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Effect of progressive yogic practices on health related physical fitness of rural middle age women: A randomized pilot study

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Abstract
The impact of progressive yogic practices on the health-related physical fitness of rural middle-aged women was investigated in the study. 36 middle-aged rural women were randomly selected for a placebo-controlled exploratory yoga intervention experiment. Experimental group followed a progressive yogic training protocol (Three sessions/week for three months), a simplified version of Common Yoga Protocol, which was released by Ministry of AYUSH. Demographic and selected health-related physical fitness components were assessed before and after three months of progressive yogic training. According to distribution pattern, a one-way ANOVA was applied and a significant change in resting heart rate ($p=0.004$), flexibility ($p=4.83^{e-6}$), and muscular endurance ($p=0.005$) were found. However, an improvement but not a statistically significant difference has been observed in predicted $\dot{V}O_{2max}$ ($p=0.059$). Three months of progressive yogic training helps middle-aged rural women keep or improve health-related physical fitness. It also lowers resting heart rate and increases flexibility and muscular endurance.

Keywords: Yogic training, women's health, sun salutation, common yoga protocol

1. Introduction
Yoga is an ancient Indian technique, which includes various combinations of controlled breathing, low-medium intensity isometric contraction and meditation [1]. Daily yogic practices improve neuro-hormonal mechanisms to promote health benefits by maintaining sympathetic-parasympathetic balance towards parasympathetic dominancy [2, 1]. Regular yogic practices increase baroreflex sensitivity, musculoskeletal flexibility, range of motion of the joints and cardiovascular efficiency which taxes on heart rate and blood pressure [3, 4, 2].Yogic practices are an effective way to stay fit without using any additional equipment. People nowadays are concerned about their health and fitness, but they are rarely worried about the health and lifestyle of rural women. The strength of the nation depends on the well-being of the mothers. Therefore the health of folk women should be a prime concern. Women need more attention and care for their health and wellbeing as they have the responsibility of maternity and the good upbringing of kids. The participation of women in competitive sports has been hampered by myths and superstitions for many years Women were the victim of prejudice and inequality because of our traditional culture and social attitude toward women in the sports field. Yoga may be an important tool for women to maintain health and quality of life. Yoga is a way of life that includes the practice of specific postures, regulated breathing and meditation [2, 1]. In this regard, the study was intended to investigate the impact of progressive yogic practices on the health-related physical fitness of rural middle-aged women. The study also promotes health-related awareness among middle-aged housewives by exploring how yogic practice might benefit them in their daily lives.

2. Materials and methods
2.1 The participants
A total of thirty six (36) middle age (30-45 years) housewives have been randomly selected from rural areas of Kalyani, Nadia, West Bengal after a comprehensive survey. All the volunteers were aware of the study's purpose, procedures, and benefits.

A brief questionnaire, containing basic health and personal information along with written consent was filled out and duly signed by the volunteers. The contained study, procedure and training protocol were approved by Viswa-Bharati University according to the code of academic and research ethics. All of the volunteers were free from any chronic health conditions (As reported in the questionnaire) and had not previously participated in any comparative sporting activity or yogic training.

2.2 Study design
A Placebo controlled trial design system has been intended for the study. All of the volunteers were separated into two groups: control (15) and experimental (15). Six volunteers were evenly divided into two groups to deal with unexpected circumstances. For the experimental group, three afternoon practice sessions per week have been organized for three months. However, volunteers were not restricted from their daily lives and household activities. The data of both groups has been collected under natural environmental conditions in the afternoon session (between 4:00 to 5:30 pm), before and after three-month yogic training.

2.3 Measuring variables
Basic personal, physical and physiological variables along with health-related physical fitness components have been measured before and after three months of training for this study.

