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IMPACT OF A STRUCTURED YOGA-BASED INTERVENTION ON ANTHRO-PHYSIOLOGICAL HEALTH INDICATORS AMONG MIDDLE-AGED HOUSEWIVES: A QUASI-EXPERIMENTAL STUDY

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ABSTRACT

Background: Middle adulthood may be accompanied by changes in cardiovascular function, body composition, respiratory regulation, and habitual physical activity. Yoga, integrating physical postures, breathing practices, relaxation, and meditation, may offer a feasible non-pharmacological approach to improving physiological health.

Objective: This study examined the effect of a structured 12-week yoga-based intervention on selected physiological health indicators among middle-aged homemakers.

Methods: A quasi-experimental pre-test–post-test control-group design was employed. Sixty apparently healthy homemakers aged 35–50 years were recruited through purposive sampling and allocated to a yoga group (n = 30) and a control group (n = 30). The yoga group participated in supervised 60-minute sessions, five days per week, for 12 weeks, comprising selected *asanas*, *pranayama*, relaxation, and meditation. The control group maintained its usual daily routine. Outcomes included resting heart rate, systolic and diastolic blood pressure, respiratory rate, body mass index (BMI), waist–hip ratio (WHR), and peripheral oxygen saturation (SpO_2). Data were analysed using descriptive statistics, paired-samples *t*-tests, ANCOVA, and Cohen's *d*, with statistical significance set at $p < 0.05$.

Results: The yoga group demonstrated significant reductions in resting heart rate, systolic and diastolic blood pressure, respiratory rate, BMI, and WHR, together with an increase in SpO_2 following the intervention (all $p < 0.001$). The control group showed no significant changes. The reported ANCOVA results indicated significant adjusted between-group differences across all seven outcomes, with partial η^2 values ranging from 0.18 to 0.48 and Cohen's *d* values from 0.68 to 1.41.

Conclusion: A supervised 12-week yoga programme was associated with favourable changes in selected cardiovascular, respiratory, and anthropometric indicators among middle-aged homemakers. Larger randomized studies with longer follow-up are warranted to confirm these findings.

Keywords: Yoga, Middle-aged women, Housewives, Physiological health, Blood pressure, Resting heart rate, Respiratory rate, Body mass index, Quasi-experimental study.

1. INTRODUCTION

Health is a multidimensional concept encompassing physical, physiological, psychological, and social well-being rather than merely the absence of disease (World Health Organization [WHO], 2022). Middle adulthood is a critical stage in a woman's life, characterized by hormonal changes, declining metabolic rate, reduced physical activity, and increased susceptibility to non-communicable diseases such as hypertension, obesity, cardiovascular disorders, and respiratory dysfunction (Loewenthal et al., 2024). These physiological alterations are often exacerbated among housewives due to prolonged household responsibilities, sedentary lifestyles, chronic stress, and limited opportunities for structured physical exercise, thereby increasing their risk of adverse health outcomes (Innes et al., 2018).

Yoga, an ancient Indian mind-body practice integrating **asanas** (physical postures), **pranayama** (breathing techniques), and **meditation**, has gained global recognition as an effective complementary intervention for promoting holistic health (Ross & Thomas, 2010). Growing scientific evidence indicates that regular yoga practice improves autonomic nervous system regulation, enhances parasympathetic activity, reduces sympathetic overactivity, lowers resting heart rate and blood pressure, improves pulmonary function, and positively influences body composition and metabolic health (Cramer et al., 2016; Patil et al., 2024). Furthermore, yoga has been shown to reduce stress, anxiety, and inflammation by modulating the hypothalamic–pituitary–adrenal axis and enhancing vagal tone, thereby improving both physiological and psychological well-being (Streeter et al., 2012; Mishra et al., 2024).

Although numerous studies have investigated the health benefits of yoga in athletes, older adults, and patients with chronic diseases, relatively few have focused on middle-aged housewives, a population particularly vulnerable to lifestyle-related health problems. Moreover, limited research has comprehensively examined the combined effects of yoga on cardiovascular, respiratory, and anthropometric health indicators within this group. Therefore, the present study aimed to evaluate the impact of a structured 12-week yoga-based intervention on selected physiological health indicators among middle-aged housewives using a quasi-experimental design. The findings are expected to provide evidence supporting yoga as an effective, affordable, and sustainable lifestyle intervention for improving women's physiological health and promoting community-based health programmes.

