Mobile based intervention for reduction of coronary heart disease risk factors among patients with diabetes mellitus attending a tertiary care hospital of India

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ABSTRACT

Background: Cardiovascular complications are now the leading causes of diabetes-related morbidity and mortality. The public health impact of cardiovascular disease (CVD) in patients with diabetes is already enormous and is increasing.

Aims: To develop a mobile based intervention model for reduction of CHD risk factors among diabetic patients. 2. To prospectively evaluate the developed intervention model in the proposed group. **Settings and Design:** Endocrinology outpatient department of a tertiary care hospital and study design was Randomized controlled trial. **Material and Methods:** Starting at random, the patients were allocated to control group and test group. Controls were given printed educational materials. Test group were counselled with intense lifestyle education using both printed materials and computers, they were contacted by telephones contacted by phone calls by the investigator in every 3 weeks for 3 months and SMS were sent in every week containing some educational tips. **Results:** In the follow up at 3 months, treatment was not changed in majority (80%) of diabetics that being taken at baseline. The change of treatment was proportionately high in control group (33.3%) than in the intervention group (11.8%). The mean measurements of blood sugar (fasting and post Prandial) were higher in the baseline control and intervention groups compared to the follow up in both arms. **Statistical analysis used:** Percentage, standard deviation, significance tests. **Conclusion:** Intervention in the form of intensive life style education and phone calls and SMS became helpful in management of increased blood sugar, blood pressure, body weight (BMI, WHR) in our study. Health information through mobile phones has great potential to improve patient care and increase patient-provider communication, and to promote life style measures.

Key words: CHD risk factors, Mobile based intervention, SMS.

INTRODUCTION

Diabetes and its complications pose a major threat to public health resources and World Health Organization (WHO) has projected the maximum increase in diabetes would occur in India.[1] WHO has observed an apparent epidemic of diabetes that is strongly related to lifestyle and economic change to exceed 200 million over the next decade; mostly with type 2 diabetes mellitus, and all are at risk of the development of complications.[2]

Cardiovascular complications are now the leading causes of diabetes-related morbidity and mortality. The public health impact of cardiovascular disease (CVD) in patients with diabetes is already enormous and is increasing.[3] The most important complication of Type 2 diabetes Mellitus (DM) is coronary heart disease (CHD) which presents with increased mortality and morbidity compared to the non-diabetic population.[4] Patients with diabetes and without

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previous myocardial infarction (MI) have as high a risk of MI as persons without diabetes and with a previous MI, and that the cardiovascular risk factors of both groups should be treated equally aggressively.[5]

We need to utilize a more systematic and informed approach to the application of information science and technology in order to take full advantage of its potential to enhance and facilitate public health activities. There is an increasing amount of evidence that the patient education is the most effective way to lessen the complications of diabetes and its management. Recently mobile phones as a new delivery system can provide medical recommendations and prescriptions at the appropriate time and to accommodate for patients' behavioural changes.[6] Mobile based education and counselling is an important way of encouraging better provider-patient communication and will undoubtedly increase its application for improving health status of patients with chronic diseases and will decrease the complications. A delayed recognition of various forms of coronary heart diseases undoubtedly worsens the prognosis for survival for many diabetic patients. It is easy to get diabetic patients in a tertiary care hospital setting and an attempt was made for reduction of coronary heart disease risk factors among these patients with following objectives

1. To develop a mobile based intervention model for reduction of CHD risk factors among diabetic patients.

2. To prospectively evaluate the developed intervention model in the proposed group.

MATERIALS AND METHODS

Study design and study period:

A Randomized controlled trial was carried out for 6 months from October 2012 to March 2013.

Sample size: Considering the time and feasibility of the study, 100 subjects were included in the study (calculated through convenience sampling i.e. 4 weeks × 5 days × 5-6 subjects per day = 100). Starting at random, 50 patients were allocated to test group and 50 patients to control group.

