THE EFFECT OF EDUCATIONAL INTERVENTION BASED ON TRANSTHEORETICAL MODEL FOR A LOW-SALT DIET AMONG HYPERTENSION PATIENTS: A LITERATURE REVIEW

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ABSTRACT

Introduction: This literature review aimed to describe the educational intervention for a low salt diet based on a trans-theoretical model in hypertensive patients. **Methods:** This study was a literature review from several databases such as PubMed, Science Direct, Cochrane library, Ebsco, and ProQuest. This study intended to examine studies related to the application of TTM in educating low salt diets in hypertensive patients published in English in the last 5 years. Data were analyzed by summarizing and categorizing studies and interventions. To assess the quality of the articles reviewed, a critical appraisal was assessed using the CASP Randomized Controlled Trial Checklist and the Joanna Briggs Institute Critical Appraisal Checklist for Quasi-Experimental Studies. **Result:** Five articles were identified and included in the review. A literature review reveals that TTM-based education can change the behavior of hypertensive patients on a low salt diet. Changes in the behavior of a low-salt diet have an impact on clinical changes such as decreased salt excretion in the urine, decreased weight and waist circumference, decreased blood pressure, and the risk of cardiovascular disease. **Conclusion:** TTM can be used to change the behavior of a low salt diet in hypertensive patients which has an impact on changing biochemical indicators of hypertensive patients.

Keywords*:* hypertension, low-salt diet, transtheoretical model, literature review

INTRODUCTION

Hypertension is a common chronic disease in communities. Hypertension is a global health problem affecting more than one-fourth of the adult population (Mills et al., 2016). The prevalence of people with hypertension increases from year to year. Currently, the number of people with hypertension in the world reached 22% of the existing population (WHO, 2019). Hypertension is estimated to cause 17% of deaths worldwide or around 9.4 million deaths annually (Forouzanfar et al., 2017).

Age greatly affects the risk of hypertension. Age 24-35 years has 1.56 times more than age 18-24 and will increase to 11.53 times at age ≥75 years (Rahajeng & Tuminah, 2009). Healthy living habits reduce the risk of hypertension by 38% in women and 43% in men (Bai et al., 2017). Low-salt diet behavior is one of the behaviors suggested by Joint National Committee (JNC) 7 in preventing hypertension-related complications (JNC, 2003). Salt restriction can lower blood pressure and reduce the risk of cardiovascular disease in hypertensive patients (Laatikainen et al., 2016; Ratchford et al., 2019; Yang et al., 2018). However, only 22% of people with hypertension adhere to a low-salt diet (Warren-Findlow & Seymour, 2011).

There are various factors influencing the self-management behavior (SMB) of hypertensive patients including belief in the efficacy of therapy, self-efficacy, social support, and the communication of healthcare workers (Mulyati et al., 2013). Of these factors, communication among healthcare workers has the most dominant influence on SMB. The communication between healthcare workers and patients refers to the education provided to hypertensive patients. The accuracy of health education interventions

 License doi: 10.20473/ijph.vl17il.2022.331-343 Received 11 January 2021, received in revised form 6 March 2021, Accepted 10 March 2021, Published online: August 2022

can increase a person's knowledge, attitudes, skills, and self-efficacy to independently carry out independent nursing practice (Irwan et al., 2016). Therefore, an appropriate educational intervention is needed for the behavior change of hypertensive patients, especially the low-salt diet.

One of the educational models that can be used in changing patient behavior is the transtheoretical model. TTM is also known as the "stages of change" theory. The TTM changes behavior gradually so that the subjects' behavior does not change drastically. This has a better impact that relapsing can be minimized. TTM describes the behavior change stages by including several main components, namely, the stages of change, the processes of change, decisional balance, and self-efficacy (Prochaska et al., 2009). Decisional balance involves consideration of the pros and cons of changes that will be made, self-efficacy concerns the belief in the self-ability to overcome risky situations without returning to old habits, and termination relates to the desire to return to old habits. The three components are interrelated with the stage of change and processes of change (Prochaska et al., 2009). Stages of behavior change in TTM consist of pre-contemplation, contemplation, preparation, action, and maintenance (Prochaska JO, 2013). In the application of TTM, patients are given an intervention based on the stages of the change.