2. REVIEW OF LITERATURE:

Yoga has gained substantial scientific recognition as an effective complementary therapy for enhancing physical and physiological well-being. Integrating **asanas (physical postures), pranayama (breathing exercises), meditation, and relaxation techniques**, yoga positively influences cardiovascular, respiratory, metabolic, and psychological functions (Ross & Thomas, 2010). Recent evidence indicates that regular yoga practice improves autonomic nervous system regulation by enhancing parasympathetic activity and reducing sympathetic overactivity, thereby contributing to reductions in resting heart rate, blood pressure, and stress levels (Loewenthal et al., 2024).

Several studies have demonstrated that yoga produces significant improvements in cardiovascular health among middle-aged adults. Systematic reviews by Cramer et al. (2016) and Patil et al. (2024) reported significant reductions in systolic and diastolic blood pressure, improved endothelial function, and enhanced cardiac efficiency following structured yoga interventions. Similarly, pranayama practices

have been shown to improve pulmonary ventilation, respiratory muscle strength, oxygen utilisation, and lung function, resulting in lower respiratory rates and improved cardiorespiratory fitness (Bhavanani, 2017; Sengupta, 2012).

Yoga also plays a vital role in improving anthropometric health. Intervention studies have reported reductions in body mass index (BMI), waist circumference, waist–hip ratio (WHR), and body fat percentage among middle-aged women, thereby reducing the risk of obesity and cardiometabolic disorders (Innes et al., 2018; Yang et al., 2025). In addition, meditation and relaxation practices reduce cortisol secretion and psychological stress, improving sleep quality, emotional well-being, and overall quality of life (Streeter et al., 2012; Mishra et al., 2024).

Despite these documented benefits, relatively few studies have specifically investigated middle-aged housewives, who are particularly vulnerable to sedentary lifestyles and lifestyle-related diseases. Furthermore, previous research has often examined isolated physiological variables rather than providing a comprehensive assessment of cardiovascular, respiratory, and anthropometric health. Therefore, the present study addresses this gap by evaluating the effects of a structured yoga-based intervention on multiple physiological health indicators among middle-aged housewives.

4. STATEMENT OF THE PROBLEM:

The purpose of the present investigation is:

To determine the impact of a structured yoga-based intervention on selected physiological health indicators among middle-aged housewives.

5. OBJECTIVES OF THE STUDY:

The present study aims:

I. To determine the effect of a structured yoga programme on resting heart rate among middle-aged housewives.

II. To evaluate the effect of yoga on systolic blood pressure.

III. To examine the influence of yoga on diastolic blood pressure.

IV. To determine the effect of yoga on respiratory rate.

V. To evaluate changes in Body Mass Index (BMI).

VI. To assess changes in Waist–Hip Ratio (WHR).

VII. To determine the influence of yoga on peripheral oxygen saturation.

VIII. To evaluate the overall effectiveness of yoga in improving physiological health.

6. HYPOTHESES:

There will be no significant difference between pre-test and post-test physiological health indicators following a structured yoga intervention among middle-aged housewives.

7. MATERIALS AND METHODS:

7.1 Study Design:

The present investigation employed a **quasi-experimental pre-test–post-test control group design** to examine the impact of a structured yoga-based intervention on selected physiological health indicators among middle-aged housewives. This design was selected because it permits evaluation of intervention

effectiveness under community-based conditions while maintaining adequate internal validity through comparison between an intervention group and a non-intervention control group.

Measurements of all physiological variables were obtained before the commencement of the intervention (baseline assessment) and immediately after completion of the 12-week intervention programme.

7.2 Study Setting:

The study was conducted in community centres and yoga training facilities located within selected urban and semi-urban areas. All assessments and yoga sessions were carried out under the supervision of certified yoga instructors and qualified exercise physiologists.

Testing sessions were conducted between **7:00 a.m. and 9:00 a.m.** to minimize circadian variation in physiological measurements.

7.3 Participants:

A total of **60 apparently healthy middle-aged housewives** participated voluntarily in the study.

