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Original Article

Improving the snakebite envenoming first aid treatment of farmers in rural areas of Indonesia: An educational intervention program

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ABSTRACT

Introduction: Snakebite Envenoming (SBE) cases are a worldwide health problem. Farmers have a big risk of becoming victims of SBE. SBE management is an issue that needs to be resolved due to a lack of information regarding the appropriate management of SBE. This study aimed to analyze the effectiveness of educational intervention programs on the knowledge, attitude, practice, and self-efficacy of farmers toward SBE management.

Methods: The design of this study was a non-blinded cluster randomized controlled trial design, applied to 80 farmers in six subdistricts from rural areas of Indonesia. A multistage sampling was used to select participants. Data collection tools included a three-part questionnaire that consisted of demographics, knowledge, self-efficacy, and an observation checklist for SBE first aid practices for farmers. Education and training sessions were carried out for eight weeks for the intervention group by providing eight sessions of education and training activities. The effectiveness of the intervention was analyzed using a dependent t-test, and analysis of covariance (ANCOVA) with $p<0.05$ was considered significant.

Results: The results of this study showed that there were significant differences in knowledge, attitude, practice, and self-efficacy ($p<0.05$) of farmers in SBE first aid before and after the program. The intervention group showed better results compared to the control group after the follow-up.

Conclusion: The educational intervention programs using the digital health education method with snakebite first aid applications have proven positive effect in increasing knowledge, attitudes, practices, and self-efficacy of SBE first aid among farmers.

Keywords: Attitude, Knowledge, Self-Efficacy, Snake Bite Envenoming First Aid

Introduction

Snakebite Envenoming (SBE) can threaten human lives because of its high death rate.[1] Indonesia is one of the largest tropical countries with most of its people working in agricultural and plantation areas as farmers. Farmers are one of the groups at risk of being bitten by poisonous snakes while carrying out agricultural activities. Based on reports, the death rate for SBE victims in tropical countries is relatively high.[2] Global SBE death case reports show that there were 63,400 deaths (95% uncertainty interval [UI] 38,900–78,600) in 2019. The number of SBE victims with permanent disabilities was three times the number of deaths due to amputations and other permanent disabilities (such as blindness and paralysis) due to poisonous snake bites.[3] Indonesia is one of the

largest tropical countries in the world with various types of venomous snakes and has the potential to contribute to SBE cases among its people.[4] In recent decades, it has been found that there have been up to 200,000 cases of snake bites with 11,000-20,000 deaths.[4]

Rice fields and plantations in Indonesia have various species of venomous snakes with high poison toxicity.[5] The majority of farmers in Indonesia still do not use personal protective equipment when working, maximize lighting, and keep the environment clean.[6] This condition causes farmers to have a significant risk of becoming victims of SBE.[7] The types of snakes that are distributed in Indonesia, especially in rural areas, are *Bungaruscandidus, Naja sputatrix, Naja sumatrana, Daboia siamensis, Cryptelytropsalbolabris,* and *Calloselasmarhodostoma*.[5] The effects of snake venom can be neurotoxins, hemotoxins, cardiotoxins, nephrotoxins, cytotoxins, necrotoxins, and myotoxins which cause various damages to the human body.[1] When snake venom enters the body it can cause necrosis, making it possible for the victim to be amputated.[8] Neurotoxins that degenerate the function of motor nerves and cranial nerves are always affected first, causing paralysis of the face, and body and weakness of the respiratory muscles.[9,10]

SBE requires quick and appropriate treatment before the effects of snake venom can cause more serious symptoms.[11] Delays in taking patients to health facilities are one of the causes of death and disability in SBE victims.[11] Correct knowledge and appropriate management in SBE management will certainly reduce the severity or death rate of victims of poisonous snake bites.[12] This is important to increase community awareness of SBEs in rural communities who are at risk of becoming victims and to provide first aid quickly and precisely.[13] This reason strengthens WHO's recommendation that education and training on the management of SBEs should be provided to anyone, including lay people in the community.[1] Education and training on SBE management in Indonesia are still rarely carried out.[7] Public health centers in Indonesia still do not have specific programs regarding appropriate education and training methods for SBE management.[7]

The SBE management handbook has been issued by WHO as a guide for SBE management.[1] However, this book is not easy for rural communities to access independently, so innovative health education regarding SBE management needs to be formulated easily by utilizing digital technology.[14] Digital health education methods using mobile apps have recently become an alternative; in addition to making it easier, it can also attract the interest of the community, in increasing knowledge, attitude, and practice regarding health concepts.[15,16] Digital health education provides the opportunity to disseminate health information massively with a wide reach to a wide audience without having to schedule meetings with participants.[15] Standardized SBE management material has been provided by WHO and only requires innovation in transferring it to digital media.[16] Previous research has proven that digital health education methods have a significant impact on increasing knowledge, attitude, and practice of health management.[16,17]

Considering this evidence, we are trying to develop an innovative digital-based educational program for farmers as a form of transformation of the SBE first aid guide. Our research aims to verify the effectiveness of the educational program we are working on farmers' knowledge, attitude, practice, and self-efficacy in managing venomous SBE.

Methods

This was a nonblinded cluster randomized controlled trial design, applied to farmers in rural areas of Jember, East Java, Indonesia. This study was conducted From January to June 2021. This research compared two educational intervention programs in improving the SBE first aid treatment of farmers in rural areas of Indonesia.