Selection Criteria

Patients registered on the day of interview were selected using simple random sampling method. Patients aged 30 years and above, and on treatment for diabetes for at least 3 months, were included in the study. Patients having gestational diabetes and major psychiatric disorders were excluded from the study as these have been identified as potential confounding factors.

Pre-Testing

For the recording of data a schedule was prepared. At the beginning of the study, this instrument was pre-tested on five subjects to test the feasibility, reliability & validity of the questions while eliciting the required information. Accordingly the questionnaire/ schedule was modified, corrected & finalized for data collection.

Data collection

The study subjects were interviewed using a predesigned, pretested and semi structured questionnaire. Both qualitative and quantitative components were included in the questionnaire. The prospect of this study for improving understanding of diabetes and its complications was explained to the participants. Those patients who were reluctant and refused strictly were excluded from the study.

Collection of data was done in a friendly atmosphere after obtaining informed consent. Some time was spent, at the beginning, on informal discussions with the purpose of gaining the confidence of the study subjects.

Data in respect of age, sex, socio economic status, per capita monthly income, family size, duration of diabetes, co-morbidity, history of cardio vascular disease, family history of diabetes and cardio vascular disease, dietary habits, tobacco and alcohol use, physical activity etc. were collected. The patients of Diabetes Mellitus were asked about the detailed clinical history and treatment history. Their heights, weight, BMI, waist circumference, waist-hip ratio, blood pressure etc. were recorded. The investigations like Fasting blood sugar, Blood cholesterol, lipid profile etc. were done as a part of routine investigations prescribed by Endocrinologist. All patients were motivated by investigator with help of Endocrinologist to come for follow up at 3 months.

Randomization and Intervention

Starting at random, the patients were allocated to control group and test group. Controls were given printed educational materials. Test group were counselled with intense lifestyle education using both printed materials and computers. Then an SMS containing some educational tips about diet, physical activity, drugs etc. was sent every week to test group. They contacted in every 3 weeks for

3 months by telephone by investigator and asked about lifestyle change and counselled if required.

Data collection at 3 months

To see the change in their knowledge, attitude and practice along with physical activity, biochemical parameters, a 3 month follow up schedule was prepared. All the patients were contacted telephonically at 3 month and motivated to come for follow up at 3 months. Data were collected in 3 month schedule.

Data processing and analysis

The information thus collected were processed and analyzed by the fellow under guidance of mentor in the Centre for Public Health Informatics, Asian Institute of Public Health, Bhubaneswar by using SPSS software and wherever necessary through manual calculation.

Ethical considerations

Ethical clearance from the Institutional Ethical Committee was obtained. The prospects of this study for developing a mobile based intervention model for reduction of CHD risk factors among diabetic patients was explained to the participants before obtaining the consent.

Method

After approval by the Institutional ethical committee, the diabetic patients who attended the Endocrinology outpatient department of a tertiary care hospital of India, during November 2012 were included in the study. Patients aged 30 years and above, and on treatment for diabetes for at least 3 months, were included in the study. Patients having gestational diabetes and major psychiatric disorders were excluded from the study as these have been identified as potential confounding factors. The study subjects were interviewed using a predesigned, pretested and semi structured questionnaire. The prospect of this study for reduction of stress among diabetic patients was explained to the participants. Collection of data was done in a friendly atmosphere after obtaining informed consent.

Starting at random, the patients were allocated to control group and test group. Controls were given printed educational materials. Test group were counselled with intense lifestyle education using both printed materials and computers. Then an SMS containing educational tips healthy diet, physical exercise, no tobacco, adherence to medication and stress management was sent every week to test group. They were contacted by phone calls by the investigator in every 3 weeks for 3 months by telephone by investigator and asked about healthy lifestyle and counselled if required. All patients were motivated by investigator with help of Endocrinologist to come for follow up at 3 months. The information thus collected were processed and analyzed by using SPSS software version 16.

