

# Comparative Effects of Isotonic and Isometric Surya Namaskar on Physiological Variables and Well-Being in Middle-Aged Women: A Study in Oman

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## ABSTRACT

**Background:** Hormonal transitions during middle age predispose women to metabolic dysregulation, cardiovascular strain, and reduced quality of life. While Suryanamaskar (Sun Salutation) is widely practiced, comparative evidence between dynamic (isotonic) and static (isometric) modalities remains limited.

**Objective:** To evaluate the differential effects of isotonic versus isometric Suryanamaskar on body weight, blood pressure, cardiovascular efficiency, and subjective well-being in women aged 40–65 years.

**Methods:** Thirty women (mean age [range]: 40–65 years) with prior yoga experience completed a single-group crossover trial. Participants underwent 12 weeks of isotonic Suryanamaskar (dynamic flow), followed by a 12-week washout period, then 12 weeks of isometric Suryanamaskar (static holds). Each intervention consisted of 90-minute sessions, five days weekly, incorporating prayer, warm-up, Suryanamaskar (50 min), counter-stretches, cyclic breathing, Yoga Nidra, and meditation. Physiological parameters (body weight, blood pressure, pulse rate) were assessed at baseline (T0), post-isotonic (T1), pre-isometric (T2), and post-isometric (T3). Subjective outcomes included fatigue levels and morning freshness.

**Results:** Both interventions significantly improved physiological parameters. Isometric practice demonstrated superior weight reduction (1.67 kg vs. 0.95 kg,  $p=0.014$ ) and greater blood pressure reduction (SBP: -2.93 vs. -1.30 mmHg,  $p=0.008$ ; DBP: -1.34 vs. -0.17 mmHg,  $p=0.028$ ). Conversely, isotonic practice significantly improved cardiovascular efficiency evidenced by greater resting pulse rate reduction (-5.07 vs. -1.00 bpm,  $p<0.001$ ). Subjectively, 80% of participants reported reduced fatigue following both interventions, while 93% reported enhanced morning freshness with isotonic practice compared to 70% with isometric practice.

**Conclusion:** Isometric Suryanamaskar appears more effective for weight management and blood pressure regulation, while isotonic practice superiorly enhances cardiovascular autonomic function and morning vitality. Integrating both modalities may provide comprehensive therapeutic benefits for middle-aged women experiencing hormonal transitions.

**Keywords:** Suryanamaskar, Yoga Therapy, Isotonic Exercise, Isometric Exercise, Women's Health, Blood Pressure, Fatigue, Holistic Wellness.

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## I. INTRODUCTION

### A. Suryanamaskar in Ancient Texts

Suryanamaskar, commonly known as *Sun Salutation*, has deep roots in ancient Vedic traditions. Classical Indian scriptures highlight the significance of the Sun as a symbol of energy, vitality, and consciousness. References to the Sun's divine role are found in ancient texts such as the *Rigveda*, *Puranas*, *Ramayana*, and *Mahabharata*, where the Sun is associated with the removal of darkness, negativity, illness, and evil. One

of the most notable hymns dedicated to the Sun is the *Aditya Hridayam*, narrated by Sage Agastya to Lord Rama before his battle with Ravana. Similarly, the *Gayatri Mantra*, originating from the *Rigveda* and attributed to Sage Vishwamitra, is considered one of the most powerful Vedic mantras that stimulates intellectual clarity and spiritual awareness. In the modern era, Sri Tirumalai Krishnamacharya (1888–1989) played a pivotal role in revitalizing the practice of Suryanamaskar by systematically integrating it with

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*Pranayama* (breathing techniques) and *Asanas* (yogic postures), thereby making it a structured component of contemporary yoga practice.

## B. Scientific Relevance

In recent decades, lifestyle-related health problems such as stress disorders, obesity, hypertension, sleep disturbances, and chronic fatigue have become increasingly prevalent. These conditions often arise due to imbalances in mental and physical health that disrupt hormonal regulation, energy metabolism, and physiological repair mechanisms. Although conventional medical treatments are available, they may produce side effects and often lack a holistic approach. As a result, complementary health practices such as yoga have gained increasing scientific attention for their potential to improve both physical and psychological well-being<sup>(1-5)</sup>.

## C. Research Gap

Previous research on Suryanamaskar has primarily focused on general health benefits, with limited studies comparing **dynamic (isotonic) and static (isometric) forms**, particularly among women over 40 years of age. This study contributes to filling this gap by providing comparative evidence on their physiological and wellness outcomes.

