Role of low-cost multi-component exercise programme on aging of Indian women

Nita Bandyopadhyay

Department of Physical Education, University of Kalyani, India

Анотація. Як і в усіх інших країнах світу, тривалість життя населення Індії зросла за останні кілька десятиліть. Чоловіки та жінки старіють по-різному – жінки більш сприйнятливі до факторів, що прискорюють процес старіння. Окрім фізіологічних факторів, старіння залежить від багатьох соціально-економічних та культурних, включаючи економічний стан, харчування, спосіб життя та місце проживання. *Мета.* Спостереження за роллю економічно ефективної багатокомпонентної програми вправ щодо процесу старіння індійських жінок. *Методи та організація.* До експериментальної групи було запрошено дванадцять жінок 55–65 років, які ведуть сидячий спосіб життя. Жінки пройшли 10-тижневу планову програму вправ, що включала ходьбу, біг підтюпцем, вправи вільними руками та з опором, довільну оздоровчо-рекреаційну рухову активність тривалістю 50–60 хв протягом чотирьох днів на тиждень. Контрольна група з дванадцяти жінок 55–65 років, які вели сидячий спосіб життя, дотримувалась свого звичного способу життя. Для збору даних було проведено стандартизовані попередні та кінцеві тести з обраними параметрами фізичної підготовленості, а саме: ізометричною силою спини, гнучкістю, координацією, рівновагою та швидкістю ходи. *Результати.* Після завершення 10-тижневої програми втручання серед літніх жінок відбулося значне покращення всіх параметрів фізичної підготовленості. На основі отриманих результатів можна зробити висновок, що низькозатратні багатокомпонентні вправи можна розглядати як ефективний спосіб розвитку фізичних можливостей жінок похилого віку. Мікро- та національне планування для легкої, економічно ефективної стратегії вправ, яка відповідає стилю життя індійських жінок, та регулярні програми підвищення рівня обізнаності були б корисними для підтримання здоров'я та фізичної форми населення.
Ключові слова: процес старіння, жінки, Індія, фізичні вправи

Nita Bandyopadhyay

РОЛЬ ПРОГРАМИ БАГАТОКОМПОНЕНТНИХ ВПРАВ ДЛЯ ЗАПОБІГАННЯ СТАРІННЯ ЖІНОК В ІНДІЇ

Abstract. Like all other countries of the world lifespan of Indian population has increased; number of aged people has increased substantially over the last few decades. There were about 119 million Indians above the age of 60 years (2015), which was about 9.56 % of the total population. Men and women age differently; women are more susceptible to factors speeding up the aging process. Apart from physiological factors, aging depends on many socio-economic and cultural factors including economic condition, nutrition, lifestyle and location of living. Due to ill health, lack of participation in daily activities, increased physical and economic dependence on others, the respect of the elder women in the society and family decreases, making them burden for the family. *Objectives.* The purpose of the present study was to observe the role of cost-effective multi-component exercise programme on aging process of Indian women. *Methodology.* Twelve sedentary volunteered elderly women of 55–65 years as Experimental group (Ex. gr N = 12) underwent a 10-week planned exercise programme that consisted of walking, jogging, free hand and resistance exercise and recreational activities of 50–60 minutes duration for four days a week. Whereas a Control group of twelve sedentary women (Cont. gr N = 12) of 55–65 years followed their usual lifestyle. For collection of data standardized pre and post tests were conducted on selected physical fitness parameters viz., grip strength, isometric back strength, trunk flexibility, hand-eye coordination, balance & gait velocity. For analysis of data t-test was conducted.
Result. Results indicate that there was significant improvement in all physical fitness parameters among elderly women after completion of the 10-weeks intervention programme. Based on the results it may be concluded that, low cost multi-component exercise can be considered as an effective modality to develop physical capabilities of Indian aged women. Micro to national level planning for easy, cost-effective exercise strategy that match the life style of Indian women, and regular awareness building programs would be beneficial in maintaining the community health and fitness.
Keywords: aging process, women, India, exercise

Nita Bandyopadhyay. Role of low-cost multi-component exercise programme on aging of Indian women. Theory and Methods of Physical education and sports. 2020; 4: 62–66
DOI: 10.32652/tmfvs.2020.4.62–66

