Strengthening Health Literacy Using Social Media: A Quasi-Experimental Study on Rice Farmers' Heat Stroke Risk in Rural Agricultural Areas of Indonesia

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Background and Objective: Heat stroke is an emergency condition that can cause death. Heat stroke is prone to occur in agricultural workers. This condition of vulnerability is related to rice farmers' knowledge of exposure to extreme environmental heat. This research aims to determine the effect of increasing health literacy through social media on rice farmers' knowledge, attitude, and first aid practice regarding heat stroke emergencies.

Materials and Methods: We used a quasi-experimental design with a pretest-posttest control group design. A cluster randomized trial sampling technique was used to select the participants. The education carried out sends visuals, audio, and narrative text via WhatsApp groups. Data were collected using a heat stroke knowledge, attitude, and first aid practice questionnaire, with a Cronbach's Alpha value of 0.73. Data was analyzed using the Wilcoxon test and the Mann-Whitney test to determine the differences within or between groups.

Result: The results showed no significant change in knowledge, attitude, or first aid practice in the control group (p-values: 0.793, 0.491, and 1.000, respectively, all > 0.05). In contrast, the intervention group showed significant improvements in all three aspects (all p-values = 0.001 < 0.05). The intervention group showed significant improvements in knowledge, attitude, and first aid practice related to heatstroke compared to the control group (all p = 0.001), with the greatest increase observed in knowledge.

Conclusion: This research concludes that increasing health literacy via social media is effective in increasing knowledge, attitude, and first aid practice about heat stroke emergencies among farmers. It is recommended that future studies explore the long-term retention of knowledge, attitude, and practice, and the impact of social media education on behavioral changes in preventing heat stroke among farmers.

Keywords: Farmers; Health Literacy; Heat Stroke; Knowledge Attitude Practice; Social Media

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Introduction

Heat-related illnesses, or what can be called heat-related illnesses, have health impacts ranging from minor to major. Major conditions can cause heat stroke and the risk of death (1). Heat stroke is prone to occur in agricultural workers because they receive more exposure to sunlight and environmental heat stress (2). This condition of vulnerability is related to farmers' knowledge of preventing exposure to extreme environmental heat (3). Farmers' lack of knowledge can increase their vulnerability to heat-related illnesses while working (4). Farmers who do not have sufficient knowledge can be at risk of experiencing dehydration because farmers are unable to prevent heat stroke (5).

The incidence of heat stroke in the United States reaches 67,512 cases that come to the emergency department, and every year, around 702 people die (6). The mortality rate for heat stroke reaches 10-50% worldwide, 7-20% of whom experience persistent neurological damage (7). In Vietnam, 83.4% of rice farmers reported at least one symptom of heat-related illness, with 55.1% experiencing two or more symptoms during the summer-autumn rice season (8). A study on sugarcane farmers in Thailand found that 48% experienced symptoms of heat-related illness, including heavy sweating, weakness, dizziness, muscle cramps, headaches, and vertigo (8). In East Kalimantan, Indonesia, a study found that participants working in deforested areas experienced increased physiological heat strain compared to those in forested areas, indicating that environmental conditions significantly affect heat exposure and related health outcomes (9). While there is no direct data on the prevalence of heat stroke among farmers in Indonesia, evidence from similar agricultural settings suggests that heat-related illnesses are a significant concern.

Furthermore, the results of measuring knowledge in previous research showed that around 27% of farmers were able to identify the acclimatization time due to heat stroke. This figure is relatively low, and it is necessary to provide education and training to farmers in dealing with risk factors and first aid (4). Similar research regarding knowledge regarding heat-related illnesses also stated that around 45% of farmers answered correctly regarding acclimatization and the need for regular training to prevent heat-related illnesses (3).

The low level of knowledge among farmers is caused by the ineffectiveness of the training provided (10). Low farmer knowledge can enable farmers to consider signs and symptoms due to heat exposure to be unimportant, so that farmers are unable to prevent the risk of heat stroke (3). Participatory health education is one effort to increase farmers' knowledge about health problems caused by exposure to the hot sun (10). The lack of optimal health education provided to farmers is due to inappropriate methods and a short time for the counseling process (11). Health education is a comprehensive learning process designed to foster health values and behaviors in individuals and communities. It includes a variety of exercises intended to raise health consciousness, accountability, and the capacity to make wise decisions about one's health (12).

