ORIGINAL ARTICLE

Effectiveness of a Dietitian-led Healthy Lifestyle Education Package in Improving Health Behaviours of Stroke Survivors in Malaysia: A Pilot Study

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ABSTRACT

INTRODUCTION: Despite a higher risk of a recurrent cerebrovascular event, many stroke survivors failed to achieve their targeted treatment goals. This study aimed to examine the effectiveness of a dietitian-led healthy lifestyle educational package targeted at improving stroke risk factors and lifestyle practices among stroke survivors. **MATERIALS AND METHODS**: A quasi-experimental pilot study was undertaken in general medical wards of two public hospitals in Malaysia. Patients were allocated into either intervention or control groups based on the week of screening. Adults aged more than 18 years old, with first-ever stroke, and whose caregivers willing to participate were included. The intervention group (patient-caregiver dyad) received three dietitian-led healthy lifestyle education sessions underpinned with Health Belief Model and Reflection and Refractive theories and was followed up for three months. The control group received the usual stroke care. Outcome variables included blood pressure, body mass index, waist circumference, dietary intake, physical activity levels, smoking status, alcohol consumption, malnutrition risk, and health-related quality of life. McNemar, Chi-square, and repeated measures Analysis of Covariance tests were conducted to examine the within - and between-group differences. **RESULTS**: A total of 54 participants (27 in each group) were included in this study. The intervention group had a significantly lower intake of sugar (P=0.002, effect size=0.50) and sodium (P=0.044, effect size=0.31), a lower proportion of active smokers (7% versus 33%, P=0.039), lesser sitting time (P=0.012, effect size=0.37), and lower proportion having pain/discomfort issues (22% versus 63%, P=0.005) than the control group. **CONCLUSION**: Early dietitian-led lifestyle modification sessions underpinned with behavioural change theories paired with the involvement of family members appear to be beneficial among stroke survivors.

Keywords
healthy lifestyle, stroke, patient education

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INTRODUCTION

Stroke survivors are at high risk of recurrent stroke if no prevention strategies are undertaken. The cumulative risk of recurrent stroke is 11% within the first year, 26% in the fifth year, and 39% in ten years.[1] Many studies, however, consistently revealed that many stroke survivors failed to achieve the targeted treatment goals and continued to have poor lifestyle practices.[2-4] A study in the East-Coast Region of Malaysia revealed that half of the stroke survivors (n=398) attending outpatient departments in hospitals had elevated blood pressure, 65% were overweight and obese, 65% had low physical activity, and most of them failed to achieve dietary recommendation goals for fibre (96%), saturated fatty acids (80%), and sodium (43%).[5] The reasons for this phenomenon are not clear. However, it may be linked to both unique patient characteristics and physician-related factors. These include inadequate follow-up and monitoring by health practitioners, suboptimal secondary prevention therapies, underuse of healthcare utilities, inadequate information provision on secondary prevention, poor knowledge and risk awareness, inadequate self-management of risk factors, and barriers in initiating healthy lifestyle modifications.[6-8]

Non-pharmacological or lifestyle intervention is a relatively new concept in secondary stroke prevention, and it has been advocated in most of the clinical guidelines since 2014.[9] The efficacy of these lifestyle interventions in secondary stroke prevention is limited and inconsistent.[9,10] Lawrence et al. (2015) demonstrated that behavioural interventions could lead to a reduction of blood pressure (BP), waist circumference (WC), and anxiety, yet increased compliance with antithrombotics and statins. Despite this, no significant changes were reported for body mass index, diet, lipid and glucose parameters, and recurrent TIA/stroke. Additionally, most of these intervention studies were conducted in Western countries, with limited evidence in Asian countries.[11–18] Most of these studies were led by either nurses or physicians, with a few of them involving a dietitian.[19]

Although most intervention studies recruited patients in the early phase of stroke, only one-third provided early education intervention in the ward.[20] The best mode of intervention is unknown, yet some studies appeared to contribute more positive outcomes than others (at least three positive changes). These studies shared some common intervention strategies, including continuous face-to-face education sessions (from inpatient to outpatient) with frequent contact (weekly to once in two months), the use of physical or exercise training, and behavioural change strategies.[21-25] Moreover, only a few studies were informed by behavioural change theories, although half employed behaviour change techniques, namely goal setting, action planning, feedback and motivation, and problem-solving. Besides, only two studies mentioned family members' involvement during the recruitment, indicating the underutilization of social support in the secondary prevention stroke research.[20] Hence, the need for more effective and feasible strategies to assist stroke survivors in achieving treatment goals and healthy lifestyle changes is highly warranted. The purpose of this pilot study was to examine the efficacy of a dietitian-led healthy lifestyle education package underpinned by behavioural theories with the involvement of family members in improving modifiable stroke risk factors of individuals with stroke or TIA in Malaysia.