Nita Bandyopadhyay. Role of low-cost multi-component exercise programme on aging of Indian women. Теорія і методика фізичного виховання і спорту. 2020; 4: 62–66
DOI: 10.32652/tmfvs.2020.4.62–66

Introduction. The life span of an organism is genetically programmed subject to environmental influences. In that context human species is no exception. Discoveries in medical sciences during the past few decades have increased life span of human. In the developed countries many people are living beyond the age of 70 years. Globally, the 60 plus population constitutes about 11.5 % of the total population of 7 billion. India's population is also greying at a very high rate. There are nearly 104 million elderly persons in India among which 53 million females and 51 million males [1].

According to 2011 census in most of the Indian states, a higher proportion (around 71 %) of the elderly lives in rural areas than in urban areas. Many rural areas are still remote with poor road and transport access, income insecurity, lack of adequate access to quality health care and isolation are more acute for the rural elderly than their urban counterparts.

Women in India are commonly portrayed as among the most oppressed and majority of them are grounded in both poverty and patriarchy. Gender based differences work force participation rate is a persistent feature of the Indian labour market. Labour face participation among women is very low and majority of women depend on their families for economic support. As per the 52nd round of national sample survey organisation nearly half of the elderly population were fully dependent on others, while another 20 % are partially dependent for their economic needs. About 85 % of the aged had to depend on others for their day to day maintenance. The situation was even worse for elderly females. Although there were various schemes and resolutions have been taken by Indian Government to support an aging population but most of these were in limited success [2].

Since 2013, the age specific death rate was higher in rural areas than urban areas. Further it was lower for female than male. But economic condition, social belief, culture, nutritional practice,

© Nita Bandyopadhyay, 2020

lack of awareness regarding government policies for aged population and lack of awareness regarding health issues making the aged women weaker section in family and as well as in society.

The increase in human life expectancy is accompanied by age-related cognitive and motor disability, thus raising the demand for strategies toward healthy aging. Women's longevity makes them more susceptible to chronic diseases. Following deficiency of oestrogen after the menopause women are more likely to suffer from osteoporosis, cardiovascular disease, diabetes, hypertension, incontinence, Alzheimer's disease and arthritis as compared to men. Some disease exclusively occurs in women such as cancers of breast, endometrium (uterus) and cervix [3].

The benefits of exercise for older adults are well known. Regular physical activity is promoted as life style behaviour associated with reductions in mortality and morbidity from cardiovascular disease, colon cancer, complications of overweight and obesity and improvements in emotional wellbeing [4]. Participation in regular physical activity (both aerobic and strength exercises) elicits a number of favourable responses that contribute to healthy aging and at the same time reduce a number of functional declines associated with aging. Further the trainability of older individuals is evidenced by their ability to adapt and respond to both endurance and strength training. Endurance training can help to maintain and improve various aspects of cardiovascular function, as well as enhance sub-maximal performance. Importantly, reduction in risk factors associated with disease states (heart disease, diabetes, etc.) improve health status and contribute to an increase in life expectancy. Strength training helps offset the loss in muscle mass and strength typically associated with normal aging [5].

Considering the socio-economic and cultural status of Indian aged women, the purpose of the present study was to observe the effect of easy and cost-effective, without-equipment, small-area, multi-component exercise program on aging process of Indian women, especially in semi-urban areas.

The study may help the aged Indian women to realize the simple, easy and cost-effective exercise programme to remain active and healthy during their old age and to maintain a healthy lifestyle through which they can actively take part in various activities in their family as well as in the society.

Participants: The present study involved twelve middle class sedentary volunteered elderly adult women of 55–65 years of from Burdwan town of West Bengal (a state in eastern part of India) as assigned the subject of the experimental group (Ex. gr, N = 12). The other twelve elderly adult of same age group were assigned as control group (Cont. gr, N = 12). Initially 30 subjects were screened and selected for the study. 15 subjects were volunteered in experimental group and other 15 females were assigned in control group. In Experimental group among 15 of them one subject did not turn up for the training and other two subjects were eliminated due to lack of optimum attendance (85 % attendance was considered). On the other hand, in control group the three extreme cases (outlier) were eliminated during the post test. So finally, 12 in each group were considered & tested. Their food habits, pattern of living was almost similar, but the researcher had little control in this regard.

