Original Research Article

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Effectiveness of using staircase as a lifestyle modification among sedentary workers of a municipal corporation in improving fitness level- an interventional study

Vinothkumar S.1*, K. Caroline Priya2, M. Vijayakumar3, Manivannan T.4

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*Correspondence:

Dr. Vinothkumar S.,

E-mail: docvinoth@gmail.com

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ABSTRACT

Background: Sedentary lifestyle is one of the important risk factors for cardiovascular diseases which is the leading cause of death globally. Workplace initiatives like promotion of staircase use are one among many simple measures to overcome the harmful effect of a sedentary workplace. Hence this study was conducted to assess effectiveness of 'using staircase' as a lifestyle modification among sedentary workers of a municipal corporation in improving fitness level.

Methods: An interventional study was conducted over a period of 8 weeks among workers of a municipal corporation office. A semi structured questionnaire including socio demographic and morbidity details was administered. sittingrising test (SRT) was administered before and after 8 weeks staircase use intervention to assess fitness levels among study participants.

Results: The mean SRT score of 172 study population at baseline was 8.79 and 115 (67%) recorded above it. 3.5-5. Younger age was associated with higher SRT score and those with history of smoking, alcohol consumption, hypertension, diabetes, hyperlipidemia and higher BMI had lower SRT scores than their counterparts. Mean value of SRT significantly improved to 9.015 following intervention.

Conclusions: Fitness level assessed using SRT score among office staff showed that people with higher age and higher BMI have low SRT score than their counterparts. This study has shown that staircase usage can be prescribed as effective method to improve fitness level at sedentary workplace.

Keywords: Cardiovascular disease, Fitness, Intervention, Lifestyle modification

INTRODUCTION

According to World Health Organisation, cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and they include coronary heart disease, cerebro-vascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolism.¹ Cardiovascular diseases (CVDs) are the leading cause of death globally i.e. 31% of all global deaths (estimated

17.9 million people) died from CVDs in 2016. Of these deaths, 85% are due to heart attack and stroke. 75% of these deaths take place in low- and middle-income countries. The most important risk factors of heart disease and stroke are behavioural i.e. unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol. The effects of behavioural risk factors may show up in individuals as raised blood pressure, raised blood glucose, raised blood lipids, and overweight and obesity. There are also several underlying determinants of CVDs

¹Senior Health Officer, Directorate of Public Health and Preventive Medicine, Chennai, Tamil Nadu, India

²Institute of Community Medicine, Madras Medical College, Tamil Nadu, India

³Institute of Community Medicine, Madras Medical College, Tamil Nadu, India

⁴Deputy Director of Health services, Sathuvacheri, Vellore, Tamil Nadu, India

or "the causes of the causes". These reflect the major forces driving social, economic and cultural change-globalization, urbanization and population ageing. Other determinants of CVDs include poverty, stress and hereditary factors. A sedentary lifestyle is a type of lifestyle involving little or no physical activity. A person living a sedentary lifestyle is often sitting or lying down while engaged in an activity like reading, socializing, watching television, playing video games, or using a mobile phone/computer for much of the day. A sedentary lifestyle can potentially contribute to ill health and many preventable causes of death.²

A sedentary lifestyle is a type of lifestyle involving little or no physical activity. Sedentary 'activity' is defined as any waking behaviour characterized by an energy expenditure ≤1.5 metabolic equivalents while sitting or reclining.³ Effects of a sedentary work life or lifestyle can be either direct or indirect. One of the most prominent direct effect of a sedentary lifestyle is an increased BMI leading to obesity. A sedentary work life or lifestyle/lack of physical activity is one of the leading causes of cardio vascular disease and preventable death worldwide. 4,5 In a study done at USA, it has been found that at-least 300,000 premature deaths, and \$90 billion in direct healthcare costs are caused by obesity and sedentary lifestyle per year.6 Sedentary lifestyle is shown to be a risk factor on its own, independent of hard exercise and BMI. People that sit-still more than 4 hours per day have a 40% higher risk than those who sit fewer than 4 hours per day. The is to be noted that a greater proportion of the workforce is now employed in low activity occupations such as office work. In a study conducted among office workers (clerical and professional), it was found that they experienced significantly more sustained sedentary time during work hours.3 Workplace initiatives are practices and programs sponsored by employers to promote employee health. Programs can be focused on either weight reduction, or prevention of further weight gain. Workplace interventions such as alternative activity workstations, sit-stand desks, and promotion of stair use are among measures implemented to counter the harms of a sedentary workplace.8 Stair use is a cost and time effective life style modification at workplace. Stair use, especially when climbing, is a vigorous physical activity that can be easily implemented in everyday life by most of the population. Several studies suggest that it is effective in improving aerobic capacity and CVD risk factors.9 So, it was decided to conduct the study at a workplace which is characterized by sustained sedentary time and contributes significantly to overall sedentary exposure of office workers using staircase as a method of promoting exercise.