MATERIALS AND METHODS

Study design, setting, and duration

A quasi-experimental pilot study was conducted in Pahang, Malaysia, from July 2020 to December 2020. This pilot study was conducted at two hospitals, namely Sultan Haji Ahmad Shah Hospital, Temerloh (HoSHAS), and Tengku Ampuan Afzan Hospital, Kuantan (HTAA). Participants were recruited at the medical wards, and these participants later received follow-ups throughout their three-month time in the rehabilitation department.

Participants

A clinically trained dietitian conducted all the screening, educational activities, and assessment during the study period, rotating from one hospital to another. The dietitian screened all first-ever stroke individuals for eligibility during their admission (within 24-48 hours) to the general medical wards during the ward round with the stroke/medical team. The inclusion criteria were a clinical diagnosis of stroke [ischaemic (thrombosis or embolic) or TIA or haemorrhagic (intracerebral or subarachnoid)]; both patient and caregiver willing to participate and the ability to communicate in Bahasa Melayu. The exclusion criteria were those aged under 18 years old; causes of stroke not related to modifiable lifestyle-related risk factors; have organ failures or severe psychiatric illness; on tube feeding; have severe visual/speech/cognitive impairment [Mini Mental State Examination (MMSE) <20]; and suffered from any systemic disease limiting the capability to exercise.[26,27]

Recruitment and assignment of group

The ratio of participants in the intervention and control groups was 1:1. The participants were assigned to either the intervention group (IG) (1st, 3rd, and 5th week) or the control group (CG) (2nd and 4th week) based on the week of screening (Figure 1). This was to minimise the chances of interaction between the two groups. Since it was a quasi-experimental pilot study, thus no randomisation or blinding was made. The data collectors or outcome

adjudicators could not be blinded since only the principal investigator was involved. The quasi-experimental study design was chosen because it is less expensive, time-consuming, and more practicable than random controlled trials.

Study Procedure

The dietitian conducted an assessment of socio-demographic characteristics, clinical profiles, lifestyle behaviours, Stroke Prevention Knowledge scores, and health-related quality of life through face-to-face interviews using different validated questionnaires and a review of the medical record. Additionally, direct measurements such as blood pressure, weight, height, waist circumference (WC), mid-upper arm circumference (MUAC), calf circumference (CC), and knee height (KH) were also conducted by using different validated measuring tools.

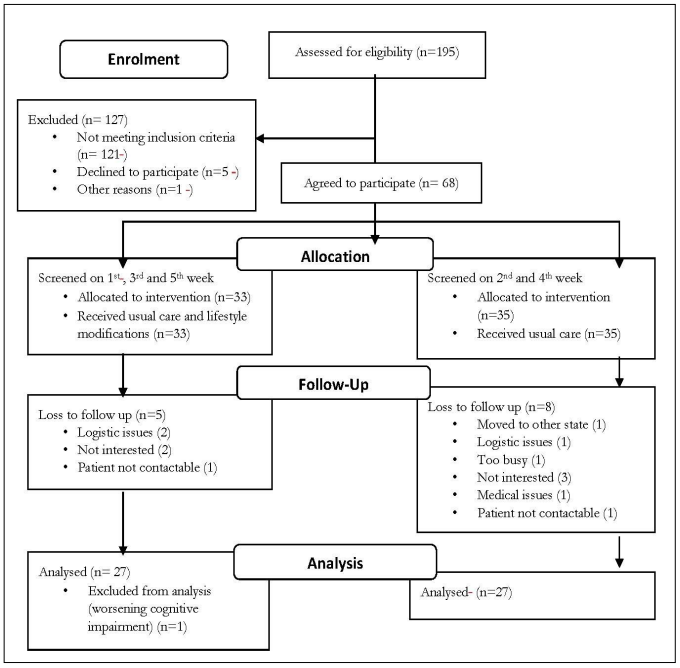

Figure 1 Consort diagram

Standard stroke care

Both the intervention and control groups received standard stroke care provided in the medical wards. These included pharmacological therapy and verbal lifestyle advice in line with the Malaysian Clinical Practice Guidelines for Acute Stroke Management in the ward.[28] All the participants continued post-discharge care at their nearest primary health clinics. After the baseline assessment in the ward, the control group was required to come for an outcome assessment in the third-month post-stroke. After the outcome assessment, the control group received individualized lifestyle education similar to those received by the intervention group.

Intervention

Apart from the usual stroke care, the intervention group and their caregivers received additional three educational sessions (two inpatients and one outpatient session) led by a dietitian. The first two education sessions were conducted in the ward, meanwhile, the third session was delivered either at the first- or second-month post-stroke at the rehabilitation department. The respondents were provided with a date for outcome assessment in the third month after the stroke.