Measurement of criteria with tools: In the present study to observe the effect of planned exercise programme of 10 weeks on elderly adult women, the physical fitness was considered as criteria. Physical fitness variables were taken as strength – Right and Left-hand grip strength (RHS & LHS) and Isometric back strength (IBS) Hand-eye coordination (Co), Trunk flexibility (Flex), Dynamic balance (Bal) & Gait velocity (GV) which were measured through Grip dynamometer (Jensen & Wirst [6]), Isometric Leg and Back Dynamometer (Wood [7]), Soda pop coordination test (Clark[8]), Trunk flexibility test (Clark [8]), Dynamic balance test (Clark[8]), and 10-meter Walk Test (Physiopedia [9]) respectively.

Design: A thorough medical cheek up was held to determine the subjects' suitability to exercise programme. Prior to collection of data all subjects were informed in written the benefits and risks of the interventions & tests in detail. After being informed the written consent from each subject was ensured & obtained. All the subjects of Experimental group and Control group were tested twice for collection of data on selected physical fitness variables once before the onset of the experimental intervention and once after the completion of 10 weeks planed exercise programme. The subjects of the Experimental group followed the planed exercise programme of 10 weeks whereas the subjects of Control group were used to perform their normal daily work.

Intervention: The Experimental group underwent in a planned exercise programme of 10 weeks duration and 4 days per week. The exercise programme was of 50–60 minutes duration out of 80–90 min session including permissible rest period in between repetition/set and the pattern followed progressive training method. The 10 weeks duration was divided in to 3 parts – first 2 weeks i.e. part-I (P1) for understanding and acclimatizing with the particular exercise programme, middle 4 weeks i.e. Part-II (P2) with little progression of load and the last 4 weeks i.e. part-III (P3) with progression of optimum load. The particular planned intervention is depicted in the following table 1.

Statistical Analysis. The pre and post-test data were collected for Experimental group and Control group to observe the influence of exercise programme and were analysed by using SPSS 21. Mean and Standard deviation were computed from pre and post-test score to describe both the groups. Independent t-test was used to compare the pre-test data between Experimental group and Control group to observe the baseline difference between the groups. The paired sample t-test was used for comparison between the pre- and post-test data of two groups separately. The level of significance was set at $p < 0.05$ level.

Results. Age was evaluated through the date of birth, weight and height were measured with minimal cloth and without shoes. The mean age, height and weight of experimental group were 61.00 (± 3.23) yr 152.5 (± 2.6) cm &

T a b l e 1. 10 weeks exercise programme schedule part-I. Part-II & Part-III for Experimental group

Name of the Exercise	Intensity			Repetition (No/Set)			Duration (Min/Sec)			Rest (Min)
	P1	P2	P3	P1	P2	P3	P1	P2	P3	
Brisk walking & Jogging	Med to High						20 m	25 m	30 m	
							@1.0 km/15 min approx.			
Freehand Ex (5–7)	Medium (Med)			6 × 1	4 × 2	5 × 2	10 m	10 m	10 m	
Skip/Astride jump	Low to Med			10 × 1	8 × 2	10 × 2	30 s	1 m	1 m	2 m
Pushing wall with hands	Low to Med			2 sets	3 sets	4 sets	30 s/set	30 s/set	30 s/set	
Jumping jacks	Low to Med			6 × 1	5 × 2	6 × 2	1 m	2 m	2 m	2 m
Wall push up	Low to Med			10 × 1	8 × 2	10 × 2	1 m	2 m	2 m	2 m
Half Sit up	Low to Med			6 × 1	5 × 2	6 × 2	30 sec	1 m	1 m	2 m
Crunches	Low to Med			2 set	3 set	4 set	30 s/set	30 s/set	30 s/set	2m
Recreational activities: 7 minutes for all										

T a b l e 2. Pre and Post-Test Mean, SD and Baseline comparison (Independent t test) between Ex. and Cont. Group and Paired sample t test between Pre and Post-test Means of Physical Fitness Variables of Ex. and Cont. group.

