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by Farah Faza Et Al.

Submission date: 15-Feb-2024 10:22AM (UTC+0800)
Submission ID: 2295153353
File name: ake_through_interactive_nutrition_education_FF_-_Farah_Faza.docx (378.39K)
Word count: 5278
Character count: 29555

Improving nutrient intake through interactive nutrition education for post-stroke survivors and their families: a lesson-learned from community service

Farah Faza[1], Lily Arsanti Lestari[1], Ismail Setyopranoto[2], Susetyowati[1*]

[1]Department of Nutrition and Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Jalan Farmako, Sekip Utara, Yogyakarta, 55281
[*]**Correspondence** : E-mail: susetyowati@ugm.ac.id, Phone +62274-547775

[2]Department of Neurology, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada – Dr. Sardjito General Hospital, Yogyakarta, 55281

ABSTRACT

Background: *Around 14–52% stroke patients experienced malnutrition during treatment. Nutrition knowledge reinforcement as a part of family-centered holistic nutrition care will be beneficial for patients, family, and caregivers to maintain their nutritional status and improve quality of life.*
Objectives: *(1) increase knowledge on nutrition management for post-stroke survivors, family, and caregivers; (2) increase nutrient intake as well as improve nutritional status of post-stroke survivors.*
Materials and Methods: *The community service used pre-experimental design and was conducted in Embung Tambak Boyo, Sleman District during August 2018. The inclusion criteria were post-stroke survivor, being members of Happy Embung, a community of post-stroke survivors, and signing the informed consent. Total subjects were 27. There were a series of activities as follows: (1) pre-test and baseline assessment, i.e., anthropometry, blood pressure, physical function, and dietary were measured in the 1st week; (2) a series of nutrition education was delivered by registered dietician in the 2nd and 3rd week; (3) post-test and endline assessment, i.e., anthropometry, blood pressure, physical function, and dietary were in the 4th week. All measurements were executed by trained enumerators.*
Results: *The subject was dominated by male (89%) and aged ≥60 years (82%). Mean of the last stroke recurrent suffered by the subject was 7 years. Interactive nutrition education elevated knowledge score and nutritional status of the survivors. After 2 weeks of nutrition education, there were significant increment on survivor's knowledge score, body weight, and BMI with the Δ of change were 0.5 point; 0.8 kg; and 0.3 kg/m^2, respectively. However, there were non-significant improvement on intake of energy, protein, and carbohydrate, and handgrip strength (HGS) where Δ of changes were 54.6 kcal; 4.7 gram; 23.9 gram; and 0.7 kg, respectively.*
Conclusion: *There were improvements in survivor's nutrition knowledge, nutrient intake (energy, protein, and carbohydrate), and nutritional status of post-stroke survivors.*

Keywords: *nutrient intake; nutrition education; post-stroke survivors; nutrition status*

BACKGROUND

Serious problem of stroke worldwide has been reported by the Global burden of diseases (GBD) that in 2019, prevalence of stroke was 101 million and being the 2nd leading cause of death by total death was 6.55 million (12%) [1]. For 30 years, the increment of stroke prevalence was 85% and death caused by stroke increased was 43% [1]. As the prevalence and mortality worldwide increase, Indonesia faced the similar problem. The national health survey conducted by the Ministry of Health (MoH) of Indonesia reported that stroke prevalence was 10.9 per mil adults in 2018, increased 4 points from 2013 [2]. The report stated that Yogyakarta Province places 2nd highest prevalence of stroke in Indonesia [2]. In a couple of decades, stroke was reported to be suffered by adults aged 60 years and above. However, in the industrialization era, there is a transition where people younger than 60 years contribute to increase stroke prevalence rates by 22% [1].

The age transition should be acknowledged related to nutrition transition, where the dietary pattern is less healthy (high in processed food and less nutrient content), and lifestyle is more sedentary [3]. Regardless of the type and phase of stroke, those who suffered from stroke have some side problems that lead to eating difficulties, such as dysphagia, decrease in appetite, inadequate food intake, and impaired mobility. All those problems are manifested in dehydration and malnutrition [4]–[6]. Previous studies reported that around 14 – 52% stroke patients experienced malnutrition during treatment [2], [7], [8]. To tackle the problem, diet management for stroke and post-stroke survivors should be well-implemented, involving some groups other than physician, dietician, and nurse, namely family, caregivers, even peers [9], [10].

