



## SMS Gateway as a Media to Improve Awareness and Dietary Compliance of Hypertensive Patients

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### Abstract

Hypertension is a major health problem in Indonesia. Prevention can be applied through health promotion and modification of a healthy lifestyle. This study aimed to analyze the effects of SMS (Short Message Service) Gateway to dietary compliance and awareness of hypertensive patients. The research design was pre-experimental with one group pretest-posttest design. The study was conducted at Primary Health Center of Putri Ayu, Jambi City. The sampling technique was accidental sampling with a total sample of 30 hypertensive patients. The intervention was conducted for 30 days by sending SMS twice a day. The results of the study showed an average awareness score of 7.3 pre-test and 10.1 post-test. The average dietary compliance score was 21.2 pre-test and 31.3 post-test. Wilcoxon test showed there was an effect of SMS Gateway to awareness and dietary compliance in hypertensive patients ( $p$ -value = 0.000). This study concludes that there is an effect of nutritional messages through SMS media to awareness and dietary compliance in hypertensive patients.

### Introduction

An improvement in health development can be measured through decreasing morbidity and mortality, and increasing life expectancy. The increasing of life expectancy is also affected in the increase number of elderly people which has an impact on shifting patterns of disease in society, from infectious diseases to degenerative diseases such as hypertension (Sarwanto & Rukmini, 2009; Lee *et al.*, 2011; Park *et al.*, 2015; Khademi *et al.*, 2017; Peltzer & Pengpid, 2018). Hypertension or high blood pressure is an abnormal increase in arterial blood pressure continuously over a period of time. Hypertension is also defined as a systolic blood pressure of more than 140 mmHg and / or a diastolic pressure of more than 90 mmHg

(Chobanian *et al.*, 2003; Weber *et al.*, 2014).

Hypertension is a major health problem because of its high prevalence and the increasing risk of cardiovascular diseases. According to the World Health Organization (WHO) and the International Society of Hypertension (ISH), there are currently 600 million people with hypertension and 3 million of them die every year. Hypertension in Indonesia is the number 3 cause of death after stroke and tuberculosis (Rahajeng & Tuminah, 2009). The Basic Health Research (Riskesdas) of the Health Research and Development Agency (Balitbangkes) in 2018 shows the prevalence of hypertension reaching 34.1% higher than in 2013, that is 25.8% (Kemenkes RI, 2018; Kemenkes RI, 2013).

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Based on Riskesdas 2013, the prevalence of hypertension in Jambi Province at the ages of 18 years was 24.6% (Kemenkes RI, 2013). Hypertension was the second highest prevalence disease in Jambi according to data from the Jambi City Health Office in 2015, starting in 2014 the number of people with hypertension continued to increase each year from 35,341 people to 36,059 people in 2015. Based on data from the Jambi City Health Office in 2015, it was found that the highest number of hypertensive patients was at Putri Ayu Health Center, which was 4,373 people. Putri Ayu Health Center Report showed that the number of hypertensive patients from January to November 2016 was 2,702 patients, where there are 808 new patients and 1,894 old patients, 926 male patients and 1,776 female patients.

Hypertension is a disease caused by various factors related to each other. Factors that increase the incidence of hypertension are genetic, age, sex, ethnicity, obesity, nutrition, smoking, alcohol, caffeine, lack of exercise, high cholesterol, drugs and toxins (Sarwanto *et al*, 2009; Hussain *et al*, 2016). Various studies recommend that hypertension can be reduced by lifestyle modifications, controlling body weight & blood pressure, exercise, healthy diet, and reducing consumption of alcohol & cigarettes. JNC (Joint National Committee) recommends emphasizing prevention, early detection, evaluation and management of hypertension can be done through health promotion and modification of healthy lifestyles (Syamsudin, 2011).

An educational approach to health promotion is one of the best ways to provide information and develop the ability to make decisions. The kind of health promotion activity is providing health information or health messages in the form of health counseling to increase awareness and attitudes about health in order to have a healthy behavior.