The intervention group was provided with a booklet and logbook. The educational curriculum and written materials were developed based on input from a need analysis conducted on local settings (quantitative and qualitative studies), previous literature, clinical practice guidelines, opinions from expert panels and healthcare providers, input from stroke survivors and their caregivers, and behavioural theories (Health Belief Model and reflection and reflective theory).[5,29–33] The educational sessions emphasise four main aspects related to stroke prevention, namely the introduction of stroke, primary diseases management, lifestyle modifications, and additional information on preventive medications, malnutrition risk, and food taboos. The first educational session is intended to assist patients to be aware of their susceptibility and severity of recurrent stroke or cardiovascular events. The second session focused on increasing their understanding of how lifestyle modifications can help in managing underlying comorbidities, reducing the susceptibility of future stroke, and bringing in health benefits. The third session focused on discussing barriers faced while making changes and tips to overcome them. The program also intended to increase confidence to adopt health behaviours despite existing barriers. Cooperation between caregiver and participant in preparing a conducive environment at home for lifestyle changes was also emphasised.

In order to encourage reflection practices, the intervention group was provided with a logbook to assist them in self-monitoring and reflecting on lifestyle practices at home. Activities included in the logbook were reflecting personal stroke risk factors, writing diaries for blood pressure, glucose, lipid profiles, INR, physical activity, and BMI, as well as food label reading, menu planning, and action planning. Besides, personal goals and strategies to achieve better disease management were also discussed. The flow chart of the research activities and education program's curriculum was shown in Figure 2 and Appendix 1, respectively.

Criteria for withdrawal

Participants could withdraw from the study at any time for different reasons. A participant will also be withdrawn if one of the following applies: i) Pregnancy during the study period, ii) Suffered from life-threatening medical issues; and iii) Had premature death. In order to improve the retention rate of participants, a few strategies were adopted, including providing financial incentives, sending reminders for upcoming visits, frequent communication with the participants, recruiting family members in the study, showing appreciation and recognition, and conducting the assessment procedures at an opportune time (same appointment with doctor appointment at rehabilitation centre). The withdrawn participants were not replaced in this study since the number of participants met the minimum sample required.

Data collection procedure

The data collection started with the screening of all stroke patients in the medical ward based on the selection criteria. Then, the principal researcher conducted a baseline assessment among the eligible stroke patients and their caregivers. Anthropometric measurements such as weight, height, WC, MUAC, CC, and KH were also conducted. The participants were assigned to either the intervention group (IG) or the control group (CG) based on the week of screening. Both groups received usual stroke care meanwhile the intervention group received an additional three individual educational sessions (two inpatient sessions and one outpatient session) led by a dietitian. Both groups were required to attend an outpatient appointment at the rehabilitation department for outcome assessment in the third-month post-stroke. After the outcome assessment, the control group was provided with an individual stroke education session (60-90 minutes) using the same education materials developed for the intervention group.

Study variables

Baseline characteristics on socio-demographics and clinical profiles

Respondents' demographic characteristics included age, sex, race/ethnicity, working status, household income, and educational level were collected. Clinical data such as stroke subtype(s), underlying disease(s), current medical diagnosis, the severity of stroke [National Institutes of Health Stroke Scale (NIHSS)], and pre-discharged medications were abstracted from the respondents' medical records.

Primary and secondary outcome variables were measured during baseline (before discharge) and 3rd-month post-stroke.

Primary outcome variables

a) Blood pressure (BP), body mass index (BMI), and waist circumference (WC)

BP (Omron Model HEM-7203, Japan), weight (Tanita BC -541, USA), height (Seca 213, USA), and WC (stretch-resistant tape) of participants were measured using different instruments following the manual instruction. BMI was calculated from the obtained data. All measurements were taken twice, and the mean values were calculated.

b) Dietary intake

The participants were required to recall their dietary intake using a two-day 24-hour dietary recall (one weekday and one weekend). The diet recall was conducted by a trained dietitian face to face individually aided with household measuring tools (e.g cup, teaspoon, bowl, etc). Nutrient

intake in terms of energy, carbohydrate (CHO), fat, saturated fatty acids (SFA), cholesterol (Chol), added sugar, sodium (Na), and fibre were calculated using the Nutritionist Pro™ Nutrition Analysis software.

c) Physical activity (PA) levels

The short Malay version of the International Physical Activity Questionnaire (IPAQ) was used to assess the PA levels of participants.[34] It consisted of seven items in four activity domains, which include vigorous, moderate, walking, and sitting. The metabolic equivalent of task values-minutes per week (MET-min week−1) was estimated using the formula: minutes of activity/day × days per week × MET level.[35]

d) Smoking and alcohol consumption

The participants were asked about their smoking status, namely never smoked, former smoker, or current smoker. The number of cigarettes consumed daily was recorded for active smokers. The participants were also asked about their alcohol consumption status ("Yes" or "No"). Information on the type(s), amount, and frequency of alcohol consumption were obtained for active drinkers.