Table 1: Measurable health related parameters

Variables	Parameters	Test/procedure	Instrument
Personal	Age (years)	Age proof certificate	-
Physical	Height (cm)	Standing posture	Stadiometer
	Body Mass (kg)	Standing posture	Weighing scale
	Body fat (%)	Four skinfolds	Harpenden skinfold calipers
Health related physical fitness	Cardiovascular Endurance (Predicted $\dot{V}O_{2\,max}$) (ml/kg/min)	12 minutes' walk or run	400m track
	Muscular Endurance	Sit Ups	Numbers of Sit-ups in one-minute
	Muscular strength (kg)	Hand grip strength	Hand grip Dynamometer
	Flexibility (cm)	Sit and reach	Sit and reach box
Physiological	Resting heart rate (bpm)	Radial artery	Radial pulse in 30 sec * 2

2.4 Training Protocol
A specified progressive yogic training protocol (modified from Common Yoga Protocol [5] which was released by Ministry of AYUSH, Govt. of India for International Yoga Day) has been prepared for experimental group (EG) housewives by the researcher [6, 7, 8]. According to their availability, three-afternoon sessions in a week have been finalized for practice. A Yoga trainer has also been arranged for them to practice the asana effectively. After each four weeks of yogic practice, one repetition has been increased for each asana. However, no treatment has been given to the controlled group (CG) of women. They were asked only during data collection of pre and post-test.

Table 2: Prescribed progressive training scheduled for Experimental group housewives.

Asana	Duration of 1 repetition (sec)	No of Repetitions	Rest Between Repetitions (sec)	Rest between asana(sec)
Sun Salutation	180	2	60	120
Padahastasana	30	2	30	60
Padmasana	30	2	30	60
Noukasana	30	2	30	60
Bhujangasana	30	2	30	90
Anulom Vilom	60	2	30	60
Meditation	120	1	-	-

The duration of each yogic practice sessions has been increased after every four weeks. The tentative duration of practice sessions for 0-4 weeks, 5-8 weeks and 9-12 weeks have been scheduled as approx. 25 minutes, 29 minutes and 33 minutes respectively.

3. Results and Discussion
3.1 Results
Basic physical, physiological and selected health related physical fitness parameters of middle aged housewife's have been displayed in the table 3.

Table 3: Demographic characteristics of the volunteers

Parameters	Control Group		Experimental Group		P value
	Pre test	Post test	Pre test	Post test	
Age (years)	37.9 ± 3.6	37.9 ± 3.6	36.1 ± 4.0	36.1 ± 4.0	0.49
Body Mass (kg)	56.2 ± 2.7	57.6 ± 2.2	61.2 ± 6.6	59.4 ± 6.4	0.18
Height (meter)	1.54 ± 0.02	1.54 ± 0.02	1.53 ± 0.04	1.53 ± 0.04	0.76
Body fat (%)	28.1 ± 2.3	29.0 ± 2.0	31.1 ± 3.7	30.0 ± 3.5	0.19
Muscle strength (Right hand)	25.54 ± 3.0	26.5 ± 2.4	27.8 ± 5.3	30.0 ± 3.5	0.09
Muscle strength (Left hand)	25.0 ± 2.8	25.3 ± 2.9	26.7 ± 4.6	27.8 ± 4.4	0.27
Muscle Endurance (au)	10.7 ± 1.9	10.9 ± 2.1	10.5 ± 1.8	12.9 ± 2.0	0.51

No significant different have been observed in basic physical and personal characteristics of middle age controlled and experimental groups of women presented in the table 3. Although due to yogic training a change in body mass has been observed in experimental group volunteers but that is not up to the mark to make a significant difference. A marginal statistical significant difference has been observed in abdominal muscle endurance between EG Pre and EG post-test.

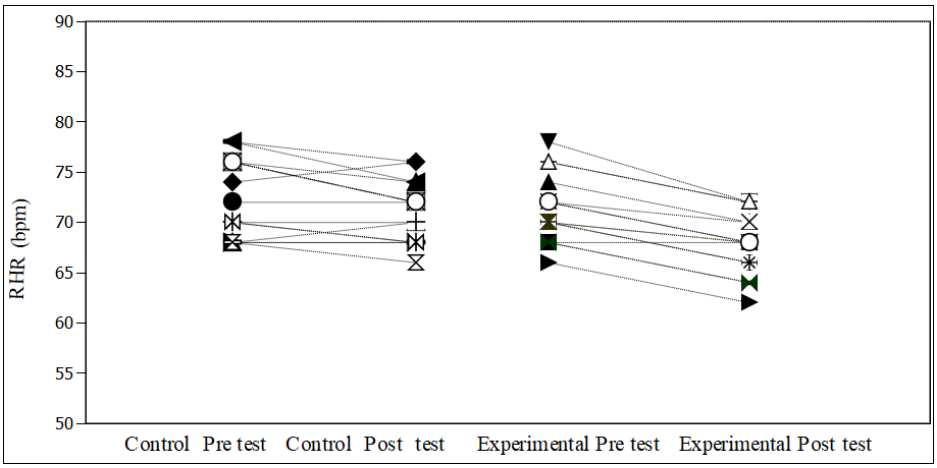

Fig 1: Variation of resting heart rate among specified assigned groups.