Variable	Group	Pre-Test Mean, SD	SE	t-Value (Baseline) df-22	Post Test Mean, SD	SE	t-value (Paired Sample) df-11
RHS (kg)	Ex gr	21.01 ± 2.04	0.59	0.12^{NS}	23.44 ± 1.99	0.06	43.64*
	Cont gr	20.87 ± 3.3	0.95		20.95 ± 3.47	0.14	0.54^{NS}
LHS (kg)	Ex gr	22.18 ± 2.29	0.66	0.11^{NS}	25.15 ± 2.25	0.06	52.64*
	Cont gr	22.33 ± 4.05	1.16		22.32 ± 4.00	0.09	0.096^{NS}
IBS (Kg)	Ex gr	23.70 ± 2.95	0.85	0.40^{NS}	26.54 ± 1.76	1.04	2.70*
	Cont gr	23.20 ± 3.21	0.92		23.00 ± 3.17	.100	1.99^{NS}
Co (sec)	Ex gr	13.34 ± 0.81	0.24	0.54^{NS}	12.38 ± 0.53	0.11	8.79*
	Cont gr	13.15 ± .86	0.25		13.13 ± .85	0.01	2.17^{NS}
Flex (cm)	Ex gr	71.63 ± 2.52	0.52	0.02^{NS}	75.61 ± .3.34	0.53	7.46*
	Cont gr	70.83 ± 2.29	0.73		70.73 ± .1.96	0.16	0.69^{NS}
Bal (sec)	Ex gr	27.60 ± 2.11	0.61	0.63^{NS}	25.65 ± 1.61	0.21	9.13*
	Cont gr	28.40 ± 3.88	1.12		28.39 ± 3.89	0.04	0.46^{NS}
GV (m/s)	Ex gr	1.17 ± 0.03	0.01	1.33^{NS}	1.23 ± 0.03	0.003	17.60*
	Cont gr	1.15 ± 0.03	0.01		1.16 ± 0.03	0.003	2.28^{NS}

* Significant at 0.05 level. NS – Not significant at 0.05

54.80 (± 9.51) kg respectively and for control group were 60.08 (± 4.12) yr, 153.2 (± 2.8) cm, & 56.03 (± 8.64) kg respectively.

Physical Fitness Variables:

In Table 2 the obtained t value for independent sample reveals no significant difference ($p < 0.05$) in physical fitness variables between the groups at base line. It indicates that the groups were initially almost similar in physical fitness.

Further the Table 2 shows that there was significant increase ($P < 0.05$) in grip strength (RHS& LHS), back strength and trunk flexibility where as significant time decrease in hand-eye coordination, dynamic balance & significant increase in gait velocity of Experimental group which indicate overall physical fitness improvement after the intervention. On

the other hand, no significant differences were observed between pre and post-test means of all variables in Control group.

Discussion. In the present study an attempt has been made to observe the influence of multi-component exercise programme on required physical fitness variables of elderly aged women for accomplishing daily living and house hold activities that include hand grip strength, back strength, trunk flexibility, hand-eye coordination dynamic balance and gait velocity.

Larsson [10] indicated that the loss of strength is accelerated with aging that ranges from 24–47 %. To maintain the strength, resistance training can be continued even in advanced years of life. Table 2 reveals that the right and left-hand grip strength increased by 11–14 % among the elderly women of Experimental group after intervention whereas Control group shows no significant change. Pioneer researchers such as Pioneer researchers such as Skeleton [11] found improvement muscle strength and power among 75 years old subjects following 4 days/week for 12 weeks of progressive resistance strength training programme. Bemben [12] observed from an experimental study that 51 years old subjects improved 20–40 % muscle strength following 24 weeks of strength training programme. Various experimental studies revealed that there was significant improvement in muscular strength of aged women following ≥ 8 weeks of progressive strength training /aerobic/functional exercise programme [13–15]. In this study, the exercise regimen consisted of isometric resistance exercise which helped the elderly women subjects to improve their grip strength as well as back strength.