RESULTS

A total of 100 subjects participated in the study out of which 50 were enrolled into intervention and 50 into control group and followed up after 3 months. Out of 100 participants, total 55 patients (control-21, Intervention-34) came for follow up (Table 1).

Mean age was 54 + 11.5 ranging from 30 years to 80 years. About two third (n=65) of participants were males with similar distribution in both the groups (intervention=33, 66%, control=32, 64%). More than 90% were Hindus in both the groups followed by other religions and around 80% belonged to general caste. 57% of the participants lived in joint families, 83% were married, 44% belonged upper social class, 39% were educated upto either graduate or above. 43% of the participants were either professionals or semiprofessionals and 37% were housewives.

Presence of diabetes ranged from a minimum of 3 months to a maximum of 24 years. Majority (55%) of the participants were diabetic up to 5 years from the time of diagnosis and about 20% were on both insulin and oral hypoglycaemic drugs.

In the follow up at 3 months, treatment was not changed in majority of diabetics that being taken at baseline. The change of treatment was proportionately high in control group (33.3%) than in the intervention group (11.8%) (Table 2 &3).

Comparing the baseline vs 3 month follow up, the mean measurements of blood sugar (fasting and post Prandial) were higher in the baseline control and intervention groups compared to the follow up in both arms. This indicates that intervention in any form controls blood sugar among patients. Serum cholesterol is decreased in intervention group in follow up compared to their mean baseline value (Table 4).

It was observed that most of the participants were prehypertensives, with marginally higher proportion in the intervention arm. In follow up, it was seen, a reduction in the number of hypertensives in both the arms, while an

Table 1: Socio-Demographic Variables (n=100)

Socio-Demographic variables	Overall (N=100)	Control (n=50)	Intervention (n=50)
Age in years (Mean + SD)	54 + 11.5	56 + 10	52 + 12
Gender			
Male	65%	33 (66%)	32(64%)
Female	35%	17 (34%)	18(36%)
Religion			
Hindu	94%	48 (96%)	46(92%)
Muslim	5%	1 (2%)	4(8%)
Christian	1%	1(2%)	0 (0%)
Caste			
General	76%	36(72%)	40(80%)
SC/ ST	6%	3(6%)	3(6%)
Socioeconomically Backward class	18%	11(22%)	7(14%)
Family Type			
Joint	57%	25(50%)	32(64%)
Nuclear	40%	23(46%)	17(34%)
Broken	3%	2(4%)	1(2%)
Marital status			
Married	83%	41 (82%)	42(84%)
Single including divorcee, widow	17%	9 (18%)	8 (16%)
Education level of the participants			
Graduates or more	39%	15 (30%)	24 (48%)
Less than graduates	61%	35 (70%)	26 (52%)
Social class (Modified Prasad)			
Upper	44%	22 (44%)	22 (44%)
Middle	36%	16 (32%)	20 (40%)
Low	20%	12 (24%)	8 (16%)
Occupation (Kuppuswami classification)			
Professional and semiprofessional	43	20 (40%)	23 (46%)
Skilled and unskilled workers	5	4 (8%)	1 (2%)
Housewife	37	20 (40%)	17 (34%)
Unemployed/Retired	15	6 (12%)	9 (18%)

Table 2: Diabetes Profile at baseline

Diabetes Profile: BASELINE		Overall (N=100) %	Control (n=50) No. (%)	Intervention(n=50) No. (%)
Duration of Diabetes Mellitus	3months-5 years	55	26(52)	29(58)
	5-10 years	28	13(26)	15(30)
	>10 years	15	11(22)	4(8)
Treatment being taken	Drug Therapy	65	31(62)	34(68)
	Insulin Therapy	16	10(20)	6(12)
	Drug + Insulin	19	9(18)	10(20)