Updated health literacy education methods for farmers need to be carried out for a more optimal level of health. The dynamics of contemporary developments require that the use of technology be applied in various fields, one of which is the health sector. Social media has been used as a method in health education, which is a means of searching for health information (13) and as a communication tool (14). Therefore, this research was conducted to determine the effect of health literacy through social media on farmers' knowledge, attitudes, and first aid practice about heat stroke emergencies.

Materials and Methods

Study Design

This study employed a quasi-experimental design with a pretest-posttest approach and a control group. Researchers used two groups in this study: the Intervention Group (IG) and the Control Group (CG). The research process was carried out for 8 weeks in 2024.

Sample Size and Sampling Method

The population in this study consisted of rice farmers living in the rural area of Jember, East Java, Indonesia. Jember is located in the eastern part of Java Island and includes diverse geographical features such as lowland agricultural fields and hilly areas, which influence the local farming practices and community characteristics. The sample size calculation was performed using G*Power 3.1 software with a two-group independent t-test. The parameters used in the computation were a significance level (α) of 0.05, a power of 0.80, and an effect size of 0.5 (a moderate category according to Cohen). The sample size formula used in GPower is based on the following equation:

$$n = \left(\frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2 \cdot \sigma^2}{\Delta^2} \right)$$

Where:

- $\alpha=0.05$ (significance level),
- $1-\beta=0.80$ (power),
- σ is the standard deviation,
- Δ is the minimum detectable difference between groups,
- and Z refers to the Z-score from the standard normal distribution.

Based on these calculations, a minimum sample size of 64 respondents was obtained (32 each for the intervention and control groups). To anticipate the possibility of a 20% dropout rate, the sample size was increased to 76 respondents (IG=38 and CG=38).

The inclusion criteria for this study included: (1) active rice farmers from farmer groups in Jember, East Java, Indonesia, both land farmers and farm laborers; (2) having WhatsApp and YouTube applications on their devices; and (3) being able to read and write. Meanwhile, the exclusion criteria included: (1) farmers who were unwilling to be research respondents; and (2) farmers who withdrew during the intervention process due to illness or other reasons so that they could not complete the entire series of activities.

The sampling technique used was probability sampling with a cluster random sampling method. The process involved randomly selecting four farmer groups from a total of nine using the wheel of names tool. To minimize contamination between intervention and control groups, the selected farmer groups were geographically separated and assigned as clusters, with two groups designated for the intervention and two for the control. The distance between intervention and control clusters was maintained to reduce the risk of information exchange. Matching was considered in terms of demographic similarities (e.g., age range, sex distribution, and smartphone ownership) across clusters to ensure baseline comparability between the groups. This approach ensured fair population representation and increased the external validity of the research results. While the sample in this study was drawn from rice farmers in Jember, the use of random sampling across multiple farmer groups and the application of well-defined inclusion criteria enhances the internal validity and representativeness of the findings. Nevertheless, caution should be exercised when extending these findings to distinctly different regions, and future research involving a more diverse geographic scope is warranted to support broader generalizability. The research flowchart is presented in **Figure 1.**