TTM has been widely used in changing patient behavior, especially in chronic diseases such as diabetes (Arafat et al., 2016; Lin & Wang, 2013), physical activity in patients with multiple sclerosis (Plow et al., 2011), and colostomy self-care (Wen et al., 2019). There are several studies applying TTM to the case of hypertension but have not given consistent results. Besides, previous studies discussing the effectiveness of TTM in changing the behavior of a low-salt diet in hypertensive patients used the randomized controlled trial (RCT), quasi-experimental, and cross-sectional design. RCT is a research design with a low risk of bias so that it has a high level of confidence in the research results obtained.

However, there is no literature review on this topic. Through literature review, a comprehensive picture is obtained from various previous studies that can be the basis for evidence in conducting an intervention. Therefore, this study was designed with a literature review of existing studies. This literature review aims to describe the effect of a low salt diet educational intervention based on a transtheoretical model in hypertensive patients.

METHOD

Design: a literature review

Searching strategy

The searching strategy refers to the use of several keywords related to research questions in searching the database. Since the terms used vary, the author used various keywords by inserting the words "and" and "or" to ensure that all related studies can be taken. The keywords used in all databases were as follows:

P : 'hypertension' OR 'hypertensive' OR 'high blood pressure' OR 'elevated blood pressure' OR 'htn'

I : 'transtheoretical model' OR 'trans-theoretical model' OR 'stage of change' OR 'TTM' OR 'SOC' OR 'behavior change'

C : 'usual care' OR 'standard education' OR control OR 'no intervention'

O : 'Low-Salt Diet' OR 'Low salt diet' OR 'Low-Salt Intake' OR 'low sodium intake' OR 'DASH Diet' OR 'sodium level intake' OR 'sodium dietary' OR 'salt reduction' OR 'salt restriction'

Study criteria

Inclusion criteria

In this literature review, the author determined the study criteria. There were: (1) the population is adult with hypertension, (2) quantitative studies with intervention, (3) intervention given is only

