Original Article

Improvement trend for individual health guidance intervention according to Japan clinical guidelines by public health nurses for type 2 diabetes mellitus who visited for medical checkups regularly: a case-control preliminary report

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We conducted a retrospective case-control study to assess the efficacy of personalized health guidance interventions on individuals with type 2 diabetes mellitus and obesity. A selection was made of individuals in regular visits to the Takagi Hospital for medical checkups between January 2017, and October 2021. Totally, 108 subjects (cases) with health guidance were divided into 2 groups: one group without pharmacotherapy for diabetes mellitus in medical institutions (*n* = 92) and another group with pharmacotherapy (*n* = 116). Cases were provided with personalized health guidance interventions by public health nurses for 30 min, in accordance with the Japanese clinical guidelines for the prevention of lifestyle-related diseases. Sex- and age-matched controls were chosen from individuals with diabetes mellitus without health guidance. The intervention without pharmacotherapy resulted in improvements in health indicators, including body weight, waist circumference, diastolic blood pressure, triglyceride levels, and γ-glutamyl trans-peptidase. These positive effects were not observed in the control group without health guidance. The therapeutic effects of health guidance were observed in cases where pharmacotherapy was administered. In conclusion, the implementation of individual health guidance interventions may prove to be effective for individuals with type 2 diabetes mellitus and obesity who regularly attend medical checkups.

***Key Words*:** **metabolic syndrome, hyperlipidemia, fatty liver, hypertension, medical staff**

The prevalence of obesity and type 2 diabetes mellitus (DM), which are caused by excessive food intake and an irregular lifestyle, has been rapidly increasing worldwide in recent years, affecting both developed and developing countries.[1–4] Related clinical pathological conditions commonly observed are characterized as metabolic syndrome, which is manifested by elevated levels of blood glucose, lipids, blood pressure, and increased waist circumference.[5–7] These conditions can lead to various severe complications such as cardiovascular and/or cerebrovascular disorders, as well as liver dysfunction.[8–14]

Obesity, a condition that leads to metabolic disorders such as type 2 DM and metabolic syndrome, has been addressed through various interventions. These interventions include pharmacotherapy,[15,16] laparoscopic surgery,[17–19] and nutritional and/or lifestyle improvement therapy.[20–26] These therapeutic approaches may not necessarily yield adequate therapeutic outcomes. Therapeutic approach aimed at improving nutrition and/or lifestyle, primarily carried out by an interdisciplinary medical team, has undergone extensive trial and error over an extended period of time, but has not yielded satisfactory results.[20–26]

In Japan, specific health checkups with health guidance intervention have started in 2008 for metabolic syndrome including obesity with type 2 DM.[27,28] The implementation of a nationwide intervention for metabolic syndrome and type 2 DM, in accordance with the Japan clinical guidelines for the prevention of lifestyle-related diseases, has been carried out. However, evaluation of the intervention's outcomes has been deemed insufficient, controversial, and unclear.[29,30] The objective of the current study was to assess the efficacy of individual health guidance intervention in preventing lifestyle-related diseases among individuals with type 2 DM who underwent medical checkups. We conducted a retrospective case-control study to investigate therapeutic effects of health guidance intervention provided by public health nurses on individuals with type 2 DM and obesity who regularly visited the Takagi hospital for medical checkups.[31]

Methods

Subjects of type 2 DM with obesity who visited to Preventive Medical Center of the Takagi hospital for medical checkups including specific health checkups regularly during January 1,

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Table 1. Therapeutic effect of individual health guidance intervention by public health nurses on medical checkups subjects with type 2 diabetes mellitus who did not receive pharmacotherapy (n = 92 in each)