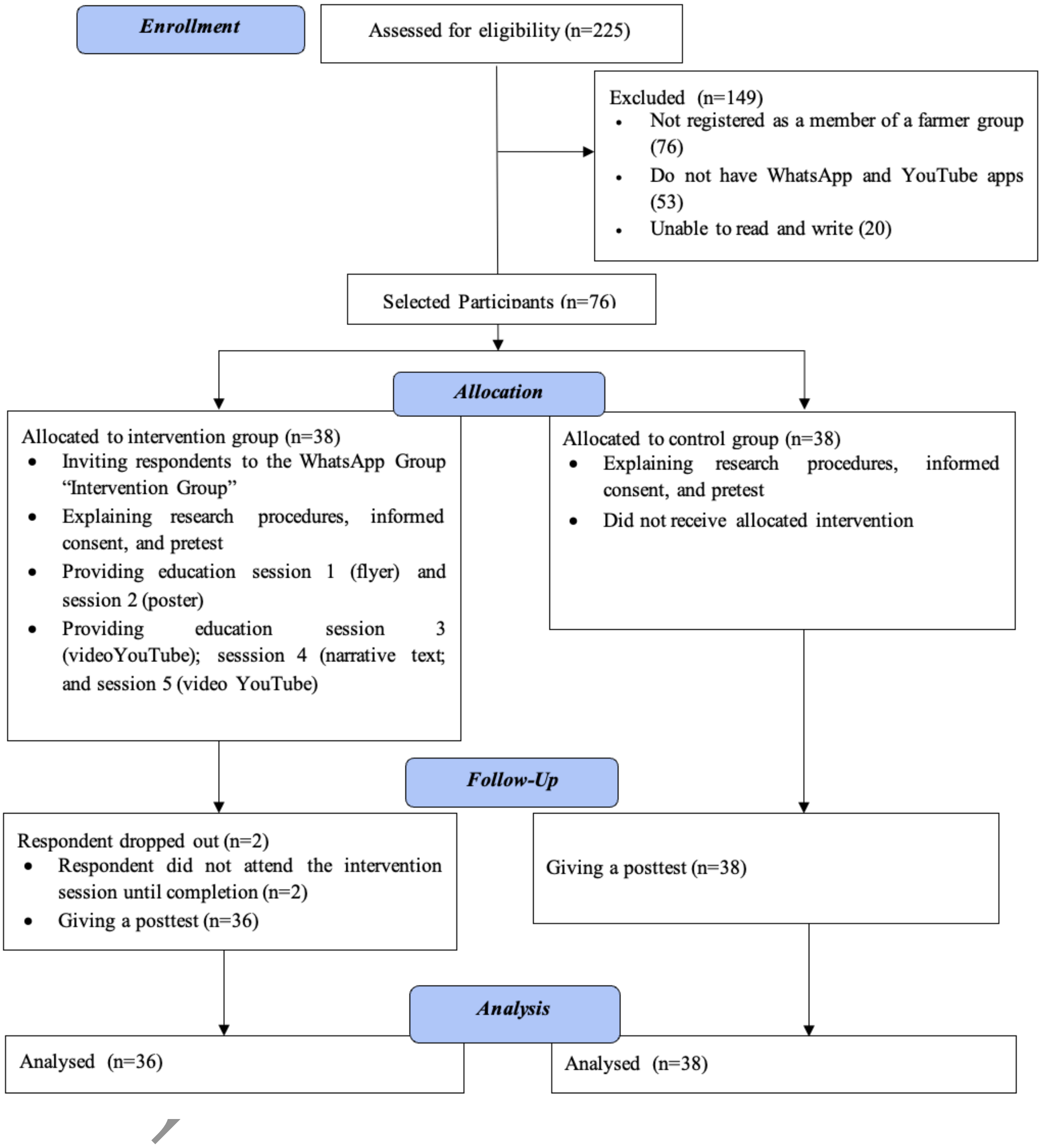

Figure 1. Study flow chart

Instrument

The instrument used in this research is a questionnaire adapted from a previous study on heat stroke knowledge, attitude, and practice (15). The instrument used in this study underwent reliability and validity testing. The reliability test results showed a Cronbach's Alpha value of 0.73, indicating good internal consistency. The instrument was also translated into Indonesian and tested for validity using the Content Validity Index (CVI), with a result of 0.97, indicating very high content validity. The heat stroke knowledge questionnaire consisted of 18 closed-ended questions, including 13 "Yes" or "No" questions and 5 multiple-choice questions. Each correct answer was scored 1, while an incorrect answer was scored 0, with a total score ranging from 0 to 18. These questions covered five indicators: the definition of heat stroke (4 questions), etiology and risk factors (2 questions), clinical manifestations (5 questions), prevention (4 questions), and management of heat stroke (3 questions).

For the attitude aspect, 4 questions were used with a Likert scale, where a score of 1 indicates a poor attitude and a score of 4 indicates a very good attitude, so that the total score ranges from 4 to 16. The attitude questions were grouped into three indicators, namely self-prevention (1 question), self-awareness (2 questions), and self-assessment (1 question). Meanwhile, the practice aspect was measured using 6 questions with "Yes" or "No" answers. "Yes" answers were given a score of 1, and "No" was given a score of 0, so that the total score ranged from 0 to 6. These practice questions were grouped into three indicators, namely motivated actions (1 question), treatment actions (2 questions), and preventive actions (3 questions). The entire structure of questions and indicators was designed to comprehensively measure changes in farmers' knowledge, attitudes, and practices in heat stroke risk management before and after the social media-based educational intervention.