Participants were allocated into two groups:

- Experimental Group (Yoga): **30**
- Control Group: **30**

Age Range: **35–50 years**

7.4 Study Variables:

Independent Variable

Structured Yoga-Based Intervention

Dependent Variables

Cardiovascular Variables

- Resting Heart Rate (beats/min)
- Systolic Blood Pressure (mmHg)
- Diastolic Blood Pressure (mmHg)

Respiratory Variable

- Respiratory Rate (breaths/min)

Anthropometric Variables

- Body Mass Index (kg/m^2)
- Waist–Hip Ratio

Oxygenation Variable

- Peripheral Oxygen Saturation (SpO_2)

7.5 Instruments Used

Variable	Instrument
Height	Portable Stadiometer
Body Weight	Digital Weighing Scale
BMI	Calculated (kg/m²)
Waist Circumference	Measuring Tape
Hip Circumference	Measuring Tape
Blood Pressure	Automatic Digital Sphygmomanometer
Resting Heart Rate	Polar Heart Rate Monitor
Respiratory Rate	Manual Observation
Oxygen Saturation	Fingertip Pulse Oximeter

All instruments were calibrated before data collection.

7.6 Control Group

Participants assigned to the control group:

- continued their normal daily household routine;
- did not participate in any organised exercise programme;
- received no yoga training during the intervention period.

Following completion of the study, the control group was offered the same yoga programme as an ethical consideration.

8. RESULTS

The present study examined the effects of a 12-week structured yoga-based intervention on selected physiological health indicators among middle-aged homemakers. Data were analysed using descriptive statistics and paired-samples *t*-tests to examine pre- to post-intervention changes within each group. The level of statistical significance was set at $p < 0.05$. The results are presented in Table 1.

Table 1. Pre- and Post-Intervention Changes in Selected Physiological Health Indicators

Physiological Variable	Group	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Change	*T-test*	*p-value*
Resting Heart Rate (beats·min^{-1})	Yoga	78.86 ± 5.24	72.31 ± 4.11	−6.55	8.92	<0.001
	Control	79.12 ± 5.01	78.45 ± 5.10	−0.67	0.88	0.38
Systolic Blood Pressure (mmHg)	Yoga	132.48 ± 8.65	122.71 ± 7.18	−9.77	9.54	<0.001
	Control	131.88 ± 8.21	130.97 ± 8.34	−0.91	0.94	0.35
Diastolic Blood Pressure (mmHg)	Yoga	84.62 ± 6.14	78.53 ± 5.42	−6.09	8.11	<0.001
	Control	84.17 ± 5.88	83.91 ± 5.74	−0.26	0.51	0.61
Respiratory Rate (breaths·min^{-1})	Yoga	18.46 ± 1.74	15.88 ± 1.32	−2.58	9.23	<0.001
	Control	18.31 ± 1.69	18.04 ± 1.71	−0.27	0.83	0.41
Body Mass Index (kg·m^{-2})	Yoga	27.38 ± 2.84	26.14 ± 2.53	−1.24	6.72	<0.001
	Control	27.09 ± 2.91	27.02 ± 2.86	−0.07	0.34	0.74
Waist–Hip Ratio	Yoga	0.91 ± 0.05	0.87 ± 0.04	−0.04	5.88	<0.001
	Control	0.90 ± 0.05	0.90 ± 0.05	0.00	0.42	0.67
Peripheral Oxygen Saturation (SpO_2, %)	Yoga	97.08 ± 0.88	98.26 ± 0.74	+1.18	5.94	<0.001
	Control	97.13 ± 0.82	97.22 ± 0.81	+0.09	0.71	0.48

Table 1 demonstrates a consistent pattern of favourable changes in the yoga group across all seven physiological indicators following the 12-week intervention. Resting heart rate decreased by 6.55 beats·min^{-1}, systolic blood pressure by 9.77 mmHg, and diastolic blood pressure by 6.09 mmHg. All three cardiovascular changes were statistically significant ($p < 0.001$). In contrast, the corresponding changes in the control group were small and statistically non-significant ($p > 0.05$).

Respiratory rate also decreased significantly in the yoga group by 2.58 breaths·min^{-1} ($p < 0.001$), whereas the control group showed only a negligible change of 0.27 breaths·min^{-1} ($p = 0.41$). This finding indicates a change in resting respiratory pattern following participation in the structured yoga programme.

Significant improvements were also observed in the anthropometric indicators. BMI decreased by 1.24 kg·m^{-2} in the yoga group ($p < 0.001$), while the control group showed a minimal reduction of 0.07 kg·m^{-2} ($p = 0.74$). Similarly, WHR decreased by 0.04 in the yoga group ($p < 0.001$), whereas no change was observed in the control group. These findings indicate favourable changes in the anthropometric profile of participants who underwent the yoga intervention.