Recently, along with the development of technology, health promotion can be applied indirectly (without face to face). One of the developments in information technology is mobile phones. In modern times, almost everyone has a mobile phone as a communication tool that is easy to use and affordable for all people. One of communication

facility on mobile phones that has been widely applied in the health sector is Short Message Service (SMS). SMS can be used as one of the media to carry out health promotion activities (Kannisto *et al*, 2014; Lau *et al*, 2014; Hall *et al*, 2015; Rathbone & Prescott, 2017).

Short message services have been used for business transactions, personal communication, and advertising. Cheap short messaging services in communication can be used to provide health messages to improve patient compliance (Fenerty, West, Davis, Kaplan, & Feldman, 2012). A study reported that the use of short message service as reminder was more easily improves patient compliance in treatment (Roux *et al.*, 2011). Another research on the use of short message services as a reminder to improve patient compliance has also shown that the use of short message services is more innovative and has cost benefit (Wells, 2011). Other studies in Bandung showed that SMS media had an effect on improving the awareness and motivation of hypertensive patients regarding the implementation of a hypertensive diet (Leon *et al*, 2015; Haicharan *et al*, 2017).

Therefore, the importance of health promotion needs to be done to increase awareness and dietary compliance in hypertensive patients. Based on this phenomenon, this study aims to analyze the effect of nutritional messages through the medium of SMS on improving awareness and dietary compliance of hypertensive patients.

#### **Method**

This study was a pre-experimental research with one group pretest-posttest design. Data collection was conducted at two points, that was pre-test (before counseling) and post-test (after counseling). The sampling technique was accidental sampling. The number of samples of this study were 30 hypertensive patients with inclusion criteria, i.e.: 1) hypertensive patients who visited the Putri Ayu Health Center; 2) patients who have and can use mobile phones for SMS feature; 3) can communicate well; 4) willing to be a respondent and 5) cooperative. Exclusion criteria were: 1) Mobile number cannot be contacted; 2) patients who didn't want to be interviewed.

The study instruments that used in

this study were SMS and questionnaires. SMS was used as a health promotion tool that was sent via mobile phones and questionnaires were prepared to obtain data on respondents' characteristics, respondents' awareness, and respondent's dietary compliance. Before conducting this study, the questionnaire was tested for validity and reliability. Validity and reliability tests were carried out at Simpang IV Sipin Health Center involving 10 patients. Based on the tests that had been conducted, it was found that out of 15 questions on the awareness questionnaire there were 3 invalid and unreliable questions so that in this study there were 12 questions that used to assess the awareness. While on the dietary compliance questionnaire, we used all 15 questions which were valid and reliable.

At the initial step of the study, we conducted a pre-test to measure the level of awareness and dietary compliance of the patient before the treatment carried out and in conjunction with the time of sampling. The next step was we gave an intervention by sending nutritional messages through SMS, which was conducted twice a day for 30 days

according to the SMS schedule attached. The day after the treatment was over, we conducted a posttest to measure the level of awareness and dietary compliance of the patient. We used the Wilcoxon test to analyze the data because they were not normally distributed with a significant level of 5%.

### Result and Discussion

The respondent's awareness was measured twice by a questionnaire containing 12 questions, i.e. before (pre-test) and after (post-test) intervention. The distribution of awareness assessment in the pretest-posttest can be seen in Table 1.

Based on Table 1, it can be seen that the most respondent answered the pre-test question no.5 correctly (n=30; 100%) which was about the source of sodium. While the most respondent answered the pretest question no.7 incorrectly (n=29; 97%) which was about carbohydrate resource that were effective in lowering blood pressure. We hypothesized that the level of respondents' knowledge is still low because they have not received enough information about the diet for hypertensive patient. This is because education, information