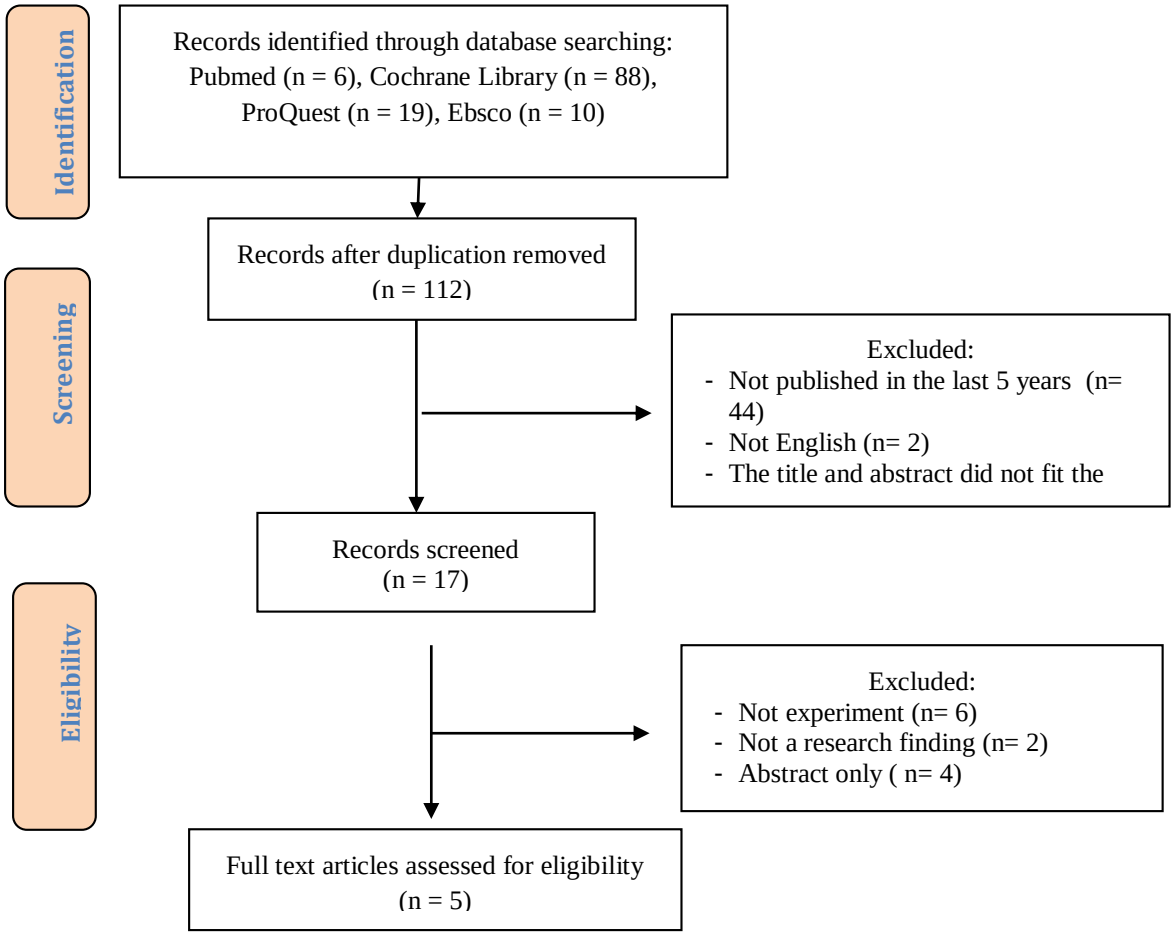
transtheoretical model, (4) research results in the form of low-salt diet behavior, (5) studies conducted in the last five years (2015-2019), and (6) studies from all countries written in English will be accepted.

Exclusion Criteria

The exclusion criteria in this literature review were (1) studies that examine patients with hypertension complicated by other diseases, (2) studies that provide additional interventions other than TTM, and (3) studies that are without interventions.

Article selection

The study selection process consists of four steps (Figure 1). The first step was the identification of articles from all search databases that were published in the last 5 years (2015-2019) (n = 44), not in English (n = 2), and the title and abstract were not in accordance with the research question (n = 49) to obtain 17 articles. In the second step, the author screened the non-research articles (n = 2), abstract only (n = 4), and not experimental/qualitative (n = 6), to obtain five articles. The third step was eligibility, in which the author checked the duplicated articles and then conducted a feasibility test of the inclusion criteria and the final result was five articles. Furthermore, in this step, the author evaluated the quality of articles that have been tested for eligibility by using the instrument that will be submitted in the article quality assessment section. The final step (included) was a literature review of the five articles that had gone through the selection.



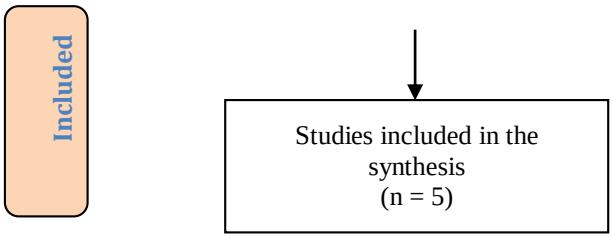


Figure 1. PISMA Flowcharts for study selection and inclusion

Quality assessment of articles

Critical appraisal was carried out to ensure that an article was reported clearly, completely, and transparently (Buccheri & Sharifi, 2017). This literature review used guidelines to analyze the quality of the selected articles. For the RCT study, the instrument used was the CASP Randomized Controlled Trial Checklist (CASP, 2018). For studies with a quasi-experimental design, the quality was assessed using the JBI Critical Appraisal Checklist for Quasi-Experimental Studies instrument. The assessment results were used to inform the synthesis and interpretation of research results (The Joanna Briggs Institute, 2017).