The objectives of our study were to calculate the scores of fitness level of the study participants with sitting rising test (SRT). To determine the factors associated with fitness level of study participants. To estimate the effectiveness of 'using staircase' as a lifestyle modification (LSM) at a sedentary workplace.

METHODS

The present study was an interventional study conducted over a period of eight weeks during August to September 2019. Through simple random sampling, Vellore district was chosen and among the offices at Vellore, Vellore Municipal Office was chosen. Ethical clearance was obtained from the Institutional Ethical Committee of Madras Medical College, Chennai. Permission was obtained from the City Health Officer, Vellore Municipal Corporation to conduct the study.

The sample size is calculated based on the formula, $N = 4pq/d^2$; (Where 'p' is the prevalence of CVD in Tamil Nadu, which is 11%, absolute precision 'd' is 5%, with 10% excess sampling to account for non-response, sample size is derived). ¹⁰That is:

$$N = \frac{4pq}{d^2}$$

 $4 \times 11 \times 89/5 \times 5 = 156.6$

169 + 10% excess sample = 172

Inclusion criteria

The list of staff was obtained from the concerned official, among the list, staff who use lift regularly were included

Exclusion criteria

Those who were not willing to participate and those who were unable to use staircase due to underlying cardio/respiratory/neurological illness/differently abled were excluded.

After getting informed written consent, semi structured questionnaire was administered to the study participants to obtain information regarding the socio demographic profile, personal habits. Their height and weight were measured to calculate body mass index (BMI).

Their fitness level was assessed by sitting-raising test. The sitting-rising test is an easy-to-administer test which provides a significant and efficient prediction of mortality risk in elders. SRT was administered on a non-slippery flat surface, in minimal space of 2×2 m, with the subject standing barefoot and wearing clothing that did not restrict body movements. Subjects were told by the evaluator "Without worrying about the speed of movement, try to sit and then to rise from the floor, using the minimum support that you believe is needed". The maximum possible score was 10. That is, 5 points for sitting down and 5 points for getting back up. Use of a hand, forearm, knee, or the side of their leg on the ground, or their hand on their own knee, each result in a deduction of one point, down to a minimum possible score of 0. An additional 0.5 points was deducted if the evaluator perceives an unsteady execution or partial loss

of balance.¹¹ A video demonstration with local language commentary was projected to orient the subjects before administering the test.¹² Their best scores among three tries was considered as their final score.

After recording SRT, the staffs were given health education about factors contributing, pathogenesis, complications and prevention strategy of non-communicable disease. Importance of physical activity in preventing CVDs was emphasized. They were educated about using staircase as a physical activity that could be inducted in workplace as a part of life style modification. They were instructed to use staircase instead of lift in the following phased manner: 1 floor: I week, 2 floors: II Week, 3 floors: III to VIII week.

The compliance of the participants was encouraged through a self-agreement chart for each day of 8 week duration. Minimum of 80% compliance to the intervention was considered necessary for post-test. Assessment of the fitness level i.e. best score of SRT among 3 tries after eight weeks was done.

Statistical analysis

The data were entered in the MS-Excel sheet and analysed using Epi info version 07. Proportions and means were calculated. Difference between proportions was assessed using chi square test, that of means between 2 groups were assessed using independent t test and more than 2 groups using ANOVA. Pre and post-test mean scores difference was calculated using paired t test.

RESULTS

The distribution of study population according to socio demographic factors are given in Table 1. The study population consisted of 172 staff, among them 46 (26.7%) were between the age of 22 to 29 years, 106 (61.6%) were between the age of 30 to 45 years and 20 (11.6%) were above the age of 45 years. Among them 115 (66.9%) were male, non-vegetarians were 161 (93.6%), smokers were 33 (19.2%), alcohol consumers

were 55 (32%), self-reported hypertensives were 29 (16.9%), diabetics were 12 (7%) and hyperlipidaemic were 14 (18.1%).

Table 1: Distribution of participants according to socio-demographic factors (n=172).

Sociodemographic factors	Frequency	%
Age in years		
22 to 29	46	26.7
30 to 45	106	61.6
>45	20	11.6
Sex		
Male	115	66.9
Female	57	33.1
Dietary pattern		
Non-veg	161	93.6
Veg	11	6.4
Smoking		-
Yes	33	19.2
No	139	80.8
Alcohol intake		
Yes	55	32
No	117	68
Hyperlipidaemic		-
Yes	14	8.1
No	158	91.9
Hypertensive		
Yes	29	16.9
No	143	83.1
Diabetic		-
Yes	12	7
No	160	93.0
BMI (kg/m ²)		
0-18.5 underweight	0	0
18.5-22.9 normal	21	12.2
23-24.9 over-weight	43	25
25-29.9 pre-obese	96	55.8
>30 obese	12	7

Table 2: Characteristic of study population according to SRT score.