**Table 1.** Distribution of the answer of awareness assessment

| No | Questions                                                      | <i>Pre-test</i>  |                    | <i>Post-test</i> |                    |
|----|----------------------------------------------------------------|------------------|--------------------|------------------|--------------------|
|    |                                                                | Correct<br>n (%) | Incorrect<br>n (%) | Correct<br>n (%) | Incorrect<br>n (%) |
| 1  | Factors that cause hypertension                                | 28 (93,0)        | 2 (7)              | 30 (100)         | 0 (0)              |
| 2  | The frequency of exercise as prevention of hypertension        | 9 (30)           | 21 (70)            | 20 (67)          | 10 (33)            |
| 3  | Drinks that contain caffeine                                   | 26 (87)          | 4(13)              | 30 (100)         | 0 (0)              |
| 4  | Causes of sodium restriction                                   | 27 (90)          | 3 (10)             | 30 (100)         | 0 (0)              |
| 5  | Sources of sodium                                              | 30 (100)         | 0 (0)              | 30 (100)         | 0 (0)              |
| 6  | Useful content in citrus fruits, bananas, tomatoes & cucumbers | 4 (13)           | 26 (87)            | 9 (30)           | 21 (70)            |
| 7  | A carbohydrate source that effectively lowers blood pressure   | 1 (3)            | 29 (97)            | 28 (93)          | 2 (7)              |
| 8  | Recommendation for consumption of animal protein               | 10 (33)          | 20 (67)            | 20 (67)          | 10 (33)            |
| 9  | Recommendation for eating vegetable protein                    | 9 (30)           | 21 (70)            | 20 (67)          | 10 (33)            |
| 10 | The content of the animal innards                              | 28 (93)          | 2 (7)              | 30 (100)         | 0 (0)              |
| 11 | Recommendation for egg consumption                             | 28 (93)          | 2 (7)              | 28 (93)          | 2 (7)              |
| 12 | Recommendation for using salt                                  | 20 (67)          | 10 (33)            | 20 (67)          | 10 (33)            |

Source: Primary Data

and guidance are given by someone or through the media become external factors that influence someone knowledge (Notoatmodjo, 2010). This result is also in line with other studies that show that before the intervention, respondents have less knowledge related to recommended diet for hypertensive patients (Saputri, 2014).

Table 1 also shows there are 5 post-test questions that were all respondents answered correctly (n=30; 100%) i.e: the causes of hypertension, caffeinated drinks, the cause of sodium restriction, the source of sodium and the innards of animal organs. Meanwhile, after being given an intervention there was a decrease in the number of the incorrect answer for question no.7 that was 7%. It showed that there was an increase in knowledge after being given an intervention. These results are in line with previous studies which stated that the provision of information using media can increase knowledge (Zulaekah, 2012).

Meanwhile, there was no significant improvement on an incorrect answer after the intervention (70%) for the question no.6 which was about the beneficial ingredients in citrus fruits, bananas, tomatoes, and cucumbers to reduce blood pressure. It is thought to be due

to a decrease in cognitive function (Maryati, Bhakti, & Dwiningtyas, 2013). Respondents in this study were mostly 56-65 years old (36.7%) and >65 years old (33.3%), so we assumed that some nutrition messages that had been delivered were not able to be understood or remembered by the respondents. Although, there was an improvement in question number who answer correctly.

Dietary compliance was measured twice by using a questionnaire that contained 15 questions, i.e: before (pre-test) and after (post-test) intervention. The distribution of dietary compliance assessment can be seen in Table 2.

Based on Table 2, it can be seen that all respondents did not consume vegetable protein 4 slice / day and eggs more than 1 egg / day (100%). These study results are in line with the research conducted by Agrina *et al* (2011) which showed that out of 60 respondents as many as 56.7% of respondents were not obedient in fulfilling the hypertension diet. We suspect that the low dietary compliance is due to several factors such as knowledge or awareness, attitude, motivation, willingness and family support. According to Novian, in his study stated that there is a relationship between

