Original Article

Physical activity adaptation towards control of selected noncommunicable diseases-A detailed part of large community trial in rural areas of India

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Abstract

Objectives: The primary aim of this study was to assess the impact of systematically induced health education on physical activity over control of hypertension, diabetes. The secondary aim of this study was to assess the changed pattern of physical activity among hypertensives and diabetics with continuous follow-up. **Methods:** This is part of a larger study A community trial in coastal Karnataka with three villages where one village was introduced with physical activity alone. A total of 105 participants who are known hypertensives with SBP more than 130 mm Hg or DBP more than 90 mm Hg and diabetics with Hb1Ac more than 7% were included. A specific module for physical activity was prepared, introduced to participants with involvement of family members, followed up for 1 year, and survey was done. The outcomes of median SBP, DBP, and RBS with Physical activity introduction as compared to baseline were done. Statistical analysis--Median, Interquartile range, and Wilcoxon sign rank test--was used. **Results:** There was 9–15 mm Hg change before and after intervention reduction in SBP and DBP. The median RBS reduced from 264 mg/dL to 205 mg/dL. Moderate activities time markedly increased & sitting hours decreased to half. **Conclusion:** There is an impact of systematically induced health education on physical activity over control of hypertension and diabetes & change in the pattern of physical activity with continuous health education module and follow-up.

Keywords: Community trial, health education module, physical activity

Introduction

Noncommunicable diseases (NCDs) are the main source of disease burden worldwide and are thus a major public health problem.[1] Major risk factors are obesity, raised BP, raised blood glucose, raised cholesterol levels, smoking, physical inactivity, sedentary behavior.[2-4] An inactive lifestyle accounts for 19 million Disability Adjusted Life Years (DALYs) and 3.3% of all deaths worldwide.[5] Physical inactivity accounts for more than one-fifth and is the fourth major modifiable risk factor of CHD.[6] There is an increased risk of 1.2 to 2.89 times for Hypertension and Stroke, 1.05 to 2.63 for CHD, 1.08 to 2.63 for Diabetes due to physical inactivity.[7] WHO recommends at least 30-45 minutes of regular, moderate-intensity physical activity on most days of the week for the prevention of complications.[8] Even a small

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reduction in the mean BP of a population will produce a large reduction in the incidence of CHD and stroke.[9] Approximately 70% of India's population lives in rural areas with resource-poor settings, where the increasing prevalence of NCDs is becoming an added burden. The goal of a population approach is to shift the community distribution of BP toward lower levels of 'biological normality'.

Objectives

The primary aim of this study was to assess the impact of systematically induced health education on physical activity over control of hypertension and diabetes. The secondary aim of this study was to assess the changed pattern of physical activity among known hypertensives, diabetics with continuous health education module & follow-up.

Methodology

This is part of a larger Community trial in coastal Karnataka with 3 villages with an average distance of 12 km. One village was introduced with complete lifestyle modification, other village with physical activity alone and another village was control village. The change of 5 mm Hg with base BP being 150 mm Hg the sample size was 99 in each village. It was decided that 30% of participants should be diabetics. Study subjects were selected by systematic random sampling using the family folders maintained in the subcenters. In this publication, we restrict ourselves to one village where Physical activity alone was introduced. A total of 105 known hypertensive and diabetics were enrolled with 34 diabetics and 71 hypertensives. Among them, 4 were not fully followed up for BP and Hb1Ac. Inclusion criteria were known hypertensives and diabetics from at least 2 years and no drug change in the past 1 year. The enrolment of hypertensives was on drug but with SBP more than 130 mm Hg or DBP more than 90 mm Hg and diabetics with Hb1Ac more than 7%. A baseline survey and BP reading of three times was recorded and average was considered. RBS was done twice and diabetics with high RBS went in for Hb1Ac and participants who fell into the inclusion criteria were included. The examination was done by trained medical social workers. The instruments used were calibrated in a quality-assured laboratory. The exclusion criteria were participants with malignant hypertension, secondary hypertension, pregnancy, or patients with severe disability unable to do physical activity, participants who are confused, comatose and unable to follow instructions. Institution ethical clearance and University ethical clearance was obtained and permissions from local governing bodies with consent from individual for trial was obtained. A specific module for physical activity was prepared by experts and trained MSW introduced this exercise pattern to the participants with involvement of family member for 2 months. The participants were followed up for one year during which physical activity was recorded every month from the participant and their household by the research associate. At the end of year survey was done. The outcomes of median SBP, DBP and Hb1Ac with Physical activity as compared to baseline were done. Also, the change in physical activity was assessed.