The results of coordination obtained from Table 2 shows significant ($p > 0.05$) improvement in hand-eye coordination ability of Experimental group by around 7 % after 10 weeks intervention, while no significant change has been observed for the Control group. Shephard [16] indicated that coordination primarily depends on motor control and regulation processes of central nervous system and is inter-related with several other traits like strength, agility, balance, power, speed, movement precision, kinaesthetic sense, and visual and hearing abilities, those diminish with age. Nakamura and Ourania [14, 17] found improvement in coordination among older women through a physical activity programme of 12 weeks. In the present study the training programme consisted of strength training, general physical exercise, and recreational activities which in turn improved the coordination of elderly women in Experimental group.

Table 2 indicates the significant ($P > 0.05$) improvement of trunk flexibility among the elderly women of Experimental group after 10 weeks intervention is around 5.5 %, whereas no significant change was occurred for the Control group. Flexibility decreases with age. It decreases by 23 % in men and 18 % in women through 65 years of age. This type of deterioration is caused by collagen cross-linkage, arthritis and joint ankylosis. Flexibility can be improved by regular stretching of muscles and connective tissue that surround the joints [16]. Adams [13] found significant gains in flexibility following progressive strength training in older African American woman. Ourania [17] observed improvement in trunk flexibility on sedentary woman aged 60–75 years following a 12-week exercise programme. In this study exercise intervention comprised of stretching and bending exercises, sit up and crunches which may influence the development of trunk flexibility.

Balance ability is a necessary pre-requisite for all type of movements, which is of two types – static and dynamic. Dynamic balance is important both for sports performance and daily life activities. Balance is highly sophisticated neuromuscular mechanism that deteriorates with age and enhances the susceptibility to fall [18]. This study reveals significant improvement ($p > 0.05$) in balance ability after 10 weeks of planned, multi-component exercise programme. Nakamura [14] observed that 12 weeks of functional exercise can improve dynamic balance of aged women above 65 years. Ghosal & Bandyopadhyay [15] found significant improvement in balance among above 50 years aged women following 17 weeks of elastic band progressive resistance exercise programme. Ourania [17] found improvement in dynamic balance following 12-weeks exercises programme on physical ability of sedentary woman aged 60–75 years. In the present study, elderly women improved their dynamic balance ability nearly 7 % through 10 weeks of multi-component exercise programme.

Adequate mobility is essential for older adults to maintain an independent and active life style. The prevalence of abnormal gait has been reported to be as high as 35 % in adults > 70 years. Gait problems are associated with falls, which can lead to hospitalization, institutionalization, and increased mortality [19]. An experimental study revealed that women aged 60–83 years improved the gait velocity and related parameters from 22 weeks of randomized controlled trial of exercise & investigator opined that the increase may be mediated by improved lower limb muscle strength [20]. Ghosal & Bandyopadhyay [16] also found the improvement in gait velocity among 50 years above old women following 17 weeks of elastic band resistance training programme. In the present study the multi-component exercise programme consisted of jumping exercise which might helped the elderly women subjects to increase their gait velocity.

Considering all the findings of the present study it can safely be concluded that 10 weeks of low-cost multi-component exercise programme was conducive to heathy and graceful aging of Indian women.

Conclusion. Based on the results and within the limitations of the present study, it may be concluded that an easy, cost-effective, planned exercise programme is helpful for improving physical capabilities of elderly adult women from semi-urban social background in India. Therefore, micro to national level fitness planning may be taken up involving all stakeholders for the benefits of this particular section of population. Sustained health

and wellness awareness building programme is also essential in this regard. Other factors those are to be considered also include participation of non-government, benevolent and social organizations in the process.

Prospects for Further Research. Further research can be conducted with the multi-component exercise to observe it's impact on BMD, Muscle mass and other physiological parameters. Similar study may be conducted with the subjects suffering from acute diabetic condition, cardiac ailments, hypertension etc.

Acknowledgement. I acknowledge my sincere thanks to University Authority, University of Kalyani, India for providing me all sorts of support and cooperation. Further I convey my sincere thanks to all subjects for their whole hearted cooperation and participation in the training programme and in entire investigation. I offer my thanks and gratitude to my scholars for helping me in collecting data, preparing text and other relevant works.

