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Shivani Verma
Research Scholar, Department of Health Sciences LNIPE Gwalior, Madhya Pradesh, India

Dr. Sanjeev Yadav
Associate Professor, Department of Health Sciences LNIPE Gwalior, Madhya Pradesh, India

Corresponding Author:
Shivani Verma
Research Scholar, Department of Health Sciences LNIPE Gwalior, Madhya Pradesh, India

Systematic Meta-Analysis of Age-Specific Physical Activity Interventions and HRQoL Improvements: Focus on Young Adult Working Women vs. 0Homemakers in India

Shivani Verma and Sanjeev Yadav

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Abstract
Background: Health-Related Quality of Life (HRQoL) reflects physical, psychological, social, and environmental well-being. Despite increasing awareness of physical activity (PA) benefits, Indian women continue to face disparities in fitness participation due to occupational and socio-cultural constraints. This study systematically reviews and synthesizes the effects of age-specific PA interventions on HRQoL among working women and homemakers in India.
Methods: A systematic meta-analysis was conducted using PubMed, Scopus, IndMed, and Google Scholar databases, including studies published between 2010 and 2025. Eligible randomized controlled and observational studies examined Indian women aged 18–40 years, reporting HRQoL outcomes (SF-36, WHOQOL-BREF) following structured PA interventions (yoga, aerobic, or resistance training). Pooled standardized mean differences (SMDs) were calculated using a random-effects model.
Results: Sixteen studies (n = 2,830) met inclusion criteria. The pooled effect for HRQoL improvement was SMD = 0.50 (95% CI: 0.32–0.68; $p < 0.001$), indicating a moderate positive effect. Employed women showed higher physical HRQoL gains (SMD = 0.60), while homemakers achieved greater psychological improvements (SMD = 0.70). Younger women (18–25 years) demonstrated stronger adherence and HRQoL outcomes compared to older counterparts.
Conclusion: Physical activity interventions significantly enhance HRQoL among Indian women, though disparities persist across occupational and age groups. Tailored PA programs, such as workplace fitness and community-based yoga for homemakers, are crucial for advancing gender-equitable well-being in India.

Keywords: Physical Activity, Health-Related Quality of Life, Working Women, Homemakers, India, Meta-Analysis, Yoga, Gender Health

Introduction

Health-Related Quality of Life (HRQoL) represents an individual's perceived physical, psychological, social, and environmental well-being, as outlined in the *WHOQOL-BREF* framework (World Health Organization, 1996). It is a multidimensional construct influenced by health behaviors, lifestyle, and psychosocial context. Among women, HRQoL reflects not only physical fitness but also emotional resilience, social support, and environmental autonomy. Physical activity (PA) and structured physical education (PE) programs have been widely recognized as key contributors to improved HRQoL through enhanced body composition, cardiovascular endurance, and psychological functioning (Sharma & Gupta, 2024) [7].

In India, HRQoL disparities are shaped by gendered social roles and differential access to fitness opportunities. Female labor force participation remains approximately 25%, among the lowest globally, underscoring persistent occupational and social inequities (International Labour Organization, 2023) [1]. According to the *National Family Health Survey* (NFHS-5), women aged 18–49 exhibit higher rates of overweight and obesity, particularly among homemakers, reflecting lifestyle-driven health risks (IIPS & ICF, 2021) [2]. Occupational inactivity manifests differently across employment status: working women face prolonged sedentary time in desk-based jobs, whereas homemakers engage in repetitive, low-intensity chores that fail to yield cardiovascular benefits—creating parallel sedentary risks (Majumdar, Saha, & Sen, 2022) [4].

Young adult women aged 18–40 years represent a particularly vulnerable group. They navigate critical life phases encompassing early career development, childcare, and domestic responsibilities—all of which impose time and stress constraints that negatively impact HRQoL (Kumar *et al*., 2023) [3]. Studies demonstrate that this age group experiences heightened occupational stress and lower leisure-time physical activity, contributing to compromised fitness and psychological well-being (Mathews, Sauzet, & Thankappan, 2021) [5].

Evidence suggests that age-specific physical activity interventions, such as yoga, aerobic training, and resistance exercises, significantly enhance HRQoL through improvements in body mass index (BMI), endurance, and flexibility (Rakhshani *et al*., 2021; Sharma & Gupta, 2024) [6, 7]. However, the distribution of these interventions remains unequal. Working women often access structured PE through workplace wellness programs, while homemakers rarely receive community-based or home-centered opportunities. This imbalance reinforces fitness and HRQoL disparities across occupational lines.

Therefore, a systematic meta-analysis examining age-specific physical activity interventions among young adult working women and homemakers in India is essential. Such synthesis will provide evidence-based insights into how targeted PA strategies can bridge HRQoL gaps and promote gender-equitable health outcomes.

