). Moreover, lifestyle practices, including dietary habits, play a pivotal role in delaying the emergence of risk factors during this phase (Greene & Visser, 1992). Lifestyle modifications, with an emphasis on sufficient exercise and a diet rich in phytoestrogens, calcium, fiber, and low in saturated fats, are advocated as a primary approach for effective perimenopause management (WHO, 2002).

After 45, women generally experience depression less often than men. Although perimenopause can be stressful and cause irritability, menopause-related hormonal changes are not usually a major cause of persistent mood issues. Mood problems in midlife are more strongly linked to daily stress, poor health, and a history of depression (Vohra & Kaur, 2023). Notably, both dietary calcium intake and engagement in physical activity are essential for maintaining bone health in perimenopausal women (Nelson et al. 2008). Physical activity, encompassing any movement engaging skeletal muscles and requiring energy, has been shown to mitigate symptoms such as anxiety, stress and depression during the perimenopausal period (WHO, 2002; Nayak et al. 2019).
Overall, the health and well-being of perimenopausal women during the climacteric phase are closely tied to adopting a healthy lifestyle, which includes a balanced diet, regular exercise and a positive outlook towards aging and perimenopause (Owens et al. 2003; Schoppen et al. 2005).

After highlighting the importance of addressing perimenopause and the necessity for suitable interventions, this research endeavours to explore the influence of dietary and movement interventions on various aspects of physical health, dietary habits, physical activity levels, BMI, and biochemical profiles among perimenopausal women. Through an analysis of lifestyle modifications, the study aims to alleviate symptoms, improve quality of life, and mitigate the risk of lifestyle-related diseases during this transitional period.

2. RESEARCH METHODOLOGY

2.1. STUDY DESIGN

This study focusing on 50 perimenopausal women from Ambala (Haryana). Participants were divided into two groups: the intervention group, which received dietary and physical activity guidance and the control group, which maintained their usual lifestyle. The intervention lasted for three months.

2.2. PARTICIPANT SELECTION

2.2.1. INCLUSION CRITERIA

- Women aged between 35 to 50 years, residents of Ambala, Haryana
- Self-reportedly undergoing perimenopause
- Hypertensive

2.2.2. EXCLUSION CRITERIA

- Women outside the specified age range, not undergoing perimenopause and pregnant or breastfeeding
- Individuals with a history of cardiovascular disease/ renal failure/ diabetic/ neuromuscular diseases or using medications affecting neuromuscular function.
- Use of hormone replacement therapy or other medications potentially altering body composition.

2.3. DATA COLLECTION

The data were collected through a questionnaire-cum-interview method.

2.4. DEVELOPMENT OF QUESTIONNAIRE:

2.4.1. ANTHROPOMETRIC MEASUREMENTS:

- Body Weight

- Body Mass Index (BMI)
- Waist Circumference (WC)
- Hip Circumference (HC)
- Waist-Hip Ratio (WHR)

2.4.2. BIOCHEMICAL PARAMETERS:

- Blood Pressure

2.4.3. CLINICAL SYMPTOMS:

- Physical
- Psychosomatic
- Vasomotor
- Urogenital
- Psychosocial
- Sexual
- Others

2.4.4. DEMOGRAPHIC CHARACTERISTICS:

- Lifestyle patterns
- Dietary intake via 24-hour dietary recall
- Types and frequency of physical activity

These measurements were assessed both at the beginning and end of the intervention to track changes and evaluate the effectiveness of the dietary and physical activity interventions on the health of perimenopausal women.

2.5. DATA PROCESSING

Data were analyzed using statistical software. The mean, percentage and standard deviation were calculated for all quantitative variables.

2.6. RATIONALE

The rationale behind choosing perimenopausal women as the study population is the high prevalence of adverse symptoms and health risks during this transitional phase. The intervention focuses on diet and physical activity modifications because of their proven effectiveness in managing hormonal fluctuations, improving quality of life and reducing disease risk without the side effects associated with pharmacological treatments.