Family and caregivers have an essential role to encourage patients to have adequate and nutritious food intake to prevent recurrent stroke [11], [12]. A literature review showed that support from family is beneficial to accelerate recovery from stroke [12]. As reported in a previous study, there is an association between family support and compliance to diet in patients with coronary heart disease, where the better support from family and caregiver, a higher the diet adherence [13]. Moreover, family support can maintain emotional strength and provide family affection as well as attention to prevent recurrent strokes.

An understanding of recurrent strokes and their progression, and specific knowledge of dietary management on stroke and post-stroke are important for family and caregivers, or even the patients to handle during acute and post-discharge phase [11]. Therefore, specific nutrition information should be provided through some schemes such as nutrition education and counselling using booklet and food models, home visits, follow-up phone/video call, hands-on training, and emotional support and counselling [9], [11], [13]. Moreover, the preliminary survey in Happy Embung, a community of post-stroke survivors under the Indonesia Stroke Foundation/*Yayasan Stroke Indonesia* (Yastroki), showed that post-stroke survivors often consuming foods high in cholesterol, saturated fat, sodium, and added sugar such as fritters, salty chips, and sweetened beverages.

Therefore, nutrition knowledge reinforcement as a part of family-centered holistic nutrition care will be beneficial for the survivors, family as well as caregivers to maintain their nutritional status and improve quality of life. This community service aims to: (1) increase knowledge in post-stroke management, especially from nutrition perspective for post-stroke survivors, family as well as caregivers; and (2) increase nutrient intake and improve nutritional status of post-stroke survivors.

MATERIALS AND METHODS

Study Design and Subjects

This was a community service-based activity with pre-experimental design, conducted in Embung Tambak Boyo, Sleman District, Special Region of Yogyakarta Province. The inclusion criteria were: (1) post-stroke survivor, (2) being members of *Happy Embung*, a community of post-stroke survivors, and (3) signing the informed consent. The exclusion criteria were: (1) passed away and (2) suffered from recurrent stroke during the period of intervention. The subjects were all 27 post-stroke survivors who were members of *Happy Embung*, a community of post-stroke survivors under the Indonesia Stroke Foundation (Yastroki) as the official

organization. The community service was carried out for 4 weeks from the 1st week to 4th week of August 2018.

Flow of Activities

There were a series of activities during 4 weeks of community service. The details as provided in Figure 1 below.

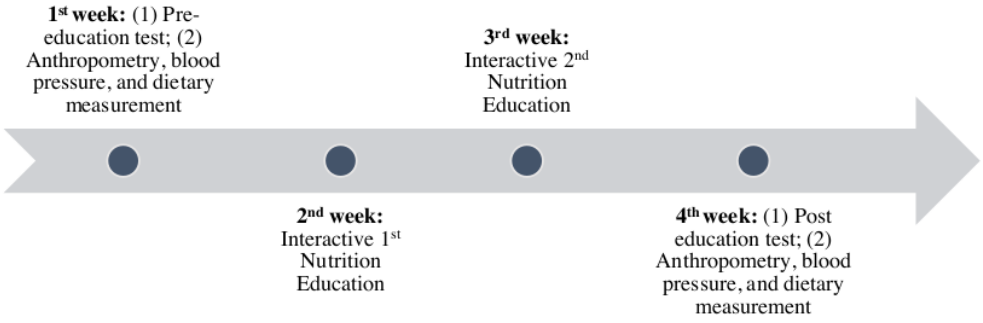

Figure 1. Flow Activity of Nutrition Education Week for Post-stroke Survivors

Pre-education test (Pre-test)

Pre-test was conducted as a preparation step in the 1st week for all subjects. This step aimed to assess the knowledge in post-stroke health management, especially nutrition and body weight, to mapping the material and way of nutrition education process. The test consisted of 10 'True' or 'False' statements about recurrent stroke-caused factors, diet recommendation for post-stroke survivors, and health maintenance to prevent recurrent stroke. The details of questions are provided in Table 1 below. All subjects were asked to fill the questions by giving the 'check' sign (√) on the 'True' or 'False' column in the paper-based questionnaire.