	Individual health guidance (+)		Individual health guidance (–)	
	First	Second	First	Second
Males/females	74/18	—	74/18	—
Age (year)	54.5 ± 7.4	—	54.6 ± 7.6	—
Body weight (kg)	75.4 ± 15.2	73.9 ± 14.8**	74.3 ± 13.6	73.9 ± 12.6
BMI (kg/m^2)	26.7 ± 4.4	26.2 ± 4.3**	26.2 ± 4.2	26.0 ± 3.9
Waist C (cm)	92.7 ± 10.8	91.3 ± 10.6**	91.3 ± 9.59	90.8 ± 9.2
Systolic BP (mmHg)	126.8 ± 13.1	124.1 ± 14.6	124.3 ± 14.9	124.6 ± 15.4
Diastolic BP (mmHg)	83.8 ± 9.5	81.6 ± 10.2**	82.2 ± 11.1	82.6 ± 10.7
FBG (mg/dl)	141.2 ± 25.6	139.7 ± 35.0	141.8 ± 22.8	142.4 ± 32.8
HbA1c (%)	6.8 ± 0.9	6.8 ± 1.1	6.7 ± 1.1	6.8 ± 1.0
HDL-C (mg/dl)	56.5 ± 15.4	56.0 ± 14.5	54.5 ± 12.2	53.9 ± 12.6
LDL-C (mg/dl)	135.2 ± 33.9	132.9 ± 34.4	133.0 ± 31.3	131.5 ± 31.9
Non-HDL-C (mg/dl)	163.0 ± 22.7	150.3 ± 34.7	153.4 ± 31.8	153.9 ± 33.3
Triglycerides (mg/dl)	181.3 ± 141.4	167.4 ± 169.6*	174.7 ± 124.2	190.2 ± 157.7
AST (U/L)	30.3 ± 17.4	27.5 ± 12.2	27 ± 16.2	27.1 ± 16.1
ALT (U/L)	37.4 ± 23.0	33.7 ± 21.6	32.2 ± 21.7	31.7 ± 20.2
γ-GTP (U/L)	68.8 ± 63.8	58.5 ± 62.2**	72.3 ± 76.5	73.2 ± 100.0

Individual health guidance for 30 min by public health nurses was performed in first medical checkups. Values are shown as mean ± SD. *p<0.05 and **p<0.01, compared to the corresponding first (before) visit value by paired t test. BMI, body mass index; Waist C, waist circumference; BP, blood pressure; FBG, fasting blood glucose; HCL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; Non-HDL-C, non high density lipoprotein cholesterol; AST, aspartate aminotransferase; ALT, alanine aminotransferase; γ-GTP, γ-glutamyl trans-peptidase.

2017 to October 31, 2021 were picked up in the present study.[27–30] Type 2 DM subjects with >126 mg/dl of fasting blood glucose who visited the Takagi hospital at least 2 times (before and after) for medical checkups during the observation period were enrolled in the present study. Most of subjects received medical checkups annually, and other subjects received once every 2 years. Totally, 208 DM subjects were examined in the present study. DM subjects who received individual health guidance intervention (cases) in the first (before) visit were divided into two groups: DM subjects without pharmacotherapy in medical institutions (n = 92), and DM subjects who received pharmacotherapy for DM in medical institutions (n = 116). At the first visit (before), cases received individual health guidance intervention by public health nurses or nurses with instruction of public health nurses around 30 min according to the clinical guidelines in Japan of the specific health guidance intervention for prevention of lifestyle-related diseases.[27–29] Sex- and age-marched controls were selected from DM subjects of medical checkups without individual health guidance intervention in each group. Subject-related clinical data were detected before (first) and after (second) individual health guidance intervention. Age, body weight, height, waist circumference, fasting blood glucose, HbA1c, high density lipoprotein cholesterol, low density lipoprotein cholesterol, non-high density lipoprotein cholesterol, triglycerides, aspartate aminotransferase, alanine aminotransferase, and γ-glutamyl trans-peptidase were evaluated in the both groups of cases and controls. The present study was conducted by the Declaration of Helsinki, and the protocol was approved by the Kouhou-kai ethical committee (KR018).

The data were compared between first and second visits using paired t test for continuous variables. Change in first and second visits were compared between case with individual health guidance and controls without guidance using multivariate logistic regression analyses. The analysis was performed for DM subjects stratified by pharmacotherapy (yes or no). Odds ratios and 95% confidence intervals were shown in tables. Statistical significance was defined as p<0.05. R ver. 4.2.3 and JMP Pro 16.1.0 (SAS Institute Inc., Cary, NC) were used for all analyses.

Results

Table 1 showed therapeutic effects of individual health guidance intervention performed by public health nurses on medical checkups subject on type 2 DM with obesity. DM subject did not receive pharmacotherapy. Subjects received individual health guidance intervention at first visit. After health guidance intervention, body weight (p<0.01), BMI (p<0.01), waist circumference (p<0.01), and diastolic blood pressure (p<0.01) of cases were improved at second visit of one or two years after. Serum triglyceride (p<0.05) and γ-glutamyl trans-peptidase (p<0.01) were improved after health guidance intervention. These factors were not improved in controls without health guidance intervention. As indicated in Table 2, change between first and second visits was not different between cases with intervention and controls without intervention.

