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A Study on the effect of Exercise on Menopausal women

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Abstract: *An increase in cardiovascular risk following menopause is well known, but studies evaluating the efficacy of the role of exercise in decreasing this risk in Indian women is lacking. This study was undertaken on 158 pre and postmenopausal womento observe the effects of exercise and Yoga on them, and analyse the role of exercise on decreasing obesity and cardiovascular changesonthe menopausal women. A large population of the premenopausal overweight women with high abdominal obesity do not exercise, while the postmenopausal women who perform Yoga regularly, recorded less WC and WHR values, establishing the role of Yoga in reducing abdominal fat.All the exercising women recorded significantly reducedResting Heart rate, indicating a beneficial effect of reduced mortality risk. Blood pressure was found significantly reduced in women who performed Yoga.*

While the importance of the findings of significantly increased S-wave and R-wave lengths in chest leads of ECG with exercise trainingremains unknown, a definite finding of diminished ischemic changes in the form of less ST-depression noted among the women who exercise regularly was noted. Thus the beneficial effects of exercise, especially Yoga, on premenopausal and postmenopausal women, in the form of reduced heart rate, Blood Pressure and ischemic changes in ECG were well documented in our study.

Keywords: *BMI, coronary ischemia, ECG, Waist Circumference, Yoga*

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I. Introduction

Menopause is an inevitable event in every woman's life, though seldom expected and rarely welcomed by the women. But with approaching menopause, the 'protection' of the women from coronary heart disease and other cerebrovascular disorders, ascribed to the higher HDL-Cholesterol, is lost, and women enter into an era of post-reproductive life – an era marked by transition from fertility to infertility, menstrual years to menopausal years and youth to senescence.

After menopause, cardiovascular disease becomes the leading cause of death [1,2]. Overweight and the more ominous obesity adds to the risk. Obesity is harder to treat than to prevent. Thus to prevent and treat Obesity dietary restrictions, life-style modifications, and exercises are generally advocated.

Exercise as a panacea for cardiovascular disease prevention has been suggested [3,4].The American Heart Association and Centers for Disease Control recommend a regular pattern of physical activity of moderate intensity, to be performed at least 3 to 5 days a week [5].Yoga, as a form of exercise, has also been accepted by the John Hopkins University School of Medicine and Harvard Medical School for preventing heart diseases [6,7], and is being practiced by many aged women due to the ease of performance and less vigorous physical activity involved. We undertook this study to investigate the effects of exercise, including Yoga, on the weight and cardiovascular status of menopausalwomen, and to evaluate how far it helps the Indian women.

II. Methodology

A cross-sectional, observational and analytical study was carried out on 158 preand postmenopausal women from different districts in West Bengal. Postmenopausal state was defined retrospectively when the last menstrual period occurred a minimum of one year back. Informed consent was taken, and the women fulfilling the inclusion criteria were enrolled in this study after noting their menopausal status. 75 premenopausal women (Group 1) and 83 postmenopausal women (Group 2) formed our study population. The Inclusion and Exclusion criteria followed were:

Inclusion criteria:Women of age 38 years and above were included, following method of total enumeration.

Exclusion criteria: Those excluded from this study were –

1) Women with surgical menopause – whose uterus and/or ovaries were removed surgically
2) Women currently on Hormone replacement Therapy (HRT)

Measurement of Height and Weight were done, and Body Mass Index (BMI)was calculated from the Formula: **BMI = Weight (in Kg)** / {**Height (in m)**}^{2}**.**

Women were categorized according to the BMI: Underweight (BMI ≤ 18.49), Normal weight (BMI = 18.5 – 24.9), Overweight (BMI = 25 – 29.9) and Obese (BMI ≥ 30)[8].
Other anthropometric measurements that were taken were:

1) Chest circumference (CC): was measured at the level of xiphoid notch, or the xiphisternal junction, in cm, midway between expiration and inspiration [9].
2) Waist circumference (WC): was measured halfway between the iliac crest and the last palpable rib of the rib cage in mid-axillary line, in cm, corresponding to the smallest part of the waist just above the umbilicus.A WC > 80cm indicates increased risk, while WC> 88cm involves substantial risk of metabolic complications[10].
3) Hip circumference (HC): in cm, was measured at a point of $1/3^{rd}$ distance between anterior superior iliac spine and patella, corresponding to the widest part of the buttocks [10].
4) Waist-Hip Ratio (WHR) was calculated from the above data,and according to WHO 2008 guideline, WHR ≥ 0.85cmwas taken as a positive indicator of abdominal fat accumulation, with substantial risk of metabolic complicationsin women [10].