Table 3: Change in Diabetes Mellitus treatment observed, at follow up

Follow up		Overall (N=55) No (%)	Control (n=21) No (%)	Intervention (n=34) No (%)
Change of Treatment	Yes	11 (20)	7 (33.3)	4 (11.8)
	No	44 (80)	14 (66.7)	30 (88.2)

Table 4: Clinical assessment: Baseline vs Follow up

Clinical Parameter	Baseline (Mean + SD)		Follow up(Mean + SD)	
	Control	Intervention	Control	Intervention
Body Mass Index (kg/m2)	25 + 4.7	25.2 + 5.3	24 + 2.9	25 + 4.9
Waist Hip Ratio	0.97+ 0.1	1.0 + 0.2	1 + .05	1 + .05
Fasting Blood Sugar	151 + 62.2	135.9 + 40.1	124 + 27.6	113.2 + 21.7
Post Prandial Blood Sugar	206 + 86.3	197 + 73.3	175 + 36.1	171 + 39.5
Serum Cholesterol	181 + 41	183 + 44.8	181 + 41.9	181 + 44.1

Table 5: Classification of Blood pressure as per JNC VII criteria

Baseline (N=100)	**SBP/ DBP**	**Control (N=50) No (%)**	**Intervention (N=50) No (%)**	**Significance**
Normal	<120 / <80	3 (6)	6 (12)	
Pre-hypertension	120-139 / 80-89	26 (52)	29 (58)	
Hypertension Stage 1	140-159 / 90-99	15 (30)	11 (22)	.55
Hypertension Stage 2	≥160 / ≥100	6 (12)	4(8)	
Follow up (N=55)	**SBP/ DBP**	**Control (n=21) No (%)**	**Intervention (n=34) No (%)**	**Significance**
Normal	<120 / <80	3 (14.3)	4(11.8)	
Pre-hypertension	120-139 / 80-89	14(66.7)	28(82.4)	
Hypertension Stage 1	140-159 / 90-99	4(19)	2(5.9)	.25
Hypertension Stage 2	≥ 160 / ≥100	0 (0)	0 (0)	

Table 6: Baseline assessment of Risk factors:

PHYSICAL ACTIVITY		**Overall (N=100) % age**	**Control (N=50) No. (%)**	**Intervention (N=50) No. (%)**	**Significance**
Physical Activity	Low	36	20 (40)	16 (32)	.30
	Moderate	45	24 (48)	21 (42)	
	Vigorous	9	2 (4)	7 (14)	
	No Activity	10	4 (8)	6 (12)	
Fried food Consumption/ week	<1	28	13 (26)	15 (30)	.89
	1-2	53	26 (52)	27 (54)	
	3-6	13	7 (14)	6 (12)	
	Everyday	6	4 (8)	2 (4)	
Starch serving/ day	0-1	96	47 (94)	49 (98)	.62
	2	3	2 (4)	1(2)	
	3	1	1 (2)	0 (0)	
Sweet servings/ day	Usually none	78	37 (74)	41 (82)	.72
	1-2	19	11 (22)	8 (16)	
	>2 <4	1	1 (2)	0 (0)	
	≥4	2	1 (2)	1 (2)	
Sugar cons/ day (teaspoon/day)	0-3	95	48(96)	47 (94)	1
	4-6	5	2 (4)	3 (6)	
	7-9	0	0 (0)	0 (0)	
	≥10	0	0 (0)	0 (0)	
Fish Consumption/ week	Rarely	28	16 (32)	12 (24)	.50
	Regularly (> 2 times/ week)	72	34 (68)	38 (76)	
Fruit servings/day	Usually none	27	14 (28)	13 (26)	1
	1 or more	73	36 (72)	37 (74)	
Vegetable servings/day	Usually none	3	0 (0)	3 (6)	.24
	2 or more	97	50 (100)	47 (94)	
Coffee cups/day	<2	98	48 (96)	50 (100)	.49
	3-4	0	0 (0)	0 (0)	
	>5	2	2 (4)	0 (0)	
Average soft drink consumption/week (ml/ week)	<500	97	47 (94)	50 (100)	.24
	1000-2000	2	2 (4)	0 (0)	
	3000-4000	0	0 (0)	0 (0)	
	>5000	1	1 (2)	0 (0)	
Water consumption/day (litres/day)	>1.25	85	42 (84)	43 (86)	.77
	501-1.25	14	8 (16)	6 (12)	
	0-500	1	0 (0)	1 (2)	
Hours of sleep per day	**Adequate (6-8)**	64	29 (58)	35 (70)	.60
	Excess (>8)	9	6 (12)	3 (6)	
	Inadequate (<4-5)	25	14 (28)	11 (22)	
	Sleep Disorder	2	1 (2)	1 (2)	
	Total	**100**	**50 (100)**	**50 (100)**	