The mean RHR of CG and EG has been found 72.5±3.9 bpm and 71.3±3.4 bpm at the time of pre-test and 71.1±3.1 bpm and 68.0±2.9 bpm during post-test. The rate of change in RHR between pre and post-test groups was not equal (Figure 1). So, ANOVA was performed to reveal differences in RHR among groups and a significant difference (p=0.004) has been observed. Then, to explore the specific significant difference between groups Tucky's post hoc test was applied and a significant low RHR has been observed in CG Post vs EG Post-test.

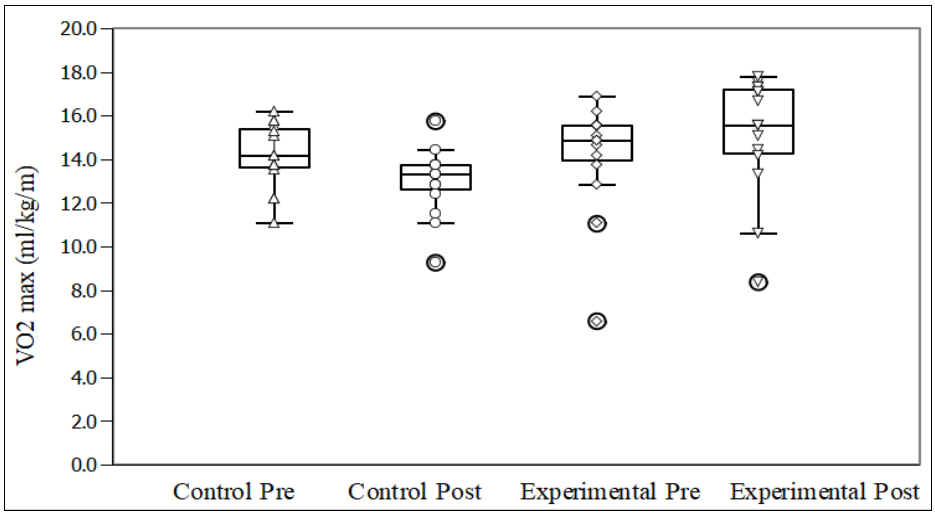

Fig 2: Comparison of cardiovascular endurance of both groups' pre and post-test.

Cardiovascular endurance in terms of predicted $\dot{V}O_{2max}$ was measured using Cooper's predicted $\dot{V}O_{2max}$ estimation formula: (22.351* kilometers) - 11.288 ml/kg/min. The mean predicted $\dot{V}O_{2max}$ of CG and EG has been observed at 14.1 ± 1.5 and 14.2±2.5 ml/kg/min at the time of pre-test and 13.0±1.5 and 15.2±2.7 ml/kg/min during post-test respectively. However, no significant difference (p=0.059) has been observed between the pre vs post-test of both groups.