**Table 2.** Distribution of the answer of dietary compliance assessment

| No | Questions                                                                     | Pre-test     |             | Post-test    |             |
|----|-------------------------------------------------------------------------------|--------------|-------------|--------------|-------------|
|    |                                                                               | Yes<br>n (%) | No<br>n (%) | Yes<br>n (%) | No<br>n (%) |
| 1  | Exercise 3 times a week for 30 minutes                                        | 4 (13.3)     | 26 (86.7)   | 11 (36.7)    | 19 (63.3)   |
| 2  | Salt consumption 6gr / 1.5 tsp                                                | 2 (6.67)     | 28 (93.3)   | 4 (13.3)     | 26 (86.7)   |
| 3  | Limit the use of food flavoring                                               | 1 (3.3)      | 29 (96.7)   | 24 (80)      | 6 (20)      |
| 4  | Fruit consumption                                                             | 18 (60)      | 12 (40)     | 30 (100)     | 0 (0)       |
| 5  | Sleep 6-8 hours a day                                                         | 29 (96.7)    | 1 (3.3)     | 29 (96.7)    | 1 (3.3)     |
| 6  | Consume vegetable protein 4 slice/day                                         | 0 (0)        | 30 (100)    | 30 (100)     | 0 (0)       |
| 7  | Consume animal protein max:2 slice/day                                        | 16 (53.3)    | 14 (46.7)   | 30 (100)     | 0 (0)       |
| 8  | Avoid cooking with coconut milk and oil                                       | 3 (10)       | 27 (90)     | 21 (70)      | 9 (30)      |
| 9  | Avoid excessive consumption of sugar and syrup                                | 6 (20)       | 24 (80)     | 22 (73.3)    | 8 (24.7)    |
| 10 | Consume food source of potassium (i.e: oranges, bananas, tomatoes, cucumbers) | 25 (83.3)    | 5 (16.7)    | 28 (93.3)    | 2 (6.7)     |
| 11 | Consume egg max: 1 egg/day                                                    | 0 (0)        | 30 (100)    | 29 (96.7)    | 1 (3.3)     |
| 12 | Limit bread, biscuits and cakes with baking soda                              | 1 (3.3)      | 29 (96.7)   | 23 (76.7)    | 7 (23.3)    |
| 13 | Limit coffee, tea and soft drinks                                             | 11 (36.7)    | 19 (63.3)   | 19 (63.3)    | 11 (36.7)   |
| 14 | Consume vegetables                                                            | 24 (80)      | 6 (20)      | 30 (100)     | 0 (0)       |
| 15 | Recommended carbohydrate consumption                                          | 29 (96.7)    | 1 (3.3)     | 30 (100)     | 0 (0)       |

Source: Primary Data

the level of knowledge and family support with dietary compliance in hypertensive patients (Novian, 2013). Similarly, there is a relationship between attitudinal and motivational factors with dietary compliance to hypertensive patients in carrying out a low salt diet (Runtutahu *et al*, 2015).

Non-compliance respondents is not only indicated by an unhealthy lifestyle which continued consumption of instant foods such as biscuits, coffee, and other instant foods that contain lots of salt but also no desire to change or lack of motivation from the closest people to have a healthy lifestyle. This non-compliance could increase the incidence of dangerous complications such as stroke, heart disease, and etc.

There are a few obstacles to maintain low-salt dietary compliance such as chronic illness, food habits, boredom, social support and lack of motivation for healthy lifestyle. Boredom and chronic illnesses often decrease the compliance to have a low salt diet and have a healthy lifestyle. Therefore, support especially from patients close family is needed so that can keep their compliance (Notoatmodjo, 2007).

After the intervention was given, there was an increase in diet compliance, where all respondents consumed 4 pcs/day of vegetable protein and a maximum of 1 egg per day (100%). This illustrates that interventions are beneficial for increasing dietary compliance. This is in line with Alfian (2014) and Leon et al. (2015) studies which stated that there was an increase in compliance to hypertensive patients which given short message service interventions through SMS media.

Changes in diet compliance occur because respondents begin to realize the dangers

and complications of hypertension if it allowed continuing. It was indicated by respondents starting to limit their salt and sodium food sources consumption, which can be seen in their healthy lifestyle changes. We suspect that this change is because respondents believe that stay have a healthy lifestyle in carrying out a diet can prevent hypertension from continuing and causing complications. We suggest they need to continue their low-salt diet and improve their healthy lifestyles which are continuing to limit low salt, exercise, and continue to increase knowledge about foods that are good for the hypertensive patient and continue to routine check of their blood pressure.

A low salt diet is essentially a diet by limiting salt consumption to food. Generally, these foods are cooked using a little salt or not using kitchen salt at all and reduce the use of foods that contain a high level of sodium. The meaning of a low-salt diet in the true sense is low sodium (Na). In addition to limiting salt, this diet should also limit other sources of sodium such as baking soda, baking powder, MSD (Monosodium glutamate, better known as food seasonings, food preservatives or sodium benzoate which found in sauces, soy sauce, jam, jelly and others), foods made from butter, and drugs containing sodium (headache drugs or other drugs) (Palmer, 2007).