INTERVENTION

The participants in the lifestyle intervention group underwent a comprehensive regimen aimed at promoting holistic well-being during the perimenopausal phase. This structured intervention encompassed nutritional guidance and physical activity recommendations tailored to perimenopause awareness and its associated factors. Initially, participants' baseline knowledge was assessed using a comprehensive questionnaire covering various aspects of perimenopause. Over a three-month period, participants attended weekly sessions where they received guidance on specific nutrients crucial for supporting health during perimenopause. The intervention highlighted the importance of incorporating a balanced diet rich in fruits, vegetables and fiber to support overall well-being. Participants were encouraged to prioritize consumption of calcium and vitamin D-rich foods to support bone health, omega-3 fatty acids for cardiovascular health and phytoestrogen-rich foods to alleviate menopausal symptoms. Hydration was also emphasized as a key component of well-being. In addition to nutritional guidance, participants were provided with counselling sessions focusing on physical activity. They were encouraged to engage in brisk walking for at least 30 minutes daily and taught basic yogasanas and pranayama practices beneficial for perimenopausal well-being. By integrating both nutritional and physical activity components, the intervention aimed to empower participants to make comprehensive lifestyle changes to support their well-being during perimenopause.

3. RESULTS AND DISCUSSIONS

Table 1: Lifestyle patterns of the respondents

Characteristics	Control group (Baseline) Frequency (percentage) n=25	Control group (post-intervention) Frequency (percentage)	Percentage improvement	Experimental group (Baseline) n=25 Frequency (percentage)	Experimental group (post-intervention) Frequency (percentage)	Percentage improvement
Physical activity						
Yes	14 (56%)	15 (60%)	4%↑	17 (68%)	23 (92%)	24%↑
No	11 (44%)	10 (40%)	4%↓	8 (32%)	2 (8%)	24%↓
Type of physical activity						
Brisk walk	9 (36%)	10 (40%)	4%↑	7 (25%)	4 (16%)	9%↓
Yoga	2 (8%)	3 (12%)	4%↑	6 (24%)	3 (12%)	12%↓
Brisk walk & yoga	3 (12%)	1 (4%)	8%↓	4 (16%)	16 (64%)	48%↑
Frequency of exercise						
Daily	5 (20%)	4 (16%)	4%↓	9 (36%)	15 (60%)	24%↑
Thrice a week	7 (28%)	5 (20%)	8%↓	3 (12%)	5 (20%)	8%↑
Weekly	2 (8%)	5 (20%)	12%↑	5 (20%)	3 (12%)	8%↓
Duration of exercise						
20-30 minutes	7 (28%)	6 (24%)	4%↓	8 (32%)	14 (56%)	24%↑
45 minutes	5 (20%)	7 (28%)	8%↑	6 (24%)	5 (20%)	4%↓
1 hour	2 (8%)	1 (4%)	4%↓	3 (12%)	4 (16%)	4%↑
Sleep hours						
4-6 hrs	1 (4%)	3 (12%)	8%↑	4 (16%)	3 (12%)	4%↓
6-8 hours	19 (76%)	21 (84%)	8%↑	17 (68%)	15 (60%)	8%↓
>8 hours	5 (20%)	1 (4%)	16%↓	4 (16%)	7 (28%)	12%↑

The table compares lifestyle patterns of two groups, control and experimental, before and after an intervention. Initially, 56% of the control group and 68% of the experimental group engaged in physical activities. Post-intervention, the control group saw a minor increase to 60%, while the experimental group markedly improved to 92%. This highlights a more substantial enhancement in physical activity within the experimental group, indicating a 24% improvement compared to the control's modest 4%. Looking at exercise types, both groups initially favoured brisk walking, with the experimental group notably shifting towards combining brisk walking and yoga post-intervention, rising from 16% to 64%. Regarding exercise frequency and duration, the experimental group showed a marked increase in daily exercise and 20–30-minute sessions, demonstrating more substantial lifestyle changes than the control group.

Sleep patterns also varied, with a slight improvement in the control group's 6-8 hours sleepers (76% to 84%), while the experimental group had more individuals sleeping over 8 hours post-intervention (16% to 28%). Overall, the intervention had a significantly positive impact on the experimental group's physical activity levels, exercise frequency, duration and sleep duration, showcasing more pronounced lifestyle improvements compared to the control group.
Physical exercise and yoga have been proved to be a fairly effective intervention for middle aged females having an elevated risk for CVD (Owens et al. 2003). Schoppen et al. (2005) demonstrated that physical activity at moderate level (like brisk walking) has a favourable impact on the overall well-being. Eliassen et al. (2010) also reviewed wholesome effect of physical activity and diet moderation on perimenopausal weight reduction. Daley et al. (2007) suggested that physical activity improves brain stimulation which further helps in reducing depressive symptoms.

According to Abedzadeh et al. (2011), consistent physical activity is reported to reduce the frequency of vasomotor symptoms which further enhances the quality of life (QOL) of middle-aged females. Furthermore, it helps in decreasing the severity of perimenopausal complaints, improves self-esteem and thereby promoting psychological well-being in perimenopausal subjects.