A multistage sampling was used to select farmers for this study. Six subdistricts from rural areas of Indonesia. Information about the recruitment of the participants was distributed using a flyer sent

by the Public Health Nurses in their working areas. A total of 198 farmers were initially identified to follow this study. The inclusion criteria for this study were respondents who work as farmers and have mobile phones; based on inclusion criteria, 105 participants were excluded (Not meeting inclusion criteria (n=85); Declined to participate (n=12); Other reason (n=8)). The 93 participants among 198 eligible participants were randomly allocated to six subdistricts and randomized using computer-generated numbers. The six subdistricts of villages were matched based on population and randomly assigned to the intervention group (three subdistricts and 47 farmers) or the control group (three subdistricts and 46 farmers). During the intervention program, seven farmers were dropped from the intervention group and six farmers were dropped in the control group due to health reasons and discontinued intervention. Data from a total of farmers divided into two groups were used and analyzed in this study (Figure 1).

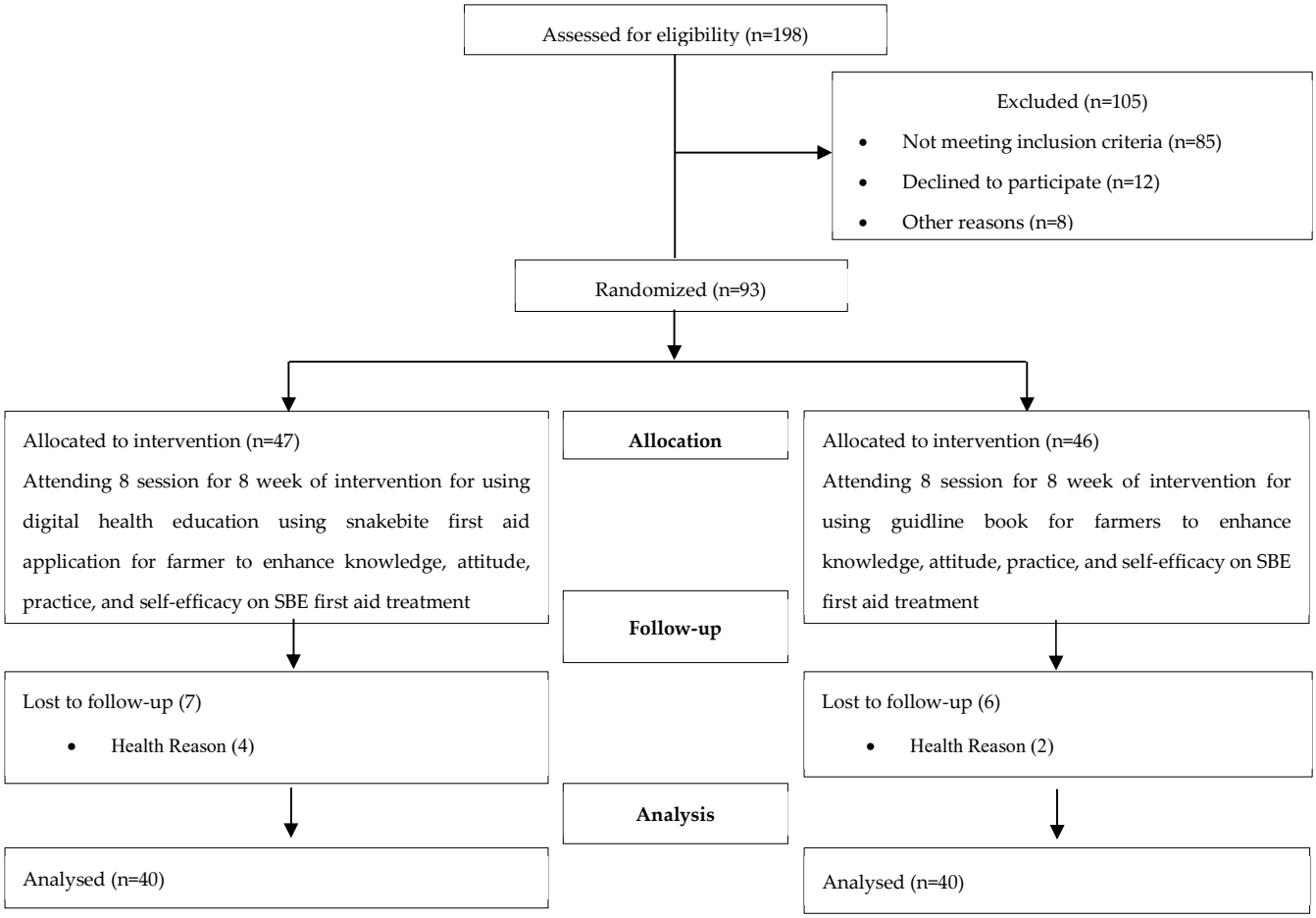

Figure 1 Consort Flow Diagram for enrollment, allocation, and follow-up study participants