Subject who was elderly or difficult to write and read due to cognitive impaired was assisted by their family or caregiver to answer the question. They read the questions per number and let the subjects choose and decide the answer. The trained enumerators monitored this step by walking around to each subject during questionnaire filling process. The monitoring process was carried out to ensure that the questions were answered by subjects, not by their family or caregivers. Each number of questions had '1' point for right answer and '0' point for wrong answer, hence the highest score of pre-tests was 10 and the lowest ones was 0. This pre-test step was then compared with the post-test step to be one of indicators to evaluate the effectiveness of nutrition education process.

Table 1. List of 'True' or 'False' Statements Related-to Nutrition Knowledge for Post-stroke Survivors.

No	Statement
1	Having hypertension (high blood pressure) history is a risk factor of stroke
2	Doing physical activity or exercise routinely can prevent the risk of stroke
3	Stress is one of risk factors that can trigger stroke
4	Feeding in supine position affect to choke easily in stroke/post-stroke survivors
5	Body weight management is one of prevention ways of stroke/recurrent stroke
6	High consumption of vegetables, fruits, and herbal medicine can prevent stroke/recurrent stroke
7	Restricting or even avoiding processed food can trigger stroke/recurrent stroke
8	Excessive added sugar consumption can increase risk of stroke/recurrent stroke
9	High cholesterol food such as innards, squid, fried food are highly recommended for stroke/post-stroke survivors
10	High consumption of fatty/oily food can increase risk of stroke/recurrent stroke

Anthropometry and Dietary Measurement

There were four measurements, namely anthropometry, blood pressure, physical function, and dietary intake. All those measurements were carried out two times, first was in baseline (pre-intervention) and second was in endline phase (post-intervention). Anthropometry measurement included body weight and body height to define body mass index (BMI), mid-upper arm circumference (MUAC) and percent body fat.

Body weight and percent body fat were assessed using Omron Karada Scan bio-electrical impedance analysis (BIA) series HBF-375 body fat and composition monitor. For some subjects who were unable to measure in standing position (ex. Subject who was in the wheelchair), body weight and percent body fat were estimated using Omron HBF-306 hand body fat monitor. The accuracy for body weight was 0.1 kg and for percent body fat was 0.1%. Prior to the day of measurement, the trained enumerator announced to the community coordinator to ask all subject wearing the lightest clothes, not wearing jeans, or double outfit. The subject was then asked to measure body weight and percent body fat two times, with the repetition in the range of 1 minute to stabilize the subject's physical condition. The result is the average of two measurements.

Body height was measured using stature meter (stadiometer) with 0.1 cm of accuracy. For some subjects who were unable to measure in standing position (ex. Subject who was in the wheelchair), body height was estimated using formula based on knee length: 56.343 + (2.102 x knee height in cm) [14]. The BMI was then calculated and determined into three categories: (1) underweight (BMI <18.5 kg/m^2), (2) normal BMI (18.5 – 24.9 kg/m^2), and (3) overweight and obesity (≥25.0 kg/m^2). Meanwhile, percent body fat was classified based on gender, where (1) normal, if percent body fat in male ≤20% or female ≤31%; (2) overfat, if in male >20% or female >31%; and (3) obesity, if male >24%, while female >35%. Subject who was under fat automatically could not be detected in BIA body fat composition monitor (N/A).

The MUAC was assessed to rapidly detect chronic-energy deficiency (CED). The measurement used MUAC tape which was flexible non-stretch with the accuracy 0.1 cm. The tape laid at the midpoint between the acromion and olecranon processes on the shoulder blade and the ulna, respectively, of the arm of subject. The subject was defined PEW if the MUAC <23.5 cm and non-PEW if ≥23.5 cm. The measurement was conducted with one time repetition in the range of 1 minute. The result is the average of the two measurements [15].