Blood Pressure (BP) measurements were taken and BP > 140/90 mm Hg in women less than 60 years, and BP> 150/90 in women more than 60 years of agewere taken as Hypertension [11].

ECG recordings were taken on all the 12 leads,with a long lead II, and were analyzed.The Axis was measured in degrees, based on standard methods of axis determination[12], the PR interval and QT interval weremeasured in seconds, and length of S-wavein V_1 and R-wave in V6 were recorded in mm. Features of left ventricular hypertrophy based on voltage criteria [R in V_5 or $V_6 \geq$ 25mm, and/or, S in V_1 + R in V_5 / $V_6 \geq$ 35mm] were included in assessment of ischemia, if associated with a strain pattern, i.e. T-wave inversion in the left ventricular leads (Leads V_5 and V_6) [13].A horizontal ST depression of ≥ 1mm and/or T-wave inversion in the concerned leads were labelled as ischemic changes [14].

A person was recorded as an Exerciser if she engaged in regular physical exercises, including Yoga, for 30 – 40 min. daily, and at least 5 days a week, for at least 3 months or more [5].The total number of women engaged in regular walking sessions almost equaled the number of women performing Yoga.

The data of this study was compiled in Microsoft Excel 2010and analyzed with appropriate statistical tests. Chi-square test was applied with a two-tailed hypothesis to assess the level of significance in the findings.A p-value of $p<0.05$ taken as a significantfinding, and $p<0.01$ as highly significant.

III. Results

The data from Table 1 show comparable age between the exercisers and non-exercisers in both pre and postmenopausal groups; though the exercisers in the postmenopausal groupwere slightly of younger age, as expected in the old-aged women group who can still perform exercise. But the mean weight and BMI of the exercisers in both the groups were more, the increase being highly significant in the Postmenopausal group.Thus, understandably the more overweight menopausal women engaged in different types of exercise program.

Among Exercisers 80% in Group 1 and 86% in Group 2 were Overweight, compared to only 50% and 55% in the non-exerciser groups respectively. A BMI ≥ 25 was taken as overweight, and noticeably the average BMI of women in all the groups were overweight – indicating the high prevalence of overweight in the pre and postmenopausal age group.

Table No. 1: shows the mean distribution of Age, Height, Weight, BMI, Blood Pressure and Heart Rate in the Exerciser and Non-exerciser groups of Premenopausal and Postmenopausal women

		Premenopausal (Group 1)			Postmenopausal (Group 2)		
		Non-Exercisers	Exercisers	P-value	Non-Exercisers	Exercisers	P-value
1.	Mean Age ± S.E.	39.6 ± 1.09	39.5 ± 1.29	--	57.1 ± 1.9	52.2 ± 0.49	--
2.	Mean Height ± S.E.	154.6 ± 0.96	152.8 ± 1.04	--	150.6 ± 1.0	150.4 ± 0.97	--
3.	Mean Weight ± S.E.	61.2 ± 1.7	63.5 ± 2.1		57 ± 2.4	62.5 ± 1.9	0.015
4.	Average BMI ± S.E.	25.8 ± 0.92	27.2 ± 0.72	0.031	25.1 ± 1.0	27.6 ± 0.7	0.010
	Overweight %	50%	80%		55%	86%	
5.	MeanBP	131/81	135/87		147/90	146/90	0.011
	Hypertension %	50%	53%		82%	68%	
6.	Mean Heart rate ± S.E.	79 ± 3	73 ±2	0.013	78 ± 2	77 ± 3	

In Group 1, the mean BP was higher among the exercisers.Also the percentages of hypertensives in this group were higher (53%) as well, compared to 50% in the non-exercisers. An exactly opposite finding was noted in the Group 2 (postmenopausal) women. Here the mean BP as well as the percentages of hypertensive women were both less in the Exerciser group. Mean heart rate was found significantly less in the Exercisers of Group 1 and also in the Exercisers of Group 2.