Data collection tools included a three-part questionnaire. The first part of the demographic questionnaire included age, gender, ethnicity, length of work as a farmer, education level, and family member as a health worker. The second part of the questionnaire included questions about snake bite first aid knowledge, attitude, and self-efficacy. The third part was an observation checklist for snake-bite first aid practices for farmers. The knowledge questionnaire was developed from previous research and consists of 7 question items.[18] For the knowledge questionnaire, responses include true/false questions and multiple-choice questions. The minimum score was 0 and the maximum score was 30. We used the attitude questionnaire from previous research to measure the attitude of farmers in delivering first aid.[19] The attitude questionnaire consists of 5 question items. The questions given consist of positive questions and

negative questions. Participants were asked to choose answers according to the participant's beliefs about first aid. The answer choices consist of five answer choices, namely strongly agree, agree, neutral, disagree, and strongly disagree. The minimum score was 5, while the maximum score was 25. We also observed the practice of farmers in performing SBE first aid using the observational sheet. We developed the SBE first aid observational sheet from a WHO practical guideline.[1] Farmer simulates SBE first aid steps. Observers consisting of a research team and community health workers observed the actions carried out by participants. The SBE first aid observation sheet consists of 30 assessment items starting from the preparation stage (5 items), implementation stage (15 items), and termination stage (5 items). The minimum score was 0 and the maximum score was 30. The general self-efficacy scale (GSES)-12 (Indonesian Version) was used to measure the self-efficacy of the farmers.[20] The scoring system in this study was giving points for the answer. The GSES consists of 12 question items. Participants were asked to choose answers according to the participant's self-efficacy about SBE first aid. The answer choices consist of five answer choices: strongly disagree, don't agree, almost agree, simply agree, and strongly agree. The maximum value of this questionnaire was 48 and the minimum score was 12.

This research was carried out by a research team in several phases, starting from the preparation, implementation, and termination phases. The preparation phase was carried out by compiling a set of media, informed consent, and questionnaires. The media used for the digital health education method was Snakebite First Aid Applications. This media was developed by the research team with professionals and trials have been carried out. SBE first aid application version 0.0.1 was designed in 2020. The contents of the SBE First Aid application include material on SBE (Type of Snakes, Signs, and Symptoms of SBE, Prevention of SBE) and demonstration videos on the practice of SBE by the WHO Guidelines (Figure 2)[1].

The phase of implementing the intervention for research participants begins with explaining the research procedures to participants and providing informed consent sheets to participants. Education and training sessions were carried out for eight weeks for the intervention group by providing eight sessions of activities (Table 1), while the control group followed routine health service procedures. The intervention process was carried out in small groups consisting of 10 participants in each group. This educational session began with directing participants in the intervention group to install the Snakebite First Aid App on their mobile phones. After that, the researcher explained several features that participants could access and how to use them. Participants one by one carried out the review in stages over a predetermined time duration. This educational was an individualized intervention by reviewing the SBE first aid application. Active discussions occurred between participants based on the learning media used. The educational program in the next session was also carried out using the same method. In the 8th week, participants re-reviewed the demonstration video and carried out a live re-demonstration with role play. Active discussions also occurred between participants and facilitators during this process. One month after the educational program, participants were asked to fill out a post-test questionnaire.

The data were entered into Statistical Package for the Social Sciences (SPSS) software (version 23) after collection, cleaning, and organization. The characteristics of the respondents such as age, length of work, gender, ethnicity, last education, and whether there are family members who work as health workers described. In addition, the measures of central tendency and dispersion indices were applied to display quantitative data. The normal distribution of data was checked by applying the Kolmogorov-Smirnov test. The demographic characteristics of farmers in the intervention and control groups were analyzed with the Chi-Square test, Likelihood ratio test, Mann-Whitney test, and Yates test (Continuity

correction).

Furthermore, the dependent t-test was used to determine changes in variables after educational intervention in each group (intra-group comparison) in knowledge about SBE and first aid, attitude in SBE Management, practice of SBE first aid, and self-efficacy about SBE first aid. Analysis of covariance (ANCOVA) was used to assess the effectiveness of the educational intervention carried out according to age, length of work as a farmer, and baseline measurement. Adjustment measures were determined by considering important factors related to the outcome based on a literature review. The comparison results were corrected using the Bonferroni method.

