The Effectiveness of Individualized Lifestyle Intervention for Diabetes Prevention and Metabolic Abnormalities



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Introduction

With the change in lifestyle, diabetes has been ranked fifth among the top ten causes of death in Taiwan. Further, hyperglycemia is frequently combined with hypertension and dyslipidemia. The aim of this study is to strengthen diet control and physical activity, and increase knowledge and awareness of high-risk groups of diabetes in community, in order to promote health and reduce the burden of chronic diseases.

Method

Adults who were overweight (BMI≥24kg/m²) and had family history of diabetes were recruited. Baseline BMI, waist, blood sugar, lipid profile, and blood pressure were evaluated. Participants were asked to fill out dietary behavior questionnaire, Behavioral Risk Factor Surveillance System (BRFSS) questionnaire, and Taiwan short form version of International Physical Activity Questionnaire (IPAQ), in order to identify barriers to behavior change. We offered monthly individualized counseling of diet and physical activity for those who were found metabolic abnormalities in pretest. A post-examination was conducted after 6 months to evaluate the effect of lifestyle intervention.

Table 1: Baseline characteristics

$n (%) / mean \pm SD$ Age, yr 46.6 ± 12.0 53.4 ± 10.5 Female sex $96 (71.1)$ $38 (62.3)$ Fasting blood glucose (mg/dL) 91.0 ± 12.9 96.6 ± 15.6 HbA1c (%) 5.9 ± 0.4 6.2 ± 0.5 Triglyceride (mg/dL) 104.0 ± 58.3 120.6 ± 61.5 Total Cholesterol (mg/dL) 193.6 ± 34.1 204.5 ± 40.5 HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	Characteristic	Total subjects N = 135	Subjects with abnormalities in pre-test n = 61			
Age, yr 46.6 ± 12.0 53.4 ± 10.5 Female sex $96(71.1)$ $38(62.3)$ Fasting blood glucose (mg/dL) 91.0 ± 12.9 96.6 ± 15.6 HbA1c (%) 5.9 ± 0.4 6.2 ± 0.5 Triglyceride (mg/dL) 104.0 ± 58.3 120.6 ± 61.5 Total Cholesterol (mg/dL) 193.6 ± 34.1 204.5 ± 40.5 HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	-	n (%)/ mean ± SD				
Female sex96 (71.1) $38 (62.3)$ Fasting blood glucose (mg/dL) 91.0 ± 12.9 96.6 ± 15.6 HbA1c (%) 5.9 ± 0.4 6.2 ± 0.5 Triglyceride (mg/dL) 104.0 ± 58.3 120.6 ± 61.5 Total Cholesterol (mg/dL) 193.6 ± 34.1 204.5 ± 40.5 HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	Age, yr	46.6 ± 12.0	53.4 ± 10.5			
Fasting blood glucose (mg/dL) 91.0 ± 12.9 96.6 ± 15.6 HbA1c (%) 5.9 ± 0.4 6.2 ± 0.5 Triglyceride (mg/dL) 104.0 ± 58.3 120.6 ± 61.5 Total Cholesterol (mg/dL) 193.6 ± 34.1 204.5 ± 40.5 HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	Female sex	96 (71.1)	38 (62.3)			
HbA1c (%) 5.9 ± 0.4 6.2 ± 0.5 Triglyceride (mg/dL) 104.0 ± 58.3 120.6 ± 61.5 Total Cholesterol (mg/dL) 193.6 ± 34.1 204.5 ± 40.5 HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	Fasting blood glucose (mg/dL)	91.0 ± 12.9	96.6 ± 15.6			
Triglyceride (mg/dL) 104.0 ± 58.3 120.6 ± 61.5 Total Cholesterol (mg/dL) 193.6 ± 34.1 204.5 ± 40.5 HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	HbA1c (%)	5.9 ± 0.4	6.2 ± 0.5			
Total Cholesterol (mg/dL) 193.6 ± 34.1 204.5 ± 40.5 HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	Triglyceride (mg/dL)	104.0 ± 58.3	120.6 ± 61.5			
HDL-C (mg/dL) 56.8 ± 13.7 56.1 ± 15.2 LDL-C (mg/dL) 126.6 ± 32.7 135.9 ± 38.2 SBP (mmHg) 125.7 ± 17.0 131.0 ± 18.2 DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	Total Cholesterol (mg/dL)	193.6 ± 34.1	204.5 ± 40.5			
LDL-C (mg/dL)126.6±32.7135.9±38.2SBP (mmHg)125.7±17.0131.0±18.2DBP (mmHg)78.4±11.779.0±12.6	HDL-C (mg/dL)	56.8±13.7	56.1±15.2			
SBP (mmHg)125.7±17.0131.0±18.2DBP (mmHg)78.4±11.779.0±12.6	LDL-C (mg/dL)	126.6 ± 32.7	135.9 ± 38.2			
DBP (mmHg) 78.4 ± 11.7 79.0 ± 12.6	SBP (mmHg)	125.7 ± 17.0	131.0 ± 18.2			
	DBP (mmHg)	78.4±11.7	79.0±12.6			