Procedure

The research procedure began with a pretest on both groups, the intervention and control groups, to measure initial knowledge, attitudes, and practices related to heat stroke risk management. After the pretest, the intervention group received social media-based health education, while the control group received no intervention. Education was delivered via WhatsApp for the first two weeks of the eight-week study. Each educational session included different educational media related to the assigned topic. To ensure participant engagement and effective delivery, researchers conducted a combination of in-person and online meetings and monitored participants' access to and understanding of the material. The procedure for providing the intervention is detailed in **Table 1.**

This educational intervention consisted of five learning sessions delivered over two weeks via social media, specifically a pre-established WhatsApp group. This timeline was adapted from previous studies utilizing social media-based health education, where interventions ranged from 2 to 4 weeks, depending on complexity and participant characteristics (16,17). The activity began with a face-to-face meeting in the first week, which served as a pre-test to measure participants' initial knowledge, attitudes, and practices regarding heat stroke. Following the pre-test, the entire educational series was conducted online using a digital media-based approach. In the first week following the pre-test, participants received two initial sessions in stages.

The first session covered the basic concepts of heat stroke emergency management. On the first day, researchers sent an educational flyer through the WhatsApp group explaining the definition of heat stroke, its impact, and the urgency of prompt treatment. Participants were given 10 minutes to read and understand the material. After the learning period ended, researchers withdrew the message from the group as a form of access control. The second session was delivered the following day through an educational poster on the etiology and risk factors of heat stroke. This material was also provided with 10 minutes of access before being removed from the group. All these interactions were designed to maintain participants' focus and discipline in actively and progressively participating in the learning sessions.

In the second week, the intervention continued with three additional learning sessions. The third session covered the signs and symptoms of heat stroke, presented through a 2–3-minute educational video from YouTube. Participants were asked to watch the video at least three times. Researchers monitored participant engagement using the view monitoring feature on the YouTube channel. The fourth session discussed heat stroke prevention efforts. The material was presented in a narrative text format in PDF format and sent via a WhatsApp group. Participants were given 10 minutes to read and understand the material before the file was removed from the group. Finally, the fifth session explained the initial management of heat stroke, or the governance of heat stroke. This session's material was again presented in the form of a short educational video that outlined the initial steps to take in the event of heat stroke. Researchers again monitored participation and provided reminders to participants who had not completed the learning session. Previous studies indicate that community-based interventions often use 3-6 sessions to ensure content retention without overwhelming participants. This range is considered effective for maintaining participant engagement and ensuring the retention of educational content (18,19).

Table 1. Procedure for providing intervention

Session	Topic	Description	Mechanism
Session 1	Heat stroke emergency	Provides a general understanding of heat stroke emergencies and their impact on farmers' health.	Attach flyers to WhatsApp groups

Session 2	Etiology and risk factors of heat stroke	Explains the causes and risk factors that can trigger heat stroke when working in hot environments.	Attach poster to WhatsApp groups
Session 3	Sign and symptomp of heat stroke	Describes the clinical signs and symptoms of heat stroke that should be recognized early.	Sending YouTube video links to WhatsApp groups
Session 4	Prevention of heat stroke	Provides practical information on steps to prevent heat stroke when engaging in outdoor activities.	Attach pdf format to WhatsApp groups
Session 5	Governance of heat stroke	Explains the initial actions or first aid that can be taken when someone experiences heat stroke.	Sending YouTube video links to WhatsApp groups

The intervention strategy was designed not only to improve knowledge but also to shape attitudes toward heat stroke prevention. Each educational session was tailored to encourage emotional engagement and personal reflection. For example, the use of narrative texts and acronym-based messages (e.g., for prevention steps) helped internalize key preventive attitudes. The educational videos depicted real-life symptoms and first-aid scenarios to evoke a sense of urgency and responsibility. Moreover, the delivery through WhatsApp enabled repeated exposure and facilitated informal peer discussions within the group, further reinforcing positive attitudes toward proactive heat stroke management.

The posttest was conducted in the eighth week after the entire series of educational interventions via social media was completed. This measurement aimed to evaluate changes in farmers' knowledge, attitudes, and practices related to heatstroke risk management after receiving five intervention sessions. With a six-week post-intervention period, it is hoped that knowledge retention, internalization of attitudes, and more stable and sustainable behavioral changes will occur. The posttest was conducted face-to-face using the same questionnaire as the pretest to ensure consistency of the evaluation instruments.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 25. Data were analyzed using univariate tests to determine the characteristics of farmers, and bivariate analysis was used to determine differences in characteristics of farmers, knowledge, attitude, and practice questions between the control group and the intervention group and to determine the effect of social media intervention on those variables. The bivariate analysis used was the Wilcoxon Test to determine intra-group differences and the Mann-Whitney Test to determine inter-group differences.