Secondary outcome variables

a) Adherence to secondary preventive medications

The participants' medication adherence was assessed by asking whether they took specific medication according to doctor's prescriptions and pharmacists' instructions ("Yes" or "No").

b) Malnutrition risk

The malnutrition risk was examined using five items in the Malnutrition Risk Screening Tool-Hospital (MRST-H) scale.[36] The scale included questions on financial dependency, feeding dependency, and unintentional weight loss as well as anthropometric measurements on mid-upper arm circumference and calf circumference. A score is given to each question with a positive answer (maximum score of 8). The MRST-H had 67% sensitivity, 90% specificity, and excellent diagnostic accuracy in discriminating the malnourished group with an area under the curve of 0.84.[36]

c) Health-related quality of life (HRQoL)

The Malay version of ED-5Q-5L was used to assess the participants' HRQoL. Respondents were classified as either having no problem or with problems (slight to extreme problems) in each specific dimension of HRQoL, namely mobility, self-care, usual activities, pain/ discomfort, and anxiety/depression. Besides, they were also required to self-rate "their health today" based on a scale of 0–100 (from worst to best score) using the VAS. The ED-5Q had acceptable internal consistency coefficients with Cronbach's alpha values of 0.58 and 0.59.[37]

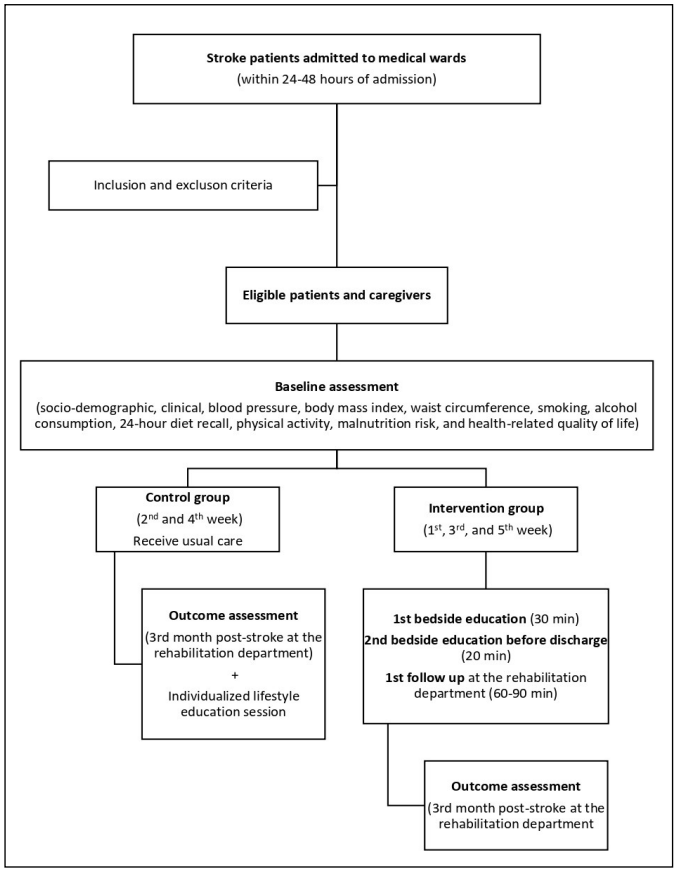

Figure 2 Flow chart of research activities

ETHICS APPROVAL

The study protocol obtained approval from the Ministry of Health Malaysia [NMRR-19-4024-47231 (IIR)] and Universiti Sultan Zainal Abidin Research Ethics Committee [UniSZA/UHREC/2019/102]. Written

informed consent was obtained from either stroke patients or their caregivers if they were having mild to moderate cognitive impairment (MMSE 21-28).

STATISTICAL ANALYSIS

SAMPLE SIZE CALCULATION

Kono et al. (2013) showed that the difference in sodium intake between the control and intervention groups was 760 mg/day; meanwhile, the within-group standard deviation was 320 mg/day. Using the Power and Sample Size Programme software, the expected detected difference in sodium intake between groups at 250 mg, within-group standard differences at 320 mg, a ratio between control and intervention individuals at 1, along with a 15% drop-out rate, a power of 0.8, and a significance level of 0.05, the desired sample size was 64 participants (32 in each group).

Analysis of results

Statistical Package for the Social Sciences (SPSS) version 25.0 was used to conduct all analyses. Baseline characteristics were compared between the two groups using the Chi-square test or Fisher's exact test for the categorical variables, and the independent t-test for the continuous variables. Repeated measures of analysis of covariance (RMANCOVA) and Bonferroni-corrected contrast were used to assess the within-group differences in the mean of the continuous outcome variables. The between-group differences were examined after being adjusted for different covariates in different models. For example, age, gender, diabetic status, and baseline energy intake were controlled when assessing BMI and WC status. Model assumptions, namely normality of residuals, homogeneity of variance, and compound symmetry were verified. The interaction between dependent variables and covariates were also checked. We transformed the physical activity levels (MET-min week−1) into log10 MET-min week−1 in order to meet the normality assumption of the RMANCOVA analysis. The McNemar and Chi-square tests were employed to compare differences in the categorical variables within- and between-group, respectively three months post-stroke. A *P*-value<0.05 for a two-sided test was considered statistically significant. The effect size (Cohen's F) was defined as f=0.1, small effect, f=0.25, medium effect, and f =0.40, large effect for the behavioral science.[38]