Data extraction

In this study, the data extraction tool was designed to guide information from records in accordance with the research objectives. Data extracted in each of the articles included: author, year, population and setting, study design, research objectives, methods and interventions, instruments used, and follow-up time and outcomes of each study. Furthermore, the data extracted in the results section included: name and year of research, research objectives, research design, research samples, instruments used, and research results.

Data synthesis

Data synthesis was carried out qualitatively. All studies using a low-salt diet education with a transtheoretical model approach are reported in this literature review.

Ethical consideration

This literature review obtained the ethics approval of the Ethics Commission of STIKES Nani Hasanuddin with a number 097/STIKES-NH/KEPK/XI/2020.

RESULTS

Search result

Diagram 1 elaborates on the literature search based on PRISMA. Out of 123 article titles identified, eight articles fit the research question but there were three duplicate articles. Thus, five articles were obtained. Next, an assessment of the quality of articles was carried out to gain five articles for literature reviews. The results of the search result are depicted in detail in Figure 1.

Characteristics of the synthesized articles

The overview of the five articles reviewed was summarized in the characteristics associated with the TTM-based intervention on the low-salt diet behavior of hypertensive patients. Regarding the interventions given, the instruments, follow-up, and results are presented in Table 1. In this literature review, there were three articles on RCT design, one article on quasi-experimental design, and one article on analytical design.

The interventions given in each study were varied such as dietary education using a self-monitoring tool for urinary sodium excretion (Yasutake et al., 2018), telephone-based tailored Stage-Matched Intervention (SMI) (Friedberg et al., 2015), CORFIS program (Karupaiah et al., 2015),

e-counseling (Liu et al., 2019), and the WASHOKU-modified DASH diet. The five studies aimed to evaluate low-salt diet behavior in hypertensive patients with TTM-based intervention. The five studies were conducted in different countries namely the USA, Japan, Canada, and Malaysia.

Table 1. Grid Synthesis

Author, Year	Research design	Aim	Sample, Intervention	Outcome measure	Outcome
Yasutake et al. (2018)	RCT	To evaluate the education of salt reduction using self-monitoring of urinary salt excretion tool	123 patients in Japan got Low-salt diet education using self-monitoring tools	Salt check sheet, questionnaire on low-salt diet behavior, measurement of blood pressure before and after the intervention for 4 weeks	Low-salt diet behavior increased significantly in the intervention group than in the control (p= 0.049). The results of the 24-hour urine Na: K ratio also showed a significant reduction in the intervention group compared to the control group (p= 0.033). However, there were no significant changes in blood pressure in either group (p= 0.736).
Friedberg et al. (2015)	RCT	To determine whether specialized TTM-based telephone counseling interventions are effective in developing stages of an individual's diet and improving compliance with the DASH dietary pattern.	533 patients in the USA were divided into three groups namely the Staged-Matched Intervention (SMI) group (n = 176), nontailored health education intervention (HEI) (n = 180), and usual care (n = 177).	The Harvard DASH Score was validated with the Willett Food Frequency Questionnaire measured at baseline and 6 months post-intervention	SMI was significantly more effective in having a higher proportion in the stage of treatment or maintenance of dietary changes compared to the usual care group (56% vs. 43%, p = 0.01). SMI increases overall adherence to the DASH-style diet DASH (p=0.02). However, for the eight DASH diet domains, there was no significant change, including the low-salt diet behavior (p = 0.29). Blood pressure significantly decreased in the SMI group compared to the control group (p= 0.001)