Result

The demographic analysis revealed that the majority of participants in both groups were male: 21 out of 36 (58.3%) in the intervention group and 30 out of 38 (78.9%) in the control group. Female participants accounted for 15 (41.7%) in the intervention group and 8 (21.1%) in the control group. The majority of farmers were of Javanese ethnicity, comprising 69.4% of the intervention group and 57.9% of the control group. In terms of education, most participants had completed senior high school (38.9% in IG and 36.8% in CG). Most farmers in both groups did not have family members working as health professionals (80.6% in IG and 84.2% in CG), and over 80% had never personally experienced heatstroke while working. Our study found that the mean age of farmers was 48.53 ± 6.446 (IG) and 48.31 ± 9.961 (CG), with a length of work of 22.05 ± 5.560 (IG) and 21.36 ± 10.609 (CG). Statistical analysis showed no significant differences between the groups across all demographic variables ($p > 0.05$), indicating baseline comparability between the intervention and control groups **(Table 2).**

Table 2. Comparison of Demographic Information in Two Groups at the Pre-Intervention Phase

Variable	Intervention Group (n=36)	Control Group (n=38)	P-value
Gender, n (%)			0.096[a]
- Male	21 (58.3%)	30 (78.9%)	
- Female	15 (41.7%)	8 (21.1%)	
Ethnicity, n (%)			0.430[a]
- Javanese	25 (69.4%)	22 (57.9%)	
- Madurese	11 (30.6%)	16 (42.1%)	
Education Level, n (%)			0.270[b]
- Not Attending School	0 (0.0%)	0 (0.0%)	
- Elementary School	7 (19.4%)	5 (13.2%)	
- Junior High School	10 (27.8%)	13 (34.2%)	
- Senior High School	14 (38.9%)	14 (36.8%)	
- Bachelor Degree	5 (13.9%)	6 (15.8%)	
Family Member as Health Worker, n (%)			0.914[a]
- Yes	7 (19.4%)	6 (15.8%)	
- No	29 (80.6%)	32 (84.2%)	
Ever Experienced Heatstroke, n (%)			0.578[a]
- Yes	4 (11.1%)	7 (18.4%)	
- No	32 (88.9%)	31 (81.6%)	
Ever Saw Heatstroke Victim, n (%)			0.471[b]
- Never	8 (22.2%)	5 (13.2%)	
- Sometimes	13 (36.1%)	13 (34.2%)	
- Often	10 (27.8%)	14 (36.8%)	
- Always	5 (13.9%)	6 (15.8%)	
Age (years), Mean ± SD	48.53 ± 6.45	48.31 ± 9.96	0.862[c]
Length of Work (years), Mean ± SD	22.05 ± 5.56	21.36 ± 10.61	0.243[c]

Note: n, Participants, %, Percentage, SD, Standard Deviation
[a]chi-Square Test; [b]kolmogorov Smirnov; [c]mann-Whitney Test

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 heatstroke before and after the intervention. **Table 3** shows the changes in knowledge, attitude, and first aid practice scores for heat stroke before the intervention in the control group and the intervention group. The results showed that both groups had the same initial knowledge, attitude, and practice indicators. The Mann-Whitney U test conducted on the pretest of both groups showed no significant differences between the groups with a P-value > 0.05, indicating that both groups were homogeneous and had the same initial conditions of knowledge, attitude, and practice.

Table 3. Parameter of Measurement Baseline

Variables	Intervention Group (n=36)	Control Group (n=38)	P-value
Knowledge			
- Definition	1.28 ± 1.21	1.11 ± 0.69	0.926[a]
- Etiology & Risk Factor	0.83 ± 0.66	0.87 ± 0.41	0.656[a]
- Clinical Manifestation	2.56 ± 1.28	2.79 ± 0.66	0.514[a]
- Prevention	3.11 ± 0.95	2.87 ± 0.67	0.120[a]
- Management	2.22 ± 0.68	2.13 ± 0.53	0.435[a]
Total Knowledge Score	10.00 ± 2.39	9.76 ± 1.24	0.295[a]
Attitude			
- Self-Prevention	1.25 ± 0.60	1.29 ± 0.61	0.672[a]
- Self-Awareness	2.83 ± 0.85	2.66 ± 0.63	0.450[a]
- Self-Assessment	1.69 ± 0.47	1.55 ± 0.50	0.212[a]
Total Attitude Score	5.78 ± 1.10	5.50 ± 0.98	0.430[a]
Practice			
- Motivation	0.36 ± 0.49	0.26 ± 0.45	0.366[a]
- Management	1.31 ± 0.47	1.26 ± 0.45	0.688[a]
- Precaution	2.14 ± 0.64	1.97 ± 0.55	0.222[a]
Total Practice Score	3.81 ± 0.92	3.66 ± 0.85	0.534[a]