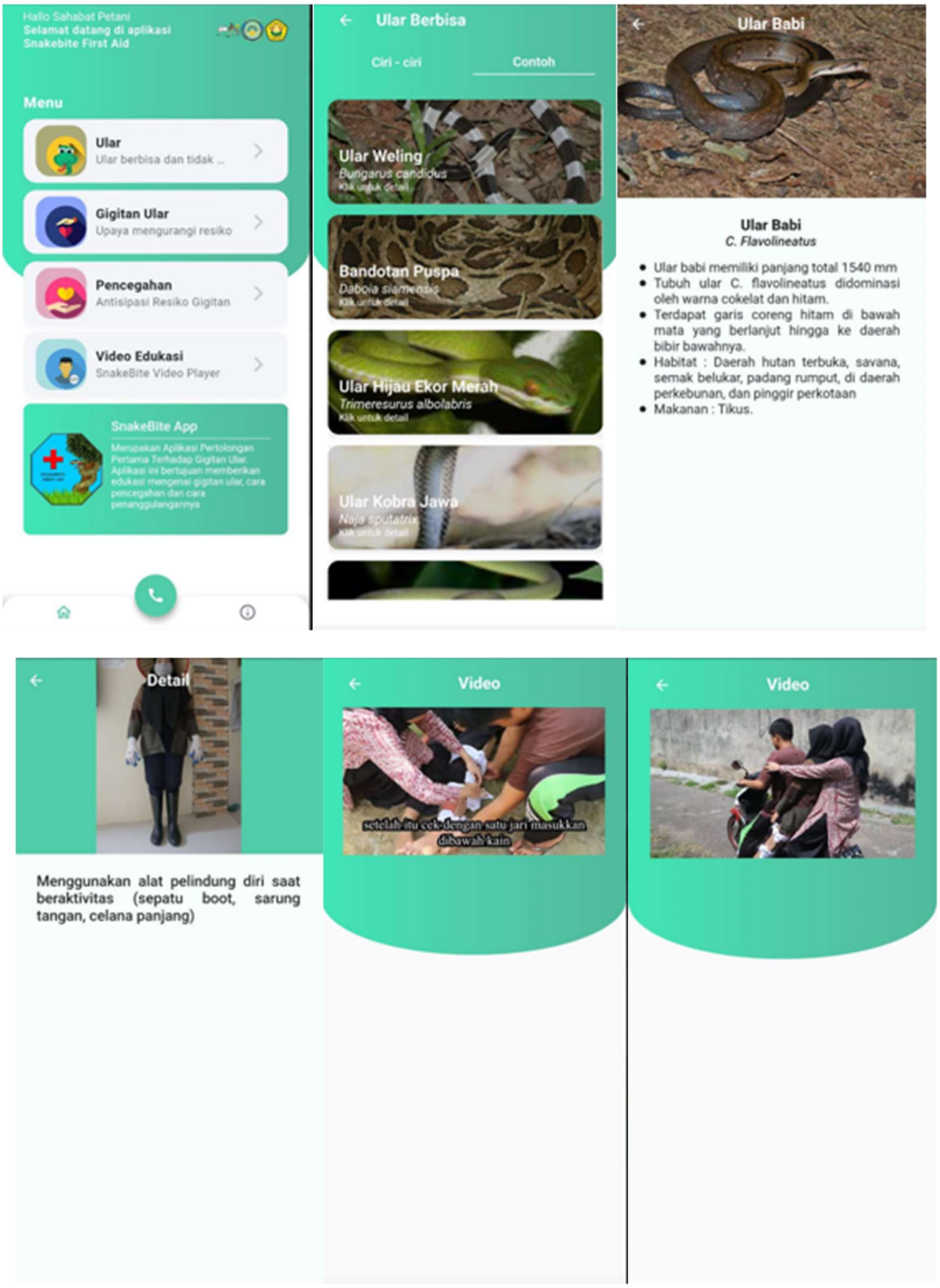

Figure 2 The Display of Snakebite First Aid Application for Farmers in Rural Area

Table 1. How to perform the digital health educational intervention program using snakebite first aid application

Sessions	Objectives	A summary of topics and activities	Educational time (mins)
1	Types of Snake	The various types of snakes such as venomous snakes and non-venomous snakes.	45
2	Types of Snakebite	The identification of snake bites, including distinguishing between venomous and non-venomous snakes.	45
3	Snakebite Risk Reduction	The steps to reduce the risk of being bitten by snakes such as recognizing snake habitats, wearing protective clothing, using protective equipment, and maintaining environmental cleanliness to avoid interactions with snakes.	45
4	Signs and symptoms after snakebites	The signs and symptoms after being bitten by a venomous snake, signs and symptoms that can appear in the victim.	45
5	First aid management after a snake bite	The video of first aid for venomous snake bites includes keeping the patient calm, limiting movement, splinting, cleaning the wound without inhaling poison, transporting the victim, and seeking immediate medical assistance.	90
6	Transportation to public health facilities	The specific steps in the safe transportation of venomous snakebite victims.	45
7	Importance of antivenom after snakebite	The importance of antivenom serum to relieve the effects of venomous snake bites.	45
8	Role play of Snake Bite Envenoming (SBE) first aid management	The role-play of SBE Management involves participants simulating the assessment, reassurance, immobilization, and positioning steps for responding to a snakebite.	120

Note: SBE = Snake Bite Envenoming

This study was approved by the Ethical Committee Review Board for Research No. 94/UN25.1.14/KEPK/2021. Ethical and administrative approval from the Department of Political Unity for the Protection of the Public and the public health centers was obtained for this study.

Results

The mean (± standard deviation) age of farmers was 47.25 ± 10.5 and 45.89 ± 12.2 respectively with length of work 14.02 ± 9.2 and 16.68 ± 11.8 in the intervention and control groups. Most farmers were men in both the intervention (90%) and the control group (85%). The Javanese tribe dominates the farmer participants who took part in this research with a percentage of more than 80%. Most of the participating farmers had a high school education in both groups (45%) and (37.5%). Most of the participating farmers in both groups did not have family members who were health workers (85%) and (87.5%). Based on experience of snake bites, more than 95% of farmers have never been victims of poisonous snake bites even though most of them often see snakes while working. Based on the results of the demographic analysis, there were no significant differences between the two groups in terms of demographic characteristics (gender, ethnicity, education level, family member as a health worker, SBE experience, age, and length of work as a farmer) with P-Value > 0.05 (Table 2).