De Azevedo and Baptista (2011) investigated the function of duration of body work out in alleviating the perimenopausal symptoms in middle aged women (aged between 40-50 years). It was noticed that women engaged in regular physical workout (at least 60 minutes daily) showed improvement in psychological symptoms as well as quality of life.

Villaverde et al. (2006) suggested that an active lifestyle has a positive correlation with improved cognitive functions and mood swings which enhances physical and emotional well-being.

Table 2: Perimenopausal Symptoms

*Symptoms	"Control group" (Baseline) Frequency (percentage)	"Control group" (post-intervention) Frequency (percentage)	Percentage improvement	"Experimental group" (Baseline) Frequency (percentage)	"Experimental group" (post-intervention) Frequency (percentage)	Percentage improvement
Physical						
Physical exhaustion	18 (72%)	20 (80%)	8%↑	21 (84%)	14 (56%)	28%↓
Joint pain	21 (84%)	18 (72%)	12%↓	19 (76%)	11 (44%)	32%↓
Psychosomatic						
Disruptions in sleep	13 (52%)	15 (60%)	8%↑	17 (68%)	8 (32%)	36%↓
Mood swings	16 (64%)	14 (56%)	8%↓	21 (84%)	15 (60%)	24%↓
Vasomotor symptoms						
Hot flashes	19 (76%)	17 (68%)	8%↓	23 (92%)	13 (52%)	40%↓
Night sweats	15 (60%)	21 (84%)	24%↑	17 (68%)	12 (48%)	20%↓
Psychosocial						
Experiencing poor memory	13 (52%)	11 (44%)	8%↓	15 (60%)	9 (36%)	24%↓
Anxiety	18 (72%)	20 (80%)	8%↑	17 (68%)	11 (44%)	24%↓
Depression	15 (60%)	13 (52%)	8%↓	13 (52%)	8 (32%)	20%↓
Irritability	21 (84%)	16 (64%)	20%↓	22 (88%)	11 (44%)	44%↓
Sexual						
Changes in sexual desire	15 (60%)	18 (72%)	12%↑	20 (80%)	12 (48%)	32%↓
Urogenital						
Vaginal dryness	17 (68%)	20 (80%)	12%↑	21 (84%)	10 (40%)	44%↓
Bladder problems	18 (72%)	15 (60%)	12%↓	16 (64%)	7 (28%)	36%↓
Others						
Heart discomfort	17 (68%)	21 (84%)	16%↑	19 (76%)	12 (48%)	28%↓

***Multiple responses**

Table 2 outlines the impact of interventions on perimenopausal symptoms within control and experimental groups, highlighting changes pre- and post-intervention. Physical symptoms like exhaustion and joint pain improved notably in the experimental group, with physical exhaustion decreasing by 28%. Psychosomatic symptoms, such as sleep disruptions and mood swings, saw mixed outcomes, with a considerable 36% improvement in sleep disruptions in the experimental group. Vasomotor symptoms, including hot flashes and night sweats, improved significantly as well, especially with a 40% reduction in hot flashes in the experimental group.

Psychosocial symptoms like anxiety, depression and irritability showed improvements, particularly in the experimental group where irritability improved by 44%. Sexual and urogenital symptoms also saw marked improvements; for instance, vaginal dryness improved by 44% in the experimental group. Overall, the experimental group experienced substantial benefits across various symptom categories, indicating the positive impact of the intervention on reducing perimenopausal symptoms.

The present findings were comparable with the results of a study by Nayak et al. (2019) where physical exhaustion was prevalent among 79.3 per cent of the perimenopausal respondents. Studies by Satpathy et al. (2016) and Rahman et al.

(2011) exhibited that 72.3 and 76.2 per cent of the perimenopausal respondents complained of joint pains which is similar to the findings of the current investigation.

The current results indicated a high prevalence of hot flashes (76%) among the perimenopausal subjects. Similar finding was observed in the study by Satpathy et al. (2016) who reported that 77.0 per cent of the perimenopausal respondents suffered from hot flashes. On the contrary, Bansal et al. (2013) and Ganapathy and Al Furaikh (2018) witnessed comparatively lower predominance of hot flashes i.e. 59.3 and 67.0 per cent, respectively. Ganapathy and Al Furaikh (2018) also reported a high frequency of depression (59%) among perimenopausal females which is nearly similar to the present results.