Note: [a]Mann–Whitney U test

Based on **Table 4**, in terms of knowledge, the control group does not show an increase, from 9,76±1,240 to 9,74±1,267 (p = 0,793). In contrast, the intervention group showed a significant increase from 10,00±2,390 to 14,78 ± 1,914 (p = 0.001). In terms of attitude, the control group does not show an increase, from 5,50±0,980 to 5,42±0,826 without statistical significance (p = 0,491), while the intervention group experienced a significant increase from 5,78±1,098 to 10,31 ± 0,822 (p=0,001). Meanwhile, in the aspect of first aid practice, the control group there was no change in value from 3,66±0,847 to 3,66±0,781 (p=1,000), while the intervention group experienced a very significant increase from 3,81±0,920 to 4,86±0,899 (p=0.001). These results indicate that the intervention given is effective in improving knowledge, attitudes, and practices of first aid for heat stroke in the intervention group, while the control group did not show significant changes.

Table 4 compares the final adjusted means based on the control and intervention groups. The results showed that the intervention group experienced significant improvements in various aspects compared to the control group. Knowledge about heatstroke and first aid increased from MI = 10,00 to FAM = 14,78 with a significant difference (Δ=12,39, p=0.001). Attitudes in heatstroke management also increased from MI = 5,78 to FAM = 10,31 (Δ = 8,04, p = 0.001). A greater improvement was seen in the practice of heatstroke first aid, where the intervention group increased from MI = 3,81 to FAM = 4,86 (Δ = 4,33, p = 0.001). In contrast, the control group does not show an increase in some variables, with insignificant changes. This indicates that without intervention, understanding and preparedness for heatstroke tend not to experience significant changes. Overall, these results prove that the intervention provided is effective in improving knowledge, attitudes, practices, and self-efficacy in handling heatstroke. This intervention can be used as an educational strategy to improve preparedness for heatstroke, especially in populations that are vulnerable to this condition.

Table 4. The Difference of Parameter Measurement Between Control and Intervention Group

Variables	Intervention					Control			
	Pre-test M ± SD	Post-test (M ± SD)	P-value within Group	Δ Pre-Post (M ± SD)	Pre-test (M ± SD)	Post-test (M ± SD)	P-value within Group	Δ Pre-Post (M ± SD)	P-value between Groups
Knowledge									
Definition	1.28 ± 1.21	2.61 ± 0.80	0.001[a]	1.94 ± 1.22	1.11 ± 0.69	1.11 ± 0.69	1.000[a]	1.11 ± 0.69	0.001[b]
Etiology and Risk factor	0.83 ± 0.66	1.78 ± 0.49	0.001[a]	1.31 ± 0.74	0.87 ± 0.41	0.97 ± 0.54	0.102[a]	0.92 ± 0.48	0.001[b]
Clinical Manifestation	2.56 ± 1.28	4.00 ± 0.79	0.001[a]	3.28 ± 1.28	2.79 ± 0.66	2.76 ± 0.71	0.317[a]	2.78 ± 0.69	0.001[b]
Prevention	3.11 ± 0.95	3.56 ± 0.74	0.017[a]	3.33 ± 0.85	2.87 ± 0.66	2.71 ± 0.80	0.084[a]	2.79 ± 0.74	0.001[b]
Governance	2.22 ± 0.68	2.83 ± 0.50	0.001[a]	2.53 ± 0.67	2.13 ± 0.53	2.18 ± 0.56	0.317[a]	2.16 ± 0.54	0.001[b]
Total	10.00 ± 2.39	14.78 ± 1.91	0.001[a]	12.39 ± 3.23	9.76 ± 1.24	9.74 ± 1.27	0.793[a]	9.75 ± 1.25	0.001[b]
Attitude									
Self prevention	1.25 ± 0.60	2.22 ± 0.49	0.001[a]	1.74 ± 0.73	1.29 ± 0.61	1.24 ± 0.43	0.317[a]	1.26 ± 0.53	0.001[b]
Self awareness	2.83 ± 0.85	5.75 ± 0.55	0.001[a]	4.29 ± 1.63	2.66 ± 0.63	2.61 ± 0.60	0.414[a]	2.63 ± 0.61	0.001[b]
Self assessment	1.69 ± 0.47	2.33 ± 0.48	0.001[a]	2.01 ± 0.57	1.55 ± 0.50	1.58 ± 0.55	0.808[a]	1.57 ± 0.52	0.001[b]
Total	5.78 ± 1.10	10.31 ± 0.82	0.001[a]	8.04 ± 2.48	5.50 ± 0.98	5.42 ± 0.83	0.491[a]	5.46 ± 0.90	0.001[b]
Practice									
Take motivation	0.36 ± 0.49	0.69 ± 0.47	0.001[a]	0.53 ± 0.50	0.26 ± 0.45	0.37 ± 0.49	0.102[a]	0.32 ± 0.47	0.009[b]
Take management	1.31 ± 0.47	1.61 ± 0.49	0.002[a]	1.46 ± 0.50	1.26 ± 0.45	1.29 ± 0.46	0.564[a]	1.28 ± 0.45	0.022[b]
Take precaution	2.14 ± 0.64	2.61 ± 0.49	0.001[a]	2.38 ± 0.62	1.97 ± 0.55	2.00 ± 0.52	0.317[a]	1.99 ± 0.53	0.001[b]
Total	3.81 ± 0.92	4.86 ± 0.89	0.001[a]	4.33 ± 1.05	3.66 ± 0.85	3.66 ± 0.78	1.000[a]	3.66 ± 0.80	0.001[b]