Table 7: Risk Factor Profile in Follow up

PHYSICAL ACTIVITY		Overall (N=55) No. (%)	Control (N=21) No. (%)	Intervention (N=34) No. (%)	Significance
Physical Activity	Low	21 (38.2)	12 (57.1)	9 (26.5)	.03
	Moderate	25 (45.5)	7 (33.3)	18 (52.9)	
	Vigorous	8 (14.5)	1 (4.8)	7 (20.6)	
	No Activity	1 (1.8)	1 (4.8)	0 (0)	
Fried food Consumption/ week	<1	18 (32.7)	4 (19)	14 (41.2)	.053
	1-2	31 (56.4)	12 (57.1)	19 (55.9)	
	3-6	4 (7.3)	3 (14.3)	1 (2.9)	
	everyday	2 (3.6)	2 (9.5)	0 (0)	
Starch serving/day	0-1	54 (98.2)	20 (95.2)	34 (100)	.38
	2	1 (1.85)	1 (4.8)	0 (0)	
	3	0 (0)	0 (0)	0 (0)	
	>4	0 (0)	0 (0)	0 (0)	
Sweet servings/ day	Usually none	46 (83.6)	15 (71.4)	31 (91.2)	.07
	1-2	9 (16.4)	6 (28.6)	3 (8.8)	
Sugar consumption/ day (teaspoon/day)	0-3	53 (96.4)	20 (95.2)	33 (97.1)	1
	4-6	2 (3.6)	1 (4.8)	1 (2.9)	
	7-9	0 (0)	0 (0)	0 (0)	
	>10	0 (0)	0 (0)	0 (0)	
Fish Consumption/ week	Rarely	12 (21.8)	7 (33.3)	5 (14.7)	.18
	Regularly (2 or more)	43 (78.2)	14 (66.7)	29 (85.3)	
Fruit servings/day	Usually none	2 (3.6)	2 (9.5)	0 (0)	.14
	1 or more	53 (96.4)	19 (90.5)	34 (100)	
Vegetable serving/day	Usually none	0 (0)	0 (0)	0 (0)	
	2 or more	55 (100)	21 (100)	34 (100)	
Coffee cups/day	<1-2	53 (96.4)	19 (90.5)	34 (100)	.14
	>3	2 (3.6)	2 (9.5)	0 (0)	
Average soft drinks consumption/week (ml/ week)	<500	54 (98.2)	20 (95.2)	34 (100)	.38
	1000-2000	1 (1.8)	1 (4.8)	0 (0)	
Water Consumption/ day (litres/day)	>1.25	51 (92.7)	20 (95.2)	31 (91.2)	1
	0.501-1.25	4 (7.3)	1 (4.8)	3 (8.8)	
	<0.5	0 (0)	0 (0)	0 (0)	
Hours of sleep per day	Adequate (6-8)	90.9 (50)	85.7 (18)	94.1 (32)	.61
	Excess (>8)	2 (3.6)	1 (4.8)	1 (2.9)	
	Inadequate (<4-5)	3 (5.5)	2 (9.5)	1 (2.9)	
	Sleep Disorder	0 (0)	0 (0)	0 (0)	

increase was noticed in prehypertensives and normal blood pressure in both the arms (Table 5).