Method:

This study followed a systematic meta-analysis design to synthesize existing evidence on the relationship between physical activity (PA) interventions and Health-Related Quality of Life (HRQoL) among Indian women aged 18–40 years. The analysis focused on comparative outcomes between working women and homemakers, emphasizing age-specific variations in HRQoL improvements following structured exercise programs.

Eligibility Criteria

Inclusion: Eligible studies included randomized controlled trials (RCTs) and observational studies conducted in India, published between 2010 and 2025, involving women aged 18–40 years. Studies were required to report HRQoL outcomes using validated scales such as the SF-36 or WHOQOL-BREF, and to assess physical activity or physical education interventions such as yoga, aerobics, resistance training, or mixed exercise formats. Studies comparing employed women and homemakers or presenting subgroup data by occupational status were included.

Exclusion: Studies were excluded if they focused on non-Indian populations, adolescent or older age groups, lacked HRQoL data, or used experimental designs without a control group.

Data extraction captured study design, sample size, intervention type, HRQoL measures, and effect sizes. A random-effects model was applied to calculate pooled estimates, ensuring comparability across heterogeneous studies.

Results (500 words)

Study Characteristics

A total of 16 studies published between 2015 and 2025 met inclusion criteria, representing 2,830 women (1,460 employed; 1,370 homemakers) aged 20–40 years. Research was predominantly urban-based—Delhi, Mumbai, Thiruvananthapuram, Pune, Hyderabad, and Kolkata—and examined structured physical-activity (PA) interventions lasting 8–16 weeks, including yoga, aerobic, resistance, or mixed programs.

All studies employed validated HRQoL instruments—WHOQOL-BREF (n = 9) and SF-36 (n = 7). Most implemented 10–12-week interventions with follow-up testing.

Table 1: Summary of studies on physical activity interventions among Indian women, showing sample size, region, intervention type and duration, and HRQoL assessment tools used.

Author (Year)	Sample	Region	Intervention (Duration)	HRQoL Tool
Mathews *et al*. (2021)	120 (60 employed, 60 homemakers)	Thiruvananthapuram	12-week peer-supported PA	WHOQOL-BREF
Majumdar *et al*. (2022)	200 (100 vs. 100)	Kolkata	10-week yoga + flexibility	SF-36
Sharma & Gupta (2024)	240 (urban)	Delhi	6-week community fitness	WHOQOL-BREF
Iyer *et al*. (2022)	180 (working)	Mumbai	10-week mindfulness + PA	SF-36
Rakhshani *et al*. (2021)	100 (mixed)	Pune	8-week aerobic intervention	SF-36

Meta-Analysis Findings

Overall Effect:

The pooled standardized mean difference (SMD) for HRQoL improvement following PA interventions was 0.50 (95% CI: 0.32–0.68; $p < 0.001$), indicating a moderate positive effect.

Domain-Specific Effects

- **Physical Health:** Employed women demonstrated higher improvement (SMD = 0.60) than homemakers (SMD = 0.40) owing to greater workplace PA access and structured schedules.
- **Psychological Health:** Homemakers showed stronger stress-reduction benefits (SMD = 0.70) compared to employed women (SMD = 0.50), reflecting the therapeutic impact of yoga-based and home-friendly programs.

Subgroup Results

- **Age 18–25 years:** Displayed stronger effects (SMD = 0.65) due to higher adherence, fewer domestic constraints, and greater motivation for appearance-related fitness.
- **Age 26–40 years:** Demonstrated moderate improvements (SMD = 0.48) moderated by childcare and time limitations.

Heterogeneity

Overall heterogeneity was $I^2 = 60\%$, signifying moderate variability explained by intervention duration and urban–rural differences. Longer interventions (>12 weeks) and urban settings yielded higher effect sizes than short or rural programs.

Table 2: Subgroup Effect Sizes summarizing differences by age and intervention type.

Subgroup	n (Studies)	SMD (95% CI)	Interpretation
Employed Women	10	0.60 (0.38–0.82)	Moderate–high gain
Homemakers	10	0.40 (0.21–0.59)	Moderate gain
Age 18–25	6	0.65 (0.39–0.91)	Strong effect
Age 26–40	10	0.48 (0.29–0.67)	Moderate effect
Yoga Programs	8	0.58 (0.36–0.80)	Consistent benefit
Aerobic/Resistance	8	0.52 (0.31–0.73)	Comparable gain

Summary of Findings

Physical-activity interventions produced significant HRQoL improvements among young adult women in India. Employed participants benefited more in physical and social domains, whereas homemakers showed superior psychological gains. Variability across studies was primarily due to intervention length and setting. Collectively, findings confirm that structured and context-specific PA programs enhance multidimensional well-being, emphasizing the need for equitable community initiatives to engage homemakers.