Table 2. Comparison of demographic information in two groups at the pre-intervention phase

Qualitative variable		Intervention group (n=40) n (%)	Control group (n=40) n (%)	*p*-value
Gender	Male	36 (90)	34 (85)	0.338[d]
	Female	4 (10)	6 (15)	
Ethnic	Java	35 (87.5)	32 (80)	0.094[a]
	Madura	5 (12.5)	8 (20)	
Education level	Not Attending School	2 (5)	3 (7.5)	0.129[b]
	Elementary School	10 (25)	12 (30)	
	Junior High School	6 (15)	8 (20)	
	Senior High School	18 (45)	15 (37.5)	
	Bachelor Program	2 (5)	2 (5)	
Family member as a health worker	Yes	6 (15)	5 (12.5)	0.745[a]
	No	34 (85)	35 (87.5)	
Snakebite experience	Yes	2 (5)	1 (2.5)	0.872[a]
	No	38 (95)	39 (97.5)	
Ever seen a snake	Never	0	0	0.776[a]
	Sometimes	12	13	
	Often	25	25	
	Always	3	2	
Quantitative variable		**Mean ± SD**	**Mean ± SD**	
Age		47.25 ± 10.5	45.89 ± 12.2	0.106[c]
Length of work as a farmer		14.02 ± 9.2	16.68 ± 11.8	0.074[c]

Note: n, Participants, % Percentage, SD, Standard Deviation

[a]Chi-Square test; [b]Likelihood ratio test; [c]Mann-Whitney test; d Yates test (Continuity correction)

After observing changes for 8 weeks in the control group and intervention group, there were significant differences in the intervention group in knowledge, attitudes, first aid practices, and self-efficacy regarding SBE before and after the intervention. In the knowledge about SBE, there was a significant increase from 21.06 ± 4.38 to 27.61 ± 2.08 (p = 0.028*) in the intervention group. Attitudes towards SBE management in the intervention group also showed a significant increase from 18.05±1.74 to 22.95±1.34 (p = 0.015*). Likewise, the SBE first aid practice variable in the intervention group experienced a greater increase from 12.58 ± 2.12 to 27.18 ± 2.49 (p <0.001*). The self-efficacy variable related to SBE first aid in the intervention group also experienced a significant increase from 30.12 ± 7.12 to 37.35 ± 3.45 (p <0.001*). These results indicate that the educational intervention program has a real positive impact in increasing knowledge, attitudes, first aid practices, and self-efficacy related to SBE in the intervention group (Table 3).

Table 3. Change in control and intervention group after 8 weeks

Variables	Control group		p value	Intervention group		p value
	M±SD			M±SD		
	Baseline	Follow-up		Baseline	Follow-up	
Knowledge about SBE (Snake Bite Envenoming) and first aid	21.75±4.35	22.08±2.67	0.067	21.06±4.38	27.61±2.08	0.028*
Attitude in SBE management	18.18±0.75	18.62±1.29	0.108	18.05±1.74	22.95±1.34	0.015*
Practice of SBE first aid	12.68±2.22	12.92±4.92	0.165	12.58±2.12	27.18±2.49	<0.001*
Self efficacy about SBE first aid	30.12±7.17	30.75±4.80	0.211	30.12±7.12	37.35±3.45	<0.001*

Note: Mean±Standard deviation. p-value = paired sample t-test; SBE = Snake Bite Envenoming

Analyses of the intervention effectiveness using ANCOVA after adjusting for age, length of work as a farmer, and baseline measurement revealed significant differences in knowledge about SBE and first aid, attitude in SBE management, the practice of SBE first aid, and self-efficacy about SBE first aid in the intervention group and the control group (p-value <0.001) (Table 4).

Table 4. Comparison of the final adjusted means, according to group allocation

Variables	Control group (CON)					Intervention group (INT)					Δ	CI (95%)	p value[1]
	n	MI	CI (95%)	FAM	CI (95%)	n	MI	CI (95%)	FAM	CI (95%)			
Knowledge about SBE and first aid	40	21.75	17.4-26.1	22.08	19.41-26.46	40	21.06	16.68-25.44	27.61	25.08-29.69	5.53	5.67; 3.23	<0.001 *
Attitude in SBE management	40	18.18	17.43-18.93	18.62	17.33-19.91	40	18.05	16.31-19.79	22.95	21.61-24.29	4.33	4.28; 4.38	<0.001 *
Practice of SBE first aid	40	12.68	10.46-14.9	12.92	8-17.84	40	12.58	10.46-14.7	27.18	24.69-29.67	14.26	16.69; 11.83	<0.001 *
Self efficacy about SBE first aid	40	30.12	22.95-37.29	30.75	25.95-35.55	40	30.12	23-37.24	37.35	33.9-40.8	6.6	7.95; 5.25	<0.001 *

Note: n refers to the actual number of responses to each team, CI confidence interval, MI mean initial, FAM final adjusted mean

[1]ANCOVA: adjusting for age and length of work as farmer at baseline and follow-up. Δ = difference between final adjusted mean

Discussion

Our educational intervention program using simulation with SBE first aid applications was found to be an effective strategy to increase awareness of SBE first aid, leading to positive effects concerning knowledge, attitude, self-efficacy, and practice. The usual health service procedures in the public health center were unsuccessful in increasing awareness about SBEs. These findings suggest the educational intervention program using SBE first aid applications is an effective method to increase awareness of the farmers on SBE cases. To our knowledge, this is the first method that investigated the impact of an innovative digital-based educational program for farmers with SBE first aid application that addressed multiple aspects for increasing awareness about SBE in rural areas.