Variables		SRT score (mean±SD)			
	All	0-3	3.5-5.5	6-7.5	8-10
Frequency n (%)	172 (100)	0	5 (2.9)	23 (13.4)	144 (83.7)
Age in years	35.6±7.9	0	51 ±3.3	40.5±7.8	34.1±6.9
Height in cm	157.1±5.4	0	153±4.3	154±4	157.7±5.5
Weight in kg	64±6.5	0	68.6±4.7	69.6±6.1	63±6
BMI (kg/m ²)	25.9±2.7	0	29.1±1.2	29.4±2.6	25.3±2.2
SRT before	8.79±1.3	0	5.2±0.3	6.7±0.5	9.3±.8
SRT after	9.01±1.2	0	5.7±.4	7±.5	9.4±.7

Table 3: Factors associated with fitness level among study participants.

Factor studied		SRT <9; N (%) (n=57)	SRT>9; N (%) (n=115)	P value
Age in years	22-29	5 (8.8)	41 (35.7)	
	30-45	36 (63.2)	70 (60.9)	< 0.05
	>45	16 (28.1)	4 (3.5)	
Gender	Male	39 (68.4)	76 (66.1)	>0.05
	Female	18 (31.6)	39 (33.9)	>0.03
Dietary pattern	Non Veg	54 (94.7)	107 (93)	>0.05
	Veg	3 (5.3)	8 (7)	>0.03
g 1.	Yes	17 (29.8)	16 (13.9)	<0.05
Smoking	No	40 (70.2)	99 (86.1)	<0.03
A1 1 1	Yes	25 (43.9)	30 (26.1)	-0.05
Alcohol	No	32 (56.1)	85 (73.9)	<0.05
Hypertension	Yes	21 (36.9)	8 (6.9)	-0.05
	No	36 (63.2)	107 (93)	<0.05
Diabetic	Yes	12 (21.1)	0	<0.05
	No	45 (78.9)	115 (100)	<0.05
Hyperlipidaemic	Yes	14 (24.6)	0	<0.05
	No	43 (75.4)	115 (100)	<0.05
BMI (kg/m²)	18.5-22.9 normal	1 (1.8)	20 (17.4)	
	23-24.9 over-weight	7 (12.3)	36 (31.3)	<0.05
	25-29.9 pre-obese	37 (64.9)	59 (51.3)	<0.05
	>30 obese	12 (21.1)	0	

Table 4: Influence of staircase in determining SRT score.

	Mean of SRT (before intervention)	Mean of SRT (after intervention)	Paired difference	t value	Df	P value (2 tailed)
SRT	8.797	9.015	-0.2180	-7.32	171	< 0.001
Standard deviation	1.3076	1.2205	0.3905	-	-	-
Standard error	0.0997	0.0931	0.0298	-	-	-

Fitness level of the study participants with sitting rising test (SRT)

Results were separated and ranked by four categories according to SRT score as follows: 0-3; 3.5-5.5; 6-7.5; and 8-10.11. Descriptive analyses for entire study population and the four categories ranked according to SRT score ranges are provided in Table 2. The relationship between SRT score and age, sex, and body mass index (BMI) were also analysed. The mean SRT score of the study participants was 8.79. Among them 115 (67%) recorded a score more than 9. From the Table 2 it is seen that people with higher score were younger (34.1 years) and their BMI (25.3) were near normal than their counterparts.

Factors associated with fitness level of the participants

Table 3 shows that younger age is associated with higher SRT score, gender and dietary pattern has no significant association and those with history of smoking, alcohol consumption, hypertension, diabetes, hyperlipidaemia and higher BMI had significantly lower SRT scores than their counterparts.

Effectiveness of 'using staircase' as a lifestyle modification at a sedentary workplace

Table 4 shows that mean value of SRT before the intervention was 8.797 and after the intervention was 9.015 and the difference was significant (p value <0.05) which implies the intervention was significant in improving the SRT score, thereby reducing the mortality risk. It was also found that 3~(60%) of staff moved from 3.5-5.5 to 6-7.5 range.