[a]Wilcoxon Signed Ranks Test; [b]Mann-Whitney U Test

Discussion

This study shows that a social media-based educational intervention significantly improved farmers' knowledge, attitudes, and practices related to heatstroke risk management in rural areas. The intervention group showed a significant improvement in scores after eight weeks compared to a control group that did not receive the same intervention. These findings indicate that utilizing social media as a health education tool can be an effective and affordable strategy for reaching vulnerable populations such as farmers, who are frequently exposed to extreme weather risks but have limited access to formal health information.

The results of the study showed that a social media-based educational intervention significantly improved participants' knowledge regarding first aid for heatstroke. This finding aligns with previous research showing that the use of social media, such as WhatsApp, can effectively increase knowledge levels after an intervention, as demonstrated in a previous study on health ambassadors (20). Social media enables the rapid and widespread dissemination of information, including within rural worker and farmer groups, as demonstrated by previous research that leveraged social networks within agricultural work groups to convey safety messages related to extreme heat (21).

This effectiveness is further supported by the characteristics of social media, which enable two-way communication. Platforms like Facebook and Instagram provide a space for users to not only receive information but also actively engage through comments, questions, and discussions, ultimately improving comprehension and retention of the information (22). Furthermore, the ability to tailor messages based on demographics such as age, interests, and geographic location also strengthens the educational impact (23).

Several public health campaigns conducted through social media have even succeeded in broadly influencing public health behaviors, such as those on mental health and smoking cessation (24,25). The user empowerment aspect is also an added value of social media, where individuals can obtain information and social support that encourages positive behavior change (26). In the context of knowledge, this engagement strengthens understanding and increases users' confidence in applying the information obtained.

Finally, social media also plays a crucial role in ensuring the accuracy of health information. Interactions between healthcare professionals, patients, and the general public allow for clarification of misinformation that may be circulating (27), and corrections are even more effective when disseminated across multiple platforms simultaneously (28). Therefore, the findings of this study confirm that social media is a strategic tool in increasing public health knowledge, particularly in communities previously difficult to reach through conventional education services.

The educational process carried out by researchers uses flyers, posters, YouTube videos, and narrative texts (multimedia) as a means of conveying information via WhatsApp and YouTube. This process can give respondents an interest in the learning process. It is said to be interesting because the use of multimedia as an educational tool gives the impression of not being monotonous. This means that it is not monotonous, meaning that each intervention session process will involve several sensory organs, including sight and hearing, so that respondents can easily remember the material provided. Using WhatsApp as an educational tool offers several benefits, making the learning process more engaging and effective. WhatsApp supports various types of educational materials, including images, videos, text, and audio. This versatility makes the presentation of material more interesting and less monotonous (29). The interactive nature of WhatsApp can increase student motivation and participation in the learning process, as students find the platform familiar and user-friendly (30). The use of multimedia in educational settings can significantly enhance memory retention and learning outcomes (31). The quality of video presentation influences cognitive load, which in turn affects learning outcomes. High-quality videos that reduce extraneous cognitive load can improve learning efficiency (32).