## D. Surya Namaskar (Sun Salutation) - Steps



**Fig.1 Surya Namaskar (Sun Salutation) - Steps**  
Surya Namaskar (Sun Salutation) is a traditional sequence of twelve yoga postures performed in a continuous flow that combines movement with controlled breathing. The Figure -1 show that practice begins with Pranamasana (Prayer Pose), followed by Hasta Uttanasana (Raised Arms Pose) and Padahastanasana (Hand to Foot Pose). The sequence continues with Ashwa Sanchalanasana (Equestrian Pose), Dandasana (Plank Pose), and Ashtanga Namaskara (Eight-Point Salute). It then moves into Bhujangasana (Cobra Pose) and Parvatasana (Mountain Pose) before repeating the equestrian and forward bending poses on the opposite side, finally returning to the raised arms position and ending again in the prayer pose. Practicing Surya Namaskar regularly helps improve body flexibility, strengthens

muscles, enhances blood circulation, and promotes overall physical and mental well-being.

## E. Strategic and Holistic Approach

Yoga offers a multidimensional approach to health by combining physical movement, breath regulation, and meditative awareness. Among various yogic practices, Suryanamaskar is particularly effective because it engages multiple physiological systems simultaneously. The sequence traditionally consists of twelve postures synchronized with breathing and mantra **chanting**. This coordinated practice stimulates the musculoskeletal system, enhances respiratory efficiency, activates internal organs, and promotes mental calmness<sup>(6-7)</sup>.

Suryanamaskar can be practiced in two distinct modes:

### 1. Isotonic Suryanamaskar (Dynamic Practice):

Characterized by continuous movement between postures, this form improves cardiovascular endurance, metabolism, and weight management.

### 2. Isometric Suryanamaskar (Static Hold Practice):

Involves holding each posture for a longer duration, which enhances muscular strength, flexibility, and stability.

When combined with the **twelve Surya mantras**, both forms deepen breath awareness and enhance mental concentration. Research suggests that regular practice may contribute to autonomic nervous system regulation, reduction of cortisol levels, improved blood pressure control, increased serotonin and dopamine activity, and enhanced meditative focus.

## II. OBJECTIVES OF THE STUDY

### A. Primary Aim

The primary objective of this study is to support women aged 40 years and above in maintaining holistic health during hormonal transitions by:

1. Preventing obesity
2. Maintaining healthy blood pressure levels
3. Reducing anxiety and mental stress
4. Improving fatigue levels and morning freshness

### B. Target Population

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The study focuses on women aged 40 years and above, a group often experiencing hormonal fluctuations that can influence mood, metabolism, and overall health.

## C. Rationale

Hormonal changes during middle age frequently lead to weight gain, fatigue, mood swings, anxiety, and elevated blood pressure. A structured program integrating isotonic and isometric Suryanamaskar with mantra chanting may help balance the body and mind while promoting long-term physiological and psychological well-being.

## III. METHODOLOGY

### A. Research Design

We employed a single-group crossover trial design with a washout period to enable within-subject comparison while controlling for inter-individual variability. Participants were monitored during fixed practice schedules of five days per week for 1.5 hours per session.

#### Study Sequence:

**T0 (Baseline):** Pre-intervention assessment

**Phase I:** 12-week isotonic intervention

**T1 (Post-Isotonic):** Immediate post-intervention assessment

**Washout:** 12-week cessation period

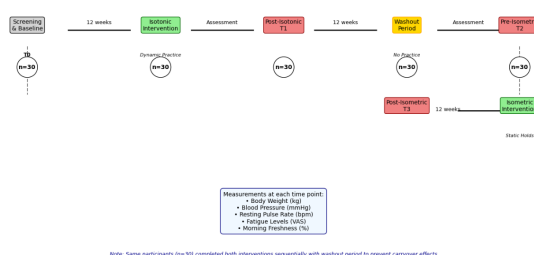
**T2 (Pre-Isometric):** Verification of baseline return

**Phase II:** 12-week isometric intervention

**T3 (Post-Isometric):** Final assessment

The 12-week washout period was selected based on evidence that cardiovascular and metabolic adaptations typically normalize within 8–10 weeks of training cessation.

**Figure 1 : Study Design flowchart: Single Group Crossover Trial**



### B. Data Collection

Two types of data were collected:

#### 1. Quantitative Data

- Body weight
- Blood pressure

- Pulse rate
- Clinical reports

#### 2. Qualitative Data

- Participant feedback regarding physical, mental, and emotional well-being

### C. Sample Size

Thirty women aged 40–65 years (mean age: 52.3 ± 7.1 years) were recruited via purposive sampling. Sample size was determined based on prior effect size estimates (Cohen's d = 0.5) for blood pressure changes in yoga interventions, requiring minimum n=26 for 80% power (α=0.05)

### D. Period

A **three-month period** was implemented between intervention phases to minimize potential carryover effects.