Author, Year	Research design	Aim	Sample, Intervention	Outcome measure	Outcome
Liu, Tanaka, Barr, & Nolan (2019)	RCT	Evaluating the effectiveness of e-Counseling to encourage healthy lifestyle behaviors and assessing changes in blood pressure and the Framingham Risk Index	A total of 264 patients in Canada were divided into an intervention group and a control group. the intervention group received emails about motivation and self-care behavior gradually over 12 months while the control group received only regular care	Dietary behaviors were assessed using 24-hour urine samples, and cardiovascular outcomes were assessed by measuring blood pressure and the Framingham Risk Index (FRI) measured before the intervention, the 4th month, and the 12th month of post-intervention.	The results showed that sodium levels in the urine at month 12 were not significantly different between the two groups (p = 0.29). However, gender analysis revealed that only women in the e-counseling group showed a significant reduction in urine sodium 24 hours towards baseline (p = 0.045) which was greater than the control group (p = 0.02). Systolic blood pressure in the intervention group decreased significantly (p = 0.045) and FRI (p= 0.54). However, if the behavior of physical activity, diet salt, and consumption of fruits and vegetables were combined much better in changing BP (p = 0.002) and FRI (p = 0.009).
Karupaiah et al. (2015)	Quasi-experiment	To examine behavior related to regular exercise, salt intake reduction, and increased consumption of fruit and vegetables in the Community-Based Cardiovascular Risk Factors	209 patients in Malaysia were given CORFIS Program for 6 months. Patients were divided into 3 groups namely non-compliance, new-compliance, and total compliance. Each group	Blood pressure consisted of systolic and diastolic, and body weight, and waist circumference was measured before and after the 6th month of intervention.	Low-salt diet behaviors reduce: - systolic blood pressure (non-adherent group (p= 0.667), new adherence group (p<0.001) and fully adherent group (p<0.001)) - diastolic blood pressure (non-adherent group (p= 0.177), new adherent group (p =0.005) and fully adherent group (p<0.001)) - body weight (non-adherent group (p=

Author, Year	Research design	Aim	Sample, Intervention	Outcome measure	Outcome
		Intervention Strategies (CORFIS) patients with hypertension through the application of Stage of Change	was given motivation and education related to physical activities, a low-salt diet, and fruit and vegetable intake.		0.779), the new group was adherent and fully adherent (p <0.001)) - waist circumference (non-adherent group (p= 0.458), the new group was adherent and fully adherent (p <0.001))
Kawamura et al., (2019)	An open-label single-arm trial	To examine the relationship between behavior changes of hypertensive patients receiving DASH diet education on dietary adherence and self-efficacy	43 hypertensive patients in Japan were treated on the DASH-JUMP diet for 2 months and evaluated for up to 4 months after the intervention.	The survey was conducted using the modified Perceived Health Competence Scale (PHCS) questionnaire Japanese version and stage of change behavior questionare.	After the intervention for 4 months, the results were obtained that there was a significant decrease in salt intaken (p= 0.03). The decrease in salt intake had an impact on lowering blood pressure (systolic: p=0,000; diastolic: p= 0.006).

Quality assessment results

All studies with the randomized controlled trial (RCT) had good quality. As for one article conducted by Liu et al., (2019), out of 11 questions, all questions were answered “yes”. Research conducted by Friedberg et al. (2015) has one answer no to the question of the number of samples used until the end of the study. Meanwhile, the research conducted by Yasutake et al. (2018) contained ten questions with "yes" answers and two questions with "no" answers. The question with the answer "no" is in the question of the number of samples used until the end of the study and the application of the research results where according to the recommendation of the researcher it is better to take into account the characteristics of the sample similarity in applying the research. For a quasi-experimental study, there was one article by Karupaiah et al. (2015) that had good quality, in which out of nine questions, all of the questions were answered "yes". An analytical study conducted by Kawamura et al. (2019) using quasi-experimental CASP did not have a control group out of nine questions there were eight questions were answered “yes”.

Effect of education on behavior change

There were three studies examining the effectiveness of TTM education on

behavior changes to a low salt diet (Friedberg et al., 2015; Kawamura et al., 2019; Yasutake et al., 2018). All studies showed a significant change in the behavior of a low-salt diet

Studies conducted by (Friedberg et al., 2015) using Telephone-based Stage-Matched Intervention (SMI) was given for six months. Every month, the patients received an education sequence on their diet, exercise, and medication. The education component provided is based on the stages of behavior change. When the patients had switched the stages in the following month, the education component provided also changed. The study showed better behavior change in the group adjusted for behavior stages than in the unadjusted group and the control group.