REFERENCES

1. SRS Statistical Report. [Internet]. India, 2011[Updated 2013; Cited 2020 Nov 8]. Available from http:// www. Census India. gov. in/ vital statistics/SRS_Reports.html.

2. Central Statistics Office. Ministry of Statistics and programme Implementation. [Internet] India, 2016 [Updated 2019; Cited 2020 Nov 8]. Available from: www.mospi.gov.in.

3. Jai Prakash I, Ageing in Indian women. In Ramachandran, C. R. & Bela Saha (Eds.). Public Implications of Ageing in India. The Indian Council of Medical Research Report; 1994: 187-91.

4. Ainsworth BE. Issues in the assessment of physical activity in women. Res. Q Exerc sport. 2000 Jun; 71(2): 37-42.

5. American College of Sports Medicine Position Stand. Exercise and Physical activity for older adults. Med Sci Sports Exerc.1998 Jun; 30(6): 992-08.

6. Jenson CR, Wirst CC. Measurement in physical education and athletics. New York, London, Macmillan Publishing Company. 1980

7. Wood R, Isometric leg Strength Test. Topend Sports; 2008: Available from https:// www.topendsports.com/testing/tests/isometric-strength.htm.

8. Clarke BA.Tests for fitness in older adults. JOPERD 1989 Mar Spl Vol: 66- 71.

9. Physiopedia. 10 meters walk Test Available from https:// www.physio-pedia.com.

10. Larsson L, Grimby G, Karlsson. Muscle strength and speed of movement in relation to age and muscle morphology. J Appl Physiol Respir Environ Exerc Physiol. 1979 Mar; 46(3): 451-6

11. Skeleton DA, Young A, Greig CA, Malbut KE. Effect of resistance training on strength power and selected functional abilities of women aged 75 and older. J Am Geriatr Soc.1995 Oct; 43(10): 1081 – 7.

12. Bemben DA, Fetters NL, Bemben MG, Nabavi N, Kohl ET. Musculoskeletal responses to high- and low- intensity resistance training in early postmenopausal women. Med Sci Sports Exerc. 2000 Nov; 32(11):1949-57.

13. Adams KJ, Swank AM, Berning JM, Sevene-Adams PG, Barnard K.L, Shimp-Bowerman J. Progressive strength training in sedentary, older African American. Med Sci Sports Exerc. 2001 Sep; 33(9):1567-76

14. Nakamura Y, Tanaka K, Yabushita, N, Sakia T, Shigematsu R. Effects of exercise frequency on functional fitness in order adult women. Arch Gerontol Geriatr. 2007 Mar–Apr; 44(2): 163-173.

15. Ghosal A, Bandyopadhyay N. Effect of Resistance Band Training on Physical Functioning and Bone Mineral Density of Indian Women. IRJMS. 2018 Dec; 4(12)

16. Shephard RJ, (1984). Physiological aspects of sport and physical activity in the middle and later years of life. The 1984 Scientific Congress Proceedings. Sports and Aging, 5:221-232

17. Ourania M, Yvoni H, Christos K, Ionannis T. Effects of physical activity programme. The study of selected physical abilities among elderly women. J Gerontol Nurs.2003 Jul; 29(7):50-5.

18. Barker SP, Harvey AH. Fall injury in the elderly. Clin Geriatr Med. 1985 Aug; 1(3): 501-12

19. Callisaya ML, Blizzard L, Schmidt M D, McGinley J, Srikanth V. Sex modifies the relationship between age and gait: A population-based study of older adults. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 2008; 63(2) :165-70.

20. Lord SR, Lioyd DG, Nirui M, Raymond J, Williams P, Stewart RA. The effect of exercise on gait patterns in older women: a randomized controlled trial. Journal of Gerontology Series A: Biological Sciences and Medical Sciences. 1996 Mar; 51(2): 64-70

ІНФОРМАЦІЯ ПРО АВТОРА

Nita Bandyopadhyay
Associate Professor, Head & Director
Department of Physical Education, University of Kalyani, India

INFORMATION ABOUT THE AUTHOR

Nita Bandyopadhyay
Associate Professor, Head & Director
Department of Physical Education, University of Kalyani, India

Надійшла 21.12.2020