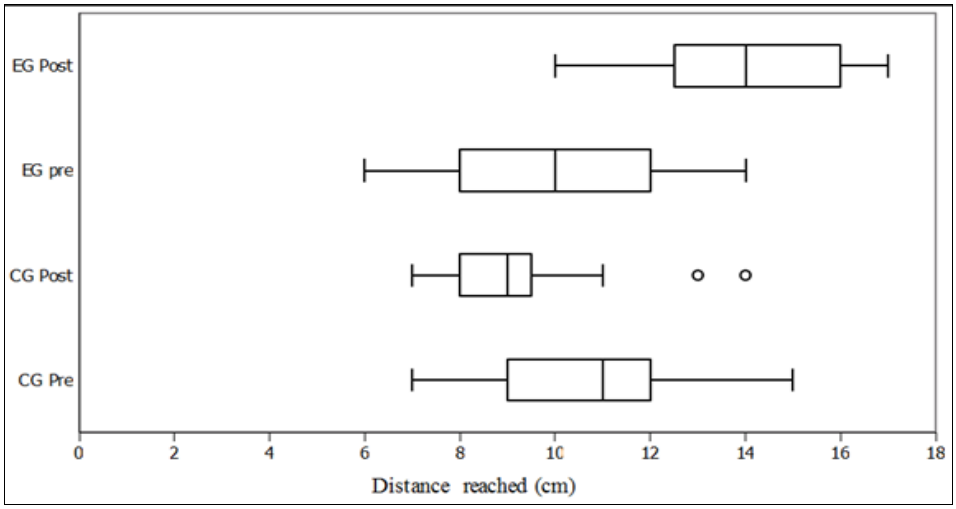

Fig 3: Effect of Yogic practices on flexibility

To understand significant differences among groups in flexibility a two-way ANOVA was performed followed by Tucky's post hoc test and a significantly higher value was observed in EG Post vs CG pre, CG post and EG pre- test.

3.2 Discussion

According to chronological age and standing height of the volunteers all the groups are merely the same which turns them into homogeneous groups and no significant differences have been observed in pre and post-test of middle age controlled and experimental groups of women (table 3). Although a trivial difference have been observed in body mass this might be come due to purposeful sampling methods. An independent but unique relationship has been observed between body mass and interest in yogic training. The study reveals that women with relatively higher body mass were showing interest in yogic training protocol and no significant difference has been observed in the BMI of group volunteers. However, due to yogic training, a negative change in body mass has been observed in experimental group volunteers but that is not up to the mark to make a significant difference [9]. The finding of Chouhan *et al*. (2017) [4] also supported this observation. To understand the overall fitness of middle age women resting heart rate was measured during pre and post-test. The RHR of both groups of volunteers lies in the normal range which indicates a healthy and active lifestyle [10]. As we know RHR is individual-centric and not altered in dose dependent manner [11]. The study has also been expressed the same. The rate of change in RHR between pre and post-test groups was not similar (figure 1). Twelve-week yogic training protocol significantly lowers resting heart rate compared to controlled group volunteers which are supported by findings of Kurwale *et al*. (2014) [6] and Biswas *et al*. (2021) [12]. Professor Sil (2021) [13] found a decline in resting heart rate after four weeks of yogic training for sedentary college women. However, in an experimental study conducted by Pal *et al*. (2013) [14], the effect of three months of yogic training on physically active men did not reveal any significant difference in resting heart rate. A similar result was also observed by Hewett *et al*. (2017) [3]. Yogic asana involves low to moderate intensity isometric contraction in a static position with controlled breathing and daily yogic practice decelerates the heart rate at rest [1, 12]. It is well known that RHR is directly correlated with cardiovascular endurance in terms of predicted $\dot{V}O_{2max}$ but no significant difference has been observed in cardiovascular endurance of both groups (figure 2). Numerous research literature explores that regular basic yogic practices improve cardiovascular endurance [1, 6, 12]. However, that might be due to using of Cooper predicted $\dot{V}O_{2max}$ test. The Volunteers did not show interest and participated actively in the Cooper test. Although, an improvement in predicted $\dot{V}O_{2\ max}$ have been observed in the post-test of Experimental group volunteers. No transformation has been found in the percentage of body fat and muscular strength of middle age women due to yogic practice but a significant difference has been observed in muscle endurance and flexibility (figure 3) [7, 15, 8]. The study clearly defines that progressive low-intensity yogic practice is an effective way to maintain or improve the health-related physical fitness of middle age women. The yogic training protocol of the study was not so comprehensive and rigorous to imply significant changes in various health-related physical fitness components. Training intensity and volume were also not up to the mark to make significant change dominantly among all parameters. However, due to the COVID-19 outbreak, some disruption happened in practice and also affected the outcomes.

4. Conclusions

The study concluded that twelve weeks of yogic practice improves selected health-related physical fitness components of middle-aged countryside women. However, the intended yogic training protocol not significantly improves overall fitness but that is realistic and good enough to maintain fitness. All the volunteers of the study were engaged in their daily household work which also affected their training. From this point of view, the internal validity of the data set taxes on resultant outcomes. This study revealed that three months of progressive yogic training protocol significantly decrease resting heart rate and improves flexibility and muscular endurance of middle aged rural housewives. However, a trivial association has been observed with body mass index, percentage of body fat and muscular strength. Further, extensive studies are required to design optimum yogic practice protocol for middle-aged active housewives.

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