Blood pressure measurement followed the protocol: (1) the subject was asked to take a seat right after they come for 5-10 minutes; (2) blood pressure was then measured using the OMRON M2 Basic – Digital

Automatic Blood Pressure Monitor. The measurement was taken two times, with the repetition in the range of 5 minutes. The result is the average of two measurements. Blood pressure was categorized as hypertension according to the 7th meeting of the Joint Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (the 7th JNC) when systolic blood pressure was ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg [16].

For physical function evaluation, CAMRY EH101 Digital Hand Dynamometer was used and followed the protocol: (1) Hold your arm with your elbow bent at a 90-degree angle; (2) Squeeze the dynamometer as hard as possible; (3) Apply grip force in a smooth motion; (4) Avoid jerking; (5) Repeat one more for a total of two times; (6) The grip strength is the average of the two readings. The result was interpreted as good strength if ≥25.0 kg for male and ≥17.8 kg for female [17]. All these measurements were executed by the trained enumerators and directly under the supervision of a registered nutritionist and the investigator team.

Dietary intake was estimated using a 24-hour food recall questionnaire to capture the actual food intake of the subject. Multiple-pass interview was used to record all foods consumed by the subject during the last 24-hour. Food model and food picture book from the Ministry of Health (MoH) of Indonesia 2014 were used to assist the subject recalling food and beverages eaten and ease the trained enumerators to describe the food or drinks as well as estimate the portions. For subjects who were elderly or unable to remember the consumption of food and drinks on their own, the trained enumerators asked their families or caregivers. Data was then inputted to Nutri-Survey software to estimate macro-nutrients (calories, protein, total fat, and carbohydrate). The database of Nutri-Survey already available, imported from Indonesia food database from the MoH of Indonesia through Indonesia Food Composition Table (IFCT). Food database from Singapore, Thailand, and U.S were also imported to cover unavailable food item at the IFCT. Adequacy food intake was defined if intake of each macro-nutrient was 70-100% of daily basis needs. The subject who has nutrient intake ≥110% was classified to excessive, while <70% was inadequate.

Interactive 1st and 2nd Nutrition Education

Interactive nutrition education was delivered by an expert speaker, a registered dietitian who was also working as a practitioner at the Dr. Sardjito General Hospital and a resident internist. The education materials were composed of: (1) risk factors and cause of stroke from nutrition perspective, (2) medical nutrition therapy (MNT) for stroke patients, and (3) lifestyle management for post-stroke survivors. All the materials lasted 60 minutes and followed by question and answer or discussion session with subjects and their family/caregiver.

The education process was delivered using wide screen (LED) and each subject and their family/caregiver obtained a set of leaflets containing (1) a brief explanation of stroke, risk factors, and the progression, (2) MNT for stroke patients, (3) do and don't for stroke and post-stroke survivors, especially on cooking methods and choosing food/drinks, supplements, and medicine products, and (4) daily meal plan. Real food models were set according to guidance of Indonesia MyPlate or '*Isi Piringku*' to describe the example of daily meal plan on what post-stroke survivors should eat for a day as explained by the speaker.

Figure 2. Real Food Model Demonstrated to the Post-stroke Survivors and Their Family

The session was then followed up by nutrition counseling for subject or family/caregiver who wanted to confirm or solve the problems related to nutrition for stroke. The counseling was a one-on-one session between a registered nutritionist or dietician and subject or family/caregiver. Each counseling session lasted about 20-30 minutes.

The 2nd nutrition education was executed in the next week and delivered by the same speakers. The aim was to strengthen the subject's understanding about all materials delivered in the 1st education and to motivate the subjects and their family or caregivers to gradually implement what has been suggested by the speakers. The materials were slightly the same as the 1st education, yet the speakers, assisted by the registered nutritionists, approached the subjects and families or caregivers in person (one-on-one) to recall their understanding and give the advice for any problems faced by them. The 2nd education lasted 90 minutes.

Post-education test

Post-test was conducted in the last week (4th week) to evaluate the knowledge and understanding of the subject after two times given nutrition education. The question used in the post-test was the same as pre-test. All subjects were asked to fill the questions by giving the 'check' sign (√) on the 'True' or 'False' column in the paper-based questionnaire. Subject who was elderly or difficult to write and read due to cognitive impaired was assisted by their family or caregiver to answer the question. They read the questions per number and let the subjects choose and decide the answer. The trained enumerators monitored this step by walking around to each subject during questionnaire filling process. The monitoring process was carried out to ensure that the questions were answered by subjects, not by their family or caregivers.