Table 2 depicts the anthropometric data of each group and sub-group in tabulated form. In the Fig. 1A and Fig. 1B, the measurements can be visually compared among the subgroups.

Table No. 2: shows the anthropometric measurements in different sub-groups of Premenopausal and Postmenopausal women (all measures are in cm)

Premenopausal group					Postmenopausal group				
	Normal	Overweight	Exercise	Yoga		Normal	Overweight	Exercise	Yoga
CC	83	93	88	90	CC	83	90	94	87
WC	72	87	79	80	WC	73	85	92	77
HC	94	104	101	100	HC	90	93	108	95
WHR (WC/HC)	0.76	0.84	0.78	0.80	WHR (WC/HC)	0.82	0.91	0.85	0.80

[Note: CC= Chest circumference, WC= Waist circumference, HC= Hip Circumference, WHR= Waist-Hip ratio]

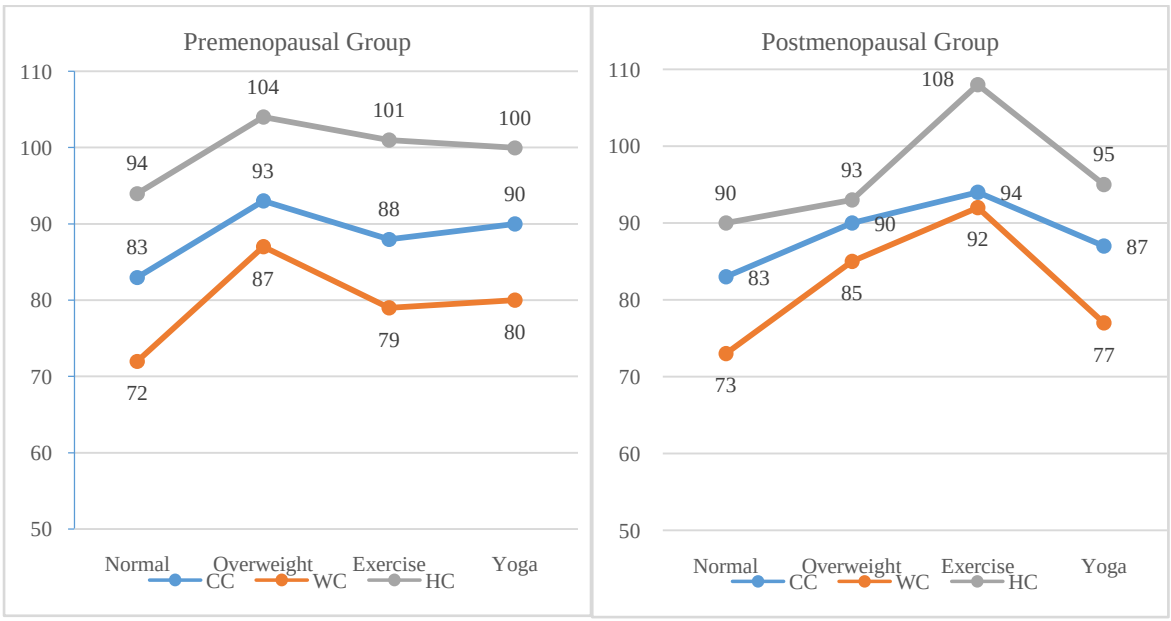

Figure 1A: line diagram depicting the Chest, Waist and Hip circumferences in different sub-populations.