As indicated in Table 3, several factors were improved after individual health guidance intervention by nurses in subjects who received pharmacotherapy in medical institutions. Namely, body weight (p<0.01), BMI (p<0.01), and waist circumference (p<0.01), were improved. In concomitant with these improvements, fasting blood glucose (p<0.01), HbA1c (p<0.01), non-high density lipoprotein (p<0.05), triglyceride (p<0.05), aspartate aminotransferase (p<0.05), alanine aminotransferase (p<0.05), and γ-glutamyl trans-peptidase (p<0.01) were lean towards normalization. These improvements were detected in controls who received pharmacotherapy but not individual health guidance intervention. In controls, body weight (p<0.01), BMI (p<0.01), systolic blood pressure (p<0.01), HbA1c (p<0.05), and γ-glutamyl trans-peptidase (p<0.01) were recovered. Changes between first and second visits was evaluated as indicated in Table 4. There was no significance difference regarding improvement between cases with intervention and controls without intervention.

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Table 2. Relationships between case with individual health guidance intervention and control without intervention by multivariate logistic regression analysis among diabetes mellitus subjects without pharmacotherapy

Variables	Odd ratios	95% confidence interval	*p* value
Body weight	0.96	0.73–1.26	0.76
Waist circumference	0.92	0.68–1.25	0.60
Systolic blood pressure	1.06	0.98–1.15	0.16
Diastolic blood pressure	0.88	0.78–1.01	0.07
Fasting blood glucose	1.00	0.96–1.05	0.94
HbA1c	1.72	0.26–11.6	0.58
HDL-cholesterol	1.02	0.91–1.14	0.75
LDC-cholesterol	0.96	0.89–1.04	0.34
Non-HDL-cholesterol	1.05	0.97–1.14	0.27
Triglycerides	0.99	0.98–1.01	0.68
Aspartate aminotransferase	1.02	0.96–1.09	0.49
Alanine aminotransferase	1.02	0.97–1.07	0.43
γ-Glutamyl trans-peptidase	0.99	0.97–1.01	0.191

Variables were basing on the change in first (before) and second (after) visits. HDL, high density lipoprotein; LDL, low density cholesterol.

Table 3. Therapeutic effect of individual health guidance intervention by public health nurses on medical checkups subjects with type 2 diabetes mellitus who received pharmacotherapy (n = 116 in each)

	Individual health guidance (+)		Individual health guidance (–)	
	First	Second	First	Second
Males/females	93/23	—	93/23	—
Age (year)	56.6 ± 7.0	—	56.6 ± 7.0	—
Body weight (kg)	75.1 ± 14.9	73.5 ± 13.8**	74.4 ± 13.9	73.5 ± 13.8**
BMI (kg/m^2)	26.9 ± 4.4	26.5 ± 4.0**	26.2 ± 3.7	25.9 ± 3.7**
Waist C (cm)	94.1 ± 10.9	92.6 ± 10.3**	91.9 ± 10.0	91.5 ± 10.0
Systolic BP (mmHg)	123.2 ± 13.0	121.5 ± 13.6	124.3 ± 15.1	121.9 ± 11.9*
Diastolic BP (mmHg)	80.2 ± 10.1	79.4 ± 9.9	81.5 ± 9.0	80.0 ± 7.9
FBG (mg/dl)	161.6 ± 37.3	146.1 ± 33.2**	155.7 ± 32.4	147.0 ± 28.7
HbA1c (%)	7.7 ± 1.2	7.3 ± 0.9**	7.7 ± 1.2	7.3 ± 0.8*
HDL-C (mg/dl)	53.9 ± 13.7	54.8 ± 14.1	53.9 ± 12.8	54.4 ± 13.7
LDL-C (mg/dl)	118.2 ± 27.9	114.8 ± 26.6	118.5 ± 23.6	115.4 ± 25.2
Non-HDL-C (mg/dl)	133.7 ± 33.5	126.8 ± 31.1*	132.4 ± 27.5	129.6 ± 30.1
Triglycerides (mg/dl)	160.2 ± 148.1	136.6 ± 78.8*	149.8 ± 85.2	146.5 ± 84.4
AST (U/L)	28.0 ± 16.0	24.4 ± 10.6*	26.3 ± 13.8	25.0 ± 12.0
ALT (U/L)	35.6 ± 24.5	29.9 ± 17.0*	34.3 ± 23.4	31.3 ± 19.1
γ-GTP (U/L)	52.2 ± 51.7	39.6 ± 28.4**	49.0 ± 46.3	46.3 ± 63.7**

The individual health guidance for 30 min by the public health nurse was performed in first medical checkups. Values are shown as mean ± SD. *p<0.05 and **p<0.01, compared to the corresponding first (before) visit value by paired t test. BMI, body mass index; Waist C, waist circumference; BP, blood pressure; FBG, fasting blood glucose; HCL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; Non-HDL-C, non high density lipoprotein cholesterol; AST, aspartate aminotransferase; ALT, alanine aminotransferase; γ-GTP, γ-glutamyl trans-peptidase.