Statistical analysis—Median, interquartile range Wilcoxon sign rank test—was used.

Results

Table 1 shows that median SBP was reduced from 160 mm of Hg at baseline to 135 mm of Hg, median DBP from 88 mm Hg at baseline to 81 mm of Hg. A significant reduction in SBP & DBP was observed with $P = 0.0000$. The median RBS was reduced from 264 mg/dL at baseline to 205 mg/dl. A significant reduction in RBS was observed with $P = 0.0000$

Table 2 shows that Physical activities have increased over the period after intervention. The moderate activities as routine and for disease control increased to a statistically significant level, average hours spent on vehicles has decreased significantly. This suggests structured education and repeated follow-up makes people adherent to physical activities.

Table 3 shows the frequency of moderate exercise has increased and intervention has brought a change in the lifestyle as a whole.

Table 4 shows that frequency of activities from mild to moderate has increased, moderate and heavy in higher uncontrolled hypertensives. There were no people with physical activities in above 101 mm Hg but after intervention it is found more in them.

Table 5 shows a rise in physical activities after the intervention. The intervention drastically reduced frequency in higher Hb1Ac.

Discussion

As the worldwide prevalence of hypertension continues to increase, the primary prevention of hypertension has become an important global public health initiative. Physical activity is commonly recommended as an important lifestyle modification for prevention of hypertension.[10] Randomized controlled trials have confirmed the favorable effects of exercise on BP reduction. This effect is more pronounced in hypertensives than in normotensives or prehypertensive.[11]

Table 1: The impact of physical activity on median blood pressure and Random blood sugars among uncontrolled Hypertensives & Diabetics

	SBP		DBP		RBS	
	Before	After	Before	After	Before	After
n	68	68	68	68	33	33
50th (Median)	160	135	88	81	264	205
IQR	0	15	14.25	5	113	88.5
Z	-7.024		-3.924		-4.342	
P	0		0.000087		0.000014	

Table 2: The change in pattern of Physical activity with continuous monitoring in the village

Physical activity as mentioned in 1 week	Mean days/hours at baseline (SD)	Mean days/hours after intervention (SD)	Statistical significance
Moderate activity as work	1.23 (4.49)	1.43 (4.73)	*P*=0.050 Test=1.952
Heavy activity as work	0.30 (0.78)	0.34 (0.84)	*P*=0.180 Test=1.342
Moderate activities as routine	2.47 (2.32)	3.35 (2.55)	*P*=0.000 Test=5.603
Moderate activities done for disease control	2.26 (2.62)	5.39 (3.34)	*P*=0.000 Test=7.784
Time spent on cycling by participants as part of routine	0.12 (0.61)	0.13 (0.61)	*P*=0.317 Test=1.000
Time spend on cycling by participants as disease control activity	0.02 (0.11)	0.02 (0.13)	*P*=0.655 Test=-0.447
Average hours spent by participants by only sitting	3.01 (1.42)	2.99 (1.34)	*P*=0.414 Test=-0.816
Average hours spent by the participants using motor vehicles	0.80 (1.50)	1.21 (1.72)	*P*=0.001 Test=3.324
Heavy activity done for disease control	0.10 (0.48)	0.21 (0.65)	*P*=0.011 Test=2.536

Table 3: The frequency of physical activity with that of their stage of Hypertension (SBP) at baseline and after intervention in village