Result

A total of 135 participants with a mean age of 46 years were enrolled. In baseline evaluation, 23 persons (17.0%) had elevated fasting blood glucose (≥100mg/dl), 43 persons (31.9%) had elevated HbA1c (>6%), 55 persons (40.7%) had hypercholesterolemia (≥200mg/dl), 22 persons (16.3%) had hypertriglyceridemia (\geq 150mg/dl), and 58 persons (43.0%) had high blood pressure $(SBP \ge 130 \text{ mmHg or DBP} \ge 85 \text{ mmHg})$. 61 persons were found metabolic abnormalities in pre-test, and 32 persons completed the post-test after 6 months. Results showed significant reductions in HbA1c, LDL-C, and systolic blood pressure after lifestyle intervention, whereas no changes were found in fasting blood glucose, triglyceride, total cholesterol, HDL-C, and diastolic blood pressure.

Table 2: Outcomes after receiving 6 months of lifestyle intervention (*n*=32)

Parameter	Pre-test	Post-test	Mean difference	P Value	
	mean±SD	mean±SD	(95% C.I.)		Key word:
Fasting blood glucose (mg/dL)	97.3 ± 15.0	100.9 ± 13.8	3.6 (0.5 <i>,</i> 6.6)	0.022*	lifestyle intervention
HbA1c (%)	6.3 ± 0.4	6.2 ± 0.5	-0.1 (-0.2 <i>,</i> -0.02)	0.018*	
Triglyceride (mg/dL)	108.5 ± 49.5	119.2 ± 63.9	10.7 (-5.3 <i>,</i> 26.7)	0.184	Correspondence to:
Total Cholesterol (mg/dL)	204.7 ± 30.0	202.6±34.3	-2.1 (-8.7, 4.5)	0.524	Ming-Ya Hsu
HDL-C (mg/dL)	52.4 ± 11.4	53.5±12.9	1.1 (-0.8, 3.1)	0.250	E-mail address
LDL-C (mg/dL)	141.9 ± 26.9	133.6±31.5	-8.3 (-15.3 <i>,</i> -1.4)	0.020*	
SBP (mmHg)	128.7 ± 17.9	131.2 ± 12.8	2.5 (-3.2 <i>,</i> 8.2)	0.382	myhsu@vghks.gov.tw
DBP (mmHg)	78.1±9.9	79.7 ± 9.8	1.6 (-2.2, 5.4)	0.402	

*p<0.05

Table 3: Outcomes after lifestyle intervention of subjects with abnormality in each parameter in pre-test

Parameter	Subjects with abnor-	Pre-test	Post-test	Mean difference	P Value
	mality in pre-test			(95% C.I.)	
_	n	mean±SD	mean ± SD		
Fasting blood glucose	9	115.33 ± 17.4	117.11 ± 13.8	1.8 (-9.0, 12.6)	0.715
HbA1c	27	6.4 ± 0.4	6.3 ± 0.5	-0.1 (-0.2, -0.0)	0.044*
Triglyceride	5	200.8±35.9	204.8 ± 83.3	4.0 (-83.9, 91.9)	0.906
Total Cholesterol	17	228.8 ± 13.9	225.5 ± 22.8	-3.2 (-11.8 <i>,</i> 5.3)	0.434
HDL-C	8	41.8 ± 3.8	44.5±5.9	2.8 (-0.3, 5.8)	0.068
LDL-C	30	145.2 ± 24.4	137.0±29.2	-8.2 (-15.5, -0.8)	0.031*
SBP	13	146.2 ± 11.8	135.2 ± 12.4	-10.9 (-17.3, -4.6)	0.003**
DBP	10	89.0±2.5	83.3±9.0	-5.7 (-11.9, 0.5)	0.068

Note. Definition of abnormality: Fasting blood glucose \geq 100mg/dL, HbA1c> 6 %, Triglyceride \geq 150 mg/dL, Total Cholesterol \geq 200 mg/dL, HDL-C male< 40 mg/dL female< 50mg/dL, LDL-C \geq 100 mg/dL, SBP \geq 130 mmHg, DBP \geq 85 mmHg. *p<0.05; **p<0.01.

Conclusion

High prevalence of metabolic abnormalities was discovered among the high-risk groups of diabetes in

community. Besides, poor adherence rate hinders outcomes of lifestyle education. Further intensive

intervention and longer follow-up time are required to improve health literacy, and enhance the

effectiveness of lifestyle intervention.