Discussion

The present retrospective case-control study yielded several findings. Firstly, it was observed that individual health guidance intervention provided by public health nurses had a positive impact on subjects with type 2 DM who did not receive pharmacotherapy. These subjects visited for regular medical checkups, including specific health checkups. The intervention resulted in improvements in various metabolic syndrome-related factors, such as body weight, BMI, waist circumference, diastolic blood pressure, serum triglyceride levels, and γ-glutamyl transpeptidase levels. These effects were not observed in controls who did not receive health guidance. Secondly, the study also found that individual health guidance by public health nurses had therapeutic effects on type 2 DM subjects who received pharmacotherapy in medical institutions.

The present study suggested that individual health guidance intervention of public health nurses, according to the clinical guideline in Japan of the specific health guidance intervention for prevention of lifestyle-related diseases,[27–29] could potentially enhance various improve syndrome-related factors. These factors include waist circumference, body weight (as measured by BMI), diastolic blood pressure, and triglyceride levels. Several prior studies conducted in Japan have reported controversial and

Table 4. Relationships between case with individual health guidance intervention and control without intervention by multivariate logistic regression analysis among diabetes mellitus with pharmacotherapy

Variables	Odd ratios	95% confidence interval	*p* value
Body weight	0.92	0.78–1.09	0.34
Waist circumference	0.10	0.86–1.16	0.97
Systolic blood pressure	1.02	0.98–1.06	0.35
Diastolic blood pressure	1.01	0.95–1.08	0.76
Fasting blood glucose	0.10	0.99–1.01	0.94
HbA1c	1.01	0.70–1.51	0.98
HDL-cholesterol	0.98	0.91–1.05	0.50
LDL-cholesterol	0.98	0.91–1.04	0.45
Non-HDL-cholesterol	1.02	0.96–1.09	0.51
Triglycerides (mg/dl)	0.10	0.98–1.01	0.50
Aspartate aminotransferase	0.95	0.89–1.02	0.16
alanine aminotransferase	1.03	0.99–1.07	0.16
γ-Glutamyl trans-peptidase	0.99	0.98–1.00	0.17

Variables were basing on the change in first (before) and second (after) visits. OR, odds ratio; HDL, high density lipoprotein; LDL, low density cholesterol.

conflicting results regarding the effectiveness of the nationwide health guidance intervention for individuals with metabolic syndrome and/or type 2 DM.[29,30] The positive results of the current study may be attributed to the focused selection of participants who regularly visited the Takagi hospital for medical checkups.[31] This approach aimed to address one of the primary challenges in implementing nutritional and/or lifestyle interventions, which is the high dropout rate among subjects in previous studies.[20,23,24,32,33]

Therapeutic approach of health guidance intervention by nurses was found to be effective in the present study for individuals with DM who were also receiving pharmacotherapy. The study suggests that health guidance had a cumulative influence, even on subjects who regularly visited medical institutions. Specifically, it is worth exploring the potential impact of providing repeated lifestyle guidance on individuals with obesity-induced DM. This investigation is necessary to assess the efficacy of the clinical guidelines in Japan for preventing lifestyle-related diseases.

The present study was subject to several limitations. Firstly, the number of subjects was limited to those from a single institution. Secondly, the tested subjects were selected from individuals who regularly visited medical checkups, introducing a potential selection bias. Thirdly, the evaluation of the intervention was conducted only once, either after one or two years. Fourthly, there was a gender bias towards males in the study sample. Lastly, the multivariate analysis used to assess the difference between pre- and post-intervention health guidance did not identify the specific factors contributing to the observed improvement. The aforementioned limitations suggest that the positive outcome may not be directly applicable to the implementation of clinical guidelines in Japan regarding specific health guidance interventions for the prevention of lifestyle-related diseases.[27–29]

In conclusion, the current case-control study has demonstrated the potential therapeutic benefits of individual health guidance intervention provided by public health nurses, in accordance with the Japan clinical guidelines for the prevention of lifestyle-related diseases. This intervention was observed to be effective in managing type 2 DM in obese individuals who regularly visited the Takagi hospital for medical checkups. Need for further explanation arises due to long-term follow-up and increase in number of subjects, in order to confirm the effectiveness of individual health guidance in accordance with the clinical guidelines in Japan.

Conflict of Interest

No potential conflicts of interest were disclosed.

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