### E. Inclusion Criteria:

- Sedentary to moderately active lifestyle (<150 min moderate exercise/week)
- Minimum six months prior yoga experience
- No acute musculoskeletal injuries or cardiovascular contraindications
- Not currently undergoing hormone replacement therapy

### F. Suryanamaskar Protocol

Each session lasted **90 minutes** and followed the structure below:

1. Prayer and Om chanting – 5 minutes
2. Warm-up exercises – 6 minutes
3. Suryanamaskar practice – 50 minutes
4. Counter stretching exercises – 7 minutes
5. Cyclic breathing – 5 minutes
6. Yoga Nidra relaxation – 10 minutes
7. Omkara meditation and closing prayer – 10 minutes
8. Participant feedback collection every four weeks

### G. Variables

#### Independent Variable

- Type of Suryanamaskar practice (Isotonic or Isometric)

#### Dependent Variables

- Body weight
- Blood pressure
- Pulse rate
- Fatigue level
- Morning freshness

## IV. RESULTS

### A. Body Weight Reduction

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Intervention	Mean Before (kg)	Mean After (kg)	Mean Reduction (kg)
Isotonic Suryanamaskar	65.17	64.22	0.95
Isometric Suryanamaskar	65.02	63.35	1.67

Table.1 Body Weight Reduction

Both forms of Suryanamaskar contributed to weight reduction. However, **isometric practice showed a greater reduction**, suggesting improved weight management potential, while isotonic practice improved cardiovascular efficiency. Table show that both isotonic and isometric Suryanamaskar practices resulted in a reduction in body weight. The mean weight decreased from **65.17 kg to 64.22 kg** in the isotonic group and from **65.02 kg to 63.35 kg** in the isometric group. The greater reduction observed in the isometric practice (**1.67 kg**) suggests improved weight management benefits compared to the isotonic form (**0.95 kg**).

### B. Blood Pressure Changes

Intervention	Mean SBP Reduction	Mean DBP Reduction
Isotonic	1.3 mmHg	0.17 mmHg
Isometric	2.93 mmHg	1.34 mmHg

Table.2 Blood Pressure Changes

Isometric Suryanamaskar demonstrated a slightly greater reduction in both systolic and diastolic blood pressure. Both interventions contributed to reductions in blood pressure. Isotonic Suryanamaskar showed a reduction of **1.3 mmHg in systolic BP** and **0.17 mmHg in diastolic BP**, while isometric Suryanamaskar demonstrated greater reductions of **2.93 mmHg (SBP)** and **1.34 mmHg (DBP)**.

### C. Pulse Rate Changes

Intervention	Baseline (bpm)	Post (bpm)	Mean Difference
Isotonic	80.17	75.10	↓ 5.07
Isometric	77.77	76.77	↓ 1.00

Table.2 Pulse Rate Changes

Isotonic practice showed greater improvement in cardiovascular efficiency, as indicated by a more significant reduction in resting pulse rate. Resting pulse rate decreased in both practices. The isotonic group showed a reduction from **80.17 bpm to 75.10 bpm** (↓5.07 bpm), whereas the isometric group showed a smaller reduction from **77.77 bpm to 76.77 bpm**

(↓1.00 bpm), indicating greater cardiovascular improvement in the isotonic practice.

### D. Fatigue Reduction

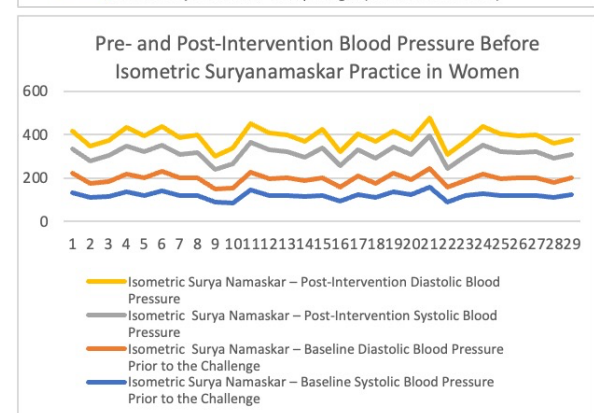
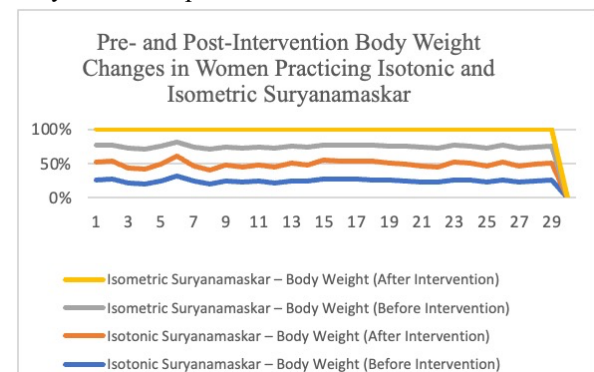
At the beginning of the study, approximately **40% of participants reported fatigue**. After three months of regular practice, **over 80% reported little or no fatigue**, indicating improved energy and endurance.