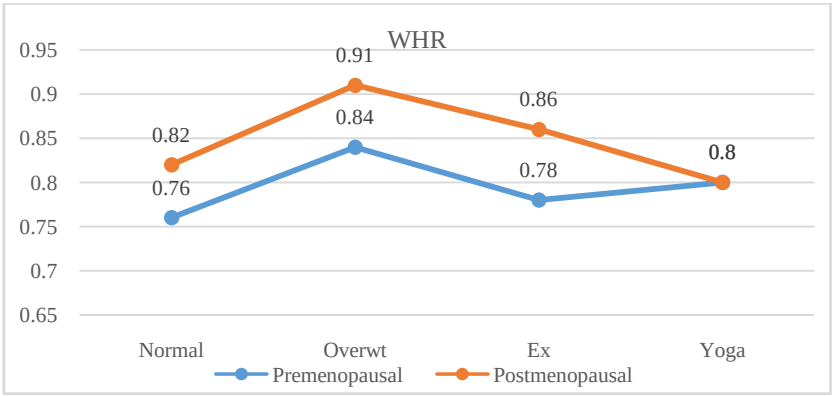

Figure 1B: line diagram depicting the Waist-Hip ratio in each sub-group of Pre and Postmenopausal women.

On comparing the data in Fig. 1A, in the Premenopausal group WC > 80cm was noted in the Overweight sub-group only, indicating an increased risk. But in postmenopusal group, a high WC was noted among the overweight and exercisers, but was recorded to be much less in women performing Yoga. In Fig. 1B,WHR ≥ 0.85cm correlatingwith substantial metabolic risk in women, according to WHO 2008, wererecorded in the overweight population of nearly both groups, but were also high in exercisers of the postmenopausal group. Interestingly the WHR recorded in women undergoing Yoga was much less (0.80cm).

Table 3 shows the ECG analysis and the only significant change noted was increase in chest lead voltages recorded as S-wave in V_1 and R-wave in V_6. Thus $\{S(V_1) + R(V_6)\}$ was found significantly increased in the exercising women of both the groups.

Table No. 3: analyses the ECG changes in sub-groups of Premenopausal and Postmenopausal women

		Premenopausal			Postmenopausal		
		Non-Exercisers	Exercisers	P-value	Non-Exercisers	Exercisers	P-value
1.	Axis (in degrees)	38	38		34	29	
2.	S (V1) + R (V6) (in mm)	16.9	17.6	0.196	14.6	18.4	0.020
3.	PR interval (in sec.)	0.15	0.15		0.15	0.16	
4.	QT interval (in sec.)	0.38	0.39		0.39	0.39	
Ischemic changes %		38%	13%	**0.05**	50%	32%	**0.0048**

Finally, the most important observation was a highly significant reduced rate of ischemic changes noted among the exercisers in both premenopausal and postmenopausal groups. Interestingly these Exerciser groups comprised of overweight females, with the highest BMI and highest Waist Circumference, but a notable feature of highly reduced ischemic changes in ECG possibly point to the good effects of exercise on the heart.

IV. Discussion

Menopausal women are prone to become overweight and obese, and due to loss estrogenic 'protection' become predisposed to cardiovascular disorders. We noticed a BMI $\geq$ 25, indicating overweight population, in all the groups of premenopausal and postmenopausal women in our study, which is highly alarming.

Studies on Indian population by ICMR – INDIAB Study (Phase 1), 2015, recorded high levels of Abdominal Obesity (measured by WC) as well as Generalized Obesity (measured by BMI) across India [15]. Report of WHO Expert Consultation, Geneva 2008, noted the finding of more central or android fat distribution in the South Asian (e.g. Indian) population and urged the measurement of WHR, or better still WC, to complement if not replace BMI [10]. Larsson B, et al in 1984 observed that abdominal obesitywas associated with an increased risk of strokes, ischemic heart disease andpremature deaths, and can be better screened by WC or WHR rather than BMI [16].

We measured WC and WHR in the menopausal women in our study, and noted a large number of premenopausal overweight women not performing any exercises. Rather a large number of postmenopausal women with high android obesity, with high WC and WHR values, are exercising regularly.Though regular aerobic exercises like walking, jogging or running were generally recommended, the menopausal women in our Study performed only walking or Yoga. While more premenopausal women perform regular walking, postmenopausal women prefer Yoga, as many of them suffering from osteoarthritis of the knee are unable to walk for larger distances. Notably, the women undergoing Yoga were mostly postmenopausal with high BMI and body weight. But interestingly these women on Yoga show the lowest WC and WHR, thus hinting at the effect of Yoga on favorably reducing the abdominal body fat, which had been proved to be so lethal.