RESULTS

BASELINE CHARACTERISTICS OF PARTICIPANTS

A total of 195 stroke participants were screened from July to October 2020, in which 68 out of 73 eligible participants consented to participate (Figure 1). However, 13 participants dropped out during the follow-up session due to different reasons. We excluded a participant from the intervention group during data analysis since we had observed worsening cognitive status during the follow-up session. Thus, only 54 participants (27 in each group) were included which is equivalent to an 81% response rate. The baseline characteristics of the participants are presented in Table I. In general, there were no significant differences between the two groups at the baseline. Caregivers involved in the study was either spouse or children of the participants. For participants who were either single, widowed, or divorced without children, their caregivers were siblings or parents.

Outcome parameters

This pilot study found that both groups had a significant increment of diastolic blood pressure (DBP), improvements in dietary habits (reduction of fat, Chol, SFA, sugar, and Na but increment of fibre intake), and health-related quality of life (self-care, usual activity, and VAS) based on time (Table II). Despite this, some changes in parameters were observed only within a specific group. For example, a significant reduction in WC, energy, CHO, and pain/discomfort was observed in the intervention group. In contrast, the control group had significantly reduced their PA level, increased their sitting hours, and faced lesser mobility problems. This study did not report on changes in alcohol consumption since none of the respondents was an alcoholic drinker during baseline and outcome assessment.

In addition, the between-group differences regardless of

Table I Comparison of sociodemographic and clinical characteristics between intervention and control group (n=54)

Variables	Total (n=54) n (%)	Intervention group (n=27) n (%)	Control group (n=27) n (%)	X^2 Statistic (df)	*P*-value[a]
Age (mean ±SD), years old	55.26±9.94	56.04±9.88	54.48±10.13	0.57 (52)[c]	0.570[b]
Sex					
Male	27 (50.0)	10 (37.0)	17 (63.0)	3.63 (1)	0.102
Female	27 (50.0)	17 (63.0)	10 (37.0)		
Ethnicity					
Bumiputra	48 (89.9)	24 (88.9)	24 (88.9)	-	1.000[c]
Non-bumiputra	6 (11.1)	3 (11.1)	3 (11.1)		
Educational level					
Primary or less	22 (40.7)	13 (48.1)	9 (33.3)	1.23 (1)	0.406
Secondary and tertiary	32 (59.3)	14 (51.9)	18 (66.7)		
Marital status					
Married	41 (75.9)	19 (70.4)	22 (81.5)	0.91 (1)	0.526
Single/widowed/divorced	13 (24.1)	8 (29.6)	5 (18.5)		
Working status					
Working	30 (55.6)	13 (48.1)	17 (63.0)	1.20 (1)	0.412
Not working	24 (44.4)	14 (51.9)	10 (37.0)		
Income status (MYR)					
< 1000	11 (20.4)	9 (33.3)	2 (7.4)	-	
1000-1999	17 (31.5)	9 (33.3)	8 (29.6)		0.061[c]
2000-2999	8 (14.8)	2 (7.4)	6 (22.2)		
≥ 3000	18 (33.3)	7 (25.9)	11 (40.7)		
Types of strokes					
Ischaemic	44 (81.5)	23 (85.2)	21 (77.8)	-	
Haemorrhagic	4 (7.4)	0 (0.0)	4 (14.8)		0.095[c]
TIA	6 (11.1)	4 (14.8)	2 (7.4)		
Severity of stroke[f]					
0-4 (minor)	40 (74.1)	20 (74.1)	22 (81.5)	-	0.745[c]
5-20 (moderate)	12 (18.5)	7 (25.9)	5 (18.5)		
Underlying diseases					
Hypertension	50 (92.6)	25 (92.6)	25 (92.6)	-	1.000
Diabetes Mellitus	19 (35.2)	7 (25.9)	12 (44.4)	2.13 (1)	0.254
Dyslipidemia	46 (85)	23 (85.2)	23 (85.2)	-	1.000
Atrial fibrillation	5 (9.3)	2 (7.4)	3 (11.1)	-	1.000[c]
Medication prescribed					
Antihypertensive	43 (79.6)	23 (85.2)	20 (74.1)	1.03 (1)	0.501
Antidiabetic	17 (31.5)	5 (18.5)	12 (44.4)	4.21 (1)	0.077
Cholesterol-lowering	53 (98.1)	27 (100.0)	26 (96.3)	-	1.000[c]
Antiplatelet	5 (9.3)	27 (100.0)	23 (85.2)	-	0.111[c]
Anticoagulant	4 (7.4)	2 (7)	2 (7)	-	1.000[c]
MMSE (Median±IQR)	28.0±3.0	28.0±4.0	28.0±2.0	-	0.692[d]

Note: MMSE= Mini Mental Screening Examination; TIA= Transient Ischaemic Attack; MYR= Malaysia Ringgit