Data Management

All data was electronically recorded first in Microsoft 365 (Office) Excel, then was analyzed using SPSS software version 25.0 (Universitas Gadjah Mada). Data were explained and presented as the mean and standard error of the mean for the continuous variables. The independent sample T-test was used to compare differences in anthropometric measures, blood pressure, physical function, and dietary intake (energy and protein) between before and after the nutrition education and counseling sessions. A p-value <0.05 was considered statistically significant, and all analyses were done in the two-tailed test.

Ethical Consideration

The ethical approval was granted by the Institutional Review Board (or Ethics Committee) of the Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada with the protocol code KE/FK/0691/EC/2017. Informed consent was obtained from all subjects or their family as well as caregivers before the interview and assessment were carried out. The consent was provided in a paper-based form and used language Bahasa Indonesia. The form explained about: (1) the aim and flow of the community service activity, (2) questionnaire used in the study, (3) measurement as well as assessment and who would be performed, (4) the benefits (both in-kind and in-cash), (5) declaration of confidential assurance, and (6) the side effects as well as the medical treatment if needed. The subject was asked to read the informed consent or was directly explained by their family/caregivers. Then, they voluntarily decided whether will follow the activity by signing the form as consent. All this process was personally guided by the trained enumerators.

RESULTS

Demographic of the community was dominated by male (89%) and elderly (82%). Mean of the last stroke recurrent suffered by the subject was 7 years. Details were explained in Table 2. Nutrition profile of the community both in pre- and post-nutrition education was majorly overweight and obesity (> 80%) with total body fat was high (> 20 – 24.9%) and very high (25% and above). Handgrip strength of the subject was mostly also poor, in which < 20 kg for female and < 30 kg for male with prevalence ≥ 70%. The nutrition profile data was provided in Supplementary file 1.

Table 2. Characteristics of Post-stroke Survivors (n=27)

Variable	n (%) or mean ± SD
Gender, n (%)	
Male	24 (88.9)
Female	3 (11.1)
Age, n (%)	
Adult (< 60.0 years)	5 (18.5)
Elderly (≥ 60.0 years)	22 (81.5)
Education level, n (%)	
Middle school	4 (14.8)
High school	21 (77.8)
University	2 (7.4)
Diseases history, n (%)	
No diseases history	14 (51.9)
Cardiovascular	1 (3.7)
Stroke	5 (18.5)
Complication	7 (25.9)
Smoking history[1], n (%)	
Yes	4 (14.8)
No	23 (85.2)
Stroke period (years), (mean ± SD)	7.0 ± 4.3

[1] Smoking history 'no' means respondent never or had been to stop smoking.

Interactive nutrition education affected the changes of nutritional status and knowledge score of the subject. Body weight, BMI, and knowledge score significantly increased from pre- to post-nutrition education

(Δ of change were 0.8; 0.3; and 0.5, respectively). However, there were non-significant increment of HGS, energy, protein, carbohydrate, and knowledge score of caregivers where Δ of changes were 0.7; 54.6; 4.7; 23.9; and 0.5, respectively. All details were served in **Table 3.**

Table 3. Mean Difference of Nutrition Profile, Nutrient Intake, and Score of Nutrition Knowledge (n=27)