Bivariate analysis was carried out to identify the effect of nutritional messages through SMS to awareness and dietary compliance. It can be seen in Table 3.

Table 3 shows that the lowest pre-test score on awareness assessment is 5 while the post-test is 8 .The highest pre-test score on awareness assessment was 9 and the post-test was 12. Based on Table 3, it can be seen that

Table 3. The effect of nutritional messages through SMS to awareness and dietary compliance in hypertensive patient

| Variable           | Min | Max | Average±SD  | P Value |
|--------------------|-----|-----|-------------|---------|
| Awareness          |     |     |             |         |
| Pre-test           | 5   | 9   | 7.33±0.994  | 0.000*  |
| Post-test          | 8   | 12  | 10.1±0.860  |         |
| Dietary Compliance |     |     |             |         |
| Pre-test           | 3   | 11  | 5.63±1.691  | 0.000*  |
| Post-test          | 10  | 14  | 12.00±1.414 |         |

\*Significance value 5% (Wilcoxon test)

Source: Primary Data

p-value = 0.000 which showed that there was an effect of nutritional messages through SMS to awareness in hypertensive patients. The results of this study were in line with previous studies which showed that nutrition education through SMS is effectively increases the level of awareness (p-value = 0.000) (Kusfriadhi *et al*, 2012). It is also in line with the results of Elliana & Kurniawati (2015) that the health education media through SMS has an effect on awareness.

We found that the average level of knowledge prior to intervention was 7.33 while after the intervention was 10.12. It means, there was an improvement of hypertensive patient's knowledge after being given an intervention through SMS by 2.77 points or around 37.78%. Information designed according to needs can determine the success in increasing knowledge. This result is in line with the research conducted by Kusfriadhi *et al* (2012) that showed interventions such as nutritional education through SMS increase the level of knowledge around 19.12 points or 30.28%.

An increment of respondent's knowledge of can be influenced by internal factors and the intervention factors that provided. We found that 30 (100%) respondents stated that the contents of the nutritional message were easy to understand and 28 (93.3%) respondents stated that intervention through SMS was useful. The benefits of providing intervention in the form of nutritional information delivered through SMS can stimulate respondent's sensing and be transformed into knowledge. This is supported by the opinion of Notoatmodjo, (2010) that knowledge is a result of "know" and this occurs after people hold a sensing of a particular object. Sensing of objects occurs through the five human senses such as vision, hearing, smell, taste and touch. Most human knowledge is obtained through the eyes and ears. Thus, Balakrishnan & Loo (2012) in his research explained that SMS is perceived as a personal communication that is cheap, easy to use, fast, convenient, fun and is part of the communication style.

After the post-test, we found that 29 (96.67%) respondents read the entire message which 25 (83.3%) respondents had an access to get a new information that never they get from media or health workers, based on

these results we assumed that providing a nutritional messages through SMS as a source of information is a major factor in increasing the patient knowledge. The ability of SMS become a medium for delivering information can support patients to understand a new information and increase their knowledge. It supported by the behavioristic theory which explains that the learning process which is an information is given in the form of stimuli can be observed and the factors that are considered important are the main factors to increase the response of a person.

We suggest that respondents continue to increase their knowledge regarding hypertension diet by accessing more information from print or electronic media, taking counseling or consulting with health workers.

Table 3 also shows that the lowest pre-test score on dietary compliance assessment was 17 and the post-test was 28 while the highest diet pre-test score on dietary compliance assessment was 31 and the post-test was 35. Based on Table 3, it can be seen that the p-value = 0,000 which indicated that there was an effect of nutritional messages through SMS to dietary compliance in hypertensive patients. These results are in line with the previous study which stated that health education using SMS as reminder had an effect to dietary compliance (Kusfriadhi, 2012; Yasmin *et al.*, 2016). A health promotion media that is designed according to the needs and the type of delivering method is greatly determines the success of the health promotion which is caused by the use of SMS as reminder applications is more easily increase the compliance to the treatment (Roux *et al.*, 2011).