[a]Chi-square test for independence; [b]Independent-t-test; [c]Fisher test for independence; [d]Mann-Whitney U test; [e]t-statistic (df); [f]Severity of stroke measured by the National Institutes of Health Stroke Scale (NIHSS); Significance level $P < 0.05$.

time were significant for nutrients intake namely sugar (F=11.25, *P*=0.002, effect size=0.50) and sodium (F=4.30, *P* =0.044, effect size=0.31) as well as sitting hours (F=6.89; *P*=0.012; effect size=0.37). Additionally, a significantly lower proportion of the intervention group were active smokers (7% versus 33%, *P*=0.039) and complained of pain/discomfort issues (22% versus 63%, *P*=0.005) when compared to the control group at the 3rd-month post-stroke (Table III).

Nevertheless, the magnitude of change (group*time) was significant for DBP (*P*=0.040, effect size=0.31), WC (*P*=0.033, effect size=0.32), fat intake (*P*=0.034, effect size=0.32), SFA intake (*P*=0.013, effect size=0.38), sitting hours (*P*<0.001, effect size=0.67), and PA (*P*=0.001, effect size=0.51). Although not significant, this pilot study observed that a higher proportion of patients in the intervention group compared to their counterparts adhered to the antihypertensive (83% versus 61%, *P*=0.111) and antidiabetic medicines (100% versus 69%, *P*=0.278) (Table IV).

DISCUSSION

The findings on the insignificant improvement of BP over time concur with previous studies which employed chronic care-based intervention and nurse-led education programmes.[11,22,39] Despite this, we did observe that the intervention group had lesser DBP increment as compared to the control group. Furthermore, there were no significant group differences in the fidelity to medical follow-up, antihypertensive prescription, intensification, and adherence, indicating that the lesser DBP increment in the intervention group might be partly due to the lower sodium intake in the intervention group than the control group (2016mg versus 2758mg).

Similarly, we had observed promising results on obesity parameters, where a greater reduction in BMI and WC was observed in the intervention group than in the counterparts. These might be explained by a greater reduction in energy intake and reduced sitting hours among the intervention group. However, the physical

Table II Comparison of continuous outcome variables within each group based on time and between groups regardless of time and concerning the time

Variable	Groups						Within group	Between groups			Group*time	
	Intervention (mean±SD)			Control (mean±SD)								
	Baseline	3rd month	*P*-value	Baseline	3rd month	*P*-value	*P*-value	*P*-value	F-stat (df)	Cohen's F	*P*-value	Cohen's F
SBP	152.67±17.70	152.13±25.24	0.889	142.94±22.01	147.32±25.05	0.288	0.492	0.364	0.84 (1)	0.14	0.112	0.24
DBP	82.15±9.66	87.15±11.25	0.014	79.28±13.54	91.80±14.06	<0.001	<0.001	0.788	0.07 (1)	0.04	0.040	0.31
BMI	28.06±6.07	27.44±5.47	0.103	28.05±5.81	27.90±5.35	0.608	0.105	0.940	0.01 (1)	0.00	0.429	0.11
WC	93.73±12.44	91.54±11.58	0.010	94.45±13.91	94.84±12.59	0.609	0.121	0.861	0.03 (1)	0.03	0.033	0.32
Energy	2034.50±445.89	1712.69±370.66	<0.001	2169.03±515.49	2042.94±571.12	0.175	<0.001	0.291	1.14 (1)	0.16	0.108	0.24
CHO	274.07±76.52	241.64±51.43	0.009	300.86±77.20	296.05±76.69	0.732	0.047	0.069	3.45 (1)	0.00	0.119	0.23
Fat	72.83±21.69	50.98±16.73	<0.001	74.16±22.71	64.83±27.26	0.029	<0.001	0.614	0.26 (1)	0.00	0.034	0.32
Chol	236.49±109.46	152.90±46.83	<0.001	261.03±112.97	193.75±64.26	0.001	<0.001	0.284	1.18 (1)	0.16	0.333	0.14
SFA	34.71±10.99	21.54±10.37	<0.001	36.93±14.39	31.29±15.57	0.014	0.001	0.275	1.22 (1)	0.16	0.013	0.38
Sugar	43.65±19.74	18.86±16.06	<0.001	57.49±28.98	45.67±25.59	0.024	<0.001	0.002	11.25 (1)	0.50	0.081	0.26
Sodium	2959.63±710.01	2016.06±551.30	<0.001	3281.47±865.73	2758.50±872.26	0.017	<0.001	0.044	4.30 (1)	0.31	0.174	0.20
Fibre	8.32±4.11	10.75±4.56	0.042	7.48±3.70	9.74±4.83	0.011	0.001	0.163	2.01 (1)	0.21	0.727	0.05
PA	2.79±0.37	2.90±0.30	0.131	2.86±0.36	2.69±0.38	<0.001	0.496	0.303	1.08 (1)	0.15	0.001	0.51
Sitting (hours)	8.70±1.98	8.37±2.31	0.287	9.00±1.59	10.41±1.67	<0.001	0.018	0.012	6.89 (1)	0.37	<0.001	0.67
MRST-H	0.74±1.16	0.52±1.19	0.352	0.48±1.01	0.52±1.19	0.896	0.613	0.556	0.35 (1)	0.08	0.615	0.07
VAS	61.85±17.33	80.19±9.66	<0.001	61.59±14.03	75.37±9.70	<0.001	<0.001	0.418	0.67 (1)	0.11	0.186	0.19