In the present investigation, anxiety was highly prevalent (72%) among the perimenopausal females. However, contrasting findings were reported by Mohamed et al. (2014) and Satpathy et al. (2016) who observed frequency of anxiety among 51.7 and 42.0 per cent of the middle-aged females, respectively. Cyriac et al. (2016) and Ahlawat et al. (2016) found that irritability was experienced by 86.7 and 81.9 per cent of the middle-aged females which is nearly similar to the current findings. Consistent with the present findings, Ahlawat et al. (2016) noticed that 58.1 per cent of the females had sleep disturbances.

Sreerenjini and Muthulakshmi (2018) assessed the effectiveness of walking and deep breathing exercises in reducing perimenopausal symptoms. The results indicated that after the practice of deep breathing and walking, there was a marked reduction in the perimenopausal symptoms like joint pain, palpitation, insomnia, poor memory and sadness among perimenopausal subjects. Cardiac disorders are a prominent reason for morbidity and mortality in women (Roger et al. 1998; Papadopoulou & Kaski, 2013).

Table: 3 Mean food intake of the respondents

Group	**Cereals and Millets (270gm/ day)**		**Pulses (60gm/ day)**		**Milk and Milk products (300ml/ day)**	
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	338.52±10.56 (125.38%)	338.83±10.42 (125.49%)	36.39±2.01 (60.65%)	36.65±2.19 (61.08%)	178.25±18.34 (59.42%)	179.51±18.95 (59.84%)
Experimental	334.72±8.83 (123.97%)	330.53±8.23 (122.42%)	31.40±6.03 (52.33%)	35.49±6.13 (59.15%)	159.48±19.75 (53.16%)	191.28±21.01 (63.76%)

Group	**Roots and tubers (200 gm per day)**		**Green leafy vegetables (100 gm per day)**		**Other vegetables (200 gm per day)**	
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	180.52±18.74 (90.26%)	181.34±9.31 (90.67%)	36.46±8.82 (36.46%)	37.25±8.12 (37.25%)	96.26±15.64 (48.13%)	96.41±14.57 (48.20%)
Experimental	166.19±16.89 (83.09%)	172.89±16.23 (86.45%)	30.49±5.23 (30.49%)	39.18±5.89 (39.18%)	95.41±14.69 (47.71%)	113.08±15.68 (56.54%)

Group	**Fruit (100 gm per day)**		**Sugar and jaggery (20 gm per day)**		**Fats and oils (20 gm per day)**	
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	50.36±12.25 (50.36%)	50.85±12.09 (50.85%)	51.24±2.52 (256.2%)	51.06±3.45 (255.3%)	49.32±5.51 (246.6%)	49.02±6.03 (245.1%)
Experimental	42.72±8.31 (42.72%)	49.13±7.24 (49.13%)	51.42±7.12 (257.1%)	46.13±5.26 (230.65%)	48.65±4.12 (243.25%)	41.58±5.41 (207.9%)