Physical activity for a week	Frequency in SBP 141-160 mm Hg at baseline	Frequency in SBP 141-160 mm Hg after intervention	Frequency in SBP 161-180 mm Hg at baseline	Frequency in SBP 161-180 mm Hg after intervention	Frequency in SBP 181 and above at baseline	Frequency in SBP 181 and above after intervention
Moderate activity as work	7	4	3	0	0	0
Heavy activity as work	7	4	3	0	0	0
Moderate activities as routine	21	19	11	0	4	0
Moderate activities done for disease control	28	20	15	0	5	0
Time spent on cycling by participants as part of routine	2	1	1	0	0	0
Time spend on cycling by participants as disease control activity	0	1	0	0	2	0
Average hours spent by participants by only sitting	37	22	18	0	6	0
Average hours spent by the participants using motor vehicles	9	4	4	0	0	0
Heavy activity done for disease control	1	0	0	0	0	0

Table 4: The frequency of physical activity with that of their stage of hypertension (DBP) at baseline and after intervention in village

Physical activity for a week	Frequency in DBP 81-90 mm Hg at baseline	Frequency in DBP 81-90 mm Hg after intervention	Frequency in DBP 91-100 mm Hg at baseline	Frequency in DBP 91-100 mm Hg after intervention	Frequency in DBP 101 and above at baseline	Frequency in DBP 101 and above after intervention
Moderate activity as work	6	10	2	0	2	0
Heavy activity as work	6	10	2	0	2	0
Moderate activities as routine	21	27	10	0	5	0
Moderate activities done for disease control	25	32	11	0	9	0
Time spent on cycling by participants as part of routine	4	3	1	0	0	0
Time spend on cycling by participants as disease control activity	1	1	0	0	1	0
Average hours spent by participants by only sitting	34	34	13	0	11	0
Average hours spent by the participants using motor vehicles	11	13	3	0	3	0
Heavy activity done for disease control	3	4	0	0	0	0

Physical activity is defined as any bodily movement produced by contraction of skeletal muscles and comprises routine daily tasks such as commuting, occupational tasks, or household activities, as well as purposeful health-enhancing movements. Exercise is a component of physical activity that is planned, structured, and repetitive with the intent of improving or maintaining health.[12]

Table 5: The frequency of Physical activity with that of their stage of diabetes

Physical activity for a week	Frequency in Hb1Ac 7%-9% at baseline	Frequency in Hb1Ac 7%-9% after in intervention	Frequency in Hb1Ac more than 10% at baseline	Frequency in Hb1Ac more than 10% after intervention
Moderate activity as work	1	4	1	2
Heavy activity as work	1	4	1	2
Moderate activities as routine	11	10	10	7
Moderate activities done for disease control	14	12	7	8
Time spent on cycling by participants as part of routine	1	1	1	1
Time spend on cycling by participants as disease control activity	0	1	1	0
Average hours spent by participants by only sitting	14	12	12	9
Average hours spent by the participants using motor vehicles	4	8	6	5
Heavy activity done for disease control	1	3	0	0

In our study, there was 9–15 mm Hg change before and after intervention showing that physical activity made a mark in reducing SBP and DBP. The moderate activities time markedly increased from around 1.5 hours to 5 hours a week and sitting hours decreased to half. It was shown that systematic increasing the physical activity is feasible and health workers can do it.

Exercise improves blood glucose control in type 2 diabetes, reduces cardiovascular risk factors, contributes to weight loss, and improves well-being.[13] Moderate to high volumes of aerobic activity are associated with lower cardiovascular and overall mortality risks in both type 1 and type 2 diabetes.[14] Daily exercise, or at least not allowing more than 2 days to elapse between exercise sessions, is recommended to enhance insulin action.[15] A meta-analysis of 12 trials in adults with type 2 diabetes reported a greater reduction in A1C following aerobic exercise.[16]

In our study diabetes control was also evident with RBS reduction and HbA1C by 2% though statistically not significant. Diabetics who had >9% came within 6-7% HbA1C.

A study done by Subitha Lakshminarayanan *et al*.[17] showed that a 10-week intervention to promote physical activity was effective in significantly decreasing the population's BP by 1.56/0.74 mm Hg, fasting blood sugar levels by 2.82 mg%. Mean SBP was reduced from 122.40 mm Hg at baseline to 120.84 mm Hg at 10 weeks.