Risk Factor Profile

Family history: More than half (56%) had a negative family history of conditions/diseases serving as a risk factor for CHD in diabetes mellitus. Among those who did have a positive family history, majority (20%) had a history of diabetes mellitus with a higher proportion in the intervention arm (22%, n=11 compared to 18%, n=9 in the control arm) (Table 6 & 7).

Personal history: Majority (70%) of the participants did not have any personal history of diseases/conditions with higher proportion (76, n=38) in the intervention arm compared to the control arm (64%, n=32). Among those who had did have a positive personal history included a combination of two or more diseases (cardiovascular disease, obesity, genetic disease).

Habits

Tobacco

About two third of the participants (66%) did not use tobacco in any form with higher proportion (70%, n=35) in the intervention arm compared to the control arm (62%, n=31). Among those who did, majority (18%) were smokers. Majority of the smokers were currently smoking (13%) and in the light smoker category (14%) with similar proportions in both the arms.

Alcohol

More than 90% of the participants were lifetime abstainers

while 6% were currently consuming alcohol with double proportion in the intervention arm (8%, n=4) compared to control arm (4%, n=2). Majority (5%) of those who consumed alcohol had light intake of alcohol.

Age of initiation of habits

Majority (8% smokers; 5% alcoholics) had initiated smoking and alcohol in the age group of 20-29 years.

Physical Activity

More than 80% consumed fried foods 2 times or less in a week with higher proportion in the intervention arm (84%, n=42) compared to the control arm (78%, n=39). Most of the participants (96%) had nil to 1 starch serving per day while almost 80% did not consume any sweets per day with higher proportions in the intervention arm. Similarly 95% participants consumed less than 3 teaspoons of sugar per day with almost equal proportions in both the arms. More than 70% consumed fish consumption more than 2 times a week and had fruit servings 1 or more times a day. Almost all participants (98%) consumed less than 2 cups of coffee per day and less than 500 ml (97%) of average soft drink consumption per week. 85% of reportedly consumed more than 1.25 liters of water on an average everyday with similar proportions in both the intervention and control arm.

More than one third of the participants reportedly had adequate sleep of 6 to 8 hours a day with higher proportion (70%, n=35) in the intervention arm compared to the control arm (58%, n=29). While a quarter of the participants slept for less than 4 to 5 hours a day (inadequate), 2% had sleep disorders.

Among the important risk factors, at baseline, about 80% had low to moderate physical activity while 10% had no activity. In the follow up, significant change in physical activity levels was noticed. The sedentary lifestyle reduced from 10% to 1.8% with none in the intervention arm. About 80% had low to moderate physical activity while 10% had no activity.

Diet

In the baseline, more than 80% consumed fried foods 2 times or less in a week with higher proportion in the intervention arm (84%, n=42) compared to the control arm (78%, n=39). This increased to about 90% with almost all participants (97%, n=33) in the intervention arm compared to about 80% in the control arm (76%, n=16).

Most of the participants (96%) consumed nil to 1 starch serving per day while almost 80% did not consume any sweets per day with higher proportions in the intervention arm. This proportion increases to 100% in the intervention arm who consumed less than 1 starch serving per day. Similarly only 9% in the intervention arm during follow up consumed 1 to 2 sweet servings per day compared to about 30% (n=6) in the control group.

Similarly 95% participants consumed less than 3 teaspoons of sugar per day with almost equal proportions in both the arms in the baseline. This increased to about 97% during follow up with similar distribution in both the arms.

More than 70% consumed fish consumption more than 2 times a week and had fruit servings 1 or more times a day at baseline. More than 80% with higher proportions in the intervention arm started consuming fish more than 2 times a week, and 100% in the intervention group started consuming fruits 1 or more times a day compared to about 90% in control group.