Peripheral oxygen saturation increased by 1.18 percentage points in the yoga group ($p < 0.001$), compared with a small and non-significant increase of 0.09 percentage points in the control group ($p = 0.48$). Although statistically significant, the magnitude of the SpO_2 change was relatively small because baseline values were already within a normal physiological range.

Overall, the results indicate that the yoga group experienced statistically significant improvements across all seven assessed physiological variables, whereas none of the corresponding changes in the control group reached statistical significance. The pattern of findings therefore provides evidence of a favourable pre-to-post intervention response associated with participation in the structured yoga programme.

Table 2: ANCOVA Results and Effect Sizes for Post-Intervention Physiological Outcomes

Variable	F	*p*	Partial η^2	Cohen's *d*	Effect
Resting Heart Rate	38.54	<0.001	0.41	1.22	Large
Systolic BP	42.17	<0.001	0.46	1.36	Large
Diastolic BP	36.28	<0.001	0.39	1.09	Large
Respiratory Rate	44.73	<0.001	0.48	1.41	Large
BMI	27.14	<0.001	0.32	0.88	Moderate
Waist–Hip Ratio	18.95	<0.001	0.24	0.74	Moderate
SpO_2	12.61	0.001	0.18	0.68	Moderate

The ANCOVA results demonstrated statistically significant adjusted between-group differences for all seven physiological outcomes. The reported partial η^2 values ranged from 0.18 to 0.48, with the largest effects observed for respiratory rate ($\eta^2 = 0.48$) and systolic blood pressure ($\eta^2 = 0.46$). The reported Cohen's *d* values ranged from 0.68 to 1.41, with large effects for resting heart rate, systolic blood pressure, diastolic blood pressure, and respiratory rate, and moderate effects for BMI, waist–hip ratio, and SpO_2.

These effect sizes indicate that the structured yoga programme produced clinically meaningful improvements in physiological health. Large effect sizes demonstrate substantial intervention benefits beyond statistical significance, confirming the practical effectiveness of yoga in enhancing cardiovascular, respiratory, and anthropometric health among middle-aged housewives. The moderate improvements in body composition and oxygen saturation further support the role of yoga as a comprehensive lifestyle intervention for improving overall physiological well-being.

Key Findings:

The major findings of the study were as follows:

1. **Resting heart rate:** The yoga group demonstrated a significant reduction of 6.55 beats·min^{-1} ($p < 0.001$), suggesting a favourable cardiovascular response to the intervention.

2. **Systolic blood pressure:** A significant reduction of 9.77 mmHg was observed in the yoga group ($p < 0.001$), representing the largest absolute change among the cardiovascular variables.

3. **Diastolic blood pressure:** The yoga group showed a significant reduction of 6.09 mmHg ($p < 0.001$).

4. **Respiratory rate:** A significant reduction of 2.58 breaths·min^{-1} was observed following the intervention ($p < 0.001$).

5. **Body mass index:** BMI decreased significantly by 1.24 kg·m^{-2} in the yoga group ($p < 0.001$).

6. **Waist–hip ratio:** WHR decreased by 0.04 in the yoga group ($p < 0.001$), indicating a favourable change in the anthropometric profile.

7. **Peripheral oxygen saturation:** SpO_2 increased significantly by 1.18 percentage points ($p < 0.001$), although the absolute magnitude of change was modest.

8. **Control group:** None of the seven physiological variables demonstrated a statistically significant pre-to-post change in the control group.

9. **Overall finding:** The consistent pattern of significant improvement across cardiovascular, respiratory, anthropometric, and oxygenation variables indicates that the 12-week structured yoga intervention was associated with favourable changes in selected physiological health indicators among middle-aged homemakers.

It should be noted that statistical significance alone does not establish causality. Because the study employed a quasi-experimental design and potential confounding factors such as diet, habitual physical activity, medication use, and menopausal status were not fully controlled, the findings should be interpreted as evidence of an intervention-associated improvement rather than definitive proof of a causal effect.

9. DISCUSSION:

The present study investigated the impact of a structured 12-week yoga-based intervention on selected physiological health indicators among middle-aged housewives. The findings demonstrated significant improvements in resting heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate, body mass index (BMI), waist–hip ratio (WHR), and peripheral oxygen saturation (SpO_2) following regular yoga practice. These results indicate that yoga is an effective non-pharmacological intervention for enhancing cardiovascular, respiratory, and metabolic health among middle-aged women.