A systematic review done by Sonu Punia *et al*.[18] showed mean reduction of 3.71 mm Hg in healthy, 5.38 mm Hg in hypertensives, and 7.24 mm Hg in diabetic Indians. Overall, aerobic training with a mean duration of 12.5 weeks reduced SBP to 05.00 mm Hg in Indians. Results from 24 articles from different parts of India showed 5.00 mm Hg reduction in SBP and 3.09 mm Hg reduction in DBP. Jaiswal *et al*.[19] study on hypertensive adults showed a mean reduction of 4.86 in SBP and 1.51 in DBP following physical activities. Patel and Desai, *et al*.[20] study showed a reduction in SBP of 3.35 and DBP of 2.00 among hypertensives. A similar study done by Bose and Dhana Lakshmi, *et al*. shows a reduction of SBP by 6.00 and DBP 03.47. Saptharishi *et al*.[21] showed a reduction in SBP 5.30 and DBP 06.00 after physical activities.[18] Studies done on Diabetic adults with aerobic exercises as intervention showed a significant reduction in blood pressure. Ghosh and Roy *et al*.[22] showed a significant decrease in SBP by11.80 & DBP by 07.75 mm of Hg. Similar studies done by Tiwari *et al*.,[23] Sridhar *et al*.,[24] Arora *et al*.,[25] showed a reduction in SBP 10.08 & DBP 05.26, SBP 08.71 & DBP 05.77, SBP −08.00, and DBP −03.00, respectively following the training in exercises.[18] A single bout of physical exercise increases circulating and muscular ceramide levels, regular exercise reduces ceramide content. Additionally, several ceramide species have been reported to be negatively associated with cardiorespiratory fitness, which is a potent health marker reflecting training level. Thus, regular exercise could optimize cardio metabolic health, partly by reversing altered ceramide profiles.[26] In a study of 1-year exposure to low-dose Physical activity (PA) recommendations aimed at progressively changing physical behaviors induced a significant increase in physical activity and helped raise PA toward the recommended standards in a not optimally active adult. Also, a significant proportion of the participants retained active behaviors until 1 year after the intervention.[27] In a study it was shown that circuit training once per week over 32 weeks prevented the aging-related decline of CRF in previously sedentary subjects and reduced systolic BP during submaximal exercise, indicating improved exercise tolerance.[28] A study concluded that physical activity of diabetes patients with hypertension is needed to control the level of blood glucose and blood pressure. It was recommended that diabetes patient with hypertension need to increase their awareness regarding the physical activity. Also, health workers can implement a program that increases the awareness and the physical activity.[29] This study was a community trial done in the community. The community primary care physicians can train their health-care workers to give health education to patients having hypertension and Diabetes. They should continue to motivate the patients during every follow-up. Hence primary care physicians can educate the patients regarding physical activity and continue to motivate them during every follow-up. This will help in controlling hypertension and diabetes to a larger extent.

The community trial shows that physical activity alone can also help in reducing hypertension and Diabetes with continuous health education, compared to all the lifestyle changes. Adopting physical activity as a routine is easier compared to other lifestyle changes like diet modification. This method is more feasible.

It this study there was change before and after intervention with a reduction in SBP and DBP among hypertensives. The median RBS also reduced among the Diabetics. Moderate activities time markedly increased & sitting hours decreased to half. Hence, there is an impact of systematically induced health education on physical activity over control of hypertension and diabetes & change in the pattern of physical activity with continuous health education module and follow-up.

Limitation

The activity trainers by themselves did final survey so there could be bias.

Conclusion

There is the impact of systematically induced health education on physical activity over control of hypertension and diabetes and change in the pattern of physical activity in group of known hypertensives and diabetics with continuous health education module and follow-up.

Implications

Short term: Development of a program model through community participation for reduction of HTN and DM. Similar models can be developed for other states too.

Long term: Similar models can be developed for other programs using local vernacular language and community participation that will reduce burden on hospitals and overall increase in healthy citizens, increase community ownership and reduce cost for public health programs.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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