At baseline, almost all participants (98%) consumed less than 2 cups of coffee per day and less than 500 ml (97%) of average soft drink consumption per week. A similar trend was seen in both the arms for coffee and soft drink consumption at follow up.

85% of reportedly consumed more than 1.25 liters of water on an average everyday with similar proportions in both the intervention and control arm at baseline. This increased to 93% at follow up.

Sleep

About three fourths of the participants reportedly had adequate sleep of 6 to 8 hours a day with higher proportion (70%, n=35) in the intervention arm compared to the control arm (58%, n=29). This increased to about 90% at follow up. While a quarter of the participants slept for less than 4 to 5 hours a day (inadequate), 2% had sleep disorders at baseline. Participants getting inadequate sleep reduced to about 6% at follow up with none of them having sleep disorders.

DISCUSSION

A total of 100 subjects participated in the study out of which 50 were enrolled into intervention and 50 into control group. Presence of diabetes ranged from a minimum of 3 months to a maximum of 24 years. Majority (55%) of the participants were diabetic up to 5 years from the time of diagnosis. About 70% were on more than one form of treatment for diabetes mellitus and 46% were on more than one oral hypoglycaemic. In the follow up at 3 months, treatment was not changed in majority (80%) of diabetics

that being taken at baseline. The change of treatment was proportionately high in control group (33.3%) than in the intervention group (11.8%). This suggests that some form of intervention is beneficial. Intensive life style education with reminder messages and calls to their mobiles has definitely a positive effect to change their lifestyles and behaviours so that treatment is not changed. In the other way in the control group, either the dose was increased or treatment was changed due to their uncontrolled blood sugar.

In the clinical assessments at baseline, most of the participants were prehypertensives, with marginally higher proportion in the intervention arm with the least proportion in the normal blood pressure category. However, almost all of the participants in both the arms had waist hip ratios above the normal levels showing the high risk for metabolic and cardiovascular complications. Follow up saw a reduction in the number of hypertensives in both the arms, while an increase was noticed in prehypertensives and normal blood pressure in both the arms. The change in other parameters like weight, waist hip ratio could not be noticed may be due to 3 month time is too less to interpret these parameters. In a study by Look AHEAD research group, participants assigned to ILI (Intensive lifestyle intervention) lost an average 8.6% of their initial weight versus 0.7% in DSE (Diabetes support education) group ($p<0.001$). Mean fitness increased in ILI by 20.9% versus 5.8% in DSE ($p<0.001$). A greater proportion of ILI participants had reductions in diabetes, hypertension, and lipid-lowering medicines. Systolic and diastolic pressure, triglycerides, HDL-cholesterol improved significantly more in ILI than DSE participants (all $p<0.01$).[7]

Comparing the baseline vs 3 month follow up, the mean measurements of blood sugar (fasting and post Prandial) were higher in the baseline control and intervention groups compared to the follow up in both arms. This indicates that intervention in any form controls blood sugar among patients.

About one third of the participants (34%) use tobacco in any form and majority (18%) were smokers. About 6% were currently consuming alcohol. Majority (8% smokers; 5% alcoholics) had initiated smoking and alcohol in the age group of 20-29 years. WHO recommends changes in attitudes, behaviour and social values for primordial prevention of CHD. Encouragement of positive health behaviour, prevention of adopting risk behaviour, elimination of established risk behaviour and promotion of the concept of health as a social value. Established principles and practices of health and general education should be included in public health programmes.[8] Prevention from adopting risky behaviours by health education from childhood and if adopted, should be encouraged to leave those behaviours by health personnel when there is contact with them.

Among the important risk factors, at baseline, about 80% had low to moderate physical activity while 10% had no activity. In the follow up, significant change in physical activity levels was noticed. The sedentary lifestyle reduced from 10% to 1.8% with none in the intervention arm having sedentary activities. This indicates that intervention has an effect on increasing the physical activity and making a slight effort by informatics will improve the situation.