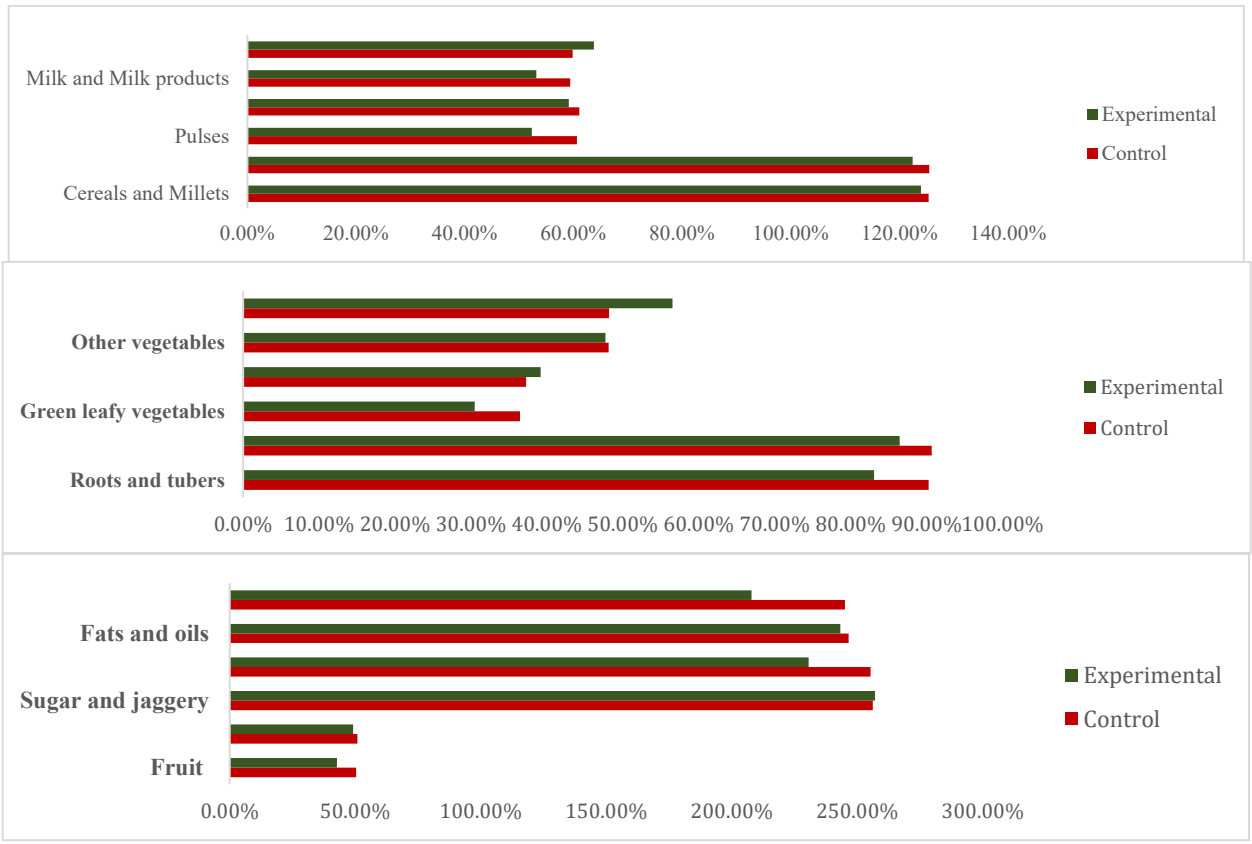


Table 3 represents the mean intake of food in participants, observed before and after the intervention trial in both control and experiment group.

Before the intervention, both groups demonstrated varying levels of adherence to dietary recommendations. The control group consistently surpassed recommended intake levels for cereals & millets, sugar & jaggery. Conversely, the experimental group's intake of cereals & millets was slightly lower but still exceeded recommendations. Both groups fell short of the recommended intake for milk & milk products.

Post-intervention, improvements were noted, particularly in the experimental group's dietary habits. There was a notable increase in milk & milk products intake, as well as in the consumption of green leafy vegetables, other vegetables, fruits and fats & oils. Despite these positive changes, both groups continued to exceed recommended intake levels for sugar & jaggery. Specifically, the control group's mean intake of cereals & millets remained stable post-intervention, still exceeding recommendations. Their intake of pulses slightly increased, though it remained below the recommended level. Milk & milk products intake also saw a slight increase but remained below the recommended intake level. The intake of roots & tubers, green leafy vegetables, other vegetables, fruits, sugar and fats & oils showed minimal changes post-intervention, with most values still either below or above the recommended levels.

In contrast, the experimental group exhibited a decrease in the intake of cereals & millets post-intervention, although it still exceeded recommendations. Their pulses intake increased slightly but remained below the recommended level. Noteworthy improvements were observed in the intake of milk & milk products, which increased notably post-intervention, approaching the recommended intake level. Additionally, there were increases in the intake of roots & tubers, green leafy vegetables, other vegetables, fruits and fats & oils, with most values either approaching or within the recommended levels.

Despite these positive changes, both groups continued to exceed recommended intake levels for sugar & jaggery. The control group's intake remained consistently high, while the experimental group showed a slight decrease post-intervention but still exceeded recommendations. This highlights an area where further dietary adjustments are needed in both groups to align with recommended intake levels.

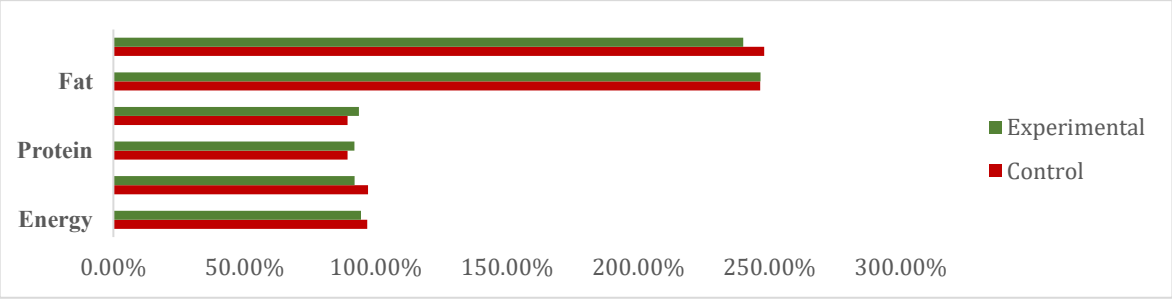
In conclusion, the intervention led to some improvements in dietary habits, particularly in the experimental group. However, there is still a need for both groups to make adjustments, particularly in reducing the intake of sugar & jaggery to align with recommended levels. Additionally, efforts should continue to promote adherence to recommended intake levels for other food groups to support overall health and well-being during the perimenopausal phase.