DISCUSSION

Cardiovascular diseases (CVDs) have now become the leading cause of mortality in India. A quarter of all mortality is attributable to CVD. The global burden of disease study estimate of age-standardized CVD death rate of 272 per 100 000 population in India is higher than the global average of 235 per 100 000 population. CVD-affected households had more outpatient visits and inpatient stays, spent an extra International Dollars 232 per member on inpatient care annually in India. Among the risk factors of CVD viz. unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol, the

most important are behavioural which is an independent risk factor too. Prolonged sitting is almost as dangerous for your health as smoking. This lifestyle has become the norm in our culture especially at workplace. Having to sit in one place for long durations, a traditional workplace is not conducive to an active and healthy lifestyle. Also, finding time to exercise on a daily basis may become a challenge for a lot of people due to lack of time or an overworked mind at the workplace. This lifestyle is hugely responsible for risks related to cardiovascular diseases, type 2 diabetes, obesity, hypertension, chronic kidney diseases, varicose veins, muscle atrophy, and even bone deterioration. Workplace interventions such as activity workstations. sit-stand alternative desks. discounted gym/fitness memberships, ergonomic controls, exercise classes at lunch, walking challenges among co-workers, or allowing employees to stand rather than sit at their desks during work and promotion of stair use are among measures implemented to counter the harms of a sedentary workplace. The sitting-rising test is a simple test that can be administered on the site which provides a significant and efficient prediction of mortality risk in elders.

Among the study population 126 (73.25%) were >30 years of age. In Western populations only 23% of CVD deaths occur before the age of 70 years; in India, this number is 52%. Therefore there is a potential to screen this young population at an early stage and induct workplace intervention to prevent mortality risk. Among the study population 115 (66.9%) were male. Men are at greater risk of heart disease than women. 13

One of the proposed explanations for sex differences in cardiovascular diseases is presence of estrogen in females. Among the study population 161 (93.6%) were non-vegetarians. In a multicentric study done across four regions in India at 2014, it was found that there is a beneficial association of vegetarian diet with cardiovascular risk factors compared to non-vegetarian diet.¹⁵ Our study population consist of 33 (19.2%) of subjects who smoke. Cigarette smoking is a major modifiable risk factor for CVD. Cigarette smoking has been associated with higher serum levels of cholesterol, coronary vasomotor reactivity, platelet aggregation, and a prothrombotic state. 16 Tobacco continues to be the second major cause of Indian death worldwide. 16 Our study population consist of 55 (32%) of subjects who consume alcohol. Alcohol consumption can cause a temporary increase in heart rate and blood pressure. In the longterm, drinking can lead to on-going increased heart rate, high blood pressure, weakened heart muscle and irregular heartbeat. All of which can increase the risk of alcohol-CVDs.¹⁷ Hypertension, diabetes hyperlipidaemia were major causes of CVD, among our study population 29 (16%) were hypertensive, 12 (7%) were diabetic and 14 (8.1%) were hyperlipidaemic.

In this study, it was seen that people with higher score were younger (34.1 years) and their BMI (25.3) were near

normal than their counterparts. It is also found that 3 (60%) of staff moved from a score of 3.5-5.5 to 6-7.5. In a study of subjects between the ages of 51 and 80, those who had the lowest score range 0 to 3 were 5-6 times more likely to die within the study period (about 6 years) than those in the group with the highest scores 8 to 10. Each unit increase in SRT score conferred a 21% improvement in survival. Hence through a simple measure it is possible to improve fitness level at workplace.

In various study it is found that age, gender, dietary pattern, smoking, alcohol consumption, hypertension, diabetes, hyperlipidaemia and higher BMI are the causative factors for CVD which is being established in this study. Stair use, especially when climbing, is a vigorous physical activity that can be easily implemented in everyday life by most of the population. Several studies suggest that it is effective in improving aerobic capacity and CVD risk factors, this fact is tested positively in this study.⁹

There are some limitations to our study. It is possible that some results were negatively influenced by subclinical degenerative changes or recent injuries that were either not reported or identified in the medical history and the fact that 80% compliance to the intervention was considered eligible for post-test due to official circumstances.

A small sample size in a single office limits the generalization of this result.

CONCLUSION

Fitness level assessed using SRT score among office staff showed that people with higher age and higher BMI has low SRT score than their counterparts. This study has shown that staircase usage can be prescribed as effective method to improve fitness level at sedentary workplace.

Recommendations

We used health education and self-compliance chart to follow the standardized protocol of incremental stair usage as a means of promoting exercise at workplace. Health education can be used as a mode of improving knowledge and awareness among the staff. Similar programs can be organized in all offices to make staff members realize the importance of physical activity in improving fitness and preventing CVDs. Self-compliance chart is effective motivational tool to make LSM among staff. Any innovative method like star rating, appraisal honour, reward giving can be practiced to make the staff to use staircase in sustained manner.

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Ethical approval: The study was approved by the

Institutional Ethics Committee, MMC

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