Digital health education methods using mobile apps provide a new alternative method with a technological approach to reach wider communities without being limited by distance, space, and time.[21] It has long been researched that digital health education has a significant effect on changes in cognitive, affective, and psychomotor aspects in respondents.[22] Digital health combined with simulation has a significant effect on changing these aspects.[22] To overcome impersonal program interventions, this study used individualized intervention according to review, analysis, and practice about snakes, SBEs, and first aid after SBEs. Adherence to guidelines is one of the main determinants of the success of the practice of SBE first aid treatment in pre-hospital settings.[23]

Digital health-based individualized intervention makes it easy for respondents to carry out independent learning.[21] This condition is a very important control for individual involvement to achieve the learning objectives.[21] Our finding showed that the post-test scores of respondents in the intervention group increased significantly compared to the control group. Previous research also explained that digital health education based on audio-visual media has significant

improvement in health knowledge, especially in rural areas of low and middle-income countries.[24] The previous research also stated that the percentage increase in knowledge level after educational programs with several media increased significantly.[13,25] We need to pay attention to and spread massively so that educational programs in this way can have a significant impact on changes in rural communities' knowledge.[13,25]

Digital health education using mobile applications can increase the level of knowledge of farmers on SBE management for several reasons.[26] Digital health education has the advantage of speeding up the delivery of information, deepening the information provided independently, increasing the level of understanding of participants, and increasing the effectiveness of teaching.[26] The results of this use have the effect of increasing the SBE knowledge scores of farmers after being given education via digital media compared to those who do not use digital media.[27]

Our findings also reveal that farmers' attitudes after the digital health-based education program was carried out also experienced positive changes. Farmers' attitudes towards SBE improved, especially in terms of attitudes towards SBE first aid. Farmers revealed that the majority strongly agreed to carry out SBE first aid in the right way and carry out aid procedures according to the guidebook. A person's attitude can be influenced by several factors, and the dominant factors are knowledge, experience, and length of time working as a farmer.[28] Previous research also states that farmers' increased knowledge of hazard management in the agricultural environment has an impact on increasingly positive attitudes.[29] Human attitudes are formed through social processes obtained during their lives, where individuals gain information, knowledge, or experience.[28] The educational program given to a person of course has an impact on the formation of attitudes by the direction of the information provided in the educational program carried out.[28]

Apart from knowledge and attitudes, the practice of SBE management among farmers has also experienced significant changes. Previously, farmers had a concept that was not aligned with WHO regarding SBE management in the prehospital phase.[7] Farmers tend to use steps such as making incisions, tying them with tourniquets, applying herbal medicine to the bite wounds, and not immediately taking the victim to the nearest health service.[7] Previous research also stated that rural communities in agricultural and plantation areas still use inappropriate SBE handling steps.[7,30] After this research was carried out, farmers had insight into SBE management following WHO guidelines. The change in SBE management behavior that occurred was due to the video tutorial that was provided in the Snakebite first aid app. The study's findings support earlier research, which found that using audiovisual media in digital information that includes specific action recommendations can improve a person's ability to perform certain tasks.[31] Interactive and interesting digital media will certainly increase someone's interest in conducting an in-depth review of the concepts being taught. Demonstrations via digital media can be set manually for repeated review, so this will increase understanding of the information provided.[32,33]

The educational program using digital health intervention also showed a significant increase in self-efficacy, with participants in the experimental group showing higher perceived self-efficacy than participants in the control group. These findings are consistent with earlier studies that demonstrate how carefully thought-out health education programs can raise participants' self-efficacy in connection with the health management techniques they are learning.[34] In reality, the offered digital health-based teaching program includes all of the intended content, including videos showing SBE management techniques in compliance with the WHO handbook and information about SBE.[1,23] All these activities increase farmers' self-efficacy in SBE management. Previous research explains that a structured health education program can increase self-efficacy values in carrying out first aid

measures.[34,35] The results of this study are also in line with Bandura's self-efficacy theory which states that increasing self-efficacy has a positive impact on self-care practices and increases health benefits.[36] Therefore, with increasing self-efficacy, the farmer's ability to practice SBE management will also increase which can be applied at any time.

Limitations

This study was conducted with small sample size, limited geographic coverage, and potential selection bias that may limit the generalizability of the findings. In addition, human intervention processes and outcome measurement efforts that rely on self-reported measurements by respondents can introduce bias and affect the validity of results. The relatively short follow-up period and reliance on digital health education methods may further limit the applicability of this study to other contexts. Finally, although efforts were made to use validated instruments, intervention effectiveness may also have been influenced by research respondents' digital literacy and access.

Conclusions

The educational intervention programs using the digital health education method with Snakebite first aid applications have proven positive effect in increasing knowledge, attitudes, practices, and self-efficacy of SBE management among farmers. It is crucial to empower farmers with skills in managing SBE through digital health education, including Snakebite first aid apps. Expanding digital health education, integrating snakebite management into public health initiatives, training health care providers, involving local communities, conducting long-term assessments, and advocating for policy support are important recommendations for policymakers. These actions will mitigate the impact of SBE and empower farmers to respond appropriately to SBE.