Nutritional Profile and Nutrient Intake	Pre-nutrition education (mean ± SE)	Post-nutrition education (mean ± SE)	Δ of change	p-value[1]
Body weight (kg)	67.8 ± 1.9	68.6 ± 1.9	0.8	0.001
Body mass index (BMI, kg/m^2)	29.5 ± 0.8	29.8 ± 0.7	0.3	0.001
Mid upper arm circumference (MUAC, cm)	30.1 ± 0.6	29.6 ± 0.7	-0.5	0.069
Body fat total (%)	26.4 ± 0.9	26.2 ± 0.9	-0.2	0.581
Handgrip strength (HGS, kg)	26.1 ± 2.0	26.8 ± 2.0	0.7	0.475
Energy intake (kcal/day)	1334.5 ± 75.7	1389.1 ± 95.0	54.6	0.536
Protein intake (grams/day)	48.4 ± 3.4	53.1 ± 3.6	4.7	0.267
Fat intake (grams/day)	45.0 ± 3.1	44.6 ± 4.1	-0.4	0.918
Carbohydrate intake (grams/day)	189.9 ± 13.0	213.8 ± 15.3	23.9	0.150
Knowledge score of subjects (points)	6.5 ± 0.6	7.0 ± 0.6	0.5	0.019
Knowledge score of caregivers (points)	8.8 ± 0.3	9.3 ± 0.3	0.5	0.054

[1] p-value was significant at the level of < 0.05.

DISCUSSION

This community service highlights that nutrition education elevated nutrition knowledge both in post-stroke subjects and the caregivers. Additionally, there was improvement in body weight, nutritional status, physical function, energy, protein, and carbohydrate intake after repeated education sessions. The findings are useful mainly for health workers, patients, family as well as caregivers to provide optimal care for post-stroke survivors. This should be recognized that several recommendations are essential to be implemented to the post-stroke survivors as well as to achieve better nutritional outcomes and to prevent recurrent stroke.

Some previous studies designed a model family-centered approach to improve nutrition and health status in post-stroke survivors [6], [11]. In this model, family support was the main key to achieving optimal nutritional status and quality of life for post-stroke survivors [11]. Five domains involvement of dietary well-being, i.e., practical, physical, informational, emotional, and social determined intervention of family support and its strategies [6], [11]. The domains were gained by health workers who would encourage and provide information and health services to support post-stroke survivors and the family through several strategies. Implementation of the strategies both for hospital and community settings would equip family and caregivers in fostering post-stroke survivors [6], [11], [18]. Subsequently, the direct impact would be an acceleration in physical and psychological recovery, as well as improvement in nutritional status and quality of life. All details were provided in Figure 3.

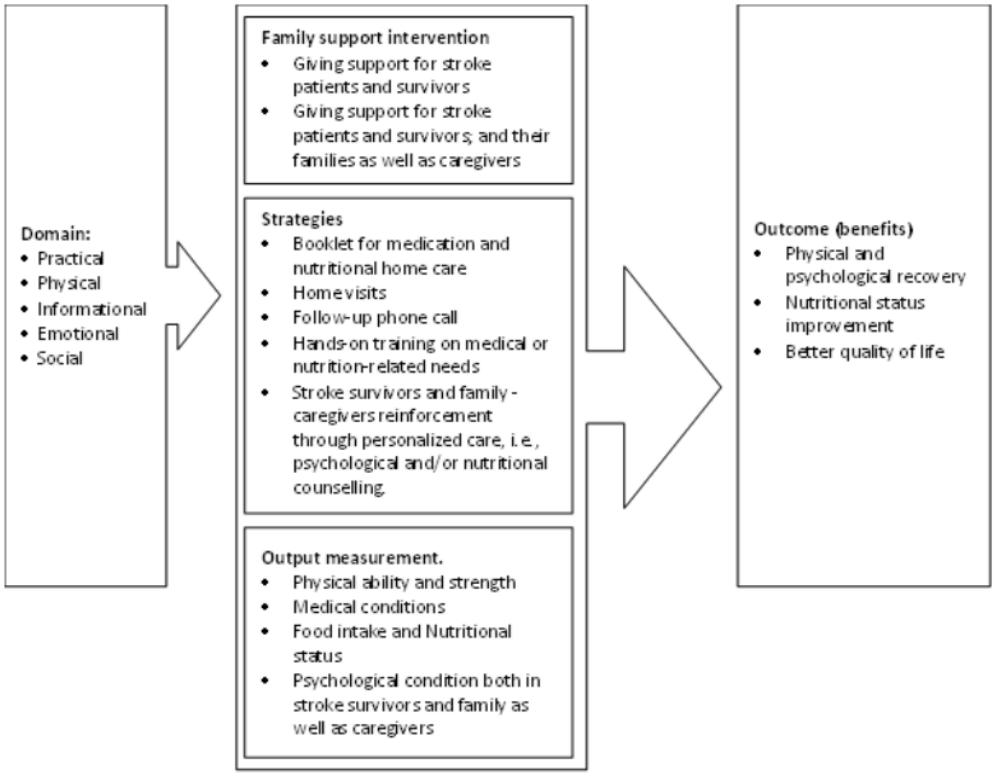

Figure 3. A Model Family-Centered Approach to Improve Nutrition and Health Status in Post-Stroke Survivors – A modification from Kosasih et., al (2020)