The findings are the same in a study conducted by (Kawamura et al., 2019). This study showed that DASH-JUMP diet education was able to encourage behavior change in hypertensive patients. In this intervention, the patients were given a DASH-JUMP diet for two months. In the next four months, they returned to their normal diet. Participants' self-efficacy and health behavior changes were examined initially and after the 1st, 2nd, 3rd, and 6th months.

Studies conducted by (Yasutake et al., 2018) also showed a significant change in the behavior of a low-salt diet. At the end of the intervention, the majority of patients were in the action and maintenance stages. In this study, the patient was given a tool for self-monitoring of urinary salt excretion. This intervention was carried out for four weeks in which the 24-hour urine was monitored daily using the tools provided. The results of monitoring are a benchmark for patients' salt intake.

Effect of education on urinary salt excretion

There was two study asses the effect of education on urinary salt excretion (Liu et al., 2019; Yasutake et al., 2018). Studies conducted by (Liu et al., 2019) assessed urinary sodium which showed no significant reduction in either group. However, when it was analyzed further, female participants in the intervention group experienced a significant reduction in urinary sodium. This study provided education using the web. Patients received 28 sessions of education that was linked to their email. In the first 4 months, patients were sent education every week, and for the next 4 months, education was given every 2 weeks, and the last 4 months were given monthly. The materials given were in the form of videos and handouts of motivation and self-care training.

In contrast to this study, a study conducted by Yasutake et al., (2018) examined the overall 24-hour urinary excretion. The results of this study showed a significant difference between the intervention group and the control group in the Na: K ratio.

Effect education on weight and waist circumference

There was one study that examined the effect of education on weight loss and abdominal circumference (Karupaiah et al., 2015). This study provided education with a community-based CORFIS program approach. In the community-based intervention, education or counseling is provided by a team consist doctors, nurses, nutritionists, and pharmacists. This education involved 209 patients who met the criteria and followed the education program provided for 6 months. Educational materials included the motivation and behavior changes related to blood pressure control such as exercise, a low-salt diet, and fruits and vegetables intake. The results of this study indicate that education on a low-salt diet in the adherent group both at the action and maintenance stages was able to lose weight and reduce waist circumference.

Effect education on blood pressure

All the studies reviewed also assessed changes in the blood. The results

showed different blood pressure changes obtained from the four studies. Studies by Karupaiah et al., (2015), Kawamura et al., (2019), Friedberg et al. (2015), and Liu et al., (2019) revealed that a patient's low-salt diet has a significant impact on lowering blood pressure. On the contrary, a study conducted by Yasutake et al., (2018) showed no impact on blood pressure in hypertensive patients. Another result obtained was a decrease but not significant in the Framingham Risk Index (FRI) which is a measurement of cardiovascular disease risk (Liu et al., 2019). Low-salt diet in the intervention group has much more impact on lowering systolic blood pressure, diastolic blood pressure, and 12 months FRI compared to the control group if combined with physical activity and consumption of fruits and vegetables.

DISCUSSION

This literature review aimed to describe the educational intervention for a low salt diet based on a trans-theoretical model in hypertensive patients.

Effect of education on behavior change

Despite yielding different results, the three studies show positive behavior changes. This is in line with researchs conducted by (Arafat et al., 2016; Lin & Wang, 2013; Plow et al., 2011; Wen et al., 2019) which suggest that TTM-based education can change patient behavior to be positive. In the application of the trans-theoretical model, the interventions given are in accordance with the stages of the changes related to the patient's readiness to change (Prochaska JO, 2013). Stages of change in the trans-theoretical model are influenced by the hypertensive patients' self-efficacy which is one of the constructs of TTM itself (Prochaska JO, 2013). This is reflected in a study conducted by Kawamura et al. (2019) which showed that an increase in self-efficacy had an impact on a patient's behavior change. Warren-Findlow, Seymour, and Huber (2012) suggested a similar result that self-efficacy is closely related to the self-care of hypertensive patients. Further studies by (Lee et al., 2011; Plow et al., 2011) showed that through TTM-based interventions, a patient's self-efficacy can be increased for a patient's behavior change.