In the baseline, more than 80% consumed fried foods 2 times or less in a week with higher proportion in the intervention arm (84%) compared to the control arm (78%). This increased to 97% with almost all participants in the intervention arm compared to about 78% in the control arm.

Most of the participants (96%) consumed nil to 1 starch serving per day while almost 80% did not consume any sweets per day with higher proportions in the intervention arm. This proportion increases to 100% in the intervention arm who consumed less than 1 starch serving per day. Similarly only 9% in the intervention arm during follow up consumed 1 to 2 sweet servings per day compared to about 30% in the control group. Similarly 95% participants consumed less than 3 teaspoons of sugar per day with almost equal proportions in both the arms in the baseline. This increased to about 97% during follow up with similar distribution in both the arms.

More than 70% consumed fish consumption more than 2 times a week and had fruit servings 1 or more times a day at baseline. More than 80% with higher proportions in the intervention arm started consuming fish more than 2 times a week, and 100% in the intervention group started consuming fruits 1 or more times a day compared to about 90% in control group. At baseline, almost all participants (98%) consumed less than 2 cups of coffee per day and less than 500 ml (97%) of average soft drink consumption per week. A similar trend was seen in both the arms for coffee and soft drink consumption at follow up. 85% of reportedly consumed more than 1.25 liters of water on an average everyday with similar proportions in both the intervention and control arm at baseline. This increased to 93% at follow up. Diet modification among the intervention group was only due to the intervention of phone calls and reminder messages.

About three fourths of the participants reportedly had adequate sleep of 6 to 8 hours a day with higher proportion (70%) in the intervention arm compared to the control arm (58%). This increased to about 90% at follow up. Intensive life style education and counselling about stress management along with constant touch with patients may be helpful in reducing their stress and improving sleep.

CONCLUSION

In patients with diabetes mellitus (DM), a cardiovascular event is of great concern as it effects on survival. As the risk of coronary heart disease increases among diabetic patients, these patients require targeted intervention. Healthy diet, physical exercise, no tobacco, adherence to medication are major things to prevent coronary heart disease among diabetes mellitus patients. Intervention in the form of intensive life style education and phone calls and SMS became helpful in management of increased blood sugar, blood pressure, body weight (BMI, WHR) in our study. Health information through mobile phones has great potential to improve patient care and increase patient-provider communication, and to promote life style measures.

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REFERENCES

1. King H, Aubert RE, Herman WH. Global Burden of diabetes 1995 - 2025 Prevalence, numerical estimates and projection. Diabetes Care 1998;21:1414-31.
2. Available from:http://www.whoindia.org/SCN/AssBOD/06-Diabetes.pdf .
3. Wingard DL, Barrett-Connor E: Heart disease and diabetes. In Diabetes in America.2nd edition. Harris MI, ed. Bethesda, Md., National Institutes of Health (NIH publication no. 95-1468), 1995, p 429-48.
4. Wingard DL, Barrett-Connor EL, Scheidt-Nave C, McPhillips JB. Prevalence of cardiovascular and renal complications in older adults with normal or impaired glucose tolerance or NIDDM: a population-based study. Diabetes Care. 1993;16:1022–1025.
5. Saydah SH, Eberhardt MS, Loria CM, Brancati FL: Age and the burden of death attributable to diabetes in the United States. *Am J Epidemiol* 2002, 156:714-719.
6. Kim H-S, Jeong H-S: A nurse short message service by cellular phone in type-2 diabetic patients for six months. *J Clin Nurs* 2007, 16:1082-1087.
7. Look AHEAD Research Group. Reduction in weight and cardiovascular disease risk factors in individuals with type 2 diabetes: one-year results of the look AHEAD trial. Diabetes Care. 2007 June; 30(6): 1374–1383.
8. WHO Expert Committee. Prevention in childhood and youth of adult cardiovascular diseases: time for action. WHO Technical Report Series 792. Geneva. World Health Organisation. 1990; 11-32.