Note: SBP=Systolic Blood Pressure; DBP= Diastolic Blood Pressure; BMI: Body Mass Index; WC: Waist Circumference; PA= Physical Activity (presented in log10 metabolic equivalent of task values/week); MRST=Malnutrition Risk Screening Tool-Hospital; VAS= Visual analogue scale; CHO= Carbohydrate; Chol= Cholesterol; SFA= Saturated Fatty Acids; CI= Confidence Interval
Repeated measures ANCOVA within group analysis was applied followed by pairwise comparison with confidence interval adjustment by Bonferroni correction; Covariates namely age, gender, diabetic status, baseline BMI, and sodium intake were controlled when assessing between group differences for BP status; Covariates namely age, gender, diabetic status and baseline energy intake were controlled when assessing between group differences for BMI and WC status; Covariates namely age, gender, diabetic status, baseline BMI, MRST-H scores and physical activity levels were controlled when assessing between group differences for nutrients intake; Covariates namely age, gender, and baseline BMI were controlled when assessing between group differences for PA and sitting time; Covariates namely age and gender were controlled when assessing between group differences for SPK scores; Covariates namely age, gender and baseline BMI were controlled when assessing between group differences for MRST-H scores; Covariates namely age and gender were controlled when assessing between group differences for VAS; Level of significance was set at 0.05 (two-tailed).

activity levels among the intervention group were probably not enough to induce significant weight loss. Besides, the higher proportion of unintentional weight loss observed in the control group than their counterparts (15% versus 4%) may have offset the program's positive impacts. Therefore, it is advisable to include a malnutrition risk screening among stroke patients involved in weight loss programmes to prevent false expectations of the study's effectiveness.

Table III Comparison of categorical outcome variables within- and between groups three months post-stroke

Variables	Intervention group (n=27)			Control group (n=27)			*P*-value[b]
	Base-line	3rd month	*P*-value[a]	Baseline	3rd month	*P*-value[a]	
Smoking status			1.000			1.000	0.039[c]
Not smoking	24 (89)	25 (93)		18 (67)	18 (67)		
Smoking	3 (11)	2 (7)		9 (33)	9 (33)		
Mobility			0.250			0.002	
No problem	14 (52)	17 (63)		9 (33)	19 (70)		0.773
With problems	13 (48)	10 (37)		18 (67)	8 (30)		
Self-care			0.016			0.001	
No problem	18 (67)	25 (93)		11 (41)	22 (81)		0.420
With problems	9 (33)	2 (7)		16 (59)	5 (19)		
Usual activities			0.031			0.001	
No problem	11 (41)	17 (63)		6 (22)	17 (63)		1.000
With problems	16 (59)	10 (37)		21 (78)	10 (37)		
Pain/ discomfort			0.039			0.289	
No problem	14 (52)	21 (78)		14 (52)	10 (37)		0.005
With problems	13 (48)	6 (22)		13 (48)	17 (63)		
Anxiety/ depression			0.070			0.219	
No problem	15 (56)	21 (78)		14 (52)	18 (67)		0.544
With problems	12 (44)	6 (22)		13 (48)	9 (33)		

Note: Health-related quality of life was assessed by EQ-5D-5L
[a]McNemar test; [b]Chi-square test for independence; Level of significance was set at 0.05 (two-tailed)

Both groups exhibited at least some improvements in their dietary habits, with more remarkable changes in the intervention group. This suggests that the stroke incident itself motivates participants to change their health behaviour, apart from the intervention. Previous evidence targeted at improving the dietary practices of stroke survivors is scant and difficult to compare due to variability in dietary assessment and intervention strategies.[21,40] For example, Spassova et al (2016) observed that a phone-based computer-aided lifestyle modifications program led to an improvement in self-reported fruits and vegetables consumption and a reduction in sweets intake in the intervention group.[21]

Furthermore, reducing sitting time seemed to be the first step in encouraging a more active lifestyle since most participants have a low level of PA prior to the stroke. A study in Japan showed that a 24-week lifestyle intervention study that included weekly exercise training and salt-reduction education resulted in increased daily steps, reduced sodium intake, decreased SBP, and an increase in HDL-C levels.[24] Therefore, more structured and intensive physical training is needed in future studies.