The results showed that the average score of dietary compliance assessment before the intervention was 5.63 and after the intervention is 12.00. It means there was an increase on dietary compliance level of hypertensive patients after being given an intervention as many as 6.37 points (113.1%). It is in line with the study of Lubis *et al* (2016) about the use of SMS as reminder can increases the medication compliance of patients with diabetes mellitus around 81.3%. And also, the study of Zolfaghari *et al* (2012) that showed a significant differences

in dietary compliance and exercise status in patients after given SMS as a reminder.

We hypothesized there are some factors that influence the increase of subject dietary compliance such as knowledge, attitudes, willingness and supporting environmental. Green's behavior theory also supported our study result which said that change on behavior is influenced by several predisposing factors (knowledge, attitudes, beliefs, beliefs, support, motivation, etc.), enabling factors (physical environment, health facilities, health promotion facilities) and reinforcing factors (attitudes and behavior of health workers) (Notoatmodjo, 2010). Likewise, the Novian (2013), Isnaeni et al. (2015), Isnaini & Saputra (2017), Widiyanti (2017) studies that showed a significant relationship between knowledge and attitudes with dietary compliance.

Nutritional information delivered through SMS is an effort to stimulate sensing and raise the awareness of respondents so that it can affect the intensity of behavior change. Better knowledge will trigger respondents to have a better awareness. A better awareness will encourage respondents to improve their dietary compliance behavior. Through this method, it is expected to facilitate, accelerate and save the costs in delivering information so that can improve the patient awareness about nutritional messages to behave positively and sustainably. A various communication media can clarify the delivery of messages so that they are not too verbal, overcoming the limitations of space, time and sense power (Suiraoaka & Supriasa, 2012). Research on the use of short message services as a medium to improve compliance has also shown that the use of short message services is more innovative and has cost effectiveness (Wells, 2011; Hall *et al.*, 2015; Wong *et al.*, 2016).

After being given messages for 30 days, it can be seen the increase level of diet compliance and 28 (93.3%) respondents stated that they got benefits from the messages through SMS. We hypothesized the changes in dietary compliance is one of the benefits felt by respondents. It is in line with the research conducted by Akhu-Zaheya & Shiyap (2017), Leon et al (2015), and Kusfiryadi et al (2012) that there is an increase in compliance after being given intervention

through SMS.

According to the results, all respondents stated that the provision of SMS did not disturb their activities so it was not burdensome (100%). A communication medium must be simple and easy to understand so that it can convey the main information, this can be seen in the results that conducted to 30 (100%) respondents which stated the contents of the messages are easy to understand. Therefore, Short Message Services (SMS) is recommended as a health promotion medium that accommodate the needs of respondents, such as fast, easy to use, easy to understand, and effective and efficient which can reach respondents in a distance apart in delivering nutritional messages as information.

We realized that the intensity of dietary compliance was not easily to improve and maintain permanently. Because it is influenced by habits and mindset that are difficult to change and related to the desires and motivations of the patient themselves to improve their dietary compliance. We advised the hypertensive patients to realize that hypertension disease cannot be cured but it can be controlled with a healthy lifestyle. They can access information about hypertension diet through the various media or consult with doctors and nutritionists in health services. We suggest the hypertensive patients should continue to improve their dietary compliance in order to establish a good healthy lifestyle.

### Conclusions

Based on the results of the study, we conclude that the average awareness assessment score before the intervention is 7.33 points and 10.12 points after the intervention is given. The average score of dietary compliance assessment before intervention is 21.20 and 31.30 after intervention is given. The results of the Wilcoxon analysis show that there is an effect of nutritional messages through SMS to awareness and dietary compliance in hypertensive patients ( $p$ -value = 0,000).

This results can be used as a reference by the Health Office Institution in collaboration with nutritionists at the Health Service (Puskesmas) in developing the design of health promotion strategies using electronic medium such as SMS. Besides that, it is needed further studies to analyze the effectiveness of

Short Message Service (SMS) media as health promotion media to improve a healthy life style, or it can be compared to other promotional media.

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