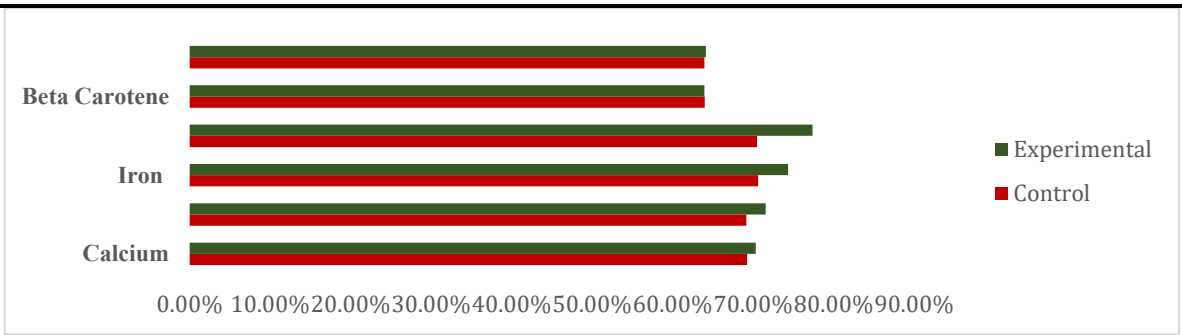
Table: 4 Mean nutrient intake of the respondents

Group	**Energy (1900 kcal per day)**		**Protein (55 gm per day)**			**Fat (20 gm per day)**
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	1836.97±59.04 (96.68%)	1842.45±63.96 (96.97%)	49.05±2.25 (89.18%)	49.06±2.41 (89.2%)	49.27±2.18 (246.35%)	49.58±2.50 (247.9%)
Experimental	1792.20±17.48 (94.32%)	1745.92±16.83 (91.89%)	50.50±1.96 (91.82%)	51.45±1.89 (93.55%)	49.30±1.97 (246.5%)	47.99±2.02 (239.95%)

Group	**Calcium (600 mg per day)**		**Iron (21 gm per day)**		**Beta Carotene (4800 µg per day)**	
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention'
Control	415.50±19.90 (69.25%)	414.88±19.45 (69.15%)	14.83±1.12 (70.62%)	14.80±1.12 (70.48%)	3070.72±31.28 (63.97%)	3068.84±21.58 (63.93%)
Experimental	421.85±26.48 (70.31%)	429.32±24.56 (71.55%)	15.61±1.35 (74.33%)	16.25±1.30 (77.38%)	3069.45±26.53 (63.94%)	3077.20±27.35 (64.11%)

Group	**Vitamin C (40 gm per day)**		**Carbohydrates (270 gm per day)**		**Fiber (30 gm per day)**	
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	26.28±1.55 (65.7%)	26.52±1.50 (66.3%)	300.14±14.37	300.10±14.72	26.27±2.20	26.41±2.12
Experimental	25.92±1.46 (64.8%)	26.85±1.48 (67.12%)	277.55±14.05	266.88±13.16	29.06±1.44	30.42±1.52





The mean nutrient intake of respondents was examined before and after the intervention, comparing the control and experimental groups across various nutrients.

For the control group, before the intervention, the mean energy intake was 1836.97±59.04 kcal/day (96.68% of recommended intake), which increased slightly to 1842.45±63.96 kcal/day after the intervention (96.97% of recommended intake). Protein intake remained consistent, with mean intakes of 49.05±2.25 grams/day before the intervention (89.18% of recommended intake) and 49.06±2.41 grams/day after the intervention (89.2% of recommended intake). Fat intake was notably high before the intervention, at 49.27±2.18 grams/day (246.35% of recommended intake), and increased slightly to 49.58±2.50 grams/day after the intervention (247.9% of recommended intake).

In the experimental group, before the intervention, the mean energy intake was 1792.20±17.48 kcal/day (94.32% of recommended intake), which decreased slightly to 1745.92±16.83 kcal/day after the intervention (91.89% of recommended intake). Protein intake remained within recommended levels both before and after the intervention, with mean intakes of 50.50±1.96 grams/day and 51.45±1.89 grams/day, respectively. Fat intake was also within recommended levels before and after the intervention, with mean intakes of 49.30±1.97 grams/day and 47.99±2.02 grams/day, respectively.