This finding, which revealed that nutrition education and counselling improved energy, protein, and carbohydrate intake, was relevant to a previous study. A previous study highlighted that proper knowledge and skill in preparing food manifested to a positive impact on dietary well-being and potential improvement in the health-related quality of life, involving the process of swallowing and nutritional status for stroke survivors [19]. As the recommendation, post-stroke survivors and their family/caregivers, especially with dysphagia should receive adequate knowledge and hands-on food preparation training to elevating food intake and achieving dietary well-being [19]. Exposure of knowledge and hands-on training related to nutrition care as well as daily meal plan, diet monitoring, food preparation and cooking improved on food intake and dietary well-being in stroke survivors, compared to the survivors who did not receive kinds of interventions [19]. In general, focusing on family support in nutrition care, there was good evidence of repeated education and counselling, hands-on training, and home-care visits on the health improvement of post-stroke survivors.

Following the increment of 0.8 kg body weight, the average BMI also elevated and placed into the overweight category. Many of prior studies explained on "obesity paradox", in which stroke patients or post-stroke survivors who have a BMI of >25 kg/m^2 have a better prognosis regarding clinical outcome in those cardiovascular diseases and have a lower risk of mortality than non-obese [20], [21]. Meanwhile, the underweight patients/survivors had higher risk of mortality at an average of 1.5 years follow-up [20]. A prior

study found that underweight acute stroke patients were more likely to have higher risk of chronic infections or malignant tumors explaining the poor prognosis [21].

There was still unclear mechanism to explain the obesity paradox. The most possible hypotheses were from a biological point of view, where the presence of adipose tissue is considered as protective against oxidative stress [21]. Furthermore, serum lipid levels increased in overweight and obese patients/survivors function as binding and detoxifying endotoxin-lipoproteins [20]. Consequently, it blocks the release of inflammatory cytokines secreted by tumor necrosis factor-alpha (TNF-alpha) [20]. These two mechanisms may impede the post-stroke pro-inflammatory phase. However, BMI categorized as obesity class III (40 to 49.9 kg/m2), the paradox is no longer applicable [21], [22]. The extreme point shaped "U" or "J" trend, worsened outcomes in both underweight and severely obese individuals as well as related to mortality [22], [23].

The transition from acute to post-stroke phase is a significant challenge for stroke survivors and their family due to recovery phase after stroke is the key to determine quality of the survivors' life. Tailored information and resources related to practical knowledge, skills, and tools for post-stroke nutrition treatment are essential to empower the family in fostering the survivors [18], [24]. Education and counselling through many ways could increase survivor and family satisfaction, reduce depression, and promote independence in daily living activities [11].

CONCLUSIONS

After post-stroke survivors and their family received repeated nutrition education and counseling, there was an improvement of nutrition knowledge related to post-stroke nutrition management. In sequence, there is an enhancement of nutrient intake and nutritional status, indicated by the increase of body weight and BMI among post-stroke survivors. Future sustainable research is encouraged to support the family as well as to maintain the knowledge to take care of the survivors. Moreover, future nutrition intervention such as the use of education toolkit is essential to equip the family with more advanced skills and best practice on applying nutrition management for post-stroke survivors.

ACKNOWLEDGMENT

We would like to acknowledge the valuable team of the community service, including trained nutritionists as counsellors and administration team from the Department of Nutrition and Health, Universitas Gadjah Mada who genuinely assisted our team to handle this activity. We also thank all subjects who participated in this activity.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

All authors have no conflict of interest in this article. This research was funded by Community Service Grant of Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada 2018.

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