Table IV Comparison of medication adherence between groups at 3rd-month post-stroke

Variables	Intervention group (n=27) n (%)	Control group (n=27) n (%)	*P*-value[a]
Antihypertensive			
Yes	20 (83)	14 (61)	0.111
No	4 (17)	9 (39)	
Antidiabetic			
Yes	5 (100)	9 (69)	0.278[b]
No	0 (0)	4 (31)	
Cholesterol-lowering			
Yes	24 (89)	24 (92)	1.000[b]
No	3 (11)	2 (8)	
Antiplatelet			
Yes	25 (93)	21 (91)	1.000[b]
No	2 (7)	2 (9)	
Anticoagulant			
Yes	1 (50)	2 (100)	1.000[b]
No	1 (50)	0 (0)	

Note: [a]Chi-square test for independence; [b]Fisher test for independence; Significance level at $P < 0.05$.

The positive effect of the intervention on patients' smoking habits needs to be interpreted with caution. The result might be affected by a higher number of active

smokers in the control group than the intervention group (33% versus 11%, P=0.062) at the baseline. Other studies demonstrated contradicted findings.[16,18,41] Having a stroke incident itself did not seem to affect the participants' decision to quit smoking since many of them continue to smoke. Many of these active smokers are heavy smokers. Additionally, they had poor motivation for proper medical care and lifestyle modifications. Therefore, the use of nicotine replacement therapy in combination with cognitive behavioural therapy for smoking cessation in these heavy smokers are highly warranted in future interventional studies.

Furthermore, the considerable improvement in the physical dimension of HRQoL and the overall VAS might be explained by neurological stroke recovery which usually peaks in the first three months and continues at a slower pace afterward.[42,43] Consistent with previous findings in Norway, improvement in the psychological dimension of HRQoL was only observed in the intervention group.[44] This phenomenon might be explained by the mutual support established between caregiver and patient as well as with healthcare professionals in the enhanced care group.[23,45] Additionally, the intervention programme emphasised the involvement of family members in facilitating behavioural changes and the adoption of a patient-centred care approach.

This pilot study has a few limitations. First, the causal association between an intervention and an outcome was not able to be concluded under a quasi-experimental study design. Second, most of the lifestyle behaviours were self-reported and therefore may be prone to recall and expectation biases (Hawthorne effect). However, objective variables, such as BP, BMI, and WC have been included to enhance data reliability. Third, it was unlikely to conclude the program's impact on long-term behavioural changes due to its brief follow-up period and small sample size. Fourth, the study was confined to two major hospitals on the East Coast of Peninsular Malaysia; thus, the study findings were unlikely to be generalized to the whole Malaysian population. Last but not least, since the construct of HBM, reflection, and reflective theories were not being measured; thus it was unlikely for us to correlate the changes in outcome parameters with changes in domains of HBM. Despite this, the findings of this pilot study provide valuable information for clinicians to improve strategies for achieving secondary stroke prevention goals. However, a more rigorous study design is highly warranted in the future.

CONCLUSION

Early patient-centred education underpinned with appropriate behavioural change strategies and the involvement of family members appears to be beneficial. This programme's outcomes can guide future interventional studies for better feasibility and effectiveness.

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DECLARATIONS OF INTEREST

None

Appendix 1 Education curriculum and activities for the intervention group

Periods (weeks)	Section	Description	Duration	Activity
The first week of admission in a ward (bedside)	Increase knowledge and risk of recurrent stroke (first meeting)	Introduce types of strokes, signs, effects and complications, treatment, and future risk of cerebrovascular events Discuss the relationship between individualized risk factors (hypertension, dyslipidaemia, diabetes mellitus, and atrial fibrillation) with stroke	30min (patient with caregiver)	Logbook: Activity 1: Identify personal risk factors -booklet and logbook are provided to the patient
	Skill develop-ment (second meeting)	Discuss treatment goals and planning Encourage self-monitoring activities at home Set up personal goals Clarify doubts Set the next appointment date	20 min (patient with caregiver)	Activity 2-4: BP, lipid, glucose, and INR diaries Activity 9: Action planning -appointment card is provided
4th -8th week after discharge (Outpatient clinic)	Skill development (third meeting)	Discuss individualized lifestyle modifications Explain the benefits of making lifestyle changes Identify barriers and provide tips to overcome Encourage cooperation between caregiver and patient Suggest reflective practice activities using a logbook Discuss malnutrition risk and food taboos (if relevant to the patient) Explain secondary preventive medication and their importance Evaluate the previous goal and build new goals if indicated Refers patient to other departments if indicated (neurology, rehabilitation, etc.)	60-90 minutes (patient with caregiver)	Discussion using slides and logbook Activity 5: Food label reading Activity 6: Menu planning Activity 7: Physical activity monitoring Activity 8: BMI assessment and monitoring
12th week after discharge (outpatient clinic)	Evaluation (fourth meeting)	Evaluate the outcome variables	60 minutes (patient with caregiver)	Questionnaire Measurements of blood pressure, weight, waist circumference, calf cir-cumference, and mid-upper arm cir-cumference

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