Calcium intake in the control group was 415.50±19.90 mg/day before the intervention (69.25% of recommended intake) and remained stable at 414.88±19.45 mg/day after the intervention (69.15% of recommended intake). In the experimental group, calcium intake increased slightly from 421.85±26.48 mg/day before the intervention (70.31% of recommended intake) to 429.32±24.56 mg/day after the intervention (71.55% of recommended intake).
Iron intake in both groups remained stable before and after the intervention, with both groups meeting the recommended intake levels. Beta carotene intake also remained consistent in both groups, with slight increases observed after the intervention.

Vitamin C intake slightly increased in both groups after the intervention, with the control group reaching 26.52±1.50 mg/day (66.3% of recommended intake) and the experimental group reaching 26.85±1.48 mg/day (67.12% of recommended intake). Carbohydrates and fiber intake remained stable in both groups before and after the intervention. Overall, these findings suggest that while there were minor fluctuations in nutrient intake levels, both groups generally maintained adequate nutrient intake levels throughout the intervention period.

Table: 5 Mean weight, height and BMI of the respondents

Group	Mean weight		Mean height		Mean BMI	
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	66.72±8.66	66.86±8.64	158.35±5.05	158.35±5.05	26.95±3.56	26.93±3.50
Experimental	67.55±10.15	66.51±10.08	157.82±5.13	157.82±5.13	28.20±3.63	27.31±3.67

Table: 6 Mean waist circumference, hip circumference and waist hip ratio

Group	Mean waist circumference	Mean Hip Circumference	Mean Waist hip ratio

	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	91.65±4.06	91.58±4.15	103.35±4.88	103.25±4.87	0.8882±0.034	0.8881±0.034
Experimental	93.77±5.40	92.94±5.36	104.95±6.23	104.29±6.19	0.8941±0.002	0.8914±0.297

Table 5 outlines the mean weight, height and BMI of participants before and after the intervention, differentiating between the control and experimental groups. The control group's weight saw a slight increase post-intervention, while the experimental group experienced a slight decrease. Heights remained consistent in both groups. Regarding BMI, the control group-maintained stability, whereas the experimental group exhibited a decrease post-intervention, indicating potential improvements in body composition.

In Table 6, the mean waist circumference, hip circumference, and waist-hip ratio are presented before and after the intervention for both groups. Both groups showed a slight decrease in waist circumference post-intervention, with stable hip circumferences. Notably, the experimental group demonstrated a decrease in waist-hip ratio, suggesting a favourable change in body composition following the intervention. A study by Lenka and Sundar (2018) determined the nutritional status of perimenopausal and postmenopausal women in Bhubaneswar city, Odisha. The results revealed that 48 per cent of the respondents were over-weight. The mean nutrient intake of the respondents was noted to be more than RDA (recommended dietary allowances). The calorie, protein, fat, iron and calcium intake of the respondents was reported to be excess by 2.4, 9.78, 30.08, 36.71 and 47.94 per cent, respectively.

Cho et al. (2011) demonstrated that high consumption of cereals, vegetables and fruits, dairy products, seaweeds and low intake of animal foods, fast foods, fried and sweet foods had a beneficial effect against impaired lipid metabolism. A healthy diet provides a protective effect against metabolic syndrome among perimenopausal women as compared to a Western diet, which has high calorie, saturated fats and carbohydrate content. Moreover, a healthy diet gives protection against high triglycerides level, obesity and hypertension to perimenopausal women.

4. BIOCHEMICAL ASSESSMENTS

4.1. HYPERTENSION

Hypertension, or commonly referred to as high blood pressure, is a prevalent condition characterized by sustained elevated pressure of blood against the walls of arteries over an extended period. This heightened pressure can lead to various health complications, including heart disease. Typically, it is diagnosed when blood pressure measurements exceed 120/80 mmHg. Due to its symptomless nature, hypertension is often dubbed the "silent killer," as it can remain undetected for years before manifesting into severe health conditions (Shao et al. 2016).

4.1.1. STATISTICS

As in April 2023, hypertension affects nearly half of adults in the United States, according to the Centres for Disease Control and Prevention (CDC). "Globally, the World Health Organization (WHO) estimates that about 1.13 billion people suffer from hypertension, with a higher prevalence in low- and middle-income countries". It's a major risk factor for cardiovascular diseases, stroke, and kidney failure (Zheng et al. 2013).