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References

1. WHO. Guidelines for the Management of Snakebites [Internet]. Vol. 1. 1–199 p. Available from: https://www.who.int/publications/i/item/9789290225300
2. Musah Y, Ameade EPK, Attuquayefio DK, Holbech LH. Epidemiology, ecology and human perceptions of snakebites in a savanna community of northern Ghana. PLoS Negl Trop Dis. 2019;13(8):1–20. Available from: https://doi.org/10.1371/journal.pntd.0007221
3. Roberts NLS, Johnson EK, Zeng SM, Hamilton EB, Abdoli A, Alahdab F, et al. Global mortality of snakebite envenoming between 1990 and 2019. Nat Commun. 2022 Oct 25;13(1):6160. Available from: https://doi.org/10.1038/s41467-022-33627-9
4. Adiwinata R, Nelwan EJ. Snakebite in Indonesia. Acta Med Indones. 2015;47(4):358–65. Available from: https://www.actamedindones.org/index.php/ijim/article/view/30
5. Rifaie F, Maharani T, Hamidy A. Where did Venomous Snakes Strike? A Spatial Statistical Analysis of Snakebite Cases in Bondowoso Regency, Indonesia. Hayati. 2017;24(3):142–8. Available from: https://doi.org/10.1016/j.hjb.2017.09.001
6. Yunanto RA, Wantiyah W, Yusuf Gito Afandi. Description of Snakebite's Prevention Efforts Towards Farmers in Panti Sub-District. Nursing and Health Sciences Journal (NHSJ) . 2021 Dec 29;1(3):184–92. Available from: https://doi.org/10.53713/nhs.v1i3.48
7. Yunanto RA, Sulistyorini L. Snakebite Cases in Agricultural Area of Jember: A Descriptive Study of Snakebite Victims at Two Public Hospitals of Jember. Jurnal Kesehatan dr Soebandi . 2021 Oct;9(2):106–14. Available from: http://dx.doi.org/10.36858/jkds.v9i2.286
8. Khan YMT, Fatema N, Shekeili NAA. Snake Bite Envenomation: Experience in a Regional Hospital,

Oman: A Retrospective Observational Study. SM Trop Med J. 2017;2(1):1015. Available from: http://dx.doi.org/10.36876/smjhrt.1015

9. Slagboom J, Kool J, Harrison RA, Casewell NR. Haemotoxic snake venoms: their functional activity, impact on snakebite victims and pharmaceutical promise. Br. J. Haematol. 2017 June;177(6):947–59. Available from: https://doi.org/10.1111%2Fbjh.14591

10. Casewell NR, Jackson TNW, Laustsen AH, Sunagar K. Causes and Consequences of Snake Venom Variation. Trends in Pharmacological Sciences. 2020;41(8):570-81. Available from: https://doi.org/10.1016/j.tips.2020.05.006

11. Esiéné A, Etoundi PO, Tochie JN, Metogo AJM, Minkande JZ. Severe Viperidae envenomation complicated by a state of shock, acute kidney injury, and gangrene presenting late at the emergency department: A case report. BMC Emerg Med. 2019 March 12;19(1):1–7. Available from: https://doi.org/10.1186/s12873-019-0239-0

12. Chen C, Gui L, Kan T, Li S, Qiu C. A survey of snakebite knowledge among field forces in China. Int J Environ Res Public Health. 2017;14(1). Available from: https://doi.org/10.3390/ijerph14010015

13. Nady SE, Amr AEF. Effect of Nursing Intervention on Educating Rural women Regarding Snake Bite's Prevention, First Aid, and Treatment. IOSR Journal of Nursing and Health Science. 2018 ;7(6):112-22. Available from: https://iosrjournals.org/iosr-jnhs/papers/vol8-issue6/Series-1/G0806014454.pdf

14. Boarder J. The Power of Health Education amongst Individuals for a Healthier Future. J Community Med Health Educ. 2023;13(3). Available from: https://www.omicsonline.org/open-access/the-power-of-health-education-amongst-individuals-for-a-healthier-future-126018.html

15. Aguerrebere PM, Medina E, Pacanowski TG. Promoting Health Education through Mobile Apps: A Quantitative Analysis of American Hospitals. Healthcare. 2022 Nov 8;10(11). Available from: https://doi.org/10.3390/healthcare10112231

16. Lee M, Lee H, Kim Y, Kim J, Cho M, Jang J, et al. Mobile app-based health promotion programs: A systematic review of the literature. Int J Environ Res Public Health. 2018;15(12). Available from: https://doi.org/10.3390/ijerph15122838

17. Torkian S, Mostafavi F, Pirzadeh A. Effect of a mobile application intervention on knowledge, attitude and practice related to healthy marriage among youth in Iran. J Educ Health Promot. 2020 Nov 1;9(1):312. Available from: http://dx.doi.org/10.4103/jehp.jehp_444_20

18. Chen C, Gui L, Kan T, Li S, Qiu C. A survey of snakebite knowledge among field forces in China. Int J Environ Res Public Health. 2017;14(1). Available from: https://doi.org/10.3390/ijerph14010015