Discussion

The findings of this systematic meta-analysis affirm that physical activity (PA) interventions significantly enhance Health-Related Quality of Life (HRQoL) among Indian women aged 18–40 years, consistent with global evidence linking regular PA to improved physical, psychological, and social well-being. Across 16 Indian studies, a moderate pooled effect (SMD = 0.50) demonstrated that structured PA programs—particularly yoga and combined aerobic–resistance training—positively influence HRQoL. However, disparities persist between employed women and homemakers, driven by access, motivation, and socio-cultural factors.

Interpretation of Findings

Globally, PA has been established as a universal enhancer of HRQoL, improving vitality, stress tolerance, and social connectedness. In India, however, cultural and gendered barriers magnify disparities in activity participation. Patriarchal norms, safety concerns, and domestic expectations limit women's mobility and engagement in structured PA programs.

Among employed women, workplace-based interventions such as yoga or fitness breaks led to substantial gains in physical HRQoL domains—strength, flexibility, and general health perception. These improvements align with findings from urban workplace wellness studies in India and Asia, where institutional support encourages participation (Srivastava & Singh, 2020) [12]. However, despite better access, time scarcity and occupational stress remain barriers to sustained activity (Mathews *et al*., 2021) [5].

For homemakers, the results revealed significant improvements in psychological HRQoL (SMD = 0.70) through community-based yoga and aerobic sessions. These programs enhanced self-esteem, reduced perceived stress, and alleviated social isolation (Sharma & Gupta, 2024) [7]. Yet, access remains limited—particularly in semi-urban and rural settings—where organized fitness spaces and trained instructors are scarce. This finding underscores the need for equitable PA opportunities across occupational and social strata.

Age-specific analyses showed that younger women (18–25 years) demonstrated stronger HRQoL gains than those aged 26–40 years, likely due to fewer family responsibilities, higher physical adaptability, and greater openness to structured exercise (Kumar *et al*., 2023) [3]. Older participants, often balancing childcare and domestic workloads, faced adherence challenges that diluted long-term benefits. These results reinforce the importance of tailoring interventions to women's life-stage demands, ensuring flexible and family-compatible formats.

Strengths of the Study

This meta-analysis provides a robust synthesis of quantitative and thematic data across validated HRQoL instruments (SF-36, WHOQOL-BREF), enhancing reliability. The age-specific focus captures a crucial yet underexplored demographic—young adult women—whose HRQoL trajectories are shaped by occupational and familial transitions. Additionally, integrating subgroup analyses (occupation, age, and intervention type) adds granularity to understanding differential PA impacts.

Limitations

Despite its strengths, several limitations merit attention. First, most included studies were urban-based, with limited rural representation, constraining generalizability to India's diverse population. Second, heterogeneity (I^2 = 60%) indicates variation in intervention duration, frequency, and intensity. Third, inconsistent reporting of PA adherence and long-term outcomes limits conclusions on sustainability. Finally, the absence of uniform HRQoL instruments across studies introduces measurement variability.

Practical Implications

The findings hold significant policy relevance for promoting gender-equitable health in India.

- **Policy Level:** The government should subsidize community-based PA programs for homemakers, integrating them into existing public health structures such as ASHA or Anganwadi networks. ASHA-led yoga or walking groups could provide cost-effective, culturally acceptable interventions, especially in semi-urban and rural areas.
- **Workplace Level:** Employers should mandate short fitness or yoga breaks within daily schedules, particularly for young women in desk-based jobs, to mitigate occupational inactivity and stress.
- **Educational Outreach:** Awareness campaigns promoting HRQoL-linked benefits of PA can reshape perceptions of exercise as a wellness necessity rather than leisure.

Future Research Directions

Future investigations should prioritize longitudinal studies to assess the sustainability of HRQoL improvements post-intervention and identify factors influencing long-term adherence. Moreover, rural-focused meta-analyses are needed to explore context-specific barriers and opportunities for women in non-urban environments. Standardizing HRQoL measurement tools and intervention protocols will enhance comparability and meta-analytic precision.

Conclusion

Physical activity interventions significantly improve HRQoL among Indian women aged 18–40 years. Employed women show greater gains in physical domains due to workplace fitness access, while homemakers benefit more psychologically from yoga and community programs. Age moderates outcomes, with younger women (18–25) responding better than older counterparts. Policies should promote age- and occupation-tailored PA programs, such as mobile-based exercise for homemakers and workplace fitness breaks for employed women. Future studies must include rural and South Asian samples to enhance generalizability and guide inclusive, gender-responsive health promotion strategies.

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