4.1.2. HYPERTENSION And PERIMENOPAUSAL WOMEN

Perimenopause is the transition period to menopause, during which a woman's body undergoes significant hormonal changes that can affect her health in various ways. These changes can increase the risk of developing hypertension due to the decrease in estrogen levels, which has a protective effect on the heart and arteries. The risk of hypertension further increases with age, especially after menopause (Liese et al. 2011).

4.1.3. IMPACT OF DIET AND EXERCISE

A good diet and regular exercise play critical roles in managing and preventing hypertension, especially for perimenopausal women. Poor dietary choices and lack of physical activity can exacerbate the risk factors, leading to weight gain, increased blood pressure, and a higher risk of cardiovascular diseases (Azadbakht et al. 2011).

"A heart-healthy diet rich in fruits, vegetables, whole grains, lean proteins, and low in sodium, processed foods, and saturated fats, combined with regular physical activity, can help manage weight, reduce blood pressure, and improve overall cardiovascular health" (Wassertheil et al. 2000). Exercise recommendations generally include at least 150 minutes of moderate-intensity aerobic activity per week, or 75 minutes of vigorous-intensity activity, along with muscle-strengthening activities on two or more days per week (Liese et al. 2011).

Ignoring these lifestyle factors can lead to a deterioration in health, increasing the risk of heart attacks, strokes, and other complications related to hypertension (Wassertheil et al. 2000). It's crucial for perimenopausal women to monitor their blood pressure regularly, make healthy lifestyle choices, and consult healthcare providers for guidance tailored to their individual health needs (Conen et al. 2015).

Table: 7 Mean of systolic and disystolic blood pressure

Group	Systolic blood pressure (SBP)		Disystolic blood pressure (DBP)	
	"Before intervention"	"After intervention"	"Before intervention"	"After intervention"
Control	137.20±2.50	137.42±2.26	89.68±2.05	89.56±2.25
Experimental	136.70±2.19	134.58±2.25	90.65±2.81	90.09±2.51

Table 7 provides the mean systolic and diastolic blood pressure (SBP and DBP, respectively) of respondents before and after the intervention, categorized into the control and experimental groups.

Before the intervention, the control group had a mean SBP of 137.20±2.50 mmHg, which slightly increased to 137.42±2.26 mmHg after the intervention. The experimental group exhibited a similar trend, with mean SBP decreasing from 136.70±2.19 mmHg before the intervention to 134.58±2.25 mmHg after the intervention.

Regarding diastolic blood pressure, the control group had a mean DBP of 89.68±2.05 mmHg before the intervention, which remained stable at 89.56±2.25 mmHg after the intervention. In comparison, the experimental group's mean DBP decreased from 90.65±2.81 mmHg before the intervention to 90.09±2.51 mmHg after the intervention.

These findings suggest subtle fluctuations in both systolic and diastolic blood pressure levels, with the experimental group showing a slight decrease in SBP and DBP after the intervention compared to the control group.

5. CONCLUSIONS

This study demonstrates the significant impact of targeted lifestyle interventions, including dietary adjustments and increased physical activity, on improving the health and quality of life of perimenopausal women. By adopting these changes, participants experienced notable benefits in dietary habits, anthropometric measurements, and biochemical parameters. These improvements included increased intake of nutrient-rich foods, which contributed to alleviating symptoms associated with perimenopause, such as irregular menstrual cycles, hot flashes, sleep disturbances, and mood swings, thereby enhancing overall well-being.

Noteworthy were the reductions in weight, body mass index (BMI), waist and hip circumferences and waist-hip ratio (WHR), alongside better management of hypertension. These changes are crucial for reducing the risk of cardiovascular diseases, which pose a significant health threat to postmenopausal women. The intervention group's results underscore the effectiveness of incorporating diet and exercise into the management of perimenopausal symptoms and associated health risks.

The study advocates for a holistic approach to managing perimenopause, emphasizing the importance of diet and physical activity. It suggests that lifestyle modifications can serve as preventive health strategies, highlights the need for broader implementation of tailored interventions. Future research should explore the long-term benefits and potential for integrating these lifestyle changes into general health care practices for perimenopausal women. This approach not only promises to improve immediate health outcomes but also fosters a supportive environment that encourages positive health behaviors during this transitional phase.

CONFLICT OF INTERESTS

"The authors declare no conflicts of interest."

ETHICAL CONSIDERATIONS

"Ethical clearance for the study was granted by the Institutional Ethical Committee of Kurukshetra University, Kurukshetra (IEC-KUK). All participants provided informed consent after being briefed on the study's purpose and benefits."

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