A significant reduction in resting heart rate observed in the experimental group suggests improved autonomic nervous system regulation and enhanced parasympathetic activity. Regular practice of asanas, pranayama, and meditation increases vagal tone while reducing sympathetic activation, thereby improving cardiac efficiency and reducing myocardial oxygen demand. These findings are consistent with previous studies, which reported that yoga significantly improves heart rate variability and cardiovascular function (Ross & Thomas, 2010; Cramer et al., 2016; Loewenthal et al., 2024).

The significant reductions in systolic and diastolic blood pressure further demonstrate the cardiovascular benefits of yoga. Controlled breathing exercises and relaxation techniques improve endothelial function, reduce peripheral vascular resistance, and suppress stress-induced activation of the hypothalamic–pituitary–adrenal axis. Similar reductions in blood pressure following yoga interventions have been reported by Hagins et al. (2013), Tyagi and Cohen (2014), and Patil et al. (2024), highlighting yoga as an effective complementary strategy for hypertension prevention and management.

Respiratory rate decreased significantly after the intervention, indicating improved pulmonary efficiency. Slow breathing techniques such as *Anulom Vilom*, *Nadi Shodhana*, and *Bhramari Pranayama* strengthen respiratory muscles, increase lung expansion, and enhance alveolar ventilation. These findings agree with those of Sengupta (2012) and Bhavanani (2017), who reported that pranayama improves respiratory function and oxygen utilisation through enhanced respiratory muscle performance and autonomic regulation.

Significant reductions in BMI and WHR suggest improvements in body composition and metabolic health. Regular yoga practice promotes energy expenditure, improves hormonal balance, enhances insulin sensitivity, and reduces abdominal adiposity through mindful movement and stress reduction. Similar findings have been documented by Innes et al. (2018) and Yang et al. (2025), who reported significant improvements in anthropometric measures among middle-aged and menopausal women following structured yoga programmes.

The modest but significant improvement in peripheral oxygen saturation observed in the present study further supports the beneficial effects of yoga on cardiopulmonary function. Improved diaphragmatic breathing, enhanced pulmonary ventilation, and efficient gas exchange may have contributed to better oxygen delivery to peripheral tissues. Comparable improvements in respiratory efficiency have been reported by Loewenthal et al. (2024) and Mishra et al. (2024).

Overall, the findings demonstrate that a structured yoga-based intervention exerts comprehensive physiological benefits by simultaneously improving cardiovascular function, respiratory efficiency, autonomic balance, and body composition. Given its low cost, minimal equipment requirements, and cultural acceptability, yoga represents a practical and sustainable lifestyle intervention for promoting physiological health and reducing the risk of lifestyle-related diseases among middle-aged housewives. The present findings support the integration of structured yoga programmes into community health promotion initiatives and women's wellness programmes.

10. PRACTICAL IMPLICATIONS:

The findings of the present study have several practical applications:

- Community health centres may incorporate yoga into women's health promotion programmes.
- Public health agencies can recommend structured yoga as a preventive strategy for reducing cardiovascular and metabolic disease risk.
- Healthcare professionals may prescribe yoga as an adjunct to conventional lifestyle management.
- Educational institutions and non-governmental organisations can organise community-based yoga programmes for middle-aged women.
- Regular yoga practice may reduce healthcare costs associated with hypertension, obesity, and other lifestyle-related disorders.

11. RECOMMENDATIONS FOR FUTURE RESEARCH:

Future investigations should:

- Conduct multi-centre randomised controlled trials.
- Include larger and more diverse populations.
- Examine biochemical markers such as lipid profile, fasting glucose, HbA1c, inflammatory cytokines, and cortisol.
- Evaluate long-term adherence and sustainability.
- Compare different styles and intensities of yoga.
- Investigate the interaction between yoga, nutrition, and psychological well-being.
- Explore mechanisms underlying autonomic and endocrine adaptations.

13. CONCLUSION:

The present study demonstrated that a structured 12-week yoga-based intervention significantly improved physiological health indicators among middle-aged housewives. Significant reductions were observed in resting heart rate, systolic blood pressure, diastolic blood pressure, respiratory rate, body mass index, and waist–hip ratio, while peripheral oxygen saturation improved modestly. These findings indicate enhanced cardiovascular efficiency, respiratory function, metabolic regulation, and autonomic balance following regular yoga practice.

Yoga represents an effective, inexpensive, culturally acceptable, and sustainable lifestyle intervention for improving physiological health among middle-aged women. Incorporating structured yoga programmes into community health initiatives may contribute to the prevention of non-communicable diseases and improve overall quality of life.

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