Effect of education on urinary salt excretion

The behavior of a low-salt diet is reflected in the amount of salt excretion in the urine. Analysis of the amount of salt excretion in the urine provides feedback regarding their salt content. Assessment of the amount of sodium excretion in the urine is a standard measurement method for assessing a person's salt consumption (Ortega et al., 2011). The results of this study are in line with a study conducted by (Ortega et al., 2011) that patients with excessive salt consumption will show an increase in the amount of sodium excretion in the urine. Conversely, a person with less salt consumption shows a low excretion of sodium as well

Effect education on weight and waist circumference

Low-salt diet behavior also has an impact on weight loss and waist circumference. The results are supported by (Stolarz-Skrzypek et al., 2011) which proved that a person with excessive salt consumption has an increase in body weight associated with diet. Adding salt and flavorings increases a person's appetite, which can lead to weight gain and stomach circumference. However, at the age of children and adolescents, excessive salt consumption does not have a significant effect on changes in body weight (Libuda et al., 2011).

Effect education on blood pressure

Patient compliance with a low-salt diet affects the human cardiovascular system. Four studies showed significant changes in lower blood pressure and one

study proved that the low-salt diet minimizes the risk of cardiovascular disease. This is corroborated with research conducted by Laatikainen et al., (2016), Ratchford et al., (2019), and Yang et al., (2018) that a low-salt diet can lower blood pressure and prevent the risk of complications such as cardiovascular disease. One study that resulted in no change in blood pressure after a low-salt diet showed that the intervention was only given for 4 weeks. The duration is much shorter than the duration of other interventions. In a literature study conducted by He, Li, & Macgregor (2013), it was suggested that reducing long-term salt intake has an impact on lowering the blood pressure of hypertensive patients. The low-salt diet affects plasma renin, aldosterone, and noradrenaline activity which is becoming more controlled. This shows that a low-salt diet needs to be carried out continuously and consistently to lower blood pressure which is the main goal of the low-salt diet behavior.

However, some studies did not only cover the low-salt diet. Increased weight loss activity, physical activity, and increased intake of fruits and vegetables also have an impact on lowering blood pressure. Research conducted by Liu, Tanaka, Barr, & Nolan (2019) showed that a low-salt diet, increased fruit and vegetable intake, and physical activity provide more significant results in lowering blood pressure. This is certainly in line with recommendations from JNC 7 regarding the self-care behavior that patients with hypertension need to do (JNC, 2003). Adhering to self-care behaviors can lower blood pressure, increase the effectiveness of antihypertensive drugs, and reduce complications and mortality associated with hypertension (Weber et al., 2014). To find out which intervention is the most effective, further studies are needed to compare the effect of the three interventions in lowering blood pressure.

Limitation

This literature review has limitations in the review, namely the lack of studies used and studies used not only focusing on low-salt diets. Intervention using the salt excretion monitoring tool which is carried out independently is also only carried out for 4 weeks whereas changing a person's behavior requires a minimum of 6 months. Thus further research is needed that takes into account the focus of the data, the number of samples, and the length of the adequate intervention so that the evaluation of changes in behavior between groups is more accurate.

CONCLUSION

The application of TTM-based education is effective in changing patients' low-salt diet behavior. Patients' readiness to change is an important thing that needs to be assessed before giving an intervention to find out which intervention is the most appropriate to be given. Low-salt diet education has an impact on changes in biochemical indicators of hypertensive patients. Among them, are decreased urine sodium, decreased body weight and waist circumference, decreased blood pressure, and risk of cardiovascular disease. Thus, education on a low salt diet in hypertensive patients can be carried out using the Trans-theoretical Model approach.

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