A social media-based educational intervention has been shown to change participants' attitudes toward heatstroke prevention and management, particularly among outdoor workers. A cross-sectional study in the general community demonstrated that targeted education can strengthen proactive attitudes regarding personal responsibility and workplace environmental awareness in the face of extreme temperatures (33,34). While this study did not directly deliver social media interventions to farmers, the findings are relevant because they confirm that positive attitudes are strongly influenced by the intensity and appropriate framing of educational messages. Meanwhile, a randomized controlled study among agricultural workers showed that participatory educational interventions based on local culture (language and context) can significantly improve knowledge and attitude scores (35). This effect also reflects a change in attitude as farmers become more aware of the importance of preventing work heat.

Social media platforms often utilize visually appealing formats such as infographics and short videos to capture users' attention and effectively convey health messages. These formats are particularly engaging and help simplify complex information, making it more accessible and easier to understand (36). Furthermore, interactive features like polls and quizzes foster active participation, enhancing user engagement and creating a sense of involvement in the content. This active engagement increases the likelihood of attitude change, as users tend to internalize information they interact with directly (37). By targeting both motivational and emotional aspects, this approach strengthens participants' commitment to heat stroke prevention and preparedness practices.

Social media platforms have provided widespread access to health information, including first aid for heatstroke, making it easier for the general public to obtain relevant and applicable knowledge (38,39). Campaigns like SafeTea have demonstrated that social media can significantly increase the reach and engagement of health messages (40). However, the quality of available information varies widely. Content created by healthcare professionals and non-profit organizations tends to be more accurate, while much user-generated content is not guaranteed to be accurate, highlighting the importance of regulation and the involvement of medical professionals in the information production process (39,41).

In addition to being a source of information, social media can also influence public behavior through timely and contextual messaging. Multimedia campaigns have been shown to improve the accuracy of first aid measures and reduce the need for hospitalizations due to heatstroke (42). The dissemination of weather information through social media has contributed to reducing the economic burden of illnesses related to extreme heat. As an educational tool, social media can improve public knowledge, attitudes, and practices (KAP) regarding heatstroke. Health education provided through this media has been shown to have a direct impact on increasing knowledge, which in turn shapes better attitudes and behaviors regarding first aid practice (43). Furthermore, emotional aspects such as anticipated regret are powerful motivators for individuals to learn and apply first aid, with social media reinforcing this drive through shared narratives of experiences and real-life stories (44).

However, some studies have reported conflicting results regarding the effectiveness of social media as a health education tool, particularly among populations with limited digital literacy. Limited digital literacy and smartphone access significantly hinder the effective utilization of social media for behavioral change among farmers (45,46). In such contexts, farmers often struggle to navigate digital platforms, resulting in low engagement and minimal behavioral transformation. This limited engagement reduces their ability to benefit from digital agricultural advisories and e-commerce services (47). Consequently, many farmers continue to rely on traditional communication channels, such as face-to-face interactions and community-based knowledge sharing (48). Additionally, factors such as subjective norms, attitudes, self-control, and anticipated emotions have been found to influence farmers' intentions to use smartphones for agricultural purposes; however, negative anticipated emotions related to the fear of failure do not significantly deter their willingness to adopt such technologies (49). These findings suggest that while social media holds considerable potential, its effectiveness is highly dependent on contextual elements such as technological infrastructure, user readiness, and cultural norms. Therefore, although our findings support the use of social media for heatstroke education, assessing digital readiness and accessibility within the target population is crucial prior to broader implementation.

These findings have practical implications for community-based health promotion programs, particularly in the agricultural sector. Local governments and health departments can utilize social media as a cost-effective and sustainable educational intervention. Education about occupational diseases such as heatstroke should be integrated into informal worker protection policies and climate-responsive village programs.

Conclusion

An educational intervention through social media significantly improved knowledge, attitudes, and first aid practices for heatstroke among farmers. After eight weeks, the intervention group showed significant improvement compared to the control group. These findings demonstrate the effectiveness of social media as a health education tool for high-risk field workers.

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