An increase in resting heart rate is ominous and 'is a signal worth watching' as remarked by Howard LeWine of Harvard Health Publishing, Harvard Medical School, which increases risk of death [17]. A.K. Reimers, et al, in 2018, conducted a systemic review and meta-analysis of Interventional studies and observed that all types of sports decrease resting heart rate, but endurance training and Yoga cause a significant decrease in resting heart rate in both sexes [18].We recorded a similar finding in our study: The mean heart rate of the women who exercised regularly were found significantly less in the premenopausal group,but the decrease in the heart rate seen in the exercising postmenopausal women were of a lesser degree.

An interesting observation on the Blood pressure recordings among the exercisers show an increase in BP in the premenopausal, but a decrease in the postmenopausal group, compared with the non-exercisers. It is to be remembered again that the premenopausal women primarily engaged in walking, while the postmenopausal women mostly performed Yoga as a method of Exercise. Thus apparently effects of Yoga on reduction of BP can be more appreciated than other forms of exercise, like walking,in our study. As this study was not intended to compare Yoga with other forms of exercise, further large scale studies comparing these two forms of exercise in their effectiveness of lowering BP is recommended to arrive at generalized conclusions about them. M. Hagins, et al, (2013) in a systemic review and meta-analysis on the effectiveness of Yoga for Hypertension, found Yoga having a modest but significant effect on lowering systolic as well as diastolic BP, and recommended Yoga as an effective intervention for reducing blood pressure [19].

In our Study we compared few ECG parameters among the women who regularly exercise and ones who do not. We noted a significant increase only in the voltage patterns identified with left ventricular mass, viz. S-wave in V_1 and R-wave in V_6, in the exercising women of both groups. The significance of these findings,though definite, could not be ascertained at this point of time, due to lack of adequate data on them. Nevertheless, some researchers have noted ECG changes with exercise training. Genovesi S., et al, in 2007, found lengths of QT interval changing with the patterns of exercise, and which are different in men and women, especially with long cycle lengths, and postulated that the effect of exercise training on the relation between ventricular repolarization and heart rate in women may contribute to a potential protective effect [20].

Among the few studies done on identifying ischemic changes in ECG following exercise training, most are related to short term and long term exercise responses following myocardial infarction [21,22]. The studies

conclusively indicate the beneficial role in reducing ST segment depression, or improving ischemic threshold by increasing the ST depression latency, though maximal ST depression is only affected with long term exercise training. In accordance to their observations, we too observed a highly significant reduced rate of ischemic changes (less ST depression)among the exercising both premenopausal and postmenopausal women. Thewomen in the Exercising groups were mostly overweight with the highest BMI and highest Waist Circumference amongst all sub-groups, but the highly significantchange of reduced ischemic changes noted in ECG certainly point to the beneficial effects of exercise on the heart.

V. Conclusion

This study was undertaken in pre and postmenopausal to observe the effects of exercise and Yoga on them. Menopausal women tend to gain weight and thus the population largely comprised of overweight women, with increased generalized obesity and abdominal obesity, reflected by high BMI, increased waist circumference and increased waist-hip ratio.Postmenopausal women preferred Yoga as a form of exercise, and they recorded less abdominal fat with less WC and WHR values, establishing the role of Yoga in reducing abdominal fat.

Resting Heart rate was found significantly reduced among all the exercising women. Blood pressure was found significantly less in the women who performed Yoga regularly. ECG parameters like S-wave and R-wave lengths in Chest leadsincreased with exercise, but its significance remains unknown. The most notable finding was the diminished ischemic changes in the form of less ST-depression noted among the women who exercise regularly, whether walking or performing Yoga. Thus the beneficial effects of exercise, especially Yoga, on premenopausal and postmenopausal women, in the form of reduced heart rate, Blood Pressure and ischemic changes in ECG were well documented in our study.

Limitations of the study

This study was done on a population who performed only walking and Yoga as forms of exercise, and thus benefits of other forms of exercise in them could not be studied. Additionally a comparison of Yoga with other forms of exercise could be a focus for further research.

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Conflicts of interest
None.

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