19. Sharif NAM, Hasan MKC, Jamaludin FIC, Firdaus MKZH. The need for first aid education for adolescents. Enferm Clin. 2018;28:13–8. Available from: https://doi.org/10.1016/S1130-8621(18)30028-7

20. Putra MDK, Rahayu W, Umar J. Indonesian-language version of general self-efficacy scale-12 using Bayesian confirmatory factor analysis: A construct validity testing. Jurnal Penelitian dan Evaluasi Pendidikan. 2019 Jun 29;23(1):12–25. Available from: http://dx.doi.org/10.21831/pep.v23i1.20008

21. Dunleavy G, Nikolaou CK, Nifakos S, Atun R, Law GCY, Car LT. Mobile digital education for health professions: Systematic review and meta-analysis by the digital health education collaboration. J Med Internet Res. 2019 Feb 12;21(2). Available from: https://www.jmir.org/2019/2/e12937/

22. Vallee A, Blacher J, Cariou A, Sorbets E. Blended learning compared to traditional learning in medical education: Systematic review and meta-analysis. J Med Internet Res. 2020;22(8):e16504. Available from: https://doi.org/10.2196/16504

23. Parker-Cote J, Meggs WJ. First aid and pre-hospital management of venomous snakebites. Trop Med Infect Dis. 2018;3(2):45. Available from: https://doi.org/10.3390/tropicalmed3020045

24. Holst C, Stelzle D, Diep LM, Sukums F, Ngowi B, Noll J, et al. Improving Health Knowledge Through Provision of Free Digital Health Education to Rural Communities in Iringa, Tanzania: Nonrandomized Intervention Study. J Med Internet Res. 2022 Jul 28;24(7). Available from: https://doi.org/10.2196/37666

25. Vaiyapuri S, Kadam P, Chandrasekharuni G, Oliveira IS, Senthilkumaran S, Salim A, et al. Multifaceted community health education programs as powerful tools to mitigate snakebite-induced deaths, disabilities, and socioeconomic burden. Toxicon X. 2023 Mar;17. Available from: https://doi.org/10.1016/j.toxcx.2022.100147

26. Li J, Kang M. Using Multimedia to Promote Teaching Effectiveness in the Classroom of China. In: International Conference on on Soft Computing in Information Communication Technology. 2014;242–4. Available from: http://dx.doi.org/10.2991/scict-14.2014.59

27. Zhu W, Pearkao C. The effect of a multimedia teaching method of a snakebite first aid program on knowledge among undergraduate students in

China. Journal of Nursing Science & Health. 2019;42(3). Available from: https://he01.tci-thaijo.org/index.php/nah/article/view/189398

28. Feith HJ, Lukács Á, Füzi R, Krekó IB. Health Education-Responsibility-Changing Attitude. A New Pedagogical and Methodological Concept of Peer Education. Acta Univ Sapientiae, Social Analysis. 2018;8:55–74. Available from: https://doi.org/10.2478/aussoc-2018-0004
29. Baksh K, Ganpat W, Narine L. Farmers knowledge, attitudes and perceptions of occupational health and safety hazards in Trinidad, West Indies and implications for the Agriculture sector. J. Agric. Ext. Rural Dev. 2015 Jul 24;7(7):221–8. Available from: https://doi.org/10.5897/JAERD2015. 0672
30. Anjum A, Husain M, Hanif SA, Ali SM, Beg M, Sardha M. Epidemiological Profile of Snake Bite at Tertiary Care Hospital, North India. J Forensic Res. 2012 March 3;3(4). Available from: http://dx.doi.org/10.4172/2157-7145.1000146
31. Yunanto RA, Wihastuti TA, Rachmawati SD. Comparison of CPR Training with Mobile Application and Simulation to Knowledge and Skill of CPR. NurseLine Journal. 2017 November;2(2):173–86. Available from: https://doi.org/10.19184/nlj.v2i2.5943
32. Thakur M, Dharni IT. Quasi experimental study to assess effectiveness of video teaching programme on knowledge regarding prevention and first aid management of selected home accidents among mothers of under five children residing in selected villages of District. International Journal of Advance Research, Ideas and Innovations in Technology. 2019;5(3):1948–51. Available from: https://www.ijariit.com/manuscripts/v5i3/V5I3-1956.pdf
33. Idrus FN, Zuhriyah L, Suharsono T. Comparison of simulation method and animation video on knowledge related to preparedness of elementary school students in Ternate, Indonesia. Indian J Public Health Res Dev. 2019 Aug;10(8):2037–41. Available from: 10.5958/0976-5506.2019.02154.5
34. Wungrath J, Khumai N, Phrommasen P. The Effect of Health Promotion Program on Perceived Self-Efficacy and Self-Care Practices among Elderly with Multimorbidity in Chiang Mai, Thailand. Kesmas. 2022 Aug 1;17(3):198–203. Available from: https://scholarhub.ui.ac.id/kesmas/vol17/iss3/6/
35. Nur'Aeni A, Mirwanti R, Anna A. Effect of a workbook in health education on self-efficacy and quality of life of patients with coronary heart disease. Belitung Nurs J. 2019 Dec 1;5(6):218–24. Available from: https://doi.org/10.33546/bnj.801
36. Bandura A. Perceived Self-Efficacy In Cognitive Development and Functioning. Educ Psychol. 1993;28(2). Available from: https://doi.org/10.1207/s15326985ep2802_3