### E. Morning Freshness

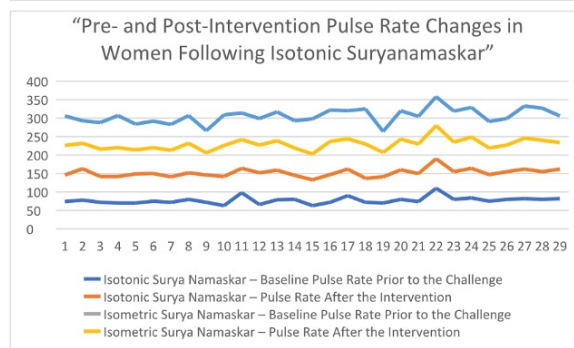
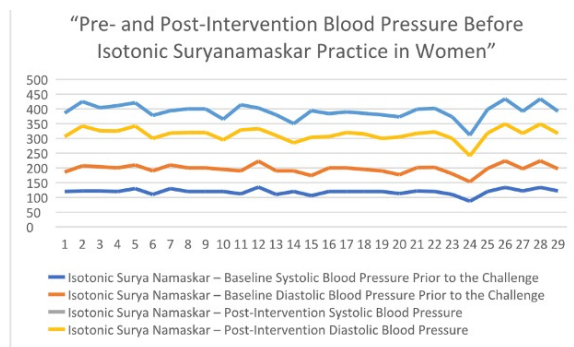
Regular practice enhanced morning freshness. **93% of participants practicing isotonic Suryanamaskar and 70% practicing isometric Suryanamaskar** reported feeling refreshed after three months. These findings suggest that regular Suryanamaskar practice enhances daily vitality and alertness.

## V. DISCUSSION

The present study examined the comparative effects of isotonic and isometric Suryanamaskar practices on physiological variables and overall well-being among women aged 40 years and above. The results demonstrated improvements in body weight, blood pressure, pulse rate, fatigue levels, and morning freshness, indicating the positive impact of regular Suryanamaskar practice.



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The findings from the graphs and statistical data show that both forms of Suryanamaskar contributed to reductions in body weight. However, the isometric practice showed a greater reduction, suggesting that holding postures may increase muscular engagement and energy expenditure, thereby supporting weight management in middle-aged women. Similarly, improvements were observed in blood pressure levels, where isometric Suryanamaskar produced slightly greater reductions in both systolic and diastolic blood pressure. This may be attributed to improved vascular function, relaxation response, and regulation of the autonomic nervous system through controlled breathing and sustained postures. In contrast, isotonic Suryanamaskar demonstrated greater improvement in cardiovascular efficiency, as reflected in the more significant reduction in resting pulse rate. Dynamic movements performed rhythmically with breath may enhance cardiovascular endurance, circulation, and oxygen utilization. The results also indicate significant improvements in fatigue levels and morning freshness. A majority of participants reported reduced fatigue and increased daily vitality after three months of practice. These outcomes highlight the combined effects of physical movement, breath regulation, relaxation techniques, and mantra chanting, which together promote both physical and psychological well-being. From a practical perspective, the findings suggest that integrating both isotonic and isometric Suryanamaskar practices may provide comprehensive health benefits for women experiencing hormonal and metabolic changes during middle age<sup>(8-11)</sup>.

## VI. CONCLUSION

This study examined the effects of isotonic and isometric forms of Suryanamaskar on selected physiological variables and overall well-being among women aged 40 years and above. The results demonstrated that both forms of practice contributed positively to health outcomes. Isometric Suryanamaskar showed greater effectiveness in reducing body weight and improving blood pressure levels, whereas isotonic Suryanamaskar demonstrated stronger effects on cardiovascular efficiency, particularly in reducing resting pulse rate and improving morning freshness. Furthermore, the regular practice of Suryanamaskar combined with breathing techniques and mantra chanting significantly reduced fatigue levels and enhanced overall vitality among the participants. These findings suggest that Suryanamaskar can serve as an effective, non-pharmacological, and holistic intervention for managing health challenges associated with hormonal changes during middle age. This study provides novel evidence that isotonic and isometric Suryanamaskar produce distinct physiological adaptations in middle-aged women. Isometric practice demonstrates superior efficacy for weight management (-1.67 kg) and blood pressure regulation (-2.93/-1.34 mmHg), while isotonic practice more effectively improves cardiovascular efficiency (-5.07 bpm resting pulse) and morning vitality (93% reporting freshness).

Healthcare providers and yoga therapists should consider integrating both modalities into lifestyle interventions for middle-aged women, potentially cycling between dynamic and static execution to maximize comprehensive health benefits. Future research should examine the underlying molecular mechanisms (autophagy, mitochondrial biogenesis